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THE ARCHAEOLOGY OF MONITOR VALLEY:
3. SURVEY AND ADDITIONAL EXCAVATIONS

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This article ends Volume 66.

ANTHROPOLOGICAL PAPERS OF
THE AMERICAN MUSEUM OF NATURAL HISTORY
Volume 66, part 2, pages 131–633, figures 1–229, tables 1–88
Issued December 22, 1988
Price: $48.00 a copy
### CONTENTS

Abstract ................................................................................................................................. 150
Introduction ............................................................................................................................. 153
Acknowledgments .................................................................................................................... 153
Chapter 1. The Monitor Valley Survey: Rationale, Strategy, and Tactics ......................... 155
  Antecedents: The Reese River Survey of 1969–70 .............................................................. 155
  The Reese River Piñon Ecotone Survey of 1971 .................................................................. 157
  Objectives of the Monitor Valley Survey ............................................................................... 159
  The Six Nonsite Survey Domains ........................................................................................ 162
    Random Quadrat Survey ..................................................................................................... 162
    Probabilistic Montane Spring Catchment Survey ............................................................... 163
    Rock Art Site Catchment Survey ......................................................................................... 165
    Linear Montane Streamside Survey ..................................................................................... 165
    Monitor Lakebed Transect Survey ....................................................................................... 165
    Valley Floor Spring Catchment Survey ............................................................................... 165
  Defining the Locus ............................................................................................................... 165
  Redefining the Archaeological “Site” .................................................................................... 167
  Nonprobabilistic Site Survey in Monitor Valley ................................................................. 169
Chapter 2. The Monitor Valley Nonsite Survey ..................................................................... 171
  The Montane Spring Catchment Survey ............................................................................... 171
    Petes Spring (Spring 2) ....................................................................................................... 171
    Deer Spring (Spring 5) ....................................................................................................... 176
    Disaster Spring (Spring 6) ................................................................................................... 176
    Sage Hen Spring (Spring 9) ............................................................................................... 178
    Willow Canyon Spring (Spring 15) .................................................................................... 178
    Johnny Potts Spring (Spring 16) ........................................................................................ 181
    White Rock Springs (Springs 17 and 18) ........................................................................... 181
    Spring 20 ............................................................................................................................ 181
    Spring 22 ............................................................................................................................ 185
    Spring 23 ............................................................................................................................ 185
    Sawlog Ridge (Springs 24 and 25) .................................................................................... 188
    Spring 26 ............................................................................................................................ 190
    Copper Mine Spring (Spring 28) ....................................................................................... 190
  Lowland Spring Catchment Survey ...................................................................................... 190
    Dianas Punch Bowl Spring .................................................................................................. 191
    Potts Ranch Spring ............................................................................................................ 192
    White Sage Spring ............................................................................................................. 192
  Monitor Lakebed Survey ....................................................................................................... 194
  Monitor Valley Streamside Catchment Survey ................................................................... 197
    Mill Canyon Streamside Survey ......................................................................................... 197
    Ikes Canyon Streamside Survey ......................................................................................... 197
    Stoneberger Canyon Streamside Survey ............................................................................ 197
  Randomized Quadrat Survey ............................................................................................... 199
  Isolated Surface Finds .......................................................................................................... 200
  Material Culture Recovered in the Monitor Valley Survey .................................................. 200
    Projectile Points .................................................................................................................. 200
    Production Stage Bifaces ..................................................................................................... 217
    Additional Bifacial Implements .......................................................................................... 219
Palynology ................................................................. 280
Faunal Remains .......................................................... 280
Implications ................................................................. 280
Grenouille Verte Cave (La1071) ......................................... 282
Butler Ranch Cave (Ny303) ............................................... 283
Excavation Strategy ....................................................... 285
Stratigraphy ................................................................. 286
Material Culture ........................................................... 286
  Projectile Points ......................................................... 286
  Cores ....................................................................... 287
  Production Stage Blanks ............................................... 287
  Unifaces ................................................................... 288
  Hammerstone .............................................................. 288
  Additional Lithic Artifacts ............................................. 288
  Bone Beads .................................................................. 288
  Ceramics .................................................................... 288
  Debitage ..................................................................... 288
Features ........................................................................ 288
Palynology ................................................................. 289
Faunal Remains .......................................................... 290
Implications ................................................................. 290
Little Empire Shelter (Ny1160) ......................................... 291
Jeans Spring Shelter (Ny302) ........................................... 293
  Excavation Strategy ....................................................... 293
Material Culture ........................................................... 294
  Projectile Points ......................................................... 294
  Cores ....................................................................... 295
  Projectile Point Preforms ............................................. 295
  Promontory Pegs ....................................................... 295
  Miscellaneous Wooden Artifacts ................................. 295
  Basketry .................................................................... 296
  Worked Bone ............................................................. 296
  Shell Beads ................................................................. 296
  Historic Artifacts ....................................................... 296
  Debitage ..................................................................... 296
Features ........................................................................ 296
Faunal Remains .......................................................... 296
Implications ................................................................. 297
Ny1059 ................................................................. 297
Northumberland Cave .................................................... 298
Hunts Canyon Shelter (Ny1158). DAVID HURST THOMAS AND
  SUSAN L. BIERWIRTH .................................................... 299
  Excavation Strategy ....................................................... 299
Material Culture ........................................................... 301
  Projectile Points ......................................................... 301
  Production Stage Bifaces ............................................. 302
  Cores ....................................................................... 303
  Projectile Point Preform .............................................. 303
  Quartz Crystals .......................................................... 303
Gatecliff Shelter (Ny301) ................................................... 348
Northumberland Petroglyph Site (Ny304) ................................ 348
  Ny918 (E-1018) ......................................................... 349
Butler Ranch Cave (Ny303) .................................................. 349
  Ny920 (E-1012) ......................................................... 350
  Ny921 (E-1013) ......................................................... 350
  Ny922 (E-1014) ......................................................... 350
  Ny923 (E-1015) ......................................................... 350
Barley Creek Petroglyph Site (Ny924) ..................................... 350
White Rock Canyon Site (Ny22) ........................................... 352
East Bald Mountain Wash (Ny1) ........................................... 354
  Ny925 (E-1009) ......................................................... 354
Hunts Canyon Shelter (Ny1158) ........................................... 357
  Ny926 ................................................................. 357
Jeans Spring Shelter (Ny302) .............................................. 359
  Ny828 ................................................................. 359
  Ny829 ................................................................. 359
  Ny830 ................................................................. 360
Kingston Canyon Rock Art Site No. 1 (Ny831) ......................... 360
Kingston Canyon Rock Art Site No. 2 (Ny832) ......................... 360

Chapter 7. The Regional Monitor Valley Sample: Analysis of Bias 361
Nature of the Regional Sample ............................................. 361
Vertical Zonation in the Monitor Valley Landscape .................... 362
Horizontal Differentiation Within Monitor Valley ....................... 362
  The Toquima Range .................................................. 362
  The Monitor Range ................................................... 364
Characterizing the Archaeology of Monitor Valley ...................... 364
Bias in the Monitor Valley Sample ........................................ 365
  Analysis of Bias: The Summit Crest ................................ 367
  Analysis of Bias: The Upland Slope ................................. 368
    The Regional Sample .............................................. 368
    The CRM Sample .................................................. 368
    Degree of Bias .................................................... 369
  Analysis of Bias: The Woodland ..................................... 369
    The Regional Sample .............................................. 370
    The CRM Sample .................................................. 370
    Degree of Bias .................................................... 371
  Analysis of Bias: The Lowland Slope ................................ 371
    The Regional Sample .............................................. 376
    The CRM Sample .................................................. 376
    Degree of Bias .................................................... 377
  Analysis of Bias: The Valley Bottom ................................ 377
    The Regional Sample .............................................. 377
    The CRM Sample .................................................. 377
    Degree of Bias .................................................... 378

Chapter 8. Pattern Recognition: Quantitative Variability in 380
  Assemblage Size and Diversity ....................................... 380
  Midrange Theory ...................................................... 380
  Sample Size Biases at Gatecliff Shelter ............................... 382
How Important Is Classification? .......................................................... 382
How Important Is Differential Fragmentation? ................................. 383
How Pervasive is Sample Size Bias in Monitor Valley? ..................... 384
Diversity Within Discrete Monitor Valley Assemblages .................... 385
The Montane Spring Assemblages ................................................. 385
The Valley Floor Assemblages ..................................................... 386
The Cave and Shelter Assemblages .............................................. 387
The Streamside Catchment Assemblages ..................................... 387
The Rock Alignment Catchment Assemblages ................................. 387
The Rock Art Catchment Assemblages ........................................ 387
A Regression Approach to Sample Size Effects ............................... 388
Regression and Slope Reconsidered ............................................. 389
Diversity Within the Elevational Zones of Monitor Valley ............... 391
The Upland Slope Subsample ..................................................... 391
The Woodland Subsample ......................................................... 392
The Lowland Slope Subsample ................................................... 392
The Valley Bottom Subsample .................................................... 392
Diversity Within the Major Geographical Clusters of Monitor Valley ............................... 392
Summary and Implications: Assemblage Size and Diversity ......... 392
Chapter 9. Pattern Recognition: The Temporal Structure of Monitor Valley ............................... 394
The Temporal Profile ................................................................. 395
Ideal Temporal Profiles ............................................................. 396
Temporal Profiles for Gatecliff Shelter ...................................... 397
Comparing Temporal Profiles .................................................... 397
Pooling Temporal Profiles .......................................................... 399
Temporal Profiles for Monitor Valley Assemblages ....................... 399
The Pooled Temporal Profile ....................................................... 401
The Concept of Expectation ......................................................... 402
Nominal Level Comparisons ....................................................... 405
Temporal Variability Pooled by Elevation .................................... 407
Temporal Variability Pooled by Geography .................................. 409
Temporal Variability Pooled by Context ...................................... 409
Summary and Implications: Temporal Structure of Prehistoric Monitor Valley ............................... 412
The Elevational Zones of Monitor Valley .................................... 415
How to Assess Elevational Variability ........................................ 418
Functional Variability Across Elevational Zones ......................... 421
Are Prehistoric General Utility Tools Differentially Distributed? .... 423
Additional Relevant Data .............................................................. 423
Are Prehistoric Weapons Differentially Distributed? ..................... 424
Comparing Artifact-level Distributions ....................................... 424
Additional Relevant Data .............................................................. 424
Comparing Time-markers at the Type Level ................................ 425
Is Prehistoric Harvesting Equipment Differentially Distributed? .... 426
Is Prehistoric Domestic Equipment Differentially Distributed? ...... 427
Comparing Artifact-level Distributions ....................................... 428
Additional Relevant Data .............................................................. 428
Are Prehistoric Fabricating and Processing Tools Differentially Distributed? ......................... 428
Comparing Artifact-level Distributions ....................................... 429
Chapter 11. Pattern Recognition: Variability by Geography

Are Prehistoric General Utility Tools Differentially Distributed?
Comparing Artifact-level Distributions .................................................. 438
Are Prehistoric Weapons Differentially Distributed?
Comparing Artifact-level Distributions .................................................. 441
Comparing the Distribution of Time-markers at the Type Level .......................... 442
Is Prehistoric Harvesting Equipment Differentially Distributed?
Is Prehistoric Domestic Equipment Differentially Distributed?
Comparing Artifact-level Distributions .................................................. 443
Are Prehistoric Fabricating and Processing Artifacts Differentially Distributed?
Comparing Artifact-level Distributions .................................................. 444
Geographic Variability in Lithic Staging Behavior ........................................... 445
Is Prehistoric Ceremonial Equipment Differentially Distributed?
Comparing Artifact-level Distributions .................................................. 447
Summary: Geographic Structure of Prehistoric Monitor Valley .......................... 447

Chapter 12. Pattern Recognition: Variability by Context

How to Analyze Contextual Variability ..................................................... 451
Are Prehistoric General Utility Tools Differentially Distributed?
Artifact-level Comparisons ................................................................. 451
Are Prehistoric Weapons Differentially Distributed?
Artifact-level Comparisons ................................................................. 453
Comparisons of Time-markers at the Type Level .......................................... 453
Is Prehistoric Harvesting Equipment Differentially Distributed?
Is Prehistoric Domestic Equipment Differentially Distributed?
Comparing Artifact-level Distributions .................................................. 455
Are Prehistoric Fabricating and Processing Artifacts Differentially Distributed?
Comparing Artifact-level Distributions .................................................. 456
Lithic Staging Variability ................................................................. 456
Is Prehistoric Ceremonial Equipment Differentially Distributed?
Is Prehistoric Recreational Equipment Differentially Distributed?
Summary: Contextual Variability ............................................................. 459

Chapter 13. Pattern Recognition: Variability in Hearth Technology

Variability in Hearth Size ............................................................... 461
Size Variability by Site ................................................................. 461
Temporal Variability ................................................................. 461
Variability in Intrasite Positioning ............................................................ 463
Hearth Size and Intrasite Geometry .......................................................... 465
Variability in Hearth Technology ............................................................. 465
Variability by Site ................................................................. 466
Relationship Between Hearth Size and Technology ........................................ 467
Temporal Variability ................................................................. 467
Intrasite Variability ........................................ 469
Summary ......................................................... 469
Chapter 14. Site Structure: Methods of Inquiry ........................................ 477
Outdoor Hearth Positioning Strategies ........................................ 477
Diurnal (Workshop) Site Structure ........................................ 477
Nocturnal (Bedroom) Site Structure ........................................ 478
A First Approach to Site Structure: The Constants of Nocturnal Lifespace ........................................ 479
Encountering the Empirical World ........................................ 481
Do Hearth Corridor Constants Apply to Monitor Valley Hearths? ........................................ 483
Are the \( n = 56 \) Hearths from Gatecliff Shelter Positioned Relative to Hearth Corridor Constants? ........................................ 483
Are the \( n = 22 \) Hearths at Triple T Shelter Positioned Relative to Hearth Corridor Constants? ........................................ 483
Are the \( n = 13 \) Hearths at the Additional Excavated Sites Positioned Relative to Hearth Corridor Constants? ........................................ 483
A Site-specific Approach to Hearth Corridor Patterning ........................................ 484
Testing the Hearth Corridor Models for Goodness-of-Fit ........................................ 484
“Outdoor” Debris Disposal Patterning ........................................ 484
Geometry of Intrasite Structure ........................................ 486
Another View of Drop/Toss Zone Patterning ........................................ 490
Rear Drop Zone Pattern ........................................ 491
Lateral Drop Zone Pattern ........................................ 493
Central Drop Zone Pattern ........................................ 493
Rear/Lateral Drop Zone Pattern ........................................ 493
Chapter 15. Site Structure: Lowland Slope and Valley Bottom ........................................ 495
Triple T Shelter ........................................ 495
Geometric Site Configuration ........................................ 495
Artifact Distributions ........................................ 495
Debitage Distribution ........................................ 496
Bone Distribution ........................................ 496
Hearth Positioning ........................................ 497
Summary ......................................................... 499
Jeans Spring Shelter ........................................ 501
Geometric Site Configuration ........................................ 502
Debitage Distribution ........................................ 502
Bone Distribution ........................................ 502
Hearth Positioning ........................................ 502
Summary ......................................................... 502
Hunts Canyon Shelter ........................................ 503
Geometric Site Configuration ........................................ 504
Debitage Distribution ........................................ 504
Hearth Positioning ........................................ 505
Bradshaw Shelter ........................................ 505
Geometric Site Configuration ........................................ 505
Debitage Distribution ........................................ 505
Summary ......................................................... 505
Chapter 16. Site Structure: The Upland Slope and Woodland ........................................ 506
Gatecliff Shelter ........................................ 506
Previous Investigations ........................................ 506
Chapter 19. Integrative Synthesis ........................................................... 579
Strategic Models for Exploiting Monitor Valley ........................................ 579
Distinguishing Residential from Logistic Patterning .................................. 580
A Caution Regarding Temporal Controls .................................................. 582
The Monitor Valley Lowlands .................................................................. 583
Archaeological Expectations ................................................................... 585
Degree of Coverage and Bias .................................................................... 586
Archaeology of the Monitor Valley Bottomland ........................................ 587
The Hickison Summit Corridor .................................................................. 587
The Box Spring Hunting Facility ................................................................ 589
Monitor Lakebed ....................................................................................... 589
Residual Lowland Assemblages .................................................................. 590
The Bottomland of Monitor Valley: A Settlement Summary ...................... 590
The Mountains of Monitor Valley: Expectations ........................................ 592
Analysis of Bias ....................................................................................... 593
The Lowland Slope .................................................................................. 593
The Piñon-Juniper Woodland ..................................................................... 594
The Upland Slope ..................................................................................... 594
The Summit Crest ..................................................................................... 594

Relative Slope: The Partitioned Monitor Valley Subsample .......................... 553
Relative Slope: Summary and Implications ................................................ 553
Elevation Above Valley Floor .................................................................... 554
Elevation Above Valley Floor: The Reese River–Monitor Valley Comparison ........................................ 555
Elevation Above Valley Floor: The Partitioned Monitor Valley Subsample ........................................... 555
Elevation Above Valley Floor: Summary and Implications ........................... 557
Distance from Foothill Margin .................................................................. 559
Distance from Foothill Margin: The Reese River–Monitor Valley Comparison ........................................... 559
Distance from Foothill Margin: The Partitioned Monitor Valley Subsample ........................................... 560
Distance from Foothill Margin: Summary and Implications ........................ 562
Distance to Nearest Water ....................................................................... 564
Distance to Nearest Water: The Reese River–Monitor Valley Comparison .................................................................. 564
Distance to Nearest Water: The Partitioned Monitor Valley Subsample ........................................ 564
Distance to Nearest Water: Summary and Implications ............................. 565
Landform ............................................................................................... 567
Landform: The Reese River–Monitor Valley Comparison ........................... 567
Landform: The Partitioned Monitor Valley Subsample ................................ 567
Landform: Summary and Implications ...................................................... 569
Aspect ..................................................................................................... 569
Aspect: The Caves and Rock-shelters of Monitor Valley ............................ 569
Aspect: Aboriginal Houses in Monitor Valley ............................................ 571
Aspect: The Reese River–Monitor Valley Comparison ................................ 571
Aspect: The Partitioned Monitor Valley Subsample ................................... 573
Aspect: Summary and Implications ........................................................... 573
Archaeology of the Monitor Range ................................................. 595
The Butler Canyon Cul-de-sac ..................................................... 595
The Table Mountain Hunting Complex ............................................ 596
The Barley Creek Subcorridor ..................................................... 597
The White Rock Canyon Cul-de-sac .............................................. 597
The Hunts/McCann Canyon Corridor ............................................ 597
Archaeology of the Toquima Range .............................................. 598
The Toquima Range North .......................................................... 599
Petes Summit/Clipper Gap: A Central Corridor .................................. 599
The Middle Toquima Block .......................................................... 602
Assemblage-level Evidence .......................................................... 602
Site Position Evidence ............................................................... 603
Evidence from the Willow Canyon Cul-de-sac .................................. 604
Evidence from the North Wildcat/Ikes Canyon Trail .......................... 604
Evidence from the South Wildcat/Mill Canyon Trail ........................... 606
The Northumberland Corridor ...................................................... 608
The Southern Toquima Range ...................................................... 611
The Mountains of Monitor Valley: Most Probable Interpretations .......... 611
Where Were the Base Camps in Monitor Valley? .............................. 611
Where Were the Field Camps in Monitor Valley? .............................. 613
Shelters with Adequate Conditions of Lifespace ...................... 613
The Temporary Trailside Shelter ................................................. 614
Additional Evidence for Field Camps ........................................... 615
Cache Sites as Evidence of Logistic Activities .................................. 615
Stations as Evidence of Logistic Activities .................................... 617
Procurement Locations as Evidence of Logistic Activities .................. 617
The Mountains of Monitor Valley: A Settlement Summary .................. 618
References ................................................................................. 620
Appendix: Additional Data on Hearths from Gatecliff Shelter ............... 631

FIGURES
1. Locations of Monitor and Reese River valleys, Nevada .................. 156
2. The sampling grid system employed in the Reese River Valley .......... 157
3. The piñon ecotone sampling scheme for the Reese River Valley ........ 158
4. Map of Monitor Valley, Nevada ............................................... 161
5. Map showing areas of relevant archaeological research in central Nevada 164
6. Sites and survey areas discussed in chapter 2 .............................. 172
7. The major montane survey area in Monitor Valley ....................... 173
8. The Petes Spring survey area (Spring 2) .................................... 174
9. The Deer Spring survey area (Spring 5) .................................... 175
10. The Disaster Spring survey area (Spring 6) ................................. 177
11. The Sage Hen Spring survey area (Spring 9) ............................... 179
12. The Willow Canyon Spring survey area (Spring 15) ..................... 180
13. The Johnny Potts Spring survey area (Spring 16) .......................... 182
14. The White Rock Springs survey area (Springs 17 and 18) ................ 183
15. The Spring 20 survey area ..................................................... 184
16. The Spring 22 survey area ..................................................... 186
17. The Spring 23 survey area ..................................................... 187
18. The Sawlog Ridge survey area (Springs 24 and 25) ..................... 188
19. The Spring 26 survey area ..................................................... 189
20. The Copper Mine Spring survey area (Spring 28) ............................................. 191
21. The survey area around Dianas Punch Bowl ...................................................... 193
22. The Potts Ranch Spring survey area ................................................................. 194
23. The White Sage Spring survey area .................................................................... 195
24. Location of survey transects between the Toquima Range and Monitor Lake ........... 196
25. The Stoneberger drainage survey area .................................................................. 198
26. Desert Side-notched points and Cottonwood Triangular projectile points recovered in
the Monitor Valley nonsite survey ........................................................................... 201
27. Rosegate series projectile points recovered in the Monitor Valley nonsite survey ...... 205
28. Rosegate series projectile points recovered in the Monitor Valley nonsite survey ...... 210
29. Elko Corner-notched projectile points from Monitor Valley nonsite survey .......... 211
30. Elko Corner-notched projectile points from Monitor Valley nonsite survey .......... 212
31. Elko Eared projectile points recovered in the Monitor Valley nonsite survey .......... 213
32. Gatecliff Split Stem projectile points recovered in the Monitor Valley nonsite survey . 214
33. Gatecliff Contracting Stem points recovered in the Monitor Valley nonsite survey ... 214
34. Humboldt series points recovered in the Monitor Valley nonsite survey ................. 215
35. Miscellaneous projectile points from the Monitor Valley nonsite survey ................. 216
36. Roughouts from the Monitor Valley nonsite survey .............................................. 216
37. Rough percussion blanks from the Monitor Valley nonsite survey ....................... 217
38. Fine percussion blanks from the Monitor Valley nonsite survey ......................... 218
39. Pressure flaked bifaces from the Monitor Valley nonsite survey ............................ 219
40. Finished bifacial "knives" and projectile point preforms from the
Monitor Valley nonsite survey .................................................................................. 219
41. Drills and gravers from the Monitor Valley nonsite survey ................................... 220
42. Unifacial tools from the Monitor Valley nonsite survey ........................................ 220
43. Incised stones from La646 ..................................................................................... 221
44. Incised stones from the Monitor Valley nonsite survey ........................................ 222
45. Incised stones from the Monitor Valley nonsite survey ........................................ 223
46. Ceramics from the Monitor Valley nonsite survey .............................................. 224
47. Miscellaneous artifacts from the Monitor Valley nonsite survey ......................... 225
48. Map showing location of Triple T Shelter ............................................................. 241
49. Contour map of Triple T Shelter and vicinity ....................................................... 242
50. Aerial photograph of the West Northumberland Wash, showing location of
Triple T Shelter ........................................................................................................... 243
51. Triple T Shelter; photograph taken looking north ................................................. 243
52. Plan of Triple T Shelter .......................................................................................... 244
53. R. L. Kelly, at Triple T Shelter, preparing stratigraphic descriptions ....................... 246
54. Photograph of the upper portion of the Triple T Shelter stratigraphic profile ........... 247
55. Schematic profile of Triple T Shelter, relating front to back facies ......................... 248
56. The pollen profile from Triple T Shelter ............................................................... 250
57. Desert Side-notched and Cottonwood Triangular points recovered
from Triple T Shelter .................................................................................................. 255
58. Rosegate series projectile points from Stratum IA at Triple T Shelter .................... 255
59. Elko Corner-notched projectile points from Triple T Shelter ............................... 256
60. Elko Eared projectile points from Stratum IA at Triple T Shelter .......................... 257
61. Various projectile points from Triple T Shelter .................................................... 257
62. Miscellaneous lithics from Triple T Shelter .......................................................... 260
63. Incised stones from Triple T Shelter ...................................................................... 260
64. Selected Promontory pegs from Triple T Shelter .................................................. 261
65. Miscellaneous wooden artifacts from Stratum IA at Triple T Shelter ..................... 262
66. Map showing major excavated sites in Monitor Valley ......................................... 273
67. Topographic map of Toquima Cave vicinity and Petes Summit vicinity ............... 274
68. Map of the interior of Toquima Cave ................................................................. 274
69. Interior of Toquima Cave, prior to 1970 excavation ............................................. 275
70. Profile of the west wall of square K-11, Toquima Cave ........................................ 275
71. Projectile points recovered from Toquima Cave ................................................. 276
72. Lithics from Toquima Cave .................................................................................... 277
73. Incised stone from Toquima Cave ........................................................................... 278
74. Bone beads and tubes from Toquima Cave ................................................................. 279
75. Scapula bone awl from Toquima Cave ........................................................................ 279
76. Atlatl fragment from Toquima Cave ........................................................................... 279
77. Plan view and cross section of Grenouille Verte Cave .................................................... 282
78. Map showing Butler Ranch Cave and Little Empire Shelter vicinity .......................... 283
79. Plan view and cross section of Butler Ranch Cave ......................................................... 284
80. Photograph of Butler Ranch Cave .................................................................................. 285
81. The interior of Butler Ranch Cave after three test pits had been excavated ................. 286
82. Master stratigraphic profile of Butler Ranch Cave ....................................................... 286
83. Projectile points from Butler Ranch Cave ...................................................................... 288
84. Photograph showing rock wall in front of Butler Ranch Cave (prior to excavation) .... 289
85. Photograph showing Little Empire Shelter ................................................................... 290
86. The interior of Little Empire Shelter ............................................................................. 291
87. Plan view of Little Empire Shelter ................................................................................ 292
88. Miscellaneous projectile points from Monitor Valley excavations ............................. 292
89. Plan view and cross section of Jeans Spring Shelter .................................................... 293
90. Photograph showing Jeans Spring Shelter .................................................................... 294
91. Projectile points from Jeans Spring Shelter .................................................................. 295
92. Selected Promontory pegs from Jeans Spring Shelter .................................................. 295
93. Miscellaneous artifacts from Jeans Spring Shelter ......................................................... 296
94. Photograph showing Ny1059 ......................................................................................... 298
95. Photograph of the outcrop containing Hunts Canyon Shelter .................................... 299
96. Plan and cross section views of Hunts Canyon Shelter ................................................. 300
97. Projectile points from Hunts Canyon Shelter ............................................................... 302
98. Miscellaneous artifacts from Hunts Canyon Shelter ..................................................... 302
99. Selected Promontory pegs from Hunts Canyon Shelter .............................................. 303
100. Miscellaneous wooden artifacts from Hunts Canyon Shelter .................................... 304
101. Photograph of Bradshaw Shelter ................................................................................ 306
102. Plan and cross section views of Bradshaw Shelter ....................................................... 307
103. Roughouts from Bradshaw Shelter ............................................................................. 309
104. Plan view and cross section of Boring-as-Hell Shelter (La1073) ............................... 310
105. Arrow parts found in a fissure crack at Boring-as-Hell Shelter .................................. 310
106. Map showing location of the major satellite sites in the Monitor Valley area ............. 317
107. Composite map of the Table Mountain rock alignments ............................................. 318
108. Oblique aerial photograph showing the Table Mountain rock alignment .................. 319
109. Oblique aerial photograph showing the serpentine rock walls on Table Mountain ...... 319
110. D. H. Thomas at Blind A of the Table Mountain rock alignment ............................... 320
111. Detail of one of the walls on Table Mountain ............................................................. 320
112. Projectile points associated with the Table Mountain rock alignment ....................... 321
113. Incised stones from the Table Mountain rock alignment ........................................... 322
114. Map of the Box Spring hunting sites .......................................................................... 326
115. Projectile points from the Box Spring drive site .......................................................... 327
116. Projectile points from Box Spring drive site .................................................................. 328
117. Map of Bob Scott rock walls ....................................................................................... 329
118. West wall of the Bob Scott alignments ......................................................................... 330
119. Rock wall at Austin Summit ......................................................................................... 331
120. Map of the Austin Summit rock feature ...................................................................... 332
121. Rock wall near Mt. Prometheus .................................................................................. 333
122. Map of the Mt. Prometheus rock feature ..................................................................... 333
123. Rock hunting blind located in Devils Gate Canyon, Reese River Valley .................. 334
124. Photograph showing the rock feature in the Monitor Hills .......................................... 335
125. Detail of the rock wall at the Monitor Hills site ............................................................ 335
126. Photograph of the Ikes Canyon wooden drift fence ..................................................... 336
127. Historic cattle drift fence on Table Mountain .............................................................. 336
128. Map showing rock art sites in the Monitor Valley area ............................................... 342
129. Map of sites associated with Hickson Summit (La9) .................................................... 344
130. Projectile points found at Hickson Summit (La9) .......................................................... 345
131. Map of sites associated with Toquima Cave (La1) ....................................................... 346
132. Projectile points from the 1 km catchment surrounding Toquima Cave ...................... 347
133. Incised stones found in the Toquima Cave survey catchment ............................................. 348
134. Map of sites associated with the Northumberland petroglyph site (Ny3O4) ................................. 349
135. Projectile points from the Northumberland survey catchment ............................................... 350
136. Map of sites associated with Butler Ranch Cave (Ny3O3) .................................................. 351
137. Projectile points from the 1 km catchment surrounding Butler Ranch Cave .............................. 352
138. Map of East Bald Mountain wash and Ny925 ..................................................................... 353
139. Projectile points from Ny925 ............................................................................................... 354
140. Incised stones from Ny925 and Ny3O4 ................................................................................. 354
141. Map of sites associated with Jeans Spring Shelter (Ny3O2) .................................................. 355
142. Projectile points from the Jeans Spring survey catchment ..................................................... 357
143. Map showing major routes of access through the Toquima Range ......................................... 363
144. Theoretical relationship between size and diversity of hunter-gatherer assemblages ................. 383
145. Size/diversity regression for 11 caves and rock-shelters excavated in Monitor Valley ................. 384
146. Pooled size/diversity regression for the overall Monitor Valley regional sample .................... 385
147. Size/diversity regression for assemblages recovered in the montane spring catchment surveys . 386
148. Size/diversity regression for raw artifact counts from lowland sites and lowland springs in Monitor Valley ........................................ 387
149. Size/diversity regression for raw artifact counts from streamside assemblages in Monitor Valley .................................................. 388
150. Size/diversity relationship for the rock alignment-associated assemblages in Monitor Valley .......... 389
151. Size/diversity regression for raw artifact counts from rock art catchment assemblages of Monitor Valley ................................................................. 390
152. Size/diversity regression for raw artifact counts from pictograph- and petrograph-associated assemblages from Monitor Valley .............................................. 391
153. Size/diversity regression profiles for Monitor Valley site and nonsite assemblages, partitioned by catchment .............................................................. 392
154. Idealized temporal profiles for three hypothetical archaeological sites ...................................... 393
155. Temporal profiles for time-diagnostics from the 10 major cultural horizons at Gatecliff Shelter ........ 394
156. Sample temporal profiles for the Monitor Valley nonsite survey .......................................... 395
157. Master temporal profile for the Monitor Valley sample ......................................................... 396
158. Temporal profiles comparing time-marker frequencies from the lowland and upland slopes of Monitor Valley .......................................................... 404
159. Temporal profiles comparing time-marker frequencies from the excavated caves and shelters and near rock alignments with master profile ........................... 405
160. Cross section through the southern end of Monitor Valley ..................................................... 406
161. Theoretical distributions of artifact assemblages across the elevational zones of Monitor Valley ................................................................. 410
162. Elevational profile for the pooled Monitor Valley assemblage and a comparison of the zonal distribution of metates in Monitor Valley ............................................ 411
163. Elevational profile of weapons in Monitor Valley, plus artifact level plots of Gatecliff series points, projectile point tips, and projectile point fragments .......................... 420
164. Elevational profile comparing the distribution of domestic equipment and ceramics with the overall Monitor Valley assemblage ........................................... 427
165. Elevational profiles of the vertical distribution of cores and roughouts, rough percussion blanks, fine percussion blanks, and pressure flaked bifaces across Monitor Valley ................................................... 428
166. Hypothetical configurations of various bifacial staging profiles ........................................... 431
167. Bifacial staging profiles for the pooled Monitor Valley assemblage, compared to those from the lowland slope, woodland, and valley bottom ........................................... 432
168. Elevational profile for ceremonial equipment across Monitor Valley ...................................... 433
169. The major corridors through the Toquima Range .................................................................. 435
170. Bifacial staging profile for the western Toquima flank assemblage .......................................... 446
171. Bifacial staging profile for assemblages from the valley floor, caves and rock-shelters, petroglyph, and rock alignment sites in Monitor Valley ................................. 457
172. Relationship between radiocarbon age and inside hearth diameter for Gatecliff Shelter and Triple T Shelter ................................................................. 462
173. Analytical coordinate system imposed on the caves and rock-shelters of Monitor Valley ................................................................. 464
174. Binford’s generalized “sleeping area” models ................................................................. 480
175. Comparing expected and observed frequencies for hearth corridor constants .................. 482
176. Model of drop/toss zone patternning as developed from observations developed at the Mask site ......................................................... 486
177. The exogene cave refuse disposal model ............................................................................. 487
178. Three dimensions used to define intrasite geometry in exogene caves and rock-shelters ................................................................. 488
179. Characterizing the degree of bilateral symmetry in caves and rock-shelters ................. 489
180. Defining the degree of lateral expansion in caves and rock-shelters .......................... 490
181. Two grid systems used to define the geometry of Gatecliff Shelter ............................... 491
182. Hypothetical drop/toss zone models and their geometric correlates ......................... 492
183. Analytical 1 m grid system superimposed on Triple T Shelter ....................................... 496
184. Debris size sorting at Triple T Shelter .............................................................................. 497
185. Distribution of hearths in upper Stratum IA at Triple T Shelter ....................................... 498
186. Distribution of hearths in lower Stratum IA at Triple T Shelter ....................................... 499
187. Distribution of hearths below Stratum IA at Triple T Shelter .......................................... 500
188. Analytical 0.5 m grid system superimposed on Jeans Spring Shelter ............................ 503
189. Debitage size sorting at Jeans Spring Shelter ..................................................................... 503
190. Analytical 2 m grid system superimposed on Hunts Canyon Shelter ........................... 503
191. Analytical 2 m grid system superimposed on Bradshaw Shelter ................................... 505
192. Analytical 2 m grid system superimposed on Gatecliff Shelter ....................................... 508
193. Distribution of hearths in Horizons 12–15 at Gatecliff Shelter ........................................ 509
194. Distribution of hearths in Horizons 9–11 at Gatecliff Shelter .......................................... 510
195. Distribution of hearths in Horizons 7 and 8 at Gatecliff Shelter ....................................... 512
196. Distribution of hearths in Horizons 4–6 at Gatecliff Shelter ........................................... 514
197. Distribution of hearths in Horizon 3 at Gatecliff Shelter .................................................. 515
198. Distribution of hearths in Horizon 1 at Gatecliff Shelter .................................................. 516
199. Analytical 2 m grid system superimposed on Toquima Cave .......................................... 518
200. Debris size sorting at Toquima Cave .................................................................................. 520
201. Analytical 1 m grid system superimposed on Butler Ranch Cave ................................. 521
202. Debris size sorting in the lower stratum at Butler Ranch Cave ........................................ 522
203. Probability model showing expected spatial outcomes from exploiting asymmetrical, linear resources ................................................................. 547
204. Probability model showing expected spatial outcomes from exploiting symmetrical, linear resources ................................................................. 547
205. Probability model showing expected spatial outcomes from exploiting symmetrical, point resources ................................................................. 548
206. The normal distribution compared with commonly observed forms of nonnormal deviation ................................................................................. 550
207. Comparative distributions of ground slope in the Reese River Valley ............................. 551
208. Distribution of ground slope in the Reese-River-compatible portion of the Monitor Valley survey ........................................................................ 552
209. Elevation above valley floor for sites and loci on the eastern slope of the Toquima Range ................................................................................. 556
210. Elevation above valley floor for sites and loci on the western slope of the Toquima Range ................................................................................. 558
211. Distance from foothill margin of sites and loci in the Reese-River-compatible portion of Monitor Valley ................................................................. 560
212. Distance from foothill margin of sites and loci in the Toquima Uplands ........................ 562
213. Orientations of the 11 excavated caves and rock-shelters in Monitor Valley .................. 570
214. Orientations of prehistoric house doorways in Monitor Valley ........................................ 572
215. Cross section of “typical” rock-shelter, showing effect of solar angle of incidence on thermal characteristics of shelter surfaces ................................................................. 575
216. Interior temperatures for various building orientations, based on summertime experimental observations ........................................................................ 576
217. Basal stratigraphy of Gatecliff Shelter .............................................................................. 584
218. High-altitude aerial view of the Monitor lakebed

219. The Hickson Summit corridor, the northernmost access route through Monitor Valley

220. View across the Monitor Lakebed site (Ny1228)

221. Weather wall constructed across the mouth of Butler Ranch Cave

222. The Petes Summit/Clipper Gap corridor, the major pass through the northern Toquima Range

223. Interior of Toquima Cave

224. View across Jeans Spring Shelter

225. View across the Mill Canyon cul-de-sac

226. West Northumberland Canyon, the major corridor through the central Toquima Range

227. Aerial view of Triple T Shelter

228. The Northumberland petroglyph site (Ny1059)

229. The interior of Gatecliff Shelter

TABLES

1. Projectile Point Frequencies at Monitor Valley Nonsite Survey Sites ........................................ 202
2. Miscellaneous Artifact Frequencies at Monitor Valley Nonsite Survey Sites .......................... 206
3. Attributes for Desert Side-notched Projectile Points from Monitor Valley Nonsite Survey .......... 226
4. Attributes for Cottonwood Triangular Projectile Points from Monitor Valley Nonsite Survey ....... 227
5. Attributes for Rosegate Series Projectile Points from Monitor Valley Nonsite Survey .............. 230
6. Attributes for Elko Corner-notched Projectile Points from Monitor Valley Nonsite Survey .......... 232
7. Attributes for Elko Eared Projectile Points from Monitor Valley Nonsite Survey ..................... 235
8. Attributes for Gatecliff Split Stem Projectile Points from Monitor Valley Nonsite Survey ........ 236
9. Attributes for Gatecliff Contracting Stem Projectile Points from Monitor Valley Nonsite Survey .... 237
10. Attributes for Humboldt Series Projectile Points from Monitor Valley Nonsite Survey .......... 238
11. Attributes for Large Side-notched Projectile Points from Monitor Valley Nonsite Survey .......... 239
12. Attributes for Miscellaneous Projectile Points from Monitor Valley Nonsite Survey ............... 239
13. Summary of Stratigraphy at Triple T Shelter ............................................................................. 245
14. Radiocarbon Determinations from Triple T Shelter ..................................................................... 245
15. Identifiable Faunal Remains from Triple T Shelter ...................................................................... 252
16. Projectile Point Frequencies at Triple T Shelter ......................................................................... 254
17. Miscellaneous Artifact Frequencies at Triple T Shelter .............................................................. 258
18. Attributes for Desert Side-notched Projectile Points from Triple T Shelter .............................. 264
19. Attributes for Cottonwood Series Projectile Points from Triple T Shelter ............................... 265
20. Attributes for Rosegate Series Projectile Points from Triple T Shelter ................................... 266
21. Attributes for Elko Corner-notched Projectile Points from Triple T Shelter ............................. 267
22. Attributes for Elko Eared Projectile Points from Triple T Shelter ............................................. 268
23. Attributes for Miscellaneous Projectile Points from Triple T Shelter ....................................... 269
24. Debitage Frequency and Weights at Triple T Shelter ................................................................. 269
25. Attributes of Promontory Pegs from Triple T Shelter ............................................................... 270
26. Radiocarbon Determinations from Toquima Cave .................................................................... 276
27. Projectile Point Frequencies at Toquima Cave .......................................................................... 277
28. Miscellaneous Artifact Frequencies at Toquima Cave .............................................................. 278
29. Debitage Frequency and Weights at Toquima Cave .................................................................. 280
30. Identifiable Faunal Remains from Toquima Cave .................................................. 281
31. Projectile Point Frequencies at Butler Ranch Cave .............................................. 287
32. Miscellaneous Artifact Frequencies at Butler Ranch Cave ................................ 287
33. Debitage Frequency and Weights at Butler Ranch Cave ....................................... 288
34. Identifiable Faunal Remains from Butler Ranch Cave .......................................... 289
35. Miscellaneous Artifact Frequencies at Jeans Spring Shelter .............................. 294
36. Debitage Frequency and Weights at Jeans Spring Shelter ................................... 296
37. Identifiable Faunal Remains from Jeans Spring Shelter ..................................... 297
38. Identifiable Faunal Remains from Ny1059 .......................................................... 298
39. Projectile Point Frequencies at Hunts Canyon Shelter ....................................... 301
40. Miscellaneous Artifact Frequencies at Hunts Canyon Shelter ......................... 301
41. Debitage Frequency and Weights at Hunts Canyon Shelter ............................... 304
42. Identifiable Faunal Remains from Hunts Canyon Shelter ................................... 305
43. Debitage Frequency and Weights at Bradshaw Shelter ...................................... 306
44. Identifiable Faunal Remains from Bradshaw Shelter ......................................... 308
45. Attributes for Miscellaneous Projectile Points from Toquima Cave .................. 308
46. Attributes for Miscellaneous Projectile Points from Butler Ranch Cave, Little Empire Shelter, and Ny1059 .......................................................... 311
47. Attributes for Miscellaneous Projectile Points from Jeans Spring Shelter .......... 312
48. Attributes of Promontory Pegs from Jeans Spring Shelter ................................. 312
49. Attributes for Miscellaneous Projectile Points from Hunts Canyon Shelter ........ 313
50. Attributes of Promontory Pegs from Hunts Canyon Shelter ............................... 314
51. Miscellaneous Artifact Assemblage Associated with the Table Mountain Rock Alignments ........................................................................................................ 322
52. Miscellaneous Artifact Assemblage Associated with the Box Mountain Features ... 325
53. Attributes for Projectile Points Associated with the Table Mountain Rock Alignment . ........................................................................................................ 337
54. Attributes for Projectile Points from the Box Spring Features ............................ 338
55. Projectile Point Frequencies at Monitor Valley Rock Art Localities .................... 341
56. Miscellaneous Artifact Frequencies at Monitor Valley Rock Art Localities .......... 343
57. Attributes for Projectile Points from the Hickson Summit Petroglyph Site (La9) .... 356
58. Attributes for Projectile Points from the Toquima Cave Survey Catchment .......... 356
59. Attributes for Projectile Points from Northumberland Rock Art Survey Catchment .......................................................... 357
60. Attributes for Projectile Points from Butler Ranch Cave Survey Catchment ........ 358
61. Attributes for Projectile Points from Ny925, in the East Bald Mountain Wash Survey Catchment .......................................................... 359
62. Attributes for Projectile Points from the Jeans Spring Shelter Survey Catchment ... 359
63. The Regional Monitor Valley Sample ..................................................................... 366
64. Zonal Distribution of Prehistoric Monitor Valley Assemblages ............................ 371
65. Additional Prehistoric Sites Recorded in the Monitor Valley Study Area ............ 372
66. Regression Coefficients (b values) for the Major Pooled Assemblages in Monitor Valley .......................................................... 391
67. Regression Coefficients (b values) for the Major Pooled Assemblages in Monitor Valley .......................................................... 392
68. Time-markers from Three Hypothetical Archaeological Sites ............................. 396
69. Distribution of Time-sensitive Projectile Points from Gatecliff Shelter ............... 397
70. Worksheet Comparing Temporal Profiles for Horizons 9 and 14 at Gatecliff Shelter .......................................................... 399
71. Distribution of Projectile Point Types in the Regional Monitor Valley Sample .... 402
72. Worksheet Comparing Temporal Distribution of Lowland Slope Sample against the Aggregate Monitor Valley Assemblage ........................................... 407
73. Elevation Distribution of Artifacts in the Regional Monitor Valley Sample .......... 420
74. The Nonperishable Assemblage from Gatecliff Shelter ....................................... 422
75. Zonal Distribution of the Pooled CRM Assemblage from Monitor Valley .......... 430
76. Geographic Distribution of Artifacts Within the Toquima Range ......................... 440
77. Geographic Distribution of Projectile Points Within the Toquima Range .............. 443
78. Distribution of Prehistoric Monitor Valley Assemblages by Catchment ............... 452
79. Distribution of Projectile Point Types by Assemblage ......................................... 454
80. Relationship of Hearth Diameter to Cultural Phase at Gatecliff Shelter ............... 463
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>81. Distribution of Hearth Technology in Monitor Valley</td>
<td>466</td>
</tr>
<tr>
<td>82. Excavated Hearths in Monitor Valley</td>
<td>470</td>
</tr>
<tr>
<td>83. Drop/Toss Zone Modeling for Natural Enclosures Smaller than 75 m²</td>
<td>491</td>
</tr>
<tr>
<td>84. Spatial Attributes for Hearth Corridors at Triple T Shelter</td>
<td>497</td>
</tr>
<tr>
<td>85. Spatial Attributes for Hearths at Gatecliff Shelter</td>
<td>507</td>
</tr>
<tr>
<td>86. Spatial Attributes for Hearth Corridors at Gatecliff Shelter</td>
<td>509</td>
</tr>
<tr>
<td>87. Locational Characteristics of Sites and Loci in Monitor Valley</td>
<td>539</td>
</tr>
<tr>
<td>88. Total Direct and Diffused Solar Radiation</td>
<td>575</td>
</tr>
</tbody>
</table>
ABSTRACT

This is the third monograph in a series analyzing the prehistoric archaeology of Monitor Valley, Nevada. The first volume (Thomas, 1983a), established the theoretical and epistemological framework within which the archaeological inquiry was conducted. The second monograph (Thomas, 1983b) focused on the archaeology, geomorphology, paleontology, and paleobotany of Gatecliff Shelter (Ny301), where we encountered more than 10 m of extraordinarily well-stratified deposits, divided into 56 geological strata and 16 cultural horizons. Primary chronostratigraphic data derive from the 47 radiocarbon dates available for Gatecliff Shelter.

This volume significantly expands the scope by considering the content and context of several additional components from throughout Monitor Valley. American Museum crews systematically surveyed 1750 ha of the Monitor Valley bottomland: one randomized 1 km spring catchment survey (Disaster Spring), seven randomly selected 500 m² quadrats, and three arbitrarily selected 1 km spring catchment surveys (Dianas Punch Bowl, Potts Ranch Spring, and White Sage Spring). Several arbitrarily selected hunting localities were also collected and mapped on the valley bottom.

On the lowland slope, we excavated Triple T, Jeans Spring, and Hunts Canyon shelters. Triple T Shelter (Ny345), a small alcove in West Northumberland Canyon, is about 12 km (7.5 mi) west of Gatecliff Shelter. The Triple T stratigraphic column, more than 6 m deep, is supported by 13 radiocarbon dates. Taken together, Gatecliff and Triple T shelters provide an important baseline of stratigraphy and chronology.

The Triple T artifact assemblage shows a superabundance of weapons, with low proportions of domestic equipment and ceremonial items. Intrisate patterning is heavily conditioned by concerns with energy efficiency. The southern aspect maximizes solar input during the day and heat retention at night. Overall hearth technology and within-site positioning further enhanced the natural heat sink effect. Hearth positioning and debris disposal during Stratum 1A times demonstrate that the enclosed rear zone functioned both as a sheltered workshop and a nocturnal sleep area.

Jeans Spring Shelter (Ny302) likewise contained a disproportionate number of weapons, especially trapping tools. These seasonally and geographically specific artifacts were probably ad hoc caches, placed in passive storage for future anticipated use. Intrisate patterning and the nature of the debris are best explained as material consequences of light maintenance and repair, secondary embedded food and other resource procurement, and boredom reduction by hunters hiding inside to monitor game watering at the nearby spring.

The surface archaeology of the lowland slope was examined in several ways: three randomized 1 km spring catchment surveys, four fully recorded rock art localities (two of which were further examined in 1 km catchment surveys), one hunting barrier, two 100-m-wide transects across the lowland slope south of Mill Canyon, and five randomized 500 m quadrats.

Slightly over 80 percent of the stratigraphic excavations in Monitor Valley took place in the pinyon-juniper woodland. Roughly 600 m³ of archaeological deposit were excavated at Gatecliff Shelter; excavations at four additional sites in the woodland of the Toquima Range totaled approximately 25.7 m³: Toquima Cave, Grenouille Verte Cave, Northumberland Cave, and Ny1059. Two other woodland sites—Butler Ranch Cave and Little Empire Shelter—were excavated in the Monitor Range.

Toquima Cave (La1) overlooks Pete's Summit, the major pass through the northern Toquima Range. The churned deposits reach 1.5 m in places, and the sequence is supported by four radiocarbon dates. Despite the elaborate polychrome pictographs evident here, we think that Toquima Cave was not a desirable place to live. The nearest water source is more than 2 km away, and the relatively high elevation brought colder temperatures than at most other shelters in Monitor Valley. Moreover, the deep and narrow cave configuration made Toquima Cave a difficult place to heat. Unlike other shelters of Monitor Valley, the intrasite patterning defined a longitudinal axis, with primary work and hearth zones toward site midpoint. Toquima Cave was used mostly as a workshop, with sparse evidence of nocturnal utilization.

Butler Ranch Cave (Ny303) contained a distinctive assemblage, with a relatively high density of early stage reduction byproducts. Debris size sorting is most pronounced in the lower stratum, both artifact and debitage distributions approximating a rear/central drop zone model, with hearths constructed near site-center. Addition of a stone weather wall sometime during the Yankee Blade phase, minimized the problem of downcanyon cold air drainage, reduced the loss of radiant heat, and enhanced efficiency of interior hearths. The rock wall did not significantly change the rear/central drop zone pattern of the lower stratum, but hearth positioning shifted toward the rear after the wall was built. Particularly during this latest occupation, Butler Ranch shows ample evidence of nocturnal utilization, concern with heat retention, and apparent maximization of interior light.
The woodland zone also accounts for about half of the systematic survey undertaken in Monitor Valley. The Toquima Range was explored in three 1 km spring catchments, eight randomized 500-m-square quadrats, and three 1-km-wide streamside surveys in Stoneberger, Ikes, and Mill canyons. A 1 km catchment survey was also conducted in the Toquima Cave/Petes Summit area. The Monitor Range woodland was systematically surveyed only in the Butler Ranch Cave catchment.

No archaeological excavations were undertaken on the upland slope of Monitor Valley, but American Museum crews covered approximately 1830 ha in an intensive close-interval systematic survey of the uplands. Several thousand hectares were also extensively surveyed for rare elements. The Toquima Range survey was primarily conducted through examination of spring catchments, with 6 of the 15 randomly selected springs falling on the upland slope.

Based on a sample of 91 hearths encountered in the Monitor Valley excavations, we found no significant correlation between the size of a hearth and the way it was constructed. Hearth construction does, however, vary by site. Gatecliff Shelter contains a disproportionate number of deep-pit hearths, and Triple T Shelter has a large proportion of shallow-pit and rock-filled hearths. Hearth technology likewise changes systematically through time. The oldest fires were generally built on unprepared surfaces. Rock-encircled hearths tended to be built somewhat later, and pit hearths were used later still. The latest hearths in Monitor Valley tend to be rock filled. In particular, the energy-efficient rock-filled hearths at Gatecliff Shelter correspond stratigraphically with the relatively colder climate during Reveille times. After this, the Gatecliff hearths become smaller, apparently in response to rising local temperatures.

We also found some intrasite variability, with hearths becoming larger toward the center of Triple T Shelter. Shallow-pit hearths tend to be constructed well inside the dripline, toward the rear and sides of the excavated Monitor Valley shelters. Deep-pit hearths are built farther toward the front of these sites. Unprepared hearths are generally found toward the outer lip.

Monitor Valley is characterized by an extraordinarily high degree of spatial redundancy, with most sites and catchment areas periodically reused over long periods of time. Since much of the prehistoric archaeological debris occurs in multicomponent palimpsest aggregations, it is very difficult to distinguish significant change through time.

In general, we found the archaeology of the Monitor Valley bottomland to be overwhelmingly water-tethered. Six major lowland water sources are available within the study area, and each contained archaeological evidence of prehistoric exploitation. Virtually no archaeological remains exist away from these small-scale oases. The bottomland also contains two distinctive prehistoric hunting facilities. The Box Spring rock alignment, on the valley floor, was probably used for summertime antelope drives. The important rock art site at Hickson Summit is situated along a naturally defined migration trail between Monitor and Big Smoky valleys. This hunting facility could have been employed year round, probably for both antelope and bighorn. We were also struck by the lack of evidence for residential utilization of the lowlands during prehistoric times.

The prehistoric archaeology of the Monitor Valley mountains is considerably more complex. Evidence of base camps was restricted to the piñon-juniper woodland, where a number of house foundations were found; assemblage-level criteria also showed significant residential utilization of the woodland. Most of the base camps were clustered near the major corridors of east-west access through the Toquima and Monitor ranges. Despite this evidence, it is clear from systematic evaluation of site positioning criteria that Monitor Valley was far less intensively populated than equivalent areas of Reese River.

Field camps were identified throughout the mountains of Monitor Valley. Although none of the caves and shelters provided sufficient conditions for full-scale base camp utilization, several natural overhangs were suitable for short-term habitation—anywhere from overnight to a week or two. Butler Ranch Cave, Gatecliff, Hunts Canyon, and Triple T shelters served as overnight stopping places for millennia. Each offered a desirable combination of southern aspect, proximity to the valley floor, shelter from foul weather, relatively easy east-west access, and potential to ambush game moving through a natural corridor.

Interior space inside such shelters was structured rather similarly. Hearths were usually constructed near site center, this artificial heat source combining with the natural heat sink of the shelter walls to define heated sleeping corridors along the rear and/or lateral walls. The most sheltered portion of these sites was generally used as a workshop area, the toss zone of larger debris commonly forming an arc near the site dripline.

Monitor Valley also contained several naturally sheltered enclosures that functioned as temporary trailside stopovers. Boring-as-Hell Shelter and Grenouille Verte Cave are tiny foul weather or overnight nests; neither has sufficient light penetration or ventilation to permit even a couple of people to remain for more than a few hours. But, significantly, the interior of each remains cool dur-
ing summer days, dry in a downpour, and cheap to heat at night and during the winter. Each cave is near a major east-west corridor and may have been used temporarily while monitoring game movement.

Most residential activity is restricted to the piñon-juniper woodland and the lowland slope. The Toquima uplands seem to have been utilized largely, but not entirely in logistic fashion. The archaeological record in the uplands is characterized primarily in negative terms: the universal absence of house foundations, the generally low proportions of domestic artifacts, the less intense proportionate utilization of loci, the absolutely lower artifact density, and the significantly higher proportion of assemblages occurring as off-site isolated finds.
INTRODUCTION

This series presents an analysis of interdisciplinary fieldwork conducted in Monitor Valley, Nevada, between June 1970 and August 1981. Inquiry ranged from stratigraphic and living floor excavations at 10-m-deep Gatecliff Shelter, to work at Alta Toquima Village, a multicomponent site located at an elevation of 3300 m (11,000 ft). Probabilistic and opportunistic site surveys resulted in the recording and collection of hundreds of additional prehistoric sites and nonsites. A dozen rock art localities were studied. Numerous satellite sites—drift fences, hunting blinds, rock ambushes, and soldier cairns—were also mapped, collected, and, in some cases, excavated.

Archaeological research in Monitor Valley required both general and midrange theoretical orientation, and the first volume in this series addresses these epistemological issues (Thomas, 1983a). At the conclusion of that volume, we present five strategic models anticipating the archaeological record of this area.

The second volume (Thomas, 1983b) discusses the archaeology, geomorphology, paleontology, and paleobotany of Gatecliff Shelter. The present volume, the third in the series, expands the scope to present the context and content from additional components in the Monitor Valley regional database: the nonsite catchment surveys, the deep stratigraphic excavation of Triple T Shelter, several other cave and shelter excavations, plus data from various satellite and rock art catchment assemblages. In all, this fieldwork has involved excavation of about 760 m$^3$ of archaeologically relevant deposits, roughly 10,500 ha (26,000 acres) of systematic surface survey and collection, plus several thousand additional hectares examined for the "rare archaeological event," as discussed in chapter 1.

The next volume in this series will present similar survey and excavation data from the Alta Toquima complex, an unusual series of very high-altitude sites and nonsites. The final volume will discuss the significance of the Monitor Valley findings against a regional and theoretical background. All five monographs will be indexed cumulatively in the final volume.

Although the various Monitor Valley monographs can be considered independently, each is but a single link in a linear argument, each involving more general data and theory.

ACKNOWLEDGMENTS

The major financial burden of the Monitor Valley fieldwork fell to the American Museum of Natural History. In addition to general support, I acknowledge specific assistance from the Frederick G. Voss Fund for Anthropology, the James Ruel Smith Fund, and the Council of the Scientific Staff. A generous grant from the Richard Lounsbery Foundation significantly aided in the preparation and publication of this manuscript.

Several other granting agencies were also involved, and we are indebted to each. The first two years of fieldwork in Monitor Valley were conducted as a summer field school for the University of California (Davis). Two Chancellor grants from that institution provided direct support for the Monitor Valley survey. Earthwatch, formerly Educational Expeditions International, furnished both funding and volunteer labor for the Monitor Valley survey during the summers of 1973, 1974, and 1975. I thank Mr. Brian Rosborough, President of Earthwatch, for his continued and enthusiastic support of the Monitor Valley research. We gratefully acknowledge support from the National Geographic Society, which supplied badly needed funding for the 1975 and 1976 expeditions. I also acknowledge a National Science Foundation grant (BNS77-24179) for major support in the analysis of the Monitor Valley materials. We also thank the Sander and Ray Epstein Charitable Foundation and the General William Mayer Foundation for helping us when such assistance was difficult to garner.

A huge measure of gratitude is due those who actually conducted the Monitor Valley survey. Individual participants are acknowledged elsewhere (Thomas, 1983a, 1983b), but
I want especially to thank Dr. Robert L. Bettinger who supervised a major portion of the surface reconnaissance.

I also thank those who assisted from afar in the Monitor Valley operation. Had it not been for the basic research-oriented philosophy and specific support of the American Museum of Natural History, the Monitor Valley research could not have been completed. Long-range institutional commitment was critical in all aspects of this work, and I specifically thank those at the American Museum who helped out: Dr. Thomas D. Nicholson, Dr. Jerome G. Rozen, Jr., Dr. Stanley A. Freed, and Ms. Joan Buttner.

Several individuals contributed to the Monitor Valley research by providing tips about site location. We thank each for trusting us with this sensitive information: Mr. Nick Bradshaw (Bradshaw Shelter), Mr. Bill Brinton (Triple T Shelter and Kingston Canyon Rock Art Site No. 1), Mr. and Mrs. William Lowe (Hunts Canyon Shelter, the Monitor Hills hunting feature, and the Barley Creek rock art site), Dr. Edwin McKee (Jeans Spring Shelter), Mrs. Myrtle Myles (Butler Ranch Cave and Little Empire Shelter), and Mr. Glade Quilter (Table Mountain rock alignments).

Personnel from the U.S. Forest Service were helpful in a number of ways, and we thank Ms. Arnie Turner for assistance in cutting through the red tape.

Had it not been for the input of Drs. M. A. Baumhoff and D. L. True, the Monitor Valley project never would have begun. Although the American Museum assumed formal responsibility for the Monitor Valley work in 1972, the University of California (Davis) continued to function as our base of operations. Mr. Leonard R. Williams and Ms. Jeannie Anderson also deserve special thanks for making things go so smoothly.

Many friends and colleagues assisted in the preparation of this manuscript. Mr. Dennis O’Brien is responsible for the overall graphic framework, and he prepared most of the field art. The late Nicholas Amorosi illustrated all artifacts, and several others also helped out: Ms. Stacy Goodman, Ms. Louise Fishman, Ms. Kristina Jacobson, and Ms. Lisa Sherman. Photographs not credited to other sources in this volume were taken by the following individuals: Susan Bierwirth, Dennis O’Brien, and David Hurst Thomas.

My own archaeological staff at the American Museum made invaluable contributions, each leaving a personal mark on the final product: Ms. Susan Bierwirth, Ms. Lisa Cook Reed, Ms. Stacy Goodman, Ms. Deborah Mayer O’Brien, Ms. Debra Peter, Ms. Lorann S. A. Pendleton, Mr. Robert Rowan, and Ms. Lisa Sherman.

I also thank Drs. Donald K. Grayson and Robert L. Bettinger, who kindly consented to review the manuscript in its entirety; although not all of their suggestions were taken, we may someday wish we had. We are likewise grateful to the following for reviewing parts of the draft: Jonathan O. Davis, Robert Elston, George T. Jones, Robert Leonard, Edwin McKee, David B. Madsen, Lorann S. A. Pendleton, and Leonard Williams.

I am grateful to Ms. Jane Epstein and especially Ms. Margot Dembo for editorial assistance. The early typescript drafts were prepared by Ms. Joan Buttner, Ms. Patricia Bramwell, and Ms. Clarissa Wilbur. Ms. Brenda Jones of the Scientific Publications Department was helpful as always, and additional editorial assistance was also provided by Mr. Fred Wayne and Ms. Anne Thek.

This volume is respectfully dedicated to the memories of Martin A. Baumhoff and Bill Lowe, two people who spanned the archaeological spectrum. For years, Marty advised us on specifics of excavation and survey; but more important, his grasp of archaeological theory and method quietly shaped the entire thrust of this project. And Bill, with his own brand of enthusiasm and involvement, proved to all who knew him that professional archaeologists overlook their avocational colleagues at great peril to both.
CHAPTER 1. THE MONITOR VALLEY SURVEY: RATIONALE, STRATEGY, AND TACTICS

The diverse survey procedures employed in the Monitor Valley research may strike some as a mixed bag of inconsistent (if not contradictory) archaeological field techniques. And in looking over the next several chapters which present the data resulting from this seven-year effort, I can readily see how someone might reach just this conclusion.

But the conclusion would be mistaken. The Monitor Valley fieldwork is based on a carefully designed strategy which specifically combines data from a wide range of archaeological observations: We questioned dozens of people at rural gas stations and bars, but we also surveyed randomly selected 500 m quadrats; the field crews often surveyed in 1 km diameter circular catchment units, but these same fieldworkers also walked 100-m-wide transects across the alluvial flats; while some field crews combed the stream drainages for sites, I was asking Forest Service personnel to keep an eye open for high-altitude sites. We even found two sites by tracking down the childhood remembrance of a lively octogenarian then living in Reno.

Our survey strategy in Monitor Valley was a blend of the more up-to-date probabilistic sampling methods with traditional techniques of finding sites. Unfortunately, some archaeologists are still choosing up sides, relying either on probability theory or intuition (rarely both). We believe that an eclectic, diversified approach is the best overall strategy for current archaeological objectives. This chapter explains what we did and why we did it.

ANTECEDENTS: THE REESE RIVER SURVEY OF 1969–70

Our research in the Reese River Valley began with a computer simulation of known Shoshonean settlement patterns; the purpose of BASIN I was to translate mid-19th century Shoshonean seasonal movements into a body of concrete, testable archaeological expectations (Thomas, 1971a, 1972a, 1973). By stipulating relevant use areas, tool kits, and discards, we simulated the archaeological record for each biotic community. BASIN I was basically a series of "if . . . then" statements: If the historic Shoshonean system had operated in prehistoric Reese River, then the archaeological patterning in lifezone X should appear like this.

We were confronted, in the Reese River case, with dozens of empirical problems: How many flakes are discarded when a bighorn sheep is butchered? How many grinding stones enter the record in a single winter village? How often are points recycled? In retrospect, it is clear that the weakest part of the BASIN I simulation was this "stipulation" of tool kits and byproducts. We now recognize such stipulation as an exercise in bridging argumentation—establishing reasonable archaeological correlates for postulated behavioral activities (e.g., Schiffer, 1976; Binford, 1981). Although archaeology over the past two decades has explicitly recognized these issues, discussion has served mostly to highlight the problems; considerably less has emerged in the way of solutions.

Once the results were available from the BASIN I simulation, we set about designing a field strategy for testing the quantitative predictions. BASIN I avoided the site concept entirely, expressing Shoshonean cultural geography in terms of regional density and distribution of archaeological items. This computer design quite literally forced us into a nonsite archaeological sampling strategy, and this nonsite imperative became the first major requirement of the early Reese River research design (Thomas, 1969b, 1975).

A second feature was the explicit use of the lifezone concept in the BASIN I modeling. This required that the Reese River design provide for relatively homogeneous sampling strata, maximizing the interstrata differences. After considering several alternatives, we decided to stratify the Reese River sample in terms of three extant lifezones in Reese River Valley.

We also had problems with logistics, figuring out exactly how to go about the actual sampling. Binford’s (1964) seminal paper had thoroughly demonstrated the advisability of
probability sampling at the regional level. But feasibility was quite another matter; at the time (1968), I knew of no substantive fieldwork which had put Binford's notions into practice. After some experimentation in a barley field near Davis, California, we found that 500 m quadrats were relatively easy to plot on the ground and then search for archaeological remains; thus the 500 m square formed the observational sampling unit of the Reese River survey (Thomas, 1969b, 1971a, 1973).

This turned out to be a fortunate choice, and this sampling element has also proved to be relatively useful in much of the Great Basin and elsewhere (e.g., Matson, 1971; Hatoff, 1974; Bettinger, 1975, 1976, 1977a; Kelly, 1983). In areas of higher artifact density, the size of the quadrat can often be reduced (Matson and Lipe, 1975; see also Plog, 1976; and Plog et al., 1978).

These considerations in the early phases of the Reese River research led us to devise a *nonsite stratified quadrat* approach to sample design. The study area was chosen more or less to approximate a "typical" annual round of the historic Western Shoshone (although we made no assumption that the diversified activities embedded within such a seasonal round had necessarily occurred in this restricted region). We gridded this area into 1400 quadrats, stratified the grid according to modern vegetational communities, and selected a 10 percent sample within each stratum. These 140 quadrats were surveyed at an interval of 5–10 m during the summers of 1969 and 1970 by crews of 25 and 40 people, respectively.

In the light of 15 years' hindsight, several points can be made about the initial research design at Reese River. First, we spent an inordinate amount of time fussing over irrelevant details. Part of this was due to the inexperience of a second-year graduate student, but equally important was the fact that random sampling on a regional scale remained untested. Although archaeology had begun to embrace the theory, archaeologists were still groping for pragmatic field techniques.

Far too much time was spent, for instance, trying to insure that our 500 m squares were perfectly square. We established a datum corner using a Brunton compass mounted on a photographic tripod; the 500 m boundaries were then chained using 100 m ropes. This system was not only cumbersome and time-consuming; it was also misleading. We lost much of our alleged accuracy when transferring distances from the aerial photographs to uneven ground. The Reese River Valley is an extremely vertical place, some of the 500 m grids containing 900 m of elevation. When conducting such surveys, after all, were we talking about 500 m measured along the actual ground surface, or 500 m as measured on an aerial photograph?

There were also minor problems with our grid system. We created a unique 500 m network, using a centrally located butte as the
horizontal datum; we now employ the standard UTMG (Universal Transverse Mercator Grid). Not only does this system create ready-made grids, but the sampling units are already defined on any U.S.G.S. quad sheet, making the sample more repeatable.

In short, the Reese River survey was hampered by the common problem of not knowing which bridges to cross and which to burn.

I would change a few nonpragmatic aspects of the Reese River survey as well, given the opportunity. We should have defined four sampling strata instead of the original three; as it was, we poststratified in order to give the riverine stratum proper emphasis (Thomas, 1973: 169). We also should have employed disproportionate sampling fractions between strata. As Cowgill (1975) has aptly noted, there is something almost seductive about a 10 percent sample, the fraction we applied throughout.

A better strategy would have been to conduct a small pilot project, then reevaluate on that basis (as suggested by Redman, 1973). Our preoccupation with the magical 10 percent sample ultimately required that we invest an additional year of fieldwork at Reese River (1971).

THE REESE RIVER PIñON ECOTONE SURVEY OF 1971

Because the uniform sampling fraction dictated that we spend equal time in all lifezones, our sample of the intensively occupied piñon-juniper woodland was insufficient.

In addition, after completing the 1969 and 1970 seasons, our objectives changed radically. We now wanted to examine topographic and geomorphological factors which would predict precise locations of residential sites, and we focused on the piñon-juniper zone. After defining a set of seven polythetic criteria, we predicted several dozen loci of potential habitation (Williams et al., 1973;
Fig. 3. The piñon ecotone sampling scheme for the Reese River Valley (modified from Thomas and Bettinger, 1976: fig. 1).

Thomas and Bettinger, 1976). Once these potential areas were plotted on aerial photographs, each locus was field checked. The ultimate objective was to see how accurately site locations could be predicted from strictly environmental criteria.

These questions differed from those posed previously at Reese River, and the design of the fieldwork changed correspondingly in the 1971 survey. Archaeological sites per se became the primary unit of observation, and there was no need to employ an artificial sampling quadrat.

The 1971 design was unstratified because the survey was restricted to a single biotic community. The sampling universe became the entire piñon-juniper zone of the 1969–70 Toiyabe Mountain study area (Thomas and Bettinger, 1976: figs. 2 and 3).

The shift in emphasis obviously conditioned the new research design, redefining even the basic unit of observation. The Reese
River fieldwork had begun with the attempt to define overall settlement and subsistence variability; for that a nonsite stratified random quadrat design was appropriate. The 1971 fieldwork was more focused—defining the positioning of a single site type—so we used an unstratified nonrandom transect site survey.

But perhaps the greatest change in the 1971 field season was the introduction of extra-cultural controls. By defining and examining potential loci, we were able to document where archaeological sites do not exist. The locus-controlled survey of 1971 determined that archaeological site patterning in this part of the Reese River Valley closely followed the distribution of natural topographic features: 97 percent of the sites occurred on predicted loci, and 95 percent of the potential loci actually contained sites.

We could also generalize about the environmental parameters per se. We found a surprisingly high degree of patterning relative to specific resource structure, and such site positioning strategies could be summarized in two rather elementary probabilistic models, one describing linear asymmetrical structure and the other projecting linear symmetrical structure (Thomas and Bettinger, 1976: 359–363). The degree to which the archaeological record of Monitor Valley conformed to these stochastic models became a major focus for the Monitor Valley research (see chap. 17).

We should note, in passing, that similar patterning might also be expected for the linear settlements along the banks of the Reese River area; one could generate these data by conducting a continuous survey parallel to the river. This fieldwork would be relatively easy to conduct and would provide an interesting counterpoint to the linear stream patterning noted by Flannery (1976: 173–180) along the Atoyac River in Oaxaca, Mexico.

OBJECTIVES OF THE MONITOR VALLEY SURVEY

General objectives of the Monitor Valley project have been discussed in Part 1 of this series. We emphasize here those aspects that amplify earlier work in the Reese River Valley.

I was concerned with the extent to which one could empirically generalize such site distributional patterning. How well, for instance, do empirical site predictors apply to other areas of the Great Basin? Do the Reese River parameters predict site positioning in Monitor Valley, about 30 km to the east? Do sites along the piñon ecotone of Monitor Valley average 450 m from nearest water source? Are such distributions structured in symmetrical and parallel fashion? Do Monitor Valley sites occupy, on the average, an 8 percent slope? What is the role of the normal distribution in Monitor Valley site positioning?

But there are also some more theoretical reasons to explore intraregional patterning, and these concerns go to the heart of the role of sampling theory in archaeology. Archaeological inference must be continually refined against the empirical record, and determining the outcome of such testing usually requires a statistical mode of inquiry. Statistical inference has, in fact, become a way of life in contemporary archaeology. But recourse to statistical theory is hardly an unmixed blessing (Thomas, 1978).

Modern inferential statistics evolved largely in response to large-scale agricultural experimentation conducted during the early 1900s. Such experiments were designed to answer pragmatic questions regarding levels and rates of fertilization, productivity of hybrid grains, and so forth (Thomas, 1976: 441–447). In most of these research designs, seeding experiments were repeated year after year, exploring a variety of soil and climatic conditions.

But a statistical difficulty arose early in the game. How can a single agricultural experiment satisfy the random sampling assumption of inferential statistics?

The answer to this disarmingly simple question established what became a cornerstone of inferential statistical theory: Any experiment can be regarded as an “individual” selected from a “population” of all experiments which might be performed under the same conditions (Student, 1908: 1). Student’s population was hypothetical; it was the population of all possible experiments that could have taken place. The outcome of a given experiment was taken to represent a random sample generated from the total population.
of all hypothetically possible experiments of exactly the same kind.

In the so-called hard sciences, this hypothetical population is commonly considered to be infinite because experimental iterations could (at least in theory) continue indefinitely. But for disciplines with a historical dimension, experimentation is restricted to a large, yet finite, universe of possibilities. A finite number of Reveille phase archaeological sites exist today; there will never be more. Although new finds will undoubtedly be made, our study universe is forever restricted to material now embodied in the archaeological record. Rather than expanding infinitely, that universe will progressively diminish through time.

Student (1908) employed a key phrase: "under similar conditions." Ceteris paribus reasoning, which underlies modern statistical inference, establishes that the hypothetical universe consists of all experiments which could have taken place under similar conditions. Physical scientists have relatively little trouble specifying these standard conditions (e.g., STP means a standard temperature of 0°C and a standard pressure of 760 mm of mercury). But what constitutes the "similar conditions" for archaeology?

Consider the Reese River project in this light. The specific study area was selected for a number of motives, none of which were statistical or random (Thomas, 1969b, 1971a). We chose a study area of about 25 × 30 km in a valley over 160 km long. A 500 m grid system was imposed over this restricted test area, and a stratified random sample of 1400 quadrats was generated. We were very careful to collect a 10 percent random sample from within the study area, and I felt sanguine about generalizing the results for the entire 25 × 30 km area.

But the ultimate objective of this fieldwork, and presumably all fieldwork, is to generate statements of anthropological rather than statistical relevance. One must wonder: How far can the Reese River pattern be generalized beyond the 1400 square tracts in the initial population? After all, three years is no small investment in such labor-intensive fieldwork, and mere description of 800 km² hardly seems worth the effort.

Could one legitimately extend the observed settlement pattern to the 160 km length of the Reese River Valley? What about generalizing to the entire central Nevada region? Or perhaps across the entire Great Basin? Did we find the settlement pattern for western North America? Even better, did the three years' fieldwork lay bare timeless, spaceless settlement patterning of all hunter-gatherers?

What is the population against which to project these sample results?

From a purely statistical perspective, the only valid generalization is the first one: A 10 percent random sample suggests that patterns X, Y, and Z probably hold for 100 percent of the population. These inferences emanate from a specified sample and extend only to the population from which that sample was randomly selected.

So far, we are on firm statistical ground. As suggested long ago by Student, all statements beyond this rock-bottom level deal with a hypothetical population. That is, I am entitled to extend my findings as far as I wish, provided Student's caveat "under similar conditions" can be defined.

Suppose one views the Reese River sample as derived from a very large but finite, hypothetical population of similar samples existing under similar conditions. The boundaries of this hypothetical population are to be defined on nonstatistical grounds and defended as such. Suppose further that one made the following case: Critical resource structure in the Reese River study area seems reasonably constant throughout the 160 km length of the Reese River Valley; therefore, the aboriginal settlement pattern is identical throughout the valley.

In so doing, one is (with some justification) asserting that all the prehistoric occupants of the Reese River Valley, at a given time, existed under similar conditions.

The skeptic might challenge the assertion of similar conditions, perhaps pointing out that the Reese River actually flows underground for some distance, and the absence of a central bisecting water source must have influenced the settlement pattern. Or somebody might observe that local drainage patterns create a large playa in the middle of the valley; fish and waterfowl associated with this playa could readily have influenced the cultural geography. Another critic might assert
that the contemporary distribution of piñon is curtailed north of Austin; similar discontinuities in the prehistoric piñon woodland could have influenced settlement patterns.

The archaeological literature thrives on just such debate, arguing about assertions of "similar conditions" or the lack of such conditions.
The important point is to recognize the distinctive levels of inference operating in archaeological survey such as this. As long as the inferences at Reese River deal with a randomly generated sample from an explicitly defined population, the results are firmly grounded in probability theory, and reliable methods exist to assess degrees of error.

But once one shifts frame of reference—from concrete populations to hypothetical ones—the arguments lose steam because of difficulties in defining "similar conditions." The facts of archaeological substance and demography are relevant only to hypothetical populations.

The Monitor Valley survey discussed here is a specific instance of hypothetical populations in action. In late 1970, we wanted another area belonging to the hypothetical universe containing the Reese River Valley: comparable vegetation, geomorphology, hydrology, and so forth. While we were not trying to find a carbon copy of Reese River, we did attempt to locate another segment of the archaeological record which could be said to exist under operationally similar conditions to those in the Reese River Valley.

In effect, we were willing to stipulate, in a statistical sense, that Monitor Valley was another "experiment" in the hypothetical universe initially defined by the Reese River sample. By Student's criteria, Monitor Valley could be viewed as a random sample generated from the total population of all hypothetically possible samples.

But why Monitor Valley? Although the ecology of the two valleys is comparable, there was one major and obvious difference: Reese River Valley has few, if any, caves and Monitor Valley has several. Heizer and Beardsley discovered and tested Toquima Cave in 1939. Northumberland Cave has been an attraction to local spelunkers for decades. We found Gatecliff Shelter, Butler Ranch Cave, and Little Empire Shelter in our first preliminary survey of Monitor Valley. That is, in just a cursory search, we located a number of caves and rock-shelters which clearly had potential for buried stratified deposits. Such stratified cultural deposits were conspicuously lacking in the Reese River Valley.

These were the prior conditions that initially drew us to Monitor Valley. Over the course of the next decade, several unexpected facets appeared in the archaeological record. But initial inquiry was guided by the presence of caves and concern over hypothetical universes. Here is how we conducted that research.

THE SIX NONSITE SURVEY DOMAINS

This chapter argues for diversity in archaeological sampling procedures. Archaeologists tend to become fossilized in their sampling, and many still insist on buying research designs off the rack.

Our own Monitor Valley survey involved both probabilistic and discretionary survey, and each of these strategies required several tactics. The probabilistic portion defined six procedural domains: randomized quadrat survey, probabilistic montane spring survey, circular surveys around rock art sites, transect survey of the Monitor Lakebed, spring catchment survey of the valley floor, and linear survey of montane streamside catchments. Each domain addressed a unique resource base, each requiring in turn its own approach to sampling.

RANDOM QUADRAT SURVEY

The initial sampling domain in Monitor Valley was a pilot project involving 500 m quadrats. Begun in 1973, the randomized quadrat survey had the very specific purpose of providing an unbiased initial sample of the woodland and upland archaeological resources. We had already excavated Toquima Cave by this time, our work at Gatecliff Shelter was in its third season; the locations of these two stratified sites determined placement of the sampling universe for the quadrat survey.

Gatecliff Shelter was taken as the southern boundary of the study area, and we arbitrarily extended the survey boundary 25 km to the north, to a point about 5 km north of Toquima Cave (Fig. 6). The universe of the quadrat sample thus consisted of an area 25 km north-south by up to 21 km east-west, a total area of approximately 525 km².

Because this survey was designed to provide extensive coverage of the Toquima Range (to derive data comparable to that from
Reese River), a relatively small sampling fraction was initially selected. We began with a pilot survey of 20 500 m square quadrats. This initial effort involved an aggregate area of 5 km², and the sampling fraction is slightly less than 1 percent (0.0095).

This relatively low sampling fraction dictated, to some degree, the way in which the sampling quadrats were to be allocated. The biotic communities of the Toquima Range are not as starkly defined as those in Toiyabe Range (see Thomas, 1983a: 141–145) and it seemed unwise to employ a biotic community stratification.

Instead, we divided the total survey area into a series of 10 blocks, each 5 km north–south and approximately 10 km east–west. These blocks were labeled sequentially from A through J. Two quadrats were randomly selected within each block, and the quadrats were assigned designations such as A2, E1, and J2 (fig. 7).

Field survey procedures were identical to those derived for Reese River. The survey team walked a series of linear parallel transects, with individual surveyors spaced at 10 m intervals. All prehistoric material, including debitage, was collected, and the artifacts were piece plotted. Presence of historic debris was noted, and standardized site forms were filled out for each “site” and locus (defined below). Data from the randomized quadrat survey are presented in chapter 2.

**Probabilistic Montane Spring Catchment Survey**

We emphasized above how the impetus to look at the archaeological record in Monitor Valley arose from questions derived at Reese River. Of primary concern at the time was the extent to which the structure of resources—particularly water—conditions archaeological site patterning.

Surface water in the Reese River Valley is distributed in small, often ephemeral streams, and we treated it as an analytically linear resource. Although a few similar creeks occur in the Toquima Mountains, most of the surface water in Monitor Valley is distributed as springs which rarely flow more than a few dozen meters in linear distance. In other words, water in Monitor Valley tends to occur as point sources, rather than in linear fashion (as at Reese River); the hydrological structure of both valleys is discussed in considerably more detail elsewhere (Thomas, 1983a; see also chap. 17–19, this volume).

The differing hydrological structure required a shift in both the statistical settlement model and the survey strategy. The appropriate spatial model for residential (and most logistic) usage of such point resources looks like a slightly flattened probabilistic doughnut (see Thomas, 1983a: fig. 9). In human terms, this circular model reflects optimal spacing behavior similar to that in the linear models (as discussed in detail in chap. 18).

Hydrological structure was viewed as a key factor in survey design, and we therefore created a second sampling domain, the montane spring catchment survey. Earlier research at Reese River suggested that a 1 km catchment should provide an adequate sample of each permanent water source, and applying similar methods to Monitor Valley, we defined catchment regions around each spring, using a radius of 1 km.

Thirty springs occur in the 21 × 25 km Toquima survey universe, defined above (fig. 7). These springs were numbered sequentially (from 1 through 30), and a simple 50 percent random sample of 15 springs was selected. The circular spring catchments were examined with the same survey procedures as the quadrats.

It turned out that a few of the 1 km spring catchments, particularly those in Ikes Canyon, overlap one another. Such overlap will occur whenever two springs are located within 2 km of one another. Overlapping survey areas create problems: One can either exclude neighboring springs, or go ahead and draw the random sample irrespective of proximity. We followed the latter strategy in designing this sample in 1973, permitting the survey areas to overlap. Statistically speaking, this is an example of sampling with replacement (after Kish, 1965: 37–43).

In reviewing this design, I now think we were overly concerned with the nuances of statistical technique, and this led to a somewhat impractical survey procedure. If we were to redesign the Monitor Valley research, I would probably throw out the overlapping
spring catchment areas, in order to provide better overall coverage. At any rate, sampling with replacement was employed, and the results from the spring catchment surveys are presented in chapter 2.
ROCK ART SITE CATCHMENT SURVEY

Several petroglyph and pictograph sites were encountered in the Monitor Valley fieldwork and, as explained in chapter 6, we wanted to place these rock art localities into the overall mosaic of prehistoric cultural geography. To do so, we defined a series of circular catchment areas to be examined by the same survey procedures as the quadrats (survey crews recording all sites, artifacts, and debitage located within each 1 km catchment). Such surveys were conducted at the following rock art sites: Hickison Summit, Toquima Cave, Gatecliff Shelter, West Northumberland Canyon, Butler Ranch Cave, East Bald Mountain Wash, and Jeans Spring Shelter.

LINEAR MONTANE STREAMSIDE SURVEY

Although water tends to be a point (rather than linear) resource in Monitor Valley, the Toquima study area has three relatively permanent sources of flowing water: Stoneberger Canyon, Ikes Canyon, and Mill Canyon. These are the only three areas which offer potential for the piñon ecotone settlement pattern discovered at Reese River. With this in mind, we conducted a 100 percent sample of these three streamside locations. Crews completely scoured a 1 km strip on both sides of each stream, and the locations of these streamside survey areas are plotted in figure 7.

MONITOR LAKEBED TRANSECT SURVEY

The large playa in Monitor Valley provided another potential focus for prehistoric human occupation (as discussed in Thomas, 1983a: chap. 11), and it was necessary to design a strategy by which to examine the archaeological record of the lacustrine zone.

We initially surveyed two randomly selected 100 m transects, from the Toquima Range to the present Monitor Valley road (NV82). The overall potential on these alluvial slopes was considered to be rather low, and the postdepositional situation was further complicated by the extensive sheetwash and colluvium known to have accumulated in this area during the Holocene (Melhorn and Trexler, 1983a). For whatever reason, virtually no archaeological remains were encountered in these early transects.

Transect sampling was then continued on the eastern side of NV82, the survey running to the Monitor Lakebed itself. A considerable amount of archaeological debris was recovered along the western shore of Monitor Lake, so six 100-m-wide transects, based at 1 km intervals, were surveyed (fig. 24). This survey located an extremely large archaeological site which paralleled the 2073 m (6800 ft) contour interval. About 10 percent of this site was mapped and completely collected; these results are presented in chapter 2.

VALLEY FLOOR SPRING CATCHMENT SURVEY

We suspected that the relatively low anticipated potential of the lowlands and the paucity of archaeological remains encountered in the pilot quadrat survey would not justify the costs and time involved in conducting a randomized survey of the alluvial flats in Monitor Valley. Our crews were to be utilized in more efficient ways. That decision has been supported by an intensive examination of the more recently available CRM data from the bottomlands of Monitor Valley (chap. 7).

We elected instead to extend the montane spring survey strategy to the three natural springs on the floor of Monitor Valley: Dia nas Punch Bowl, Potts Ranch Spring, and White Sage Spring (figs. 6 and 21–23). Each 1 km spring catchment was intensively surveyed using the same technique as described for the quadrat survey. In a sense, we utilized a disproportionate, 100 percent sampling fraction of the lowland spring areas.

DEFINING THE LOCUS

In Part 1 of this series we discussed expected behavioral characteristics and strategies based on various protohistoric Shoshonean patterns throughout the area. One goal of the Monitor Valley project was to examine this variability in the prehistoric record.

A key factor was the redundancy in site positioning strategies. There was, for instance, a relatively high degree of year-to-year redundant behavior along the Reese River piñon ecotone, ultimately creating a
series of coarse-grained archaeological sites. Although we have much to learn about the behavioral activities which laid down such archaeological records, we know enough about the ecological characteristics of these areas to predict site locations rather accurately.

These sites served, at least in part, as residential bases (in the sense of Binford, 1980). Because of behavioral redundancy and the correspondingly greater buildup of material remains, these residential bases are archaeologically quite visible. Few archaeologists encountering these concentrations of assemblages and features would hesitate to employ the term “archaeological site.” Other logistic accumulations had less archaeological visibility.

But the contemporary Monitor Valley environment engendered considerably less behavioral redundancy than did Reese River (Thomas, 1983a, chap. 17), and archaeological debris throughout Monitor Valley is generally more dispersed and less centralized.

The visibility problem is this: Precisely the same behavioral situation which would have produced mostly discrete archaeological sites in the Reese River Valley would have created mostly dispersed surface scatters in Monitor Valley—simply because of differences in local topography and plant cover.

Such considerations of relevant behavioral factors obviously influenced the direction of our archaeological fieldwork. We began the Monitor Valley survey by attempting to use the 1971 Reese River site definitions but were quickly forced to adopt more flexible field strategies. We ultimately refrained from defining sites at all in the Monitor Valley survey, placing emphasis instead on recognition of areas of potential human residential activity (loci)—a locus may or may not have associated archaeological debris (after Thomas and Bettinger, 1976). Actual definition of “site” was postponed until the laboratory phase.

The pragmatic difficulty was how to identify a locus in the field. Recognizing a locus depends upon one’s expertise as a field archaeologist, and, as every field archaeologist knows, there are no rigid rules for good fieldwork.

But this realization is balanced against the need to work within an operational framework. Other things being equal, the locus you define should be comparable to the loci that I define. Complicating matters still further, we were forced to define loci in two ways in the Monitor Valley survey (see chap. 17 for a more detailed discussion of how the locus concept was employed in this survey).

For the woodland portion of the Monitor Valley survey, we used the previous polythetic definition of potential habitation areas derived at Reese River (and elaborated in Williams et al., 1973). Areas of potential residence, loci, were defined when a place satisfied at least five of the following seven criteria (after Thomas and Bettinger, 1976: 272):

\[ f_1 \text{ The locus should be on a ridge or saddle.} \]
\[ f_2 \text{ The ground should be relatively flat: i.e., } \leq 5 \text{ percent.} \]
\[ f_3 \text{ The locus should be in the low foothills: i.e., } \leq 250 \text{ m above the valley floor.} \]
\[ f_4 \text{ The locus should be within the modern piñon-juniper biotic community.} \]
\[ f_5 \text{ The locus should be near the extant piñon-juniper ecotone: i.e., } \leq 800 \text{ m.} \]
\[ f_6 \text{ The locus should be near a semipermanent water source: i.e., } \leq 1000 \text{ m.} \]
\[ f_7 \text{ The locus should be some minimal distance from this source: i.e., } \leq 100 \text{ m.} \]

Defining potential loci on the upland slope required modification of the former criteria (Thomas and Bettinger, 1976: 272). Because the upland slope is (by definition) not situated in the low foothills, potential places to live cannot satisfy the operational definition of “low foothills” (i.e., within 250 m above the valley floor). Similarly, the upland slope is not “near” the extant piñon-juniper ecotone, so any criterion requiring a locus to be within 800 m of that ecotone will not apply. But we continued to think that the locus concept was useful for comparing potential with realized exploitative strategies. So to retain the concept, we redefined the polythetic definition by discounting the two inoperative variables.

Upland loci must satisfy three of the following five conditions:

\[ f_1 \text{ The locus should be on a ridge or saddle.} \]
\[ f_2 \text{ The ground should be relatively flat: i.e., } \leq 5 \text{ percent.} \]
The locus should be within the modern piñon-juniper biotic community.

The locus should be near a semipermanent water source: i.e., ≤1000 m.

The locus should be some minimal distance from this source: i.e., ≤100 m.

The recorded upland loci are discussed in chapter 2.

Practical field definitions also require an areal component: the minimum area of a locus is considered to be about 50 m². This stipulation was necessary in order to avoid recording the thousands of 1 m² flat spots on otherwise steep areas. Keep in mind that a locus is defined in terms of minimum extent; some loci, such as those at Spring 9 (fig. 11) and Spring 26 (fig. 19), extended for several hundred meters in each direction.

A survey form was filled out to record the characteristics of each locus and any associated archaeological debris. These data are presented in chapters 2 and 17. Each locus was also plotted on a spring survey map, reproduced as figures 8–20.

The locus became the minimum spatial unit of observation throughout the montane spring catchment survey. While many loci were littered with prehistoric and historic artifacts, others lacked archaeological materials entirely. By defining and recording these potential areas on purely environmental and topographic criteria, we could plot the distribution of naturally occurring loci, as compared with the culturally conditioned subsample of archaeological sites selected from that population.

Although this procedure is rather cumbersome and time-consuming in the field, we think the potential of locus-control survey makes it worthwhile (see chap. 18). As argued previously, the contemporary objectives of archaeology require that at times we introduce different archaeological concepts. We will also find it necessary to discard—or drastically modify—some of our most cherished ones.

REDEFINING THE ARCHAEOLOGICAL “SITE”

Little archaeology was done in the central Great Basin before 1965 because archaeologists had not yet come to grips with the predominantly nonsite character of such regions. Spectacularly visible dry caves and lakeside Early Holocene occupations are rare, and the multiroom pueblo is absent. In part because of this, some of archaeology’s most desirable artifacts—basketry, fluted points, and painted pottery—are almost absent in this area. By the standards of the 1950s, the central Great Basin had little archaeological potential (see Thomas, 1982b), particularly because archaeologists were trapped in a prevalent and pervasive site-specific mindset. We now know that the central Great Basin is extremely rich in archaeological remains. But these assemblages do not necessarily occur in buried contexts, and they are not necessarily concentrated in convenient “sites.”

Across this nation, surface archaeology has become a respectable venture, and archaeologists have developed a powerful body of techniques to cope with this record (see e.g., Lewarch and O’Brien, 1981). Correspondingly, the concept of nonsite archaeology is now widely used (Thomas, 1975; see also Goodyear, 1975; Doelle, 1977; Binford, 1980:9; Foley, 1981b; Dunnell and Dancey, 1983).

Precisely the same assemblages can be considered from a site-specific context, a nonsite context, or (preferably) from both perspectives. Only the research framework differs. Gatecliff Shelter—an archaeological “site” in the conventional sense—illustrates this point. Following established procedure, we nominated Gatecliff Shelter to the National Register of Historic Places, assigning the Nevada State Museum trinomial 26Ny301; Gatecliff is clearly a “site” in cultural resource management terms. When it came time for the final analysis of materials recovered from Gatecliff, we approached the National Science Foundation for funds to write up our “site.” During the 1970s, when my colleagues asked me where I was working, it was convenient for me to tell them that I had a “neat site,” which I called Gatecliff Shelter.

And yet, for many purposes, Gatecliff Shelter is not a “site” at all. More realistically, Gatecliff is a composite of 16 relatively independent “sites” which happen to be stacked one on top of another inside a chert and dolomite overhang in Mill Canyon, Ne-
vada. Had each horizon been deposited as a surface scatter, several—but not all—would undoubtedly have qualified as "sites" by the traditional definition.

So what is Gatecliff Shelter: one site, 10 sites, or 16 sites?

Good definitions depend on how they are to be used. As argued elsewhere (Thomas, 1975), archaeological sites need not always be viewed as Easter eggs, scattered about the landscape awaiting discovery. For administrative purposes, Gatecliff can be viewed as a single site. In terms of cultural chronology, it is convenient to think of Gatecliff as one site within which 5500 years of human prehistory is recorded. But in terms of spatial analysis, it is much more useful to isolate horizontal segments of Gatecliff Shelter as analytical units. It is irrelevant whether or not these subsegments are themselves "sites."

From the outset, it was clear that we should leave the actual definition of archaeological sites for a later time. We found it quite feasible, in the Monitor Valley surveys, to conduct our fieldwork totally unencumbered by archaeological sites. We considered "sites" to be little more than a necessary analytical evil; we only needed "sites" when the time came to assign numbers for the Nevada State recording system.

We used a similar approach in the earlier fieldwork at Reese River, simply taking the site concept as an analytical given. "We... rely upon our experience to tell us when we encountered a site in the field. We recorded an archaeological site whenever we thought one occurred" (Thomas and Bettinger, 1976: 271).

This is a perfectly justifiable approach to nonsite archaeology. But at the same time, our concern with operational criteria compelled us to provide a "simple field definition of site": "any discrete locality (e.g., a segment of a ridge, a clearing, a saddle, etc.) containing more than one category of artifacts or features (e.g., points, ceramics, house rings), or more than one representative of any category of features or artifacts, this category requiring at least 10 examples to qualify as a site" (Thomas and Bettinger, 1976: 271).

This relatively concrete definition notwithstanding, we noted that it would be "quite useless" for many of the sites in the Reese River Valley, where linear lithic scatters accumulated over kilometers. At the time, we felt obliged to add, "Despite its utility, we continue to be uneasy about this definition and would like to stress that it is a tentative measure" (Thomas and Bettinger, 1976: 271).

Nearly 15 years later, I remain uneasy about this specific definition, and about the site definition problem in general. This issue comes up frequently, and has been discussed in some detail by Plog et al. (1978: 385–389). The Southwestern Archaeological Research Group, for instance, employed a rigid density criterion: a site is any concentration of cultural materials, artifacts, or facilities with an artifact density of at least five artifacts per square meter (Plog and Hill, 1971: 8). This is a relatively poor definition for the American Southwest, as Plog et al. (1978) agree. If applied to the Great Basin, such a definition would effectively exclude two-thirds of the archaeological record discussed in this volume.

Because the archaeological site remained undefined in the field during the Monitor Valley survey, we filled out forms for everything. Our sites were defined in the laboratory (sometimes five years after the fieldwork had been completed). Although this procedure followed no rigid definition, I generally agree with the site definition provided by Plog et al. (1978: 389): "A site is a discrete and potentially interpretable locus of cultural materials. By discrete, we mean spatially bounded with those boundaries marked by at least relative changes in artifact densities. By interpretable we mean that materials of sufficiently great quality and quantity are present for at least attempting and usually sustaining inferences about the behavior occurring at the locus. By cultural materials we mean artifacts, ecofacts, and features." This definition describes rather well the way in which the Monitor Valley sites were defined in post hoc fashion.

In the next five chapters, archaeological assemblages are often grouped by sites. Please keep in mind that this is primarily a bookkeeping convenience, since much of the analysis proceeds in nonsite terms. But we must caution the reader that the term "locus" is...
used more specifically in the rest of this chapter.

NONPROBABILISTIC SITE SURVEY IN MONITOR VALLEY

Despite our interest in the nonsite aspect of the archaeological record, we could hardly ignore the conventional archaeological sites, even in primary fieldwork. By "conventional," I mean the caves and rock-shelters, rock art localities, spring midden accumulations, rock alignments, house rings, and large lithic scatters that form the empirical basis of today's archaeology in the Desert West.

The Reese River survey relied upon a number of chronological and paleoenvironmental assumptions, which were badly in need of empirical examination. That survey also generated specific settlement pattern expectations for archaeologically unknown areas such as Monitor Valley. Both research modes required new, undiscovered sites of a more "conventional" nature.

Another specific spin-off of the Reese River research was a concern with the extent to which surface sites can be relied upon as a reflection of the prehistoric past. David Madsen (1981) objected to the Reese River research design, suggesting that our reliance on surface archaeology somehow spawned a confusion between correlation and causality. Although we disagree with most of these assertions (Thomas, 1981c; see also Bettinger, 1981), Madsen did raise one excellent point: Inferences derived strictly from surface archaeology—involving what Madsen terms "locational data"—must be tested against and supported by data derived from sealed, stratigraphic contexts. Madsen was absolutely correct in stressing the importance of coordinating in a single project the data derived from both surface and subsurface archaeology.

By 1970, it was clear that our Reese River Valley research required integration with controlled stratigraphic excavations. But where to find the suitable archaeological sites? We looked literally high and low for buried sites in Reese River Valley. Although some such sites undoubtedly exist there, we could not find them (perhaps because of an almost slavish adherence at the time to our newly developed probability-based techniques). The search for stratified sites ultimately brought us to Monitor Valley.

Specifically, we were looking for a series of archaeological sites that would produce a sufficiently large assemblage of datable time markers and ecofacts. Although extremely useful in this regard, Gatecliff is but a single site; several additional independent contexts were also needed.

Although nowhere did we find stratigraphic deposits as fine-grained as those at Gatecliff, through the Monitor Valley nonprobabilistic survey we did succeed in locating a series of additional caves and shelters which provided an index of archaeological, paleontological, geomorphological, and paleobotanical variability. The nonprobabilistic survey also located a wide range of satellite sites (Thomas and McKee, 1974): game drives, rock art, caches, and isolated habitation structures.

Whereas in some areas stratified and satellite sites may involve large-scale areal patterning, in most cases, such sites are rare elements; many are unique. This is why, in this case, probability sampling is a poor search technique (Flannery, 1976: 132–135; Thomas, 1979: chap. 9).

Fortunately, archaeologists learned long ago how to find rare elements and, at this point, we quickly reverted to tradition: employing every scrap of information available to us, talking to the people who knew the area best, and going out to have a look for ourselves.

This is one side benefit of conducting long-term research projects. The year-after-year commitment to a research area creates a certain visibility, and as local residents grow familiar with the project, many of them become interested in helping out. It behooves the archaeologist to be as open as possible with the public—seeking out those locals interested in the regional archaeology. Not only does this openness allay distrust bred by secrecy, but such an approach can create a task force of local allies. Many of these people have prowled the hills for years, and once their confidence is won, they can be invaluable sources of information about the traditional archaeological site.
All told, we spent a dozen summers working in the central Great Basin, and it was our pleasure to get to know some local residents rather well. At first, there was the inevitable suspicion about outsiders exploiting the sites. But as people became more familiar with our work—and we made a concerted effort to be as public as possible—several came forward to help out.

I elaborate on this common-sense approach only because common sense is becoming less common in our profession. Only one cave site (Toquima Cave) and three rock art sites (Hickison Summit, Ny1, and Ny22) had been recorded when we first came to Monitor Valley. Although we quite naturally followed up on these sites, we wanted to find more such sites.

A local miner, Mr. Gale Peer, told us about Gatecliff Shelter that same year (Thomas, 1983b: chap. 1). We heard about Butler Ranch Cave and Little Empire Shelter from Myrtle Myles, a long-time resident of the tiny town of Belmont. Bill Britton, then U.S. Forest Service Ranger in Austin, told us about Triple T Shelter and the rock art sites in Kingston Canyon. C. Glade Quilter, then District Ranger in Tonopah, told us about the Table Mountain rock alignment and provided information that ultimately led to the discovery of the Alta Toquima complex of high-altitude sites. Information about several rock alignments (discussed in chap. 5) came from Edwin McKee, U.S. Geological Survey geologist working in the area. We found out about Hunts Canyon Shelter, the Monitor Hills drive site, and the Barley Creek rock art site from Bill and Kemma Lowe, first-rate amateur archaeologists from Tonopah. Nick Bradshaw, another dedicated Tonopah amateur, showed us Bradshaw Shelter.

The details can go on indefinitely, but the message should be clear: there was no need to employ probability theory at this stage of the Monitor Valley survey. Instead, we relied upon what my colleague Jim O'Connell calls "gumshoe survey technique"—asking local people the right questions and listening for the right answer. Although many false leads arise, there is always that one gem in a dozen which makes the search worthwhile. American archaeologists have worked this way for a hundred years.

I emphasize our use of traditional discovery techniques in the Monitor Valley survey because strangely they seem to have fallen into disrepute over the last decade or so. I am not quite sure why this is so. Part of the reason is undoubtedly that the probabilistic survey has become fashionable, even trendy. Particularly aggravating is the inclination for some "Cultural Resource Managers" to climb aboard the bandwagon, insisting on probabilistic sampling (too often a 10% sample), even when such a scheme is wildly unsuited to the task at hand. Sometimes this short-sightedness is merely amusing; in other cases, such ill-conceived research designs have wasted millions of dollars that could have been profitably spent on any number of useful archaeological projects.

This is not to put down probabilistic sampling, for there are many cases in which probability sampling can—and should—be employed. But slavish adherence to any single research strategy is bound to introduce both myopia and bias.

The next five chapters present data derived from both site specific and nonsite research in Monitor Valley. Once presented, these data are synthesized into a single Monitor Valley database; in order to determine the degree of bias in our sample, we compare these results with the more recent CRM samples that have been generated in Monitor Valley.

The remaining chapters develop several methods sufficiently robust to examine the primary objectives of this project, as advanced in the first volume of this series.

NOTES

1. In fact, until the last few years, our entire perception of the archaeological record was based on rare elements because of systematic (if unintentional) discrimination against the nonsite and small site component.
CHAPTER 2. THE MONITOR VALLEY NONSITE SURVEY

The preceding chapter explained the overarching research design behind the Monitor Valley survey. A ponderous quantity of field data was generated, and we begin here describing our field and laboratory observations. This is the first of five such descriptive chapters; more general analyses and interpretations are postponed until later in the volume, where we develop a single interpretive framework for the lowland and woodland zones of Monitor Valley. The summit crest is considered in the next volume of this series.

THE MONTANE SPRING CATCHMENT SURVEY

Figure 7 plots the location of the 15 randomly selected spring catchments that we surveyed throughout the Toquima Range. The sites and loci are plotted on individual spring catchment maps (figs. 8–20). Assemblage frequencies for each site and locus are listed on tables 1 and 2 (later in this chapter; primary locational attributes are also provided at the end of chapter 17). The E designations (in parentheses after each site number) reflect our field nomenclature, provided to allow interested investigators to correlate the present discussion with the original fieldnotes. The following narrative presents additional spring-by-spring information.

PETES SPRING (SPRING 2)

Petes Spring is situated at an elevation of 2121 m (6960 ft) on the northwestern side of Petes Canyon, overlooking the major access route between upper Big Smoky Valley and Monitor Valley. Toquima Cave (discussed in chap. 4) is approximately 3.2 km south of the spring, on the northern side of the canyon. Well-watered springs such as this are rarely found along routes of easy access, and this combination no doubt conditioned the prehistoric cultural geography of the Petes Spring catchment (fig. 8).

La630 (E-1). This site, situated on a small ridge to the southwest of Petes Spring, consists of a small artifact and chippage scatter approximately 100 m in diameter. Access to the spring is relatively easy, and a rock outcrop on the downslope side could have effectively concealed hunters in ambush. The artifact assemblage contains only production stage bifaces.

Tin cans and bottle glass are scattered about, probably associated with the historic period cabin roughly 300 m to the west. La632 (E-3). This site occurs uphill from La630 and consists of a small but dense concentration of lithic debris scattered over an area approximately 15 m in diameter; two broken bifaces were found in the chippage scatter.

La633 (E-4). This small site (approximately 25 m in diameter) is on a low ridge behind a small rock outcrop. The area has been recently bulldozed by miners, and a claim was staked in 1968.

La634 (E-5). A dense artifact concentration occurred on the southern slope of the ridge, covering an area approximately 25 × 10 m.

La635 (E-6). A sparse artifact and debitage scatter was found on a very flat portion of an east–west trending ridge.

La636 (E-7). A small artifact concentration is scattered along a ridge top approximately 500 m northwest of Petes Spring. One house-size stone circle (Fig. 1), on the western edge of the site, had a chippage concentration at its southern margin. Six limestone incised stones were concentrated on the eastern portion of the site.

La637 (E-8). Directly to the north, on the same ridge as La636, was a chippage concentration approximately 20 m in diameter.

La638 (E-10). This small chippage scatter occurs on the next ridge north of La637.

La641 (E-15). Chippage and artifacts along this ridge were concentrated in small zones across the larger site area which is approximately 20 m in diameter.

La643 (E-18). Approximately 900 m north of Petes Spring is a chippage and artifact scatter, concentrated within an area 10 m in diameter.

La645 (E-20). On this ridge artifacts and lithic debris were scattered across an area 50 m in length and 10 m wide. The most dis-
distinctive artifacts are five sherds of Snake Valley Black-on-gray pottery. This is, to our knowledge, the farthest west that Sevier/Fremont ceramics have been reported.
Fig. 7. The major montane survey area in Monitor Valley. Three systematic survey strategies are evident in this area: the small shaded squares (A1, A2, etc.) denote the randomized quadrats; the numbered circular zones indicate the randomly selected montane spring catchments; the linear zones (Stoneberger, Ikes, and Mill canyons) show the streamside survey areas.

La646 (E-21). This site occurs on a small bench, along the northern side of a fairly extensive ridge. Three dozen incised limestone fragments were found in a distinct concentration.

La647 (E-22). This small site contained
artifacts and chippage concentrated in a 5 m diameter area on a small ridge to the northwest of Petes Spring. Nearby was an extremely fine end/side-scraper, made of a large piece of obsidian. Obsidian, never abundant in Monitor Valley, was generally used for projectile points; scrapers were usually made of chert.

La648 (E-23). On this ridge, a dense concentration of chippage extended over an area
300 m long and 60 m wide, across the entire ridgetop. The diversified assemblage was rather evenly distributed. Some historic debris was also present.

La650 (E-25). This site is approximately 250 m long and 20 m wide. Extensive chippage covers the length of the site, and historic debris lies about here and there.

La651 (E-26). This is another long site, a scatter extending approximately 300 m across a ridgetop.

La652 (E-36). This site is situated across the toe of a ridge and consists of a chippage and artifact scatter approximately 20 m by 50 m.

La657 (E-43). This long, linear scatter of artifacts and chippage occurs on a ridge due south of Petes Spring. It contained a diverse artifact assemblage, including a worked turquoise nugget.

La658 (site not on locus). Immediately adjacent to Petes Spring was a great profusion of both historic and aboriginal debris. The artifact inventory includes unworked turquoise and a very well-made uniface made of amber bottle glass.

La660 (E-47). Here a dense concentration of artifacts and chippage parallels the modern dirt road for a distance of 20 m.

DEER SPRING (SPRING 5)

La662 (E-48). This linear artifact and debitage scatter extends for 500 m parallel to the dry wash running out of Sams Canyon. The artifact inventory contains a wide variety of projectile point forms and one piece of ground stone. Six of the bifaces were found together in a "pothunter pile" beside the road.

La663 (E-49). A very sparse chippage scatter occurs on a low ridge rising from the nearby flats, the debitage extending over an area roughly 200 × 100 m.

La664 (E-51). A 100 × 25 m scatter of artifacts was found along a small saddle surrounded by gently sloping ridges that run to the valley floor. Access to both Deer and Sams creeks is relatively easy from La664, and the area is well protected (especially when compared to nearby locus E-50, which was devoid of aboriginal debris). Several pieces of a distinctive yellow/red chert occurred in this assemblage, associated with hundreds of flakes of the same material.

La665 (E-52). Small quantities of debitage occurred on this site, in an area about 10 m in diameter.

La666 (E-53). This site, situated on the southern side of a ridge, contains virtually no chippage. Feature 1, a small stone ring (inside diameter 90 × 152 cm), is probably a cache feature.

Ny850 (E-57). Just south of Turquoise Spring Wash is a fairly dense chippage and artifact scatter, about 150 × 75 m. Several Shoshone-ware sherds were recovered, as well as a single piece of Snake Valley Corrugated. This site contained one of the largest lithic assemblages in the Monitor Valley survey.

La667 (E-59). Located on a saddle, this site lies immediately below a small knoll. Only isolated pieces of chippage and a light artifact scatter were found within an area approximately 50 × 70 m. Obsidian nodules occur naturally here in some abundance.

La668 (E-60). This site, just inside two slightly depressed dry washes, is restricted to an area 15 m in diameter. The archaeological materials may have been redeposited here as a result of sheet erosion.

La672 (E-69). This site consists of a large (150 × 50 m) scatter of artifacts and debitage along a ridge above the present roadcut. The chippage is extremely indurated and difficult to distinguish from unmodified (native) rock.

DISASTER SPRING (SPRING 6)

This spring is located in the Big Smoky Valley drainage, at an elevation of 1978 m (6490 ft). Although scattered prehistoric debris was recorded at several localities, no "sites" as such were found (fig. 10). Local tradition denotes this area as "Disaster Spring," but that name does not appear on the U.S. Geological Survey map.

Despite the lack of definable sites, several potential habitationlalociexist throughout the foothills to the southeast of Disaster Spring.

At a distance of nearly 1 km from the spring, a small flat saddle contains three rock fea-

Features—cleared spaces with circular rock "floors." These are probably piñon nut caches that had been opened for removal of the foodstores (cf. Davis, 1964; see also Thomas, 1983a: 57–64). Two of these features, each 1 m in diameter, were on the northwestern side of the ridge. The third, roughly 1.5 m in diameter, was 80 m away. No chippage, ground stone, or artifacts were found here. These features would seem to date from the prehistoric
ANTHROPOLOGICAL PAPERS AMERICAN MUSEUM OF NATURAL HISTORY

period, since historic debris was totally absent from the area (except for historic mineshafts and tailings some distance away). Further down the ridge, however, a number of smaller saddles (E-243, E-244, E-246, E-247) lacked archaeological materials.

To the east of Disaster Spring is a potential habitation locus (E-248) on a narrow ridge almost adjacent to the modern piñon-juniper ecotone. The ground in this area is frost heaved and heavily eroded; access to the contemporary piñon groves is difficult, and the spring is some distance away. A very small chippage scatter was found here, along with the base of a finished bifacial knife.

Across the ravine is locus E-249, a low ridge with a very light chippage scatter. The ground surface is quite sandy, and sheet erosion has drastically affected this locus. A historic period cabin stands not far to the west; three biface fragments and a projectile point section were found nearby.

Another light chippage scatter (E-251) was found about 50 m to the north of Disaster Spring. This concentration extends for 150 m along a low ridge, immediately adjacent to the modern piñon-juniper ecotone. The scatter contained a Great Basin Stemmed (?) point, a utilized flake, and a fine percussion biface.

**SAGE HEN SPRING (SPRING 9)**

Sage Hen Spring is a montane water source at an elevation of 2500 m (8200 ft) above sea level (fig. 11). This spring lies in Clipper Gap, a major access route between Big Smoky Valley and Monitor Valley (see Thomas, 1982a; 1983a: chap. 8). A toll road was established over Clipper Gap in the early 1860s (Thomas, 1983a: 135), but we found no evidence of that road in the archaeological survey. Today this area provides a major game route between Monitor and Big Smoky valleys.

**Ny856 (E-155).** A thin artifact scatter was found on a small flat area about 700 m west of Sage Hen Spring (on the Big Smoky Valley side). This site occurs in a modern stand of mountain mahogany, associated with the remains of a very recent campsites. The artifact and light chippage scatter is restricted to a circular area about 100 m in diameter.

**Ny857 (E-157).** A light artifact scatter occurs on a flat ridge, approximately 900 m northwest of Sage Hen Spring. Not a single flake was found associated with the artifacts listed on tables 1 and 2.

**Ny858 (E-162).** Ny858 is situated due north of Sage Hen Spring, in a rather shallow basin. The site itself stairsteps downward from east to west, with a continuous artifact scatter throughout its length. Despite the size of this extensive site (roughly 200 × 50 m), surprisingly little debitage was present. Obsidian was relatively abundant, and worked turquoise was also found.

**Ny859 (E-163).** This site lies due south of Ny858, approximately 600 m northwest of Sage Hen Springs. Chippage was virtually absent.

**Ny860 (E-164).** A sparse artifact scatter, associated with very little chippage, covers an area roughly 150 × 25 m. Over half the chippage encountered was obsidian.

**Ny863 (E-170).** A light chippage scatter, without associated artifacts, occurs on a small bench south of Sage Hen Spring.

**E-154.** A light chippage scatter occurs on a saddle due east of Sage Hen Spring, within an area of less than 1 m in diameter.

**E-166.** A projectile point fragment and a piece of a biface occurred on an undulating, sparsely vegetated ridge, 100 m south of Sage Hen Spring; fewer than one dozen chips were associated.

**E-167.** On a sloping ridge immediately west of E-166, was a small scatter of unworked flakes.

**WILLOW CANYON SPRING (SPRING 15)**

This spring is located at the head of the North Fork of Willow Canyon, on the western slope of the Toquima Range (fig. 12).

**Ny864 (E-219).** A number of archaeological sites lie along the North Fork of Willow Canyon, immediately to the north of Spring 15. This site, approximately 50 m in diameter, occurs on a plateau-like ridge that drops off as an outcrop to the spring below. Feature 1 is a stone circle (1 × 1.5 m) on the southeastern portion of the site. There was a ceramic sherd concentration approximately 30 m to the west. Two mano fragments were found near the stone circle and projectile points were scattered about the site. Chippage

was rare, and historic debris was totally absent.

Ny865 (E-220). This site, approximately 250 m northwest of Ny864, is nearly 200 m long and 50 m wide. It lies in a narrow saddle with a small flat area on the southern end. Very little chippage occurred on the saddle proper, but flakes and artifacts were concen-
trated on the flat portion. The three stone circles at Ny865 are probably house foundations. A ceramic concentration was found roughly 20 m from Feature 1 (1.5 m in diameter). Feature 2 (2 × 1.5 m in diameter), on a small flat area to the south, is associated with a flake scatter. Feature 3, on the other extreme end of the saddle, measures 1.5 × 2 m; chippage and artifacts were absent in this area.

Ny866 (E-222). Feature 1, an isolated stone circle (2.5 × 3 m), that is probably a house
foundation lies southwest of Ny864. This site is on a small flat ridge top, at an elevation of about 2400 m (7880 ft). No historic or prehistoric artifacts were present.

**Ny867 (site not on locus).** Ny867 occurs on the major drainage of Spring 15 which flows to the southwest into Big Smoky Valley. Chippage and artifacts were found in patchy distribution on both sides of the wash.

**Ny868 (E-226).** Feature 1 is a single stone circle (2.0 m in diameter)—probably a house foundation—approximately 150 m northeast of Spring 15, on a long sloping ridge. A light chippage and artifact scatter was associated. **Loci.** A number of additional habitation loci were recorded in the Willow Canyon Spring catchment (fig. 12), but all lacked archaeological debris, except for E-227, where a metate fragment was recovered.

**JOHNNY POTTS SPRING (SPRING 16)**

Johnny Potts Spring is located on the eastern scarp of the Toquima Range, at an elevation of approximately 2225 m (7300 ft).

**Ny871 (E-80).** This small site more or less surrounds Johnny Potts Spring. The area has been disturbed by a modern livestock enclosure, and at least one “pithunter pile” of artifacts was encountered. The chippage scatter is relatively light.

**Ny872 (E-81).** This small site, approximately 30 m in diameter, occurs on the small ridge to the south of and directly overlooking Johnny Potts Spring. Access to Ny872 is very steep.

**Ny875 (E-92).** This site occurs on a saddle, extending over an area approximately 150 × 50 m. Chippage was found in light, patchy distribution throughout.

**Ny876 (E-93).** This site, a chippage and artifact scatter approximately 250 m in diameter, lies in a saddlelike area, extending across three adjacent knolls. Feature 1 is a stone circle (3.5 × 4 m), probably a house ring, on the southwestern portion of the site; a metate had been incorporated into the western margin of the ring. This is a sheltered spot, and the ring itself is on the uppermost margin of the chippage scatter. There seems to be a high proportion of artifacts to flakes. Access to the local spring is relatively easy.

Some historic metal and cut wood was found in the vicinity.

**Ny877 (E-94).** This very small site (approximately 15 m in diameter) lies on a ridge projecting to the east of Johnny Potts Spring.

**Ny878 (E-95).** This site is located on, and restricted to, the margins of a sagebrush-grass meadow; standing water periodically exists in the center of this area, and rimrock borders the meadow to the east. Feature 1 is a well-defined house ring (3 × 2.5 m) on the eastern margin of Ny878. The stone circle is quite distinct, with very little washover, suggesting a more recent origin than for most of the others recorded in the Monitor Valley survey. The house entrance is on the northwestern side, and a wooden piñon hook was found hanging in a tree immediately to the north of the ring. Although there is some evidence of charcoal in the ring itself, no additional historic or prehistoric debris was directly associated with it. None of these houses were excavated.

**WHITE ROCK SPRINGS (SPRINGS 17 AND 18)**

Two of the sample springs (nos. 17 and 18) were quite close, and their 1 km survey catchment areas overlapped significantly (fig. 14).

**Ny870 (E-240).** The only site associated with White Rock Springs lies on a sheltered saddle south of Spring 18. This dense chippage concentration was associated with a scatter of lithic artifacts, ceramics, anddebitage. Although no surface water is immediately available, the thick aspen stand on the site suggests the presence of ample subsurface water.

**Loci.** A few artifacts anddebitage concentrations occurred on potential habitation loci, but this material was unassociated with any archaeological sites as defined here. An isolated Gatecliff Contracting Stem point was found at E-231 on top of the peak overlooking White Rock Spring, at an elevation of 3096 m (10,156 ft). A few flakes were found at E-233 to the north of White Rock Spring.

**SPRING 20**

Spring 20 occurs in the Toquima Range, to the north of Ikes Canyon, at an elevation
of 2579 m (8460 ft). The spring itself is situated in a fairly steep ravine, and the associated archaeological sites cluster along the overlooking ridge to the north. Only one site was found on the southern part of the Spring 20 catchment.

**Ny882 (E-110).** This is the first in a string of five sites to the north of Spring 20. Ny882 occurs in an open, flat, rocky area, 80 m in diameter, bordered by a mixed stand of piñon, juniper, and mountain mahogany. The area drops off sharply to the south (toward...
the canyon and the spring) and becomes quite steep to the north. This position affords an excellent view downcanyon, but the site itself is hidden from game trails within the canyon.

*Ny883 (E-111).* Ny883 is approximately 200 m to the east, on the same ridge. But unlike the previous site, it is near a steep wash, and cultural material has been somewhat disturbed by sheet erosion. A moderate amount ofdebitage was present.

*Ny884 (E-112).* Approximately 200 m to the southeast of Ny883 is Ny884, on a flat area near a very small springy seep. The ground here is rather swampy, covered by high grass. The artifact scatter, roughly 30 m in diameter, included both chippage and broken bifaces.

*Ny885 (E-113).* This large site lies on a long, sloping ridge, with another springy area on the west side. The artifact anddebitage scatter extended for approximately 600 m along the entire length of the ridge although the southern 200 m yielded most of the cultural material. Ny885 had an unusually high

proportion of obsidian. Three worked geode fragments indicated the unusual source of lithic raw material.

Ny886 (E-114). This site occurs nearly 1 km due east of Spring 20, on a low, sprawling ridge that supports a dense stand of mature piñon and juniper trees. Chippage was lightly scattered over an area approximately 30 × 100 m.

Ny887 (E-120). The final site associated with Spring 20 occurs to the south, on the ridge separating the two forks of Ikes Can-
yon. Ny887 lies in a small saddle area crossed by a contemporary game trail that follows the contours up the north slope of the ridge. Nearby is a large rock outcrop; small piñon, juniper, and mountain mahogany trees grow throughout the vicinity. The area is well-suited for ambush, and the association of modern tin cans indicates such use by contemporary deer and/or sage grouse hunters.

**Loci.** Isolated artifacts occurred here and there in the Spring 20 catchment. Locus E-106 contained a series of isolated finds along the wash near the spring. Isolates were also found at E-107 and E-108, not far from Ny882. In both cases, the artifacts were on small ridges, with a very thin veneer of chippage never larger than 30 m in diameter.

Potential site loci lacking archaeological debris also occurred along the ridge to the south of Spring 20. However, with the exception of Ny887, this ridge complex appears to have been unused.

**SPRING 22**

Spring 22 flows down the north fork of Wildcat Canyon, approximately 1000 m east of Jeans Spring Shelter (see chap. 4). The vegetation of this area is predominantly piñon-juniper woodland (fig. 16). Four archaeological sites occurred within the 1 km catchment of Spring 22, and nearly one dozen potential loci were defined in this area.

*Ny890 (E-176).* This site lies almost 1 km southeast of Spring 22 between two large rock outcrops in the piñon-juniper zone and consisted of a very small artifact cluster (+10 m × 5 m). Very little chippage was present. The two rock outcrops could have effectively served as a natural blind for ambush.

*Ny891 (site not on locus).* A second site, approximately 600 m to the southwest of Spring 22, lies in a flat area between two ridges, sheltered by rocky outcrops to the north and south. A moderate amount of chippage was scattered over an area 120 × 30 m; historic debris was absent.

*Ny892 (site not on locus).* This is the major archaeological site associated with Spring 22; cultural debris occurred in the wash, both upstream and downstream for a distance of nearly 1700 m.

Two stone circles, probably house rings, exist at Ny892. Feature 1 (1.7 m in diameter) is approximately 100 m upstream from the spring. A granite metate (30 × 15 cm) was in situ, in the northeastern quadrant of the circle.

Feature 2 (4.5 m in diameter) occurs downstream from the spring, on the southern side of the canyon. Aboriginal artifacts were scattered nearby but not in direct association with the feature. Historic debris was found up and down the wash.

*Ny894 (E-192).* Approximately 900 m due north of Spring 22, at an elevation of about 2320 m (7600 ft) is Ny894, a series of patchy artifact and chippage concentrations scattered along a ridgetop.

*Loci.* Although four sites were recorded at Spring 22, isolated artifacts and small chippage scatters were also present. At E-174, approximately 600 m southeast of Spring 22, on a saddle which drops off rapidly to each side, a projectile point midsection and a fine percussion biface butt occurred with chippage. Archaeological debris was also present at E-183, on the ridge immediately north of Ny892. One projectile point tip, a scraper, and a utilized flake were found on the large ridge running parallel to the dry creek wash. No features or chippage were associated with these artifacts.

More than one dozen potential habitation loci were recorded within 1 km of Spring 22. Most loci were long, flat ridgetops, running parallel to the North Fork of Wildcat Canyon. Virtually no archaeological materials were found on these potential loci.

**SPRING 23**

Spring 23 is in the Stoneberger Basin of the Toquima Range, at an elevation of 2710 m (8900 ft). Located in a relatively flat area, the spring drainage extends into Big Smoky Valley to the west and into Monitor Valley on the east (by way of Ikes Canyon). Three archaeological sites and a number of potential loci were recorded in the Spring 23 catchment.

*Ny897 (E-203).* A relatively large site was found approximately 250 m due north of Spring 23 along a small ridge that ends abruptly at a rock outcrop; an ephemeral stream runs approximately 50 m due west.
Archaeological materials were densely concentrated in an area about 25 x 15 m. All specimens described on the tables were found on the surface, but there is also buried deposit at Ny897. Because midden deposits are relatively rare at such high elevations, it would be of great interest to excavate this site (although access is difficult).

Many of the artifacts and much of the debitage is made of a distinctive green/brown
chert. At least one of the rough percussion bifaces also functioned as a core, since several flakes removed from this biface were subsequently reworked into bifacial tools.

*Ny898 (E-205).* This small site lies toward the end of a ridge, where the slope begins. It is a light scatter (25 × 35 m) containing a number of large, bulky flakes.

*Ny900 (E-215).* This site (20 m in diameter) occurs on the tip of a low ridge over-

looking the small intermittent stream flowing east of Spring 23. The spot has an excellent view of both the streambed and the spring.

Loci. Light scatters of chippage and artifacts existed throughout the Spring 23 catchment, but their density was too low to qualify such areas as sites by the current definition. At E-195, an Elko Corner-notched point was found on a saddle overlooking the small drainage to the west of the spring. An isolated point tip (perhaps from an Elko or Gatecliff series artifact) was found at 2800 m (9200 ft). On this ridge, not far below, is E-198, which contained the broken distal edge of a well-used end-scaper. Farther down the ridge at E-199 there was an excellent side scraper made of high quality brown chert and a pressure flaked biface of black chert. Finally, near the base of the ridge, is E-200, which contained a rough percussion biface and associated chippage that seems to have resulted from reduction of a single dark brown chert nodule.

To the west, at E-208, three utilized flakes were associated with some very recent historic debris.

Sawlog Ridge (Springs 24 and 25)

The survey catchments for Springs 24 and 25 overlap somewhat and are combined in the following discussion (see fig. 18). Only five archaeological sites were found within these combined catchment areas.
Ny910 (site not on locus). This site consists of a stone hunting blind constructed adjacent to a rock outcrop overlooking the draw leading to Spring 25. The wall is 1 m long, 75 cm high, and 75 cm across. No prehistoric or historic artifacts were associated; chippage was likewise absent. As is often the case with such features, hard evidence identifying the builders is lacking, but we suspect that this blind is aboriginal.

Ny911 (E-130). Ny911 is a small lithic scatter on a limber pine-covered saddle between Springs 24 and 25.

Ny902 (E-134). This site occurs on a saddle
hidden from the major valley by a small knoll but commanding an excellent view of both the valley and Spring 24. Artifacts and chippage were scattered over an area about 20 m in diameter. Two grinding stone fragments were found nearby along with a percussion flaked biface and a scraper of extremely poor quality chert. 

Ny903 (E-137). This site occurs on top of a very small ridge affording an excellent view of both the valley and the Sawlog Springs. A light debitage and artifact scatter was found over an area approximately 10 m in diameter. All bifaces here were manufactured of the same green/brown chert. 

Ny906 (E-146). This site lies west of Spring 24 on a long, narrow ridge that ultimately leads to Spring 23. As with other sites in this area, Ny906 provides an excellent vantage point overlooking Spring 24 to the east. An artifact and chippage scatter covers approximately 10 × 20 m along a very rocky area overgrown today with sagebrush and mountain mahogany. Most bifaces, spall, and debitage were made of a distinctive green/brown chert.

Loci. Isolated finds and small chippage scatters were found at several loci throughout the Sawlog Ridge catchments. At E-133, a projectile point fragment was found on a low ridge between Springs 24 and 25. A very modest flake scatter occurred in a 20 m² area at E-138, on a small flat ridge southwest of Spring 24. Almost immediately adjacent, at E-145, was a slight chippage scatter. A Gatecliff Split Stem point was found at E-150, near a small ridge roughly 500 m south of Spring 24. At E-152, an excellent chert scraper was recovered.

**SPRING 26**

This unnamed spring occurs approximately 700 m south of the mouth of Ikes Canyon, next to a series of steep, cliffy formations forming the eastern margin of the Toquima Range (fig. 19).

Ny912 (E-100). Roughly 200 m due west of Spring 26, at the very foot of the steep Toquima Range, is Ny912. This site consists of a light chippage scatter with associated artifacts extending over an area approximately 10 × 30 m along a very low ridge. This area is totally exposed, although a dense stand of piñon grows not far away. A historic campsite is located nearby. The artifact assemblage consisted of a Desert series point, six incised stones made of Roberts Mountain limestone, and a biface. 

Ny913 (E-101). This medium-sized site is approximately 100 m south of Spring 26, on a low, steep, short ridge separated from Ny912 by a small, intermittent drainage. Artifacts and chippage were scattered across a 15 × 40 m area. A single Desert series point was found, as were six incised stones.

Ny914 (E-102). Farther to the south, on a small and rather steep ridge, is Ny914, a small chippage scatter, with four incised stone fragments. This site is 30 m in diameter and immediately to the south of Ny912. The artifact scatter was quite light, and little debitage was present.

Ny916 (E-104). Approximately 100 m north of Spring 26 is Ny916, on a low, broad ridge projecting from the foot of the Toquima Range. Small, ephemeral washes occur to the north and south of the ridge. Incised stones were found, but temporal diagnostics were absent. Obsidian chippage was relatively common at Ny916.

Loci. E-103 is on a long, exposed ridge; it had a single incised stone fragment and obsidian debitage.

**COPPER MINE SPRING (SPRING 28)**

Copper Mine Spring, at an elevation of 2682 m (8800 ft), is almost due west of Gatecliff Shelter. The standard 1 km survey catchment was examined (with some difficulty), and three potential loci were mapped. Not a single archaeological artifact was located anywhere within the Copper Mine Spring catchment (fig. 20).

**LOWLAND SPRING CATCHMENT SURVEY**

There are only three active water sources within the study area on the floor of Monitor Valley: Dianas Punch Bowl, Potts Ranch Spring, and White Sage Spring. A 1 km catchment area was surveyed around each, following the same survey method as in the montane research.
Dianas Punch Bowl Spring

Dianas Punch Bowl is a well-known landmark in the middle of Monitor Valley (figs. 6 and 21). Formerly known as Devil's Punch Bowl, this feature was described in the 1881 *History of Nevada*:

About a mile east of the [Springfield Mining] district is the remarkable feature of nature known as the Devil's Punch Bowl. It consists of a butte in the form of an inverted wash-bowl, which is a quarter of a mile in diameter where it touches the ground, and a hundred feet in diameter at the apex. Upon ascending the smooth side of
the bowl to the top, the visitor is confronted by an immense chasm, almost perfectly circular, with vertical walls, and of great depth, at the bottom of which is a seething cauldron of boiling water of unfathomable depth, which is incessantly foaming and exhalning hot vapors and steam. (Angel, 1881: 519)

Although we cannot accurately date the first Euro-American settlement at Dianas Punch Bowl, the 1875 Nye County Tax rolls list the following entry: “I. G. McMonigal—claim to tract of grazing land in Monitor Valley known as the Punch Bowl, with slab house thereon—$200.00.” The rock chimney from this house still stands on the western margin of Dianas Punch Bowl. This historic site is recorded as Ny3139 in the files of the Nevada State Museum.

The Punch Bowl itself consists of two seeps. One of these exudes nearly boiling water, whereas fairly cold water flows from the other. The hot seep previously emptied into a small sink on the northeast of the crater. Sometime after 1950, personnel from the Monitor Ranch excavated a drainage ditch allowing the hot spring water to course northward, ultimately reaching Potts Ranch. Examination of the 1 km catchment indicates that the previously existing Dianas Punch Bowl marsh must have extended for several acres to the northeast, providing a reasonably large body of standing water.

A number of small piles of broken bifaces and projectile point fragments were found; these “pothunter piles” amply document the impact of relic collectors who have been looting the Dianas Punch Bowl area for decades.

In 1877, William and Mary Potts had left Rofsay, Scotland, where they had been married, traveling to establish a home in newly developed Monitor Valley (Reese River Reveille, October 9, 1948: 1). The Potts’s Ranch served as a settlement focal point in the upper Monitor Valley for over six decades.

William Potts died in 1915 (Reese River Reveille, July 17, 1915), but Mrs. Potts continued to operate the ranch through the 1930s. It was sold in 1944 to Harvey Sewell and O. G. Bates (Reese River Reveille, September 16, 1944). Prior to this sale, Potts Ranch was considered to be in Lander County, and taxes were paid to the Austin county seat. But when the ranch changed hands, it was agreed that since most of the land was actually in Nye County, some of the taxes previously collected by Lander County would be awarded to Nye County.

According to Hall (1981: 89–90), a U.S. Post Office was established at Potts Ranch on August 12, 1898, and continued to operate until October 31, 1941. Potts Ranch also functioned variously as a schoolhouse and a U.S. Forest Service ranger station. This historic site is denoted as Ny3140 in the files of the Nevada State Museum.

The flurry of 19th and 20th century activities have obviously disturbed the prehistoric archaeological record at Potts Ranch, and we were able to record only a single archaeological site. Ny1240 is perched on the large knoll not far from the Potts Ranch complex. Chippage and artifacts are scattered over an area approximately 150 m in diameter, extending downhill into the meadow adjacent to the ranch buildings.

**Potts Ranch Spring**

Another series of hot and cold springs occur in the center of Monitor Valley (fig. 22), in the area commonly known as the Potts Ranch. The 1872 Nye County Tax Rolls show that Messrs. Bailey and Wrinzel owned 160 acres of grazing land, then called the Empire and Rye Patch Ranch. In 1874, Joseph Wrinzel still claimed the Empire Ranch, but by 1879, the title had passed to Mr. William Potts, who owned half interest in the tract of grazing land (still called the Empire Ranch), 4 miles north of the Punch Bowl.

**White Sage Spring**

About 5 km northeast of Potts Ranch, at an elevation of 2024 m (6640 ft), is White Sage Spring (fig. 23). A 1 km catchment was totally surveyed, and one prehistoric archaeological site was encountered. Ny1236 consists of an extensive chippage scatter across a series of small rolling bluffs overlooking the spring area. These bluffs could readily have served as ambush localities for game watering at White Sage Spring. The artifact concentration was particularly dense along the
southern margin, roughly 200 m from the spring. There is a small historic mine nearby, and a water trough has been set up at the spring itself. A surprisingly large sample of prehistoric ceramics was recovered here.

Two isolated production stage blanks from White Sage Springs have also been subsequently recorded as La1389. Roughly 1 km east of the spring is a small historic dugout structure, about 1.5 m on a side. This historic site is recorded as Ny3141 in the files of the Nevada State Museum.
MONITOR LAKEBED SURVEY

An extensive survey was conducted along the margins of Monitor Lake (fig. 24). As discussed earlier, two randomly selected 100 m transects were run between the Toquima Range and the present Monitor Valley road (NV82); virtually nothing was found in either transect. The area slopes rather steeply and probably never served as more than a short-term procurement location. But even had this...
area been extensively utilized prehistorically, the massive alluvial fan system emanating from Mill Canyon would have effectively obscured all but the most recent sites (see Melhorn and Trexler, 1983a).

A major prehistoric site, Ny1228, exists to the east of NV82, along the margins of Monitor Lake. To sample this extensive site, six 100 m wide transects, spaced at 1 km intervals, were totally surveyed and collected. Dense artifact and debitage concentrations were encountered in every transect at roughly the 2073 m (6800 ft) contour interval (fig. 24). Ny1228, the Monitor Lakebed site, contained a rich array of aboriginal remains, but features were conspicuously absent. Subse-
sequent to our work, the Monitor Lakebed site has been re-recorded (see chap. 7).

It is also of interest to note that more recent research has revealed another large site (Ny3698 and Ny3699; see chap. 7). This is apparently a counterpart of the Monitor
Lakebed site, but located on the eastern shore of the playa, outside the present study area. In October, 1981, D. J. Dechambre noted "an extremely large" (ca. 3000 m N-S by 300 m E-W) open habitation site demonstrating marked variation of artifact assemblage. One and two handed manos were observed as well as Shoshone ceramics. A couple of possible hearth areas were seen and numerous flakes of various materials. "The site is too large to record all artifacts" (Dechambre et al., 1981; see also chap. 7, this volume). Except for the grinding implements, the contents and contexts seem quite similar to what we observed at Ny926.

**MONITOR VALLEY STREAMSIDE CATCHMENT SURVEY**

In our survey design we have, to this point, considered the archaeological record associated with 1 km catchments of several springs (point water sources) and that found near Monitor Lake (an asymmetrical, linear resource). We now consider the final water source in Monitor Valley—the symmetrical, linear resource.

The Monitor Valley survey area contains only three permanent or semipermanent symmetrical, linear water sources, in Mill, Ikes, and Stoneberger canyons. Each drainage was surveyed by methods described in chapter 1, and the findings are presented below.

**MILL CANYON STREAMSIDE SURVEY**

A 1 km linear catchment was defined for each of the streamside survey areas, in effect, a 2-km-wide strip following the water course (fig. 7). The Mill Canyon survey extends from the mouth of Mill Canyon, upstream to the spring at the head of the canyon. In addition to Gatecliff Shelter, described elsewhere (Thomas, 1983b), only a single archaeological site (Ny926) was recorded in the Mill Canyon catchment (although it is likely that additional, deeply buried sites may have gone undetected).

Ny926 lies on a low ridge at the mouth of Mill Canyon, on the south side of the streambed. This locality is superficially similar to the piñon ecotone sites commonly encountered in the Reese River Valley (cf. Thomas and Bettinger, 1976), and a rather large assemblage was recovered. Both ground stone and features were conspicuously absent at Ny926.

**IKES CANYON STREAMSIDE SURVEY**

Streamside survey of the Ikes Canyon drainage was somewhat restricted since many of the springs in this area had already been examined in conjunction with the randomized spring survey (fig. 7). We defined the Ikes Canyon 1 km catchment as extending from 300 m west of the canyon mouth (i.e., from the margin of the Spring 26 catchment) to the margin of the survey of the Spring 20 catchment, near the bifurcation of Ikes Canyon (roughly 1.5 km upcanyon).

Only one archaeological site was encountered in this streamside survey. Ny1229 lies on the ridge above a small seep, approximately 1 km upstream from the mouth of Ikes Canyon, overlooking a small, grassy meadow adjacent to Ikes Canyon Creek. The aboriginal site consists of an artifact and debitage scatter along approximately 200 m of the ridge. There is a small historic homestead in the bottomland.

We also recorded a long wooden drift fence on the northern margin of Ikes Canyon. This feature is discussed in chapter 5.

No other potential locus of habitation exists in the Ikes Canyon catchment, due primarily to the steepness of the canyon walls on both sides. We repeat, however, that several sites were mapped and collected in the adjacent spring catchment surveys (above).

**STONEBERGER CANYON STREAMSIDE SURVEY**

The Stoneberger Canyon catchment begins at "the Monitor," a prominent rock feature on the floor of Monitor Valley (Thomas, 1983a: 133–134, fig. 31); the survey continued upstream to approximately 1 km past the fork separating Stoneberger Canyon proper from Corral Canyon (fig. 25). Five archaeological sites occur in the Stoneberger Creek catchment, as defined here.

*Ny1241 (E-1003).* This site occurs high on a ridge overlooking Corral Canyon, at an el-
Fig. 25. The Stoneberger drainage survey area. Key to sites: A. Ny1241; B. Ny1243; C. Ny1244; D. Ny1245; E. Ny1246. Key to loci: 1. E-1004.

Evation of approximately 2487 m (8160 ft). Chippage was scattered across a saddle in a 40 m diameter area.

*Ny1243 (E-1005).* This site is on the ridge overlooking the bifurcation between Corral and Stoneberger canyons, at an elevation of about 2320 m (7600 ft). Chippage was scattered across an area approximately 200 m in length. No features were noted.

*Ny1244 (E-1006).* Ny1244 lies on a ridge near Stoneberger Creek at an elevation of 2243 m (7360 ft). Chippage extends approximately 200 m parallel to the Stoneberger drainage.

*Ny1245 (E-1007).* Ny1245 is on a ridge to the south of Stoneberger Creek, at an elevation of 2200 m (7200 ft). Two distinctive chippage concentrations were present, neither very extensive. We note in passing that both Ny1244 and Ny1245 are much closer to the creekbed than any of the sites observed in the Reese River survey (Thomas and Bettinger, 1976).

*Ny1246 (E-1008).* This diffuse site extends along several low ridges immediately to the south of Stoneberger Creek and consists of a fairly continuous artifact and debitage scatter along the southern bluffs bounding the creek.

*Loci.* Only one locus (E-1004) in the entire Stoneberger drainage was found to be lacking archaeological debris. This area is on a small
ridge immediately southeast of Ny1241, north of Corral Canyon.

RANDOMIZED QUADRAT SURVEY

As explained earlier, 20 randomly selected 500 m square quadrats were surveyed throughout the Toquima Range/Monitor Valley area. This section describes the findings of this survey (see fig. 7).

Quad A1. This quad is on the sagebrush flat, at an elevation of 2120 m (6600 ft). Four incised stones were found outside its boundaries.

Quad A2. Quad A2 intersects the western edge of the piñon-juniper ecotone, just east of Henry Meyer Canyon. Two rough percussion biface fragments were recovered; chippage was entirely absent.

Quad B1. Located on the sagebrush flats, this quad exists in an area of very steep relief (30–60%). An isolated Rosegate series point was found.

Quad B2. B2 is located on the western margin of the piñon-juniper slopes, in an area dissected by several small, ephemeral washes. No archaeological debris was encountered.

Quad C1. This quad occurs on a large, even slope in the Big Smoky drainage. Several isolated flakes were found, as well as isolated projectile point and biface fragments.

Quad C2. This quad occurs within the mountain mahogany zone, high on the western slope of the Toquima Range. The area is extremely steep, and no archaeological remains were found.

Quad D1. Located at 2320 m (7600 ft), this quad occurs in the upper piñon-juniper zone, on the western slope of the Toquima. The relief varies from 0 to 30 percent, and two archaeological sites were encountered. Site Ny1231 (D1-1): This small site is a dense chippage scatter spread over an area approximately 50 m in diameter. Site Ny1232 (D1-2): Ny1232 occurs on the northwestern margin of the quad, consisting of a 100 × 50 m artifact and debitage scatter. The site is near a wash on the edge of the piñon-juniper ecotone.

Quad D2. Located just north of the Willow Canyon Road, D2 contained several mining prospects but no aboriginal archaeological remains.

Quad E1. This quad, located near the main wash flowing out of Hoodoo Canyon, contained a historic homestead, but aboriginal remains were restricted to a single projectile point fragment.

Quad E2. This quad occurs on the greasewood and rabbitbrush flats, approximately 1500 m north of the Northumberland Canyon road. Only one unmodified flake was found.

Quad F1. This is the northernmost in a series of randomized 500 m squares on the eastern drainage of the Toquima Range. No aboriginal remains were encountered.

Quad F2. This quad, amidst an association of piñon, juniper, and mountain mahogany, contained no aboriginal archaeological materials.

Quad G1. Three archaeological sites were recorded in this quad, located on the piñon-juniper slopes roughly 1.5 km from the mouth of Sams Canyon. Site La699 (G1-1): A dense chippage and artifact scatter occurred over an area approximately 25 m in diameter. Site La700 (G1-2): This site was found on the extreme southeastern corner of the quad, at an elevation of 2195 m (7200 ft). Chippage and artifacts were concentrated in an area roughly 30 m in diameter. Site La701 (G1-3): This site lies almost in the center of the quad, at an elevation of 2207 m (7240 ft). The artifacts and debitage occur in an area about 20 × 50 m. Forty-nine sherds of Shoshone-ware were found here.

Quad G2. This quad, located on the sagebrush flats near the mouth of Petes Canyon, contained no aboriginal remains.

Quad H1. Located on the lower piñon-juniper ecotone, quad H1 is approximately 500 m from Mud Spring. One potential habitation locus was encountered, at an elevation of 2160 m (7080 ft), but it contained no archaeological materials. An isolated biface fragment was found elsewhere in the quad.

Quad H2. This quad occurs at an elevation of 2500 m (8200 ft) in a mixed stand of piñon, juniper, and mountain mahogany. An isolated Rosegate point was found.

Quad II. This quad occurs on the alluvial flats, to the southeast of Johnny Potts Spring. Only a single flake was present.
Quad I2. Located adjacent to I1, this quad contained two archaeological sites. Site Ny1233 (I2-1): This site is an artifact and debitage scatter roughly 30 m in diameter. Site Ny1234 (I2-2): This site lies on a ridge, near the western margin of quad I2. Cultural debris was spread over an area 50 m in diameter. Particularly notable was the relatively large concentration of Snake Valley Corrugated ceramics.

Quad J1. This quad covers a steep alluvial fan between Ikes and June canyons. Only two flakes were found.

Quad J2. Located near the mouth of June canyon, this quad contained only a single habitation locus, and no archaeological debris.

ISOLATED SURFACE FINDS

In the course of the eight field seasons in Monitor Valley, we mapped and collected a number of isolated surface finds; the relevant data appear on table 1.

MATERIAL CULTURE
RECOVERED IN THE MONITOR VALLEY SURVEY

Several thousand artifacts of aboriginal manufacture were recovered in the survey domains described above. We now present the basic data for these assemblages. Keep in mind that we describe here only one of several subsets of Monitor Valley material culture. Additional artifact descriptions are provided for the several stratified sites that were excavated (chaps. 3 and 4) and also for the various satellite catchments examined throughout the Monitor Valley area (chaps. 5 and 6). The aggregate Monitor Valley assemblage is summarized and analyzed for bias in chapter 7.

PROJECTILE POINTS

The projectile points recovered in the Monitor Valley fieldwork have been classified according to criteria discussed in detail elsewhere (Thomas, 1981a, 1983b: chap. 9). This section only briefly summarizes the classification criteria employed. All typable points are illustrated, and key attributes are tabbed in standardized fashion, using attributes defined initially by Thomas (1970a) and subsequently modified (Thomas, 1981a).

DESSERT SERIES: The Desert series consists of three apparently coeval projectile point types: Desert Side-notched, Cottonwood Triangular, and Cottonwood Leaf-shaped. Desert series points are diagnostic of the Yankee Blade phase in central Great Basin prehistory, generally considered to postdate A.D. 1300. Available evidence (summarized by Thomas, 1981a: 27) suggests that the Desert series types, as defined by the Monitor Valley criteria, are acceptable time-markers in the western and central Great Basin, and probably in the eastern Great Basin as well.

Desert Side-notched: Originally defined by Baumhoff and Byrne (1959); the present definition follows a modification by Lanning (1963: 253): small triangular points with notches high on the sides.

Small: Weight less than or equal to 1.5 g.
Triangular: Basal width/maximum width ratio greater than 0.90.
Side-notched: Proximal Shoulder Angle greater than 130°.

Twenty Desert Side-notched points were recovered in this portion of the Monitor Valley survey. All specimens are illustrated on figure 26a–t, and defining attributes are listed in table 3. Roughly one-third (7 of 20) of these points are made of obsidian, a relatively scarce raw material at Gatecliff Shelter (Thomas, 1983b) and elsewhere in Monitor Valley.

Cottonwood Triangular: Initially defined at Iny-2, Cottonwood Triangular points are categorized as small, unnotched, thin, triangular projectile points (Thomas, 1981a: 16):

Small: Weight less than or equal to 1.5 g; Length less than 30 mm.
Thin: Thickness less than 4.0 mm.
Triangular: Basal width/maximum width ratio greater than 0.90.

Sixteen Cottonwood Triangular points were recovered in this part of the Monitor Valley non-site survey. All specimens are illustrated on figure 26u–jj, and defining attributes are listed on table 4. In contrast to the presumably coeval Desert Side-notched points, Cottonwood Triangular points are made exclusively of chert.
ROSEGATE SERIES: The Monitor Valley criteria combine the previously recognized Rose Spring Corner-notched and Eastgate Expanding Stem types into a single temporally significant designation; although subsequent research may ultimately establish that the Rose Spring/Eastgate differentiation is valid, it has yet to be demonstrated that these two types differ in temporal range.

The Rosegate series is diagnostic of the Underdown phase in central Great Basin prehistory, thought to date between about A.D. 700 and A.D. 1300. The available evidence suggests that the Rosegate series, as defined by the Monitor Valley criteria, can probably function as an adequate time-marker throughout most of the Great Basin (except in areas characterized by small, contracting stem points).

Definition of the Rosegate series parallels that of Lanning (1963: 252) for Rose Spring points in general: small . . . corner-notched . . . stem expands, but usually not markedly.

Small: Basal width less than or equal to 10 mm.
Corner-notched: Proximal Shoulder Angle between 90 and 130°.
Expanding Stem: Neck width less than or equal to [basal width plus 0.5 mm].

Fifty-seven Rosegate series points were recovered in this part of the Monitor Valley survey. All specimens are illustrated in figures 27 and 28, and the defining attributes are listed in table 5.

ELKO SERIES: The Monitor Valley criteria define the Elko series in terms of two apparently coeval projectile point types: Elko Corner-notched and Elko Eared. The Elko series is diagnostic of the Reveille phase in central Great Basin prehistory, thought to date between 1300 B.C. and A.D. 700.

Available evidence suggests that the Elko series, as defined by the Monitor Valley criteria, applies only to the central and western Great Basin; morphologically identical forms
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*a Great Basin Stemmed point (?).
*b Archaeological site not on potential locus.
*c Leaf-shaped point.
*d Large Side-notched point.
*e 2 Large Side-notched, Great Basin Stemmed (?), untypeable concave base point.
*f 2 Large Side-notched points.

to be much earlier in the eastern Great Basin.

The Elko series can be defined only relative to the smaller (and later) Rosegate series. The Elko series consists of large, corner-notched projectile points:

**Large**: Basal width greater than 10 mm.  
**Corner-notched**: Proximal Shoulder Angle between 110 and 150°.

The following definitions allow one to subdivide the Elko series into the now-conventional Corner-notched and Eared types:

**Elko Corner-notched**: Basal indentation ratio greater than 0.93.
**Elko Eared**: Basal indentation ratio less than or equal to 0.93.

Seventy-eight Elko Corner-notched projec-
tile points were recovered in this aspect of the Monitor Valley survey. Three Elko Corner-notched points were made of quartzite, one of obsidian, one of slate, and the remaining points were manufactured of chert. All artifacts are illustrated on figures 29 and 30, and the defining attributes are listed on table 6.

Twenty-nine Elko Eared projectile points were recovered in this part of the Monitor Valley non-site survey. One Elko Eared point is made of obsidian; the rest are manufactured of chert and rhyolite. All specimens are illustrated on figure 31, and the defining attributes are listed on table 7.

GATECLIFF SERIES: Monitor Valley criteria define the Gatecliff series as two apparently coeval projectile point types: Gatecliff Split Stem and Gatecliff Contracting Stem. Gatecliff Split Stem points are elsewhere designated as Pinto series (Clewlow, 1967; Thomas, 1971a: 89; Heizer and Hester, 1978: 157–158), Little Lake series (Bettinger and Taylor, 1974: 13), Silent Snake series (Layton, 1970), and Bare Creek Eared (O’Connell, 1971). Gatecliff Contracting Stem points have previously been designated as Elko Contracting Stem (Heizer and Baumhoff, 1961: 128) and Gypsum Cave points (Harrington, 1933; Fowler et al., 1973: 20–21; Heizer and Berger, 1970).

The Gatecliff series is diagnostic of the Devils Gate phase of central Great Basin prehistory, thought to date between roughly 3000 and 1300 B.C. (Thomas, 1981a). Available evidence suggests that while the Gatecliff series seems appropriate throughout most of the western and central Great Basin, it is like-
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TABLE 2—(Continued)

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Subtotals 7 16 11 12 0 3 1 1 196

Totals 101 241 531 429 11 22 24 70 657

*a* Shoshone ware.

*b* Stone pendant, 2 obsidian core fragments.

*c* Mano 100 m downslope.

*d* Sevier/Fremont ware.

*e* Worked turquoise, unworked obsidian nodule.

*f* Worked turquoise, mano.

*g* Mano.

*h* Unworked obsidian nodules, mano.

*i* Worked turquoise.

+j* 2 manos.

+k* 2 metates, mano.

+l* Archaeological site not on potential locus.

+m* Metate.

+n* Mano, metate.

+o* Piñon hook.

+p* Slate pendant fragment.

+q* Mano, 2 metates.

+r* Mano, 4 metates, obsidian nodules.

+s* 2 metates.

+t* 2 hammerstones, worked turquoise, slate pendant, 2 *Olivella* beads, 3 manos, 5 metates.

+u* 2 metates, 2 hammerstones.

ly that rather different temporal relationships may exist in the eastern Great Basin.

The Gatecliff series comprises medium to large contracting stem projectile points:

**Size:** Weight greater than 1 g.

**Contracting Stem:** Proximal Shoulder Angle less than or equal to 100° or notch opening index greater than 60°.

The Gatecliff series is subdivided further into morphological types according to the following criteria:

**Gatecliff Split Stem:** Basal indentation ratio less than or equal to 0.97.

**Gatecliff Contracting Stem:** Basal indentation ratio greater than 0.97.

Although these morphological types add nothing to our knowledge of the temporal structure of Great Basin prehistory, I reluctantly make this distinction to emphasize that the Monitor Valley criteria have restructured the Elko series (dropping the former Elko Contracting Stem designation), and to point out that the Gatecliff series combines previously distinct contracting and split stem forms.

Twenty Gatecliff Split Stem points were recovered in this part of the Monitor Valley nonsite survey. Two Gatecliff Split Stem points are manufactured of obsidian, one point is made of quartzite, and the rest are either chert or rhyolite. All specimens are illustrated on figure 32, and the defining attributes are listed on table 8.

Twenty-two Gatecliff Contracting Stem points were recovered in this portion of the Monitor Valley survey. Note that nearly one-
Fig. 28. Rosegate series projectile points recovered in the Monitor Valley nonsite survey. a. 20.3/60; b. 20.3/5852; c. 20.3/4428; d. 20.2/8658; e. 20.3/4265; f. 20.3/4231; g. 20.2/9169; h. 20.2/9271; i. 20.3/5136; j. 20.3/5870; k. 20.2/519; l. 20.3/207; m. 20.3/5127; n. 20.3/5128; o. 20.3/5127; p. 20.3/5870; q. 20.2/9174; r. 20.2/9973; s. 20.3/5136; t. 20.3/652; u. 20.2/8795; v. 20.3/5128; w. 20.3/5870; x. 20.3/4225.

quarter (5 of 22) of the Gatecliff Contracting Stem points were manufactured of basalt. Single pieces were made of obsidian and rhyolite; the remaining examples were manufactured of chert. All specimens are illustrated on figure 33, and the defining attributes are listed on table 9.

**Humboldt Series:** Elsewhere (Thomas, 1981a), I have discussed the genesis of this designation, suggesting that severe problems remain in the classification of the Humboldt series. At present, we retain the earlier definition (Thomas, 1981a), considering the Humboldt series to be an unnotched, lanceolate, concave base projectile point of variable size:

- **Lanceolate:** Basal width/maximum width ratio less than or equal to 0.90.
- **Concave Base:** Basal indentation ratio less than 0.98.
- **Variable Size:** Weight tends to be greater than or equal to 1.5 g. Length tends to be greater than 40 mm. Thickness tends to be greater than or equal to 4.0 mm.

The Humboldt series remains at this stage a residual category, containing most of the previously defined Humboldt Concave Base A, Humboldt Concave Base B, and Humboldt Basal-notched types. But even this approach is unsatisfactory, since some of the basal-notched specimens are excluded from this definition of the Humboldt series (Pendleton, 1985).

I have also suggested that Humboldt points are relatively poor time markers, that size may be a misleading basis for subclassification of the Humboldt series, and that Humboldt series points tend to be associated with intercept strategy hunting sites (Thomas, 1981a, 1983b; Pendleton and Thomas, 1983).

This does not mean, however, that the Humboldt series cannot be profitably sub-
divided in light of new data. In fact, partial subdivision can be accomplished on the basis of artifacts recovered at Hidden Cave in the Carson Sink (Pendleton, 1985). But for now, we will deal with these artifacts strictly at the series level.

A number of Humboldt series and Humboldt Basal-notched points were recovered in this portion of the Monitor Valley survey (fig. 34, table 10). A great deal of variability is evident in this rather small sample of points, probably resulting from an intermingling of functional, temporal, and technological factors.

A couple of the surface specimens grouped here as Humboldt series could arguably be considered Triple T Concave Base points (as defined by Thomas, 1981a: 18). Definitions of both series remain tentative, and I have taken the temporally more conservative position in this volume.

**LARGE SIDE-NOTCHED:** This residual category includes all side-notched projectile points not designated as Desert Side-notched:

- **Large:** Weight greater than 1.5 g.
- **Side-notched:** Proximal Shoulder Angle greater than 150°.

This category lumps several previously de-
Fig. 30. Elko Corner-notched projectile points from Monitor Valley nonsite survey. a. 20.3/1654; b. 20.3/970; c. 20.3/5021; d. 20.2/8917; e. 20.2/8823; f. 20.2/9323; g. 20.3/1647; h. 20.3/808; i. 20.2/8814; j. 20.2/9293; k. 20.2/8817; l. 20.3/4413; m. 20.3/5129; n. 20.3/2564; o. 20.2/8825; p. 20.2/8664; q. RR2701; r. 20.2/8565; s. 20.2/9266; t. 20.2/9860; u. 20.3/5075; v. 20.3/1645; w. 20.3/5134; x. 20.3/1217; y. 20.3/5900; z. 20.3/461; aa. 20.2/9284; bb. 20.3/5790; cc. 20.2/8782; dd. 20.3/404; ee. 20.2/8640; ff. 20.2/8822; gg. 20.2/8873; hh. 20.2/9917; ii. 20.2/9277; jj. 20.2/8761; kk. 20.3/14; ll. 20.3/485; mm. 20.2/9232; nn. 20.2/8981; oo. 20.3/520; pp. 20.3/1214.

Refined Great Basin projectile points, including Northern Side-notched, Bitterroot Side-notched, Madeline Dunes Side-notched, Elko Side-notched, and Rose Spring Side-notched. I suspect that, as with the Humboldt series, we are lumping a rather high degree of variability into the Large Side-notched category. But lacking adequate data from stratified central Great Basin contexts, we will simply leave further subdivision for future research.

The seven Large Side-notched points from this aspect of the Monitor Valley survey are illustrated in figure 35a–g, and the attributes are listed in table 11.

ADDITIONAL PROJECTILE POINTS: The remaining pseudotypable points are illustrated
Fig. 31. Elko Eared projectile points recovered in the Monitor Valley nonsite survey. a. 20.2/9932; b. 20.3/435; c. 20.2/9934; d. 20.2/8826; e. 20.2/8866; f. 20.2/8867; g. 20.2/9970; h. RR2695; i. 20.3/5866; j. 20.3/396; k. 20.3/4176; l. 20.3/4438; m. 20.3/480; n. 20.3/5481; o. 20.3/5710; p. 20.3/5453; q. 20.3/4741; r. 20.3/4438; s. 20.3/480; t. 20.3/9256; w. 20.2/8564; x. 20.3/5131; y. 20.3/5409; z. 20.2/9076; aa. 20.2/9231; bb. 20.3/5710; cc. 20.2/9649.

in figure 35, and the attributes are provided in table 12.

Specimen 20.3/5829 (fig. 34t) is an asymmetrical, concave base point. Although we have assigned this example to the Humboldt series, somewhat similar points were recovered at Silent Snake Springs (Layton and Thomas, 1979: fig. 9b, j, and t), and it is possible that this specimen more properly belongs in the Gatecliff series.

The three rather large points (fig. 35j–l) would seem to belong to the Great Basin Stemmed series (as defined by Tuohy and Layton, 1977). If so, then this is the first evidence of a pre-Mazama occupation in the Monitor Valley area.

Previously (Thomas, 1982b: 161), I had observed that “pre-Mazama (that is, pre-7000 B.P.) sites are conspicuously absent in the central Great Basin.” Hints of such early occupation had certainly appeared in the Reese River Valley surveys (cf. Thomas, 1971a: 81–85, fig. 3.4; Thomas and Bettinger, 1976: fig. 23d), but at the time, nobody knew “whether the low number of pre-Mazama sites identified in the central Great Basin points to the absence of Paleo-Indians during this period or is a product of sampling error” (Thomas, 1982b: 161).

Recent evidence identifies sampling error as the culprit. An interesting Early Holocene site has been discovered in Grass Valley, ap-
Fig. 32. Gatecliff Split Stem projectile points recovered in the Monitor Valley nonsite survey. a. 20.2/9000; b. 20.3/518; c. 20.3/442; d. 20.2/8900; e. 20.3/4272; f. 20.3/2255; g. 20.2/8870; h. 20.2/9933; i. RR2700; j. 20.3/4410; k. RR2699; l. 20.2/8990; m. 20.3/510; n. 20.3/5829; o. 20.3/5123; p. 20.3/4412; q. 20.2/9156; r. 20.2/9341; s. 20.3/815; t. 20.3/4551.
approximately 120 km north of Monitor Valley (Crittendon and Elston, 1982). Having personally inspected this site, I am now convinced that there was indeed a significant Early Holocene occupation of the central Great Basin area.

PROJECTILE POINT PREFORMS: The term "preform" is used, in the restricted sense discussed elsewhere (Thomas, 1983b: chap. 10), to designate those unfinished production stage artifacts in which the intended finished product (projectile point, knife, drill, etc.) is clearly evident. The more general term "pressure flaked blank" is applied to those unfinished artifacts whose ultimate form remains undefined (cf. Crabtree, 1972: 85).

The distribution of projectile point preforms is listed in table 1. Several of these unfinished production stage blanks are illustrated on figure 40d–f.

TIPS AND FRAGMENTS: A large sample of projectile point fragments was recovered in the Monitor Valley survey; basal fragments sufficiently complete to allow classification

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**Fig. 33.** Gatecliff Contracting Stem points recovered in the Monitor Valley nonsite survey. a. 20.2/9209; b. 20.2/9181; c. 20.3/407; d. 20.3/4459; e. 20.3/834; f. 20.2/9239; g. 20.3/4411; h. 20.3/387; i. 20.3/673; j. 20.2/9867; k. 20.3/399; l. 20.3/5440; m. 20.3/5084; n. 20.3/4985; o. 20.2/9494; p. 20.2/9117; q. 20.3/8; r. 20.3/4966; s. 20.3/4973; t. 20.3/1657; u. 20.3/4973; v. 20.3/1262.

**Fig. 34.** Humboldt series points recovered in the Monitor Valley nonsite survey. a–o. Humboldt Basal-notched; p–y. Humboldt Concave Base. a. 20.3/2556; b. 20.3/11; c. 20.2/8661; d. 20.2/8865; e. 20.3/401; f. 20.3/4239; g. 20.2/9991; h. 20.2/9300; i. 20.3/806; j. 20.2/8863; k. 20.3/2551; l. 20.2/8611; m. 20.2/9071; n. 20.3/23; o. 20.3/693; p. 20.3/8910; q. 20.3/4408; r. 20.3/4416; s. 20.3/5829; t. 20.3/2568; u. 20.3/9063; v. 20.3/5198.
Fig. 35. Miscellaneous projectile points from the Monitor Valley nonsite survey. a–g. Large Side-notched; h. Elko series; i. Gatecliff series; j–l. Great Basin Stemmed (?); m. untypable concave base; n. leaf-shaped point. a. 20.3/1274; b. 20.3/1269; c. 20.3/4460; d. 20.2/8860; e. 20.3/5598; f. 20.3/4139; g. 20.2/8645; h. 20.3/5746; i. 20.3/238; j. 20.3/5636; k. 20.2/8562; l. 20.3/695; m. 20.3/5724; n. 20.2/9091.

Fig. 36. Selected roughouts from survey sites in Monitor Valley. a. 20.3/77; b. 20.3/5555; c. 20.3/5750; d. 20.2/8938; e. 20.2/8259; f. 20.2/8615; g. 20.3/4959; h. 20.3/5910.

Provenience: a. Ny1235; b, g. Ny1228; c. La657; d. La631; e. La630; f. La662; h. Ny1243.
are included under the appropriate series in table 1.

Residual point fragments pose more of a problem. Broken projectile points can easily be confused with fragments of other bifacial artifacts—knives, drills, gravers, etc.—so we follow a rather conservative approach (discussed in Thomas, 1983b: chap. 9). The acute angles of the distal fragments (“tips”) are fairly distinctive, and we feel confident in considering these to be projectile point fragments (table 1). But because projectile point midsections are so readily confused with other bifacial fragments, we will group all biface midsections merely as production stage bifaces, defined below.

**Production Stage Bifaces**

In a previous volume (Thomas, 1983b: chap. 10), we adopted a rather ad hoc position relative to the definition of production stage bifaces. While acknowledging the importance of “intent” in controlled lithic reduction experiments, we emphasized the difficulty in defining it for undifferentiated prehistoric archaeological assemblages. Instead, we underlined the importance of the “blank-preform-product” continuum (Muto, 1971; see also Womack, 1977). This continuum of bifacial reduction can, somewhat arbitrarily, be subdivided into descriptive, ordinal-level categories: roughouts, rough percussion blanks, fine percussion blanks, and pressure-flaked bifaces.

**ROUGHOUTS:** Roughouts are bifacially worked implements resulting from the initial steps of lithic reduction. Removal of flakes from the roughout functions to trim the tool rather than to impart a definite shape. Roughouts are much larger and heavier than artifacts at the later stages of reduction. The flakes removed from roughouts can, of course, also serve as tools or flake blanks, and roughouts can function as both tools and cores.

Selected roughouts of those recovered in this portion of the Monitor Valley survey are illustrated in figure 36. These artifacts tend to be manufactured from low-quality materials, mostly locally available chert. Many roughouts have cortex adhering to the surface.

Roughouts clearly qualify as “blanks” (in the sense of Crabtree, 1972 and Muto, 1971);
it is impossible—at this stage of manufacture—to determine the intended form of the final product.

ROUGH PERCUSSION BLANKS: Blanks at this stage are generally smaller than roughouts, not as thick, more symmetrical, showing more refined patterns of percussion flaking, more regular and less sinuous lateral margins, increasing symmetry, and a more defined outline. Rough percussion blanks give some indication as to the shape of the artifact, but the nature of the final tool has yet to be defined.

Over 200 rough percussion blanks were recovered in the Monitor Valley nonsite survey; selected examples are illustrated in figure 37. Most are made of chert, and the quality of the raw material is generally higher than that of roughouts. Rough percussion blanks also tend to be significantly thinner than the roughout stage.

FINE PERCUSSION BLANKS: Generally well
shaped, fine percussion blanks have a symmetrical outline and fairly straight margins. Implements at this stage lack evidence of pressure flaking. Although fine percussion blanks have a definite shape, one cannot yet determine the intended nature of the final product.

More than 500 fine percussion blanks were recovered in this survey; selected examples are illustrated on figure 38. Fine percussion blanks are significantly smaller than rough percussion blanks, with a reduced thickness/width ratio. Raw materials tend to be of higher quality, and obsidian is somewhat more common.

**Pressure Flaked Bifaces**: Pressure flaked bifaces are unfinished implements which have been partially shaped by pressure flaking. These are not, technically speaking, "preforms" since the intended final shape remains undefined at this stage. Some pressure flaked bifaces were certainly intended for manufacture into projectile points; others were probably being fashioned into knives, drills, or other bifacial tools. Still others were probably utilized as is.

More than 400 pressure flaked biface fragments were recovered in this survey; selected examples are illustrated in figure 39.

**Additional Bifacial Implements**

**Finished Bifacial "Knives"**: Finished bifacial knives are characterized by very straight edges shaped by pressure retouch; these ar-
Fig. 41. Selected drills (a–k) and gravers (l–n) from survey sites in Monitor Valley. a. 20.2/9166; b. 20.2/8644; c. 20.3/37; d. 20.3/4732; e. 20.2/8970; f. 20.3/4720; g. 20.3/4232; h. 20.2/9119; i. 20.2/8179; j. 20.2/9060; k. 20.3/823; l. 20.2/8935; m. 20.3/825; n. 20.2/9479.

Provenience: a. La648; b. La657; c. Ny1240; d, f, g. Ny1228; e. Ny878; h. La658; i. La634; j. La665; k, m. Ny867; l. Ny916; n. La701.

Fig. 42. Selected unifacial tools from survey sites in Monitor Valley; note that e is made of amber bottle glass. a. 20.2/8623; b. 20.3/427; c. 20.2/9160; d. 20.2/9310; e. 20.2/9125, 20.2/9160; f. 20.2/8571; g. 20.2/8570.

Provenience: a. La657; b. E-199; c. La647; d. La652; e. La658; f, g. La633.
Fig. 43. Selected incised stones from La646. a. 20.2/9031; b. 20.2/9032; c. 20.2/9033; d. 20.2/9007; e. 20.2/9029; f. 20.2/9025; g. 20.2/9006; h. 20.2/9027; i. 20.2/9028; j. 20.2/9009; k. 20.2/9026; l. 20.2/9010; m. 20.2/9020; n. 20.2/9014; o. 20.2/9021; p. 20.2/9012; q. 20.2/9015; r. 20.2/9017; s. 20.2/9022; t. 20.2/9005a; u. 20.2/9005b; v. 20.2/9023; w. 20.2/9024; x. 20.2/9004c; y. 20.2/9030; z. 20.2/9004b (4 fragments); aa. 20.2/9008; bb. 20.2/9019; cc. 20.2/9011; dd. 20.2/9016; ee. 20.2/9018; ff. 20.2/9004a. NOTE: Fragments illustrated as t, u, x, and ff probably derive from the same artifact.
Fig. 44. Selected incised stones from the Monitor Valley nonsite survey. a. 20.2/9043; b. 20.2/9041; c. 20.2/9040; d. 20.2/9042; e. 20.2/9039; f. 20.2/9003; g. 20.2/9037; h. 20.2/9034; i. 20.2/9035; j. 20.2/9036; k. 20.2/9045; l. 20.2/9047; m. 20.2/9046; n. 20.2/9038; o. 20.2/8592; p. 20.2/8587; q. 20.3/367; r. 20.2/9044; s. 20.3/263.

Provenience: a–e. Ny912; f. Ny913; g–j. Ny914; k–m, r. Ny916; n. E-103; o, p. La636; q. border of grid A1; s. Ny864.
Artifacts are generally leaf-shaped and symmetrical in outline. The terms "finished" and "knife" are employed here without specific functional connotation (as emphasized in Thomas, 1983b). Artifacts at this stage usually have been shaped by the removal of broad, relatively flat flakes.

Fewer than a dozen finished knives were recovered in the Monitor Valley nonsite survey; selected knives are illustrated in figure 40. These artifacts tend to be manufactured of very-high-quality raw materials.

**Drills and Gravers:** Twenty-two drills and gravers were recovered in this sample (fig. 41). Three fairly distinct kinds of drills can be distinguished in the Monitor Valley nonsite survey collection. One form is merely a flake, with one end bifacially retouched into a fine, rounded beak (figs. 41b, h, j, k, l). The bases of such drills are generally left unmodified, and retain the shape of the original flake.

Other drills have been carefully fashioned in a bifacial format. Bases vary from fully rounded to squared; some of the bases are not finished at all; selected examples are illustrated on figure 41c–g.
Drills and gravers are also occasionally manufactured with projectile pointlike bases. One specimen (fig. 41i) appears to have been made on a reworked Rosegate series point; two others appear to be reworked Desert Side-notched points (fig. 41m,n).

**Unifacial Tools**

**Scrapers:** Scrapers are small to medium size flakes, the margins of which have been deliberately retouched, predominantly from a single direction. Although the term “scraper” has unfortunate (if unintentional) connotations, we shall follow conventional usage. From time to time, we also use the term “uniface” to describe these implements.

Unlike many bifacial tools, scrapers do not conform to a single set of morphological patterns, and further subdivision (“end-scraper,” “side-scraper,” etc.) would be unwise at this point.

Two dozen scrapers were recovered in the nonsite survey; several of these are illustrated on figure 42.

**Cores:** All cores recovered in this survey were manufactured of chert. Two show signs of battering (probably from use as hammerstones).

**Hammerstones:** Four hammerstones were recovered in the survey. These are merely

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**Fig. 46.** Miscellaneous ceramics from the Monitor Valley nonsite survey. a–o. Shoshone ware; p. Snake Valley Black-on-gray; q, r. Snake Valley Corrugated. a. 20.3/4593; b. 20.3/833; c. 20.3/7071; d. 20.3/6825; e. 20.3/4967; f. 20.2/9650; g. 20.2/9475; h. 20.3/7072; i. 20.3/262; j. 20.2/9650; k. 20.2/7072; l. 20.3/7074; m. 20.3/7075; n. 20.3/1952; o. 20.2/9475; p. 20.2/8684; q. 20.3/4134a; r. 20.3/4134b.

Provenience: a, k, m. Ny925; b. Ny865; c, l. Ny1228; d. Ny828; e. isolated find; f. Ny850; g, j, o. La701; h. La627; i. Ny864; n. isolated find 1 km east of Gabel Canyon; p. La645; q, r. Ny1234.
stream cobbles that show battering on one or more edges. These hammerstones have not been deliberately shaped.

GROUND STONE

MANOS: The manos recovered in this part of the Monitor Valley nonsite survey are listed on table 2. These manos had been deliberately shaped, generally by rough percussion and pecking. All have well-defined parallel sides, and a few show secondary use as hammerstones.

METATES: Twenty-three metate fragments were recovered in this aspect of the survey. Like the nearly 100 metates recovered from Gatecliff Shelter, these examples define a continuum from barely modified specimens to finely finished tools.

INCISED STONES

An incised stone is an easily portable pebble or flat stone slab, the surface of which has been purposefully cut by one or more shallow lines (T. Thomas, 1983a). The raw material is occasionally preshaped; but more commonly, the decorations are merely added to a naturally occurring shape.

Seventy incised stones were recovered in this portion of the Monitor Valley survey; they are illustrated in figures 43–45. These incised stones are quite similar to the more than 400 pieces excavated at Gatecliff Shelter (T. Thomas, 1983a); additional Monitor Valley examples are discussed by McKee and Thomas (1972). All are made of a platy limestone from the Roberts Mountains Formation (McKee, 1976).

CERAMICS

### TABLE 3

Attributes for Desert Side-notched Projectile Points from Monitor Valley Nonsite Survey

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Location</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Width neck (mm)</th>
<th>Thickness (mm)</th>
<th>DSA</th>
<th>PSA</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
<th>Material</th>
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<td>10.5</td>
<td>9.1</td>
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<td>(0.6)</td>
<td>Obsidian</td>
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<td>(20.0)</td>
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<td>(13.0)</td>
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<td>150</td>
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<td>(0.6)</td>
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<td>2.4</td>
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<td>(15.5)</td>
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<td>180</td>
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<td>(0.6)</td>
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<td>2.3</td>
<td>210</td>
<td>170</td>
<td>0.2</td>
<td>0.2</td>
<td>White chert</td>
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</tbody>
</table>

| $\bar{x}$ | 21.96 | 19.80 | 13.43 | 13.38 | 7.92 | 2.93 | 197.63 | 161.50 | 0.51 | 0.72 |
| $S$       | 3.98  | 3.72  | 2.51  | 2.50  | 1.27 | 0.54 | 13.37  | 11.82  | 0.21 | 0.31 |
| $n$       | 20    | 20    | 20    | 19    | 19   | 20   | 19     | 19     | 20   | 20   |
In the late 1500 Shoshone sherds recovered in Monitor Valley, roughly 600 came from this part of the nonsite survey (table 2). Three sherds were also found in Gatecliff Shelter (Thomas, 1983b: chap. 14), 66 sherds were recovered at the Butler Ranch Cave (chap. 4, this volume), 24 more came from Hunts Canyon Shelter (chap. 4, this volume), and over 850 were collected as part of the rock art catchment surveys (chap. 6, this volume).

Monitor Valley sherds show considerable variety in paste, temper, and hardness. The paste is generally light tan or buff, although occasionally sherds take on a gray cast, and dark firing clouds are not uncommon. Temper is probably residual, inclusions varying in size up to about 1.5 mm in diameter. The sherds are quite friable and tend to be highly fragmented. Fracture is generally random, although a few sherds show breakage along coil lines.

Surfaces are generally rather well smoothed. Several sherds show slight decoration by finger pinching about 75 mm below rim, at intervals of 1 cm. Shoshone ware sherds from the features are probably caused by the breakage. Fracture is generally random, although a few sherds show breakage along coil lines.

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that "more extensive work must be done on Shoshoni ware"; unfortunately, that statement remains true some three decades later.

**Sevier/Fremont Wares:** Over 150 non-Shoshone prehistoric ceramics were recovered in Monitor Valley. Of these, three sherds are Snake Valley Black-on-gray ceramics, all recovered at La645 (fig. 46p, table 2). The remaining sherds are Snake Valley Corrugated, found at La645, Ny850, and Ny1234 (fig. 46q-r, table 2).

Both types are associated with the Parowan variant of the Fremont culture (e.g., Marwitt, 1970), also known as the Sevier culture. The chronological range for Snake Valley ceramics is estimated to be from about A.D. 800 to A.D. 1300 (Madsen, 1977).

Sevier/Fremont ceramics are very rare in the Central Great Basin floristic province (as defined by Cronquist et al., 1972: fig. 54, and Thomas, 1983a: fig. 17). To my knowledge, the only other Sevier/Fremont material from this area is a lone sherd of Snake Valley Black-on-gray pottery from Newark Cave, roughly 100 km northeast of Monitor Valley (Fowler, 1968a: 22-23). Tuohy has also recovered corrugated ceramics at La26 (personal commun.).

Fremont ceramics are not, of course, at all rare to the east, in the Calcareous Mountain area (e.g., Wheeler, 1942; Rudy, 1953; Fowler, 1968b; Fowler et al., 1973; Fowler and Sharrock, 1973; Brooks et al., 1977; Busby, 1977, 1979; Tuohy, 1956: 70, 1974; Gruhn, 1979: 146-147; Tuohy, personal commun.). Isolated Snake Valley sherds also occur (infrequently) in the Tonopah section, to the south (Brooks, 1969; McGonagle and Waski, 1978: 22-23; Self, 1980: 126-127).

This occurrence of Sevier/Fremont ceramics in Monitor Valley at present defines the westernmost extent of both types (David B. Madsen, personal commun.).

**Stone Pendants**

20.3/1953 (fig. 47a): a complete pendant made of dark gray slate (max. length = 76.6 mm, max. width = 39.9 mm, max. thickness = 3.7 mm). The pendant was initially shaped by grinding the blank across a large, probably stationary surface, creating distinct facets of abrasion. Finishing was accomplished by a rather small, presumably hand-held abrader that created hundreds of small linear striations. The biconical perforation was created by a tool with rapidly expanding bit (max. perforation diameter = 3.7 mm; min. perforation diameter = 2.1 mm).

20.3/5691 (fig. 47b): a rudely fashioned pendant made of tabular slate (max. length = [56+ mm]; max. width = [29+ mm]; max. thickness = [6.2+ mm]). The surfaces were roughly ground to shape. The piece was broken sometime after manufacture, and only about ⅓ of the original pendant was recovered. The central biconical perforation was very carefully made (max. perforation diameter = 5.0 mm; min. perforation diameter = 2.1 mm).

20.2/9328 (fig. 47c): a painstakingly manufactured pendant made of the same dark gray slate as was used for 20.3/1953 (max. length = 47.6 mm; max. diameter = 18.9+ mm; max. thickness = 1.8 mm). Both sides are very finely polished, with tiny linear manufacturing striations visible in places. The pendant was decorated on both sides by a series of radiating tick marks and a complex set of "rocked" motifs similar to those observed on the incised limestone slates from Gatecliff Shelter (T. Thomas, 1983a, 1983b). The original piece appears to have been tear-drop shaped; it was broken after manufacture. The perforation is biconical (max. perforation diameter = 3.7 mm; min. perforation diameter = 3.0 mm).

20.3/5628 (fig. 47d): a fragmentary whitish soft talc pendant (max. length = 41.4+ mm; max. width = 9.2+ mm; max. thickness = 4.2 mm). The raw material contains a series of decorative parallel bands, running perpendicular to the axis of the artifact. Sides and edges have been very highly polished; very few manufacturing striations are evident. The proximal end has been deliberately cut off (as if a handle had been attached during manufacture, then later discarded); a few longitudinal cut marks are evident in this area. The biconical perforation was completed before breakage.

**Shell Beads**

20.3/5149 (fig. 47e): a complete Large Spire-lopped Olivella bead (length = 15.4 mm; diameter = 10.3 mm; perforation diameter = 3.5 mm). The spire has been ground perpen-
tical to the long axis of the shell, with no other modification apparent. This bead is very similar to one recovered from Horizon 8 at Gatecliff Shelter (Bennyhoff and Hughes, 1983).

20.3/1280 (fig. 47f): complete Olivella Large Saucer bead (length = 15.0 mm; diameter = 15.0 mm; perforation diameter = 2.5 mm). This bead was made from the wall of an Olivella shell, and the edges have been roughly ground so that the finished product is nearly round. The central perforation has been punched rather than drilled.

**Worked Turquoise**

Four pieces of worked turquoise were found in this part of the nonsite survey (fig. 47g–j). Specimen 20.2/9901 was highly polished on both sides, but broken in the process of perforation. Artifact 20.3/2442 is bifacially polished, retaining linear and circular manufacturing striations; the edges have also been ground smooth. The remaining two turquoise fragments are only minimally modified.

**Notes**

1. These general observations apply to the total ceramic assemblage recovered in Monitor Valley. For more specific comments, see descriptions provided with each site/nonsite discussion. Note also that we have illustrated a couple of unusual sherds and pendants not recovered from Monitor Valley.

2. These identifications have been graciously confirmed by Dr. David B. Madsen.
<table>
<thead>
<tr>
<th>Spec.</th>
<th>Location</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Width neck (mm)</th>
<th>Thickness (mm)</th>
<th>DSA</th>
<th>PSA</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
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$n$ 29 29 27 29 29 21 29 29 29 29

TABLE 7
Attributes for Elko Eared Projectile Points from Monitor Valley Nonsite Survey
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TABLE 8
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|$\bar{x}$: 40.55, $S$: 9.62, $n$: 22

TABLE 9
Attributes for Gatecliff Contracting Stem Projectile Points from Monitor Valley Nonsite Survey.
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<th>Width max. (mm)</th>
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\* 20.3/4408 was repeatedly resharpened, thus reducing its length and weight below Humboldt criteria.
### TABLE 11
Attributes for Large Side-notched Projectile Points from Monitor Valley Nonsite Survey

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### TABLE 12
Attributes for Miscellaneous Projectile Points from Monitor Valley Nonsite Survey

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<th>Weight actual (g)</th>
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<td>17.0</td>
<td>7.5</td>
<td>170</td>
<td>130</td>
<td>9.0</td>
<td>9.0</td>
</tr>
<tr>
<td>20.3/5724</td>
<td>Ny1228</td>
<td>24.9</td>
<td>23.9</td>
<td>11.2</td>
<td>9.6</td>
<td>—</td>
<td>4.5</td>
<td>—</td>
<td>—</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>20.3/5746</td>
<td>Ny1228</td>
<td>(33.5)</td>
<td>—</td>
<td>(24.6)</td>
<td>(13.0)</td>
<td>—</td>
<td>3.1</td>
<td>170</td>
<td>130</td>
<td>1.5</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Red chert  | White quartzite  | Gray chert  | White chert  | Brown chert  | Tan chert  | Brown chert
CHAPTER 3. THE ARCHAEOLOGY OF TRIPLE T SHELTER (Ny345)

DAVID HURST THOMAS AND ROBERT L. KELLY

Triple T Shelter (Ny345) is a small south-facing alcove in West Northumberland Canyon. Its location is NE ¼ of Section 9, T13N, R45E (fig. 48). Situated at an elevation of ca. 2024 m (6640 ft), Triple T is about 12 km (7.5 mi) due west of Gatecliff Shelter, although direct access requires a journey three times that distance (fig. 49). The shelter is a domelike concavity in the base of a highly weathered outcrop of the Northumberland Tuff (McKee, 1976: 29–33). Triple T Shelter is approximately 7 m wide and 6 m high at the opening and extends about 3 m into the tuff outcrop.

This previously unreported locality was brought to our attention by Mr. Bill Britton, District Ranger for the U.S. Forest Service, then stationed in Austin. We named the site after an important ranch in nearby Big Smoky Valley.

Triple T Shelter is situated where West Northumberland Canyon becomes extremely narrow and steep-sided, approximately 500 m downcanyon from the extant margin of the piñon-juniper community (fig. 50). The site is about 300 m above the floor of Big Smoky Valley, roughly 2 km from the mouth of the canyon. Strictly speaking, Triple T Shelter lies outside the Monitor Valley drainage.

The shelter fronts on a large dry wash (fig. 51) which, while not active during the 1973, 1974, or 1976 excavations, saw massive flooding in June 1979; Davis (1983) discussed the geomorphological consequences of this event. At present, the nearest permanent water source is a small spring about 8.5 km east of Triple T Shelter.

EXCAVATION STRATEGY

Triple T Shelter was first recorded and tested by crews from the American Museum of Natural History in 1973 as part of overall reconnaissance in the Monitor Valley area. The initial 1 m square test pit, excavated to a depth of 80 cm, revealed a fairly thick and dry subsurface deposit. We continued excavations in 1975 and 1976 with the hope that this site might provide an independent complement for the natural and cultural stratigraphic sequence at Gatecliff Shelter. These initial hopes were fulfilled.

In 1975, the site was gridded at 1 m intervals defined by an alphanumeric coordinate system (fig. 52), the initial test pit was expanded, and a permanent datum was established at ground level against the cave wall to the rear of the shelter. The deposits were excavated in arbitrary 10 cm levels, split when necessary to conform with natural stratigraphic divisions. All fill was troweled and passed through 1/8 in. mesh screens. Artifacts were piece-plotted whenever possible. The deepest unit in 1975 reached a depth of 370 cm below datum, but the bottom of the site was not exposed that year.

We returned to Triple T Shelter in 1976. By combining the 1975 fieldnotes with a preliminary stratigraphic profile prepared by Melhorn and Trexler, we could readily distinguish sterile units from those containing cultural debris. The site was regridded into a 2 m alphabetic system and sterile strata were shoveled out. Deposits containing cultural material were excavated as before. In this manner, a large portion of the site was excavated with a high in situ recovery technique; 63 percent of the artifacts recovered in 1976 were found in place and piece-plotted. Remaining artifacts were recovered in the 1/8 in. mesh screens.

During the 1976 season, artifact provenience was mapped using surveyor's level and stadia rod. A permanent cement datum (roughly 80 cm below the top of the deposit) was established about 2 m in front of the shelter; 1975 measurements were then correlated to this permanent datum. The 1976 excavations reached the bottom of the site at 555 cm below (permanent) datum. The total depth of the stratigraphic column is about 640 cm.
American Museum of Natural History crews excavated approximately 55 m³ of deposit from Triple T Shelter. This total represents roughly half the fill contained in the shelter. Additional culture-bearing deposits still remain at Triple T, and the site was completely backfilled to protect these unexcavated sediments.
Fig. 49. Contour map of Triple T Shelter and West Northumberland Canyon. Contour interval is 2 m.

PHYSICAL STRATIGRAPHY

WILTON N. MELHORN,
DENNIS T. TREXLER,
AND DAVID HURST THOMAS

Triple T Shelter is located at the base of a nearly vertical cliff where the creek has cut through flat-lying, poorly welded and indurated units within a thick, composite, rhyolite ash-flow sheet named the Northumberland Tuff by McKee (1974). About 4 km farther upstream, the valley floor widens where the creek cuts through a thick section of white-colored, fine-grained waterlaid sediments that were redeposited by ponding within the Northumberland Caldera after the collapse occurred. Valley slopes also are more gentle in this upstream reach and several small springs issue from erosional reentrants that crenulate the canyon walls. In this setting, evulsion and spring sapping have created a miniature badlands topography characterized by development of the spires and turrets called demoiselles or hoodoos (Bryan, 1925).

Near the shelter, the generally level but locally hummocky valley floor is box-shaped in cross section; the nearly flat alluvial surface rises at a sharp angle where it meets the valley walls. The creek is incised about 1.5 m into coarse, rubbly alluvium. This depth of incision is a local characteristic rather than a general condition in the valley and seems to have resulted from steepening along a short reach of channel where it was relocated during road construction. A dramatic flood in July 1979 scoured the area in front of Triple T Shelter, filling the channel incision.

Along with a few local tributaries to the main channel, a small canyon joins the creek at an acute angle just upstream from the shelter, and thus the valley widens somewhat in front of the site. There are no significant local alluvial fans or stream terraces, but small alluvial cones occur at the base of the steeper slopes. The fan trench at the apex of the West Northumberland fan is insignificant.

The total aspect suggests that (1) the area has been tectonically quiescent for a consid-
erable time, (2) the channel is in equilibrium, and (3) the dominant long-term geomorphological process is slow mechanical breakdown of tuff from the valley walls. The shelter alcove seems to have formed originally at the juncture of joints in the ash-flow tuffs. Subsequently, Triple T Shelter was enlarged by a combination of stream evulsion at the base and mechanical backwasting along the fractures.

The physical stratigraphy of Triple T Shelter was formally measured, described, photographed, and drawn on two occasions (July 1975 and August 1976). Excavation was confined to a 2 m square area at these times, so stratigraphic descriptions are limited to what was apparent in the single vertical trench (figs. 52 and 53; tables 13 and 14).

The sedimentary column at Triple T is rather striking when compared to the extant geomorphic landforms and attendant processes. It is worth noting that the total area between the frontal berm and the shelter backwall is quite small in relation to that at Gatecliff Shelter. However, fluvial and ponded sediments, as at Gatecliff, comprise a major portion of the deposits below the surface rubble that has accumulated over the past 3000 years. Interpretation of this sedimentary record has been included in the analysis of the Gatecliff stratigraphic record (Thomas, 1983b).
Fig. 52. Plan view of Triple T Shelter.

The stratigraphic divisions are apparent in both the measured section (fig. 54) and in an internal cross-section correlation between the front wall and the rear of the shelter (fig. 55). The following descriptions are subdivided into major and minor strata designated by Roman numerals and letters, respectively.

**Stratum I**

This is a rubble unit with a cemented gravel conglomerate underneath, denoted as IA and IB, respectively. Two radiocarbon dates are available from Stratum I:

- QC-167 920 B.P. ± 105; near the top of Stratum IA.
- QC-172 2700 B.P. ± 105 and 3030 B.P. ± 110; from hearth dug from Strata IA and IIA into Stratum IB.

Stratum I contained cultural remains from the Yankee Blade, Underdown, Reveille, and Devils Gate phases. We estimate the radiocarbon age of Stratum I to be from 0 to approximately 3500 years B.P.
### Table 13

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Deposit</th>
<th>Field design</th>
<th>Age (C-14 years B.P.)</th>
<th>Date (C-14 years A.D./B.C.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>Rubble</td>
<td>GU 1</td>
<td>0–3500 B.P.</td>
<td>1550 B.C. to present</td>
</tr>
<tr>
<td>IB</td>
<td>Gravel conglomerate</td>
<td>GU 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIA</td>
<td>Sand and silt</td>
<td>GU 3</td>
<td>3500–4000 B.P.</td>
<td>2050–1550 B.C.</td>
</tr>
<tr>
<td>IIB</td>
<td>Gravel and sand</td>
<td>GU 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIC</td>
<td>Sand</td>
<td>GU 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIIA</td>
<td>Rubble</td>
<td>GU 6</td>
<td>4000–5400 B.P.</td>
<td>3450–2050 B.C.</td>
</tr>
<tr>
<td>IIIB</td>
<td>Silty sand</td>
<td>GU 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIIIC</td>
<td>Organic mat</td>
<td>GU 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIIID</td>
<td>Rubble</td>
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<td>IIIIE</td>
<td>Sand</td>
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<td>IIIIF</td>
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</tr>
<tr>
<td>IIIIG</td>
<td>Sand</td>
<td>GU 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIIIH</td>
<td>Rubble</td>
<td>GU 13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVA</td>
<td>Gravel</td>
<td>GU 14</td>
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<td></td>
</tr>
<tr>
<td>IVB</td>
<td>Sand</td>
<td>GU 15</td>
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<td></td>
</tr>
<tr>
<td>IVC</td>
<td>Rubble</td>
<td>GU 16</td>
<td>5400–6000 B.P.</td>
<td>4050–3450 B.C.</td>
</tr>
<tr>
<td>IVD</td>
<td>Sand and silt</td>
<td>GU 17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVE</td>
<td>Rubble</td>
<td>GU 18</td>
<td></td>
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</tr>
</tbody>
</table>

### Table 14

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Lab. no.</th>
<th>Age (B.P.)</th>
<th>Date</th>
<th>Provenience &amp; comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>QC-167</td>
<td>920 ± 105</td>
<td>A.D. 1030 ± 105</td>
<td>Charcoal scatter near top of Stratum IA</td>
</tr>
<tr>
<td>IA/IIA</td>
<td>QC-172</td>
<td>2700 ± 105</td>
<td>750 B.C. ± 105</td>
<td>Charcoal from hearth dug from Stratum IA and Stratum IIA. Lab. ran sample twice.</td>
</tr>
<tr>
<td>IIB</td>
<td>QC-171</td>
<td>3720 ± 95</td>
<td>1770 B.C. ± 95</td>
<td>Charcoal scatter near top of Stratum IIB</td>
</tr>
<tr>
<td>IIB</td>
<td>UCLA-1989H</td>
<td>3640 ± 85</td>
<td>1690 B.C. ± 85</td>
<td>Charcoal from oxidized zone in Stratum IIB</td>
</tr>
<tr>
<td>IIIA</td>
<td>QC-168</td>
<td>4880 ± 120</td>
<td>2930 B.C. ± 120</td>
<td>Charcoal from an apparent occupation surface near bottom of Stratum IIIA. Lab ran sample twice.</td>
</tr>
<tr>
<td>IIIA</td>
<td>UCLA-1989G</td>
<td>5000 ± 90</td>
<td>3050 B.C. ± 90</td>
<td>Charcoal scatter from near bottom of Stratum IIIA</td>
</tr>
<tr>
<td>IIC</td>
<td>UCLA-1989F</td>
<td>5700 ± 100</td>
<td>3750 B.C. ± 100</td>
<td>Charcoal scatter from oxidized area</td>
</tr>
<tr>
<td>IIID</td>
<td>QC-169</td>
<td>5000 ± 170</td>
<td>3050 B.C. ± 170</td>
<td>Charcoal scatter from middle of Stratum IIDs</td>
</tr>
<tr>
<td>IIIF</td>
<td>UCLA-1989E</td>
<td>5350 ± 100</td>
<td>3400 B.C. ± 100</td>
<td>Charcoal scatter from throughout Stratum IIIF</td>
</tr>
<tr>
<td>IIIH</td>
<td>UCLA-1989D</td>
<td>5430 ± 105</td>
<td>3480 B.C. ± 105</td>
<td>Charcoal scatter from throughout Stratum IIIH</td>
</tr>
<tr>
<td>IVA</td>
<td>QC-294</td>
<td>5385 ± 145</td>
<td>3435 B.C. ± 145</td>
<td>Charcoal scatter from throughout Stratum IVA</td>
</tr>
<tr>
<td>IVC</td>
<td>UCLA-1989C</td>
<td>5430 ± 120</td>
<td>3480 B.C. ± 120</td>
<td>Charcoal scatter from throughout upper Stratum IVC</td>
</tr>
<tr>
<td>IVC</td>
<td>QC-170</td>
<td>6340 ± 160</td>
<td>4390 B.C. ± 160</td>
<td>Charcoal scatter from throughout lower Stratum IVC. Lab note: “Sample . . . was small and had to be diluted with 'dead' benzine . . . might concede several hundred years.”</td>
</tr>
</tbody>
</table>

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*All radiocarbon determinations are computed using the Libby half-life of 5568 ± 30 years.*
coal and rested on a stone ring of angular cobbles. Stratum IB contacted both Strata IA and IIB irregularly and thinned out to the south.

**Stratum II**

This stratum consists of gravel and sand (IIB), underlain and overlain by fluvial sand layers. Two radiocarbon determinations are available for Stratum II:

- QC-171 3720 B.P. ± 95; near the top of Stratum IIB.
- UCLA-1989H 3640 B.P. ± 85; from oxidized zone in Stratum IIB.

Stratum II contained cultural remains from at least the Devils Gate phase. We estimate that the radiocarbon age of Stratum II is from approximately 3500 to 4000 years B.P.

**Stratum IIA, Sand and Silt:** Pale brown (10 YR 7/4) to light gray (10 YR 7/2), well cemented, weakly calcareous, with filled desiccation cracks throughout. Thickness ranged from 18 to 20 cm with a few pebbles scattered throughout, some cobbles near base, and a lens of intercalated gravel 50 mm above base on the west and southwest faces. There were also scattered charcoal fragments and rodent burrows on the south face.

**Stratum IIB, Gravel and Sand:** Light yellowish brown to tan (10 YR 5/4): gravel and sand substrata alternating, with 50 mm of gravel at top, underlain by 25 mm of finer grained sand containing a few pebbles, then 100+ mm of gravel, and 75+ mm of partly black chert sand at base. A few charcoal fragments occurred at base, and a large 200 mm diameter boulder was embedded in the south face of Stratum IIB and extended downward 100 mm into the underlying stratum.

**Stratum IIC, Sand:** Light grayish brown (10 YR 5/2) to light gray (10 YR 7/2), noncalcareous, with angular fragments of feldspar, quartz, and black chert. Thickness varied from 13 to 28 cm and was greater toward the west. A very fine network of roots and angular cobbles of welded tuff as large as 105 mm in diameter were scattered throughout. The stratum appeared to be laminated due to colors of varying lithologies.
Fig. 54. Photograph of the upper portion of the Triple T Shelter stratigraphic profile (looking south); stratum numbers have been added.
**STRATUM III**

This stratigraphic unit contains seven subdivisions consisting of alternate bands of fluvial and in situ deposits. Six radiocarbon determinations are available from Stratum III:

- QC-168: 4880 B.P. ± 120 and 4320 B.P. ± 90; near bottom of Stratum IIIA.
- UCLA-1989G: 5000 B.P. ± 90; near bottom of Stratum IIIA.
- UCLA-1989F: 5700 B.P. ± 100; oxidized area in Stratum IIIC.
- QC-169: 5000 B.P. ± 170; near middle of Stratum IIID.
- UCLA-1989E: 5350 B.P. ± 100; scatter from throughout Stratum IIIF.
- UCLA-1989D: 5430 B.P. ± 105; Stratum IIIH.

The cultural affiliation of Stratum III is confused, but it appears that this stratum contained at least one Clipper Gap phase occupation. We estimate that the radiocarbon age of Stratum III is about 4000 to 5400 years B.P.

**STRATUM IIIA, RUBBLE:** Yellowish brown (10 YR 5/4), muddy or powdery in appearance, strongly calcareous, and containing angular weathered blocks of roof breakdown. It is as much as 18 cm thick; the unit thinned slightly toward the west. A reddish colored baked zone lay at the top of the stratum on the south face, and charcoal fragments extended laterally at the same level on the west and north faces.

**STRATUM IIIB, SILTY SAND:** White to yellowish brown (10 YR 5/4), strongly calcareous, with a few small rootlets. Thickness varied from 6 to 9 cm and it contained scattered krotovinas up to 35 mm in diameter. Contact with upper unit was regular except at hearth on south wall.

**STRATUM IIIC, ORGANIC MAT:** Very dark brown (10 YR 2/2) tightly packed roots in a matrix of light brownish gray (10 YR 6/2) calcareous silty sand. Thickness was 13 to 14 cm, underlain by moderately to strongly developed, moderately calcareous, yellowish brown incipient A soil horizon with a reddish cast (10 YR 6/2–10 YR 6/6). Roots and root casts penetrated to 1 cm above base of unit. Contact with Stratum IIIB was undulating to hummocky on south and west, otherwise regular.

**STRATUM IIID, RUBBLE:** Yellowish brown (10 YR 5/4), muddy to powdery in appearance. Thickness ranged from 16 to 19 cm; similar to Stratum IIIA but contained angular clasts up to 1.5 cm in diameter. A hearth occurred at the top of the unit.

**STRATUM IIIE, SAND:** Light gray to yellow gray (5 Y 7/2–5 Y 7/4) weakly calcareous, faintly laminated in appearance, and roots throughout; otherwise lithologically similar to Stratum IIC. Thickness ranged from 28 to 30 cm; a laterally discontinuous lens of strongly calcareous silt, 10 to 15 mm thick, occurred 2.5 cm below top of unit. Stratum was conformable with Strata IIID above and IIIF below.

**STRATUM IIIF, RUBBLE:** Yellow brown (10 YR 5/4), strongly calcareous, and contained fine threadlike roots throughout. Thickness was 8 cm; it appeared identical to Strata IIIA and IIID and was apparently derived from highly altered and weathered tuff.

**STRATUM IIIG, SAND:** Light brownish gray (10 YR 6/2) to light yellowish brown (10 YR 6/4), fine-grained, crossbedded sand composed of chert, angular quartz grains, plagioclase, and volcanic clasts. As much as 18 cm thick; the upper 12 cm was weakly calcareous; the lower 12 to 14 cm was inert and contained scattered pebbles as large as 1 cm with desiccation cracks near the back face of
the shelter. It appeared identical to Strata IIIC and IIIF, with fine threadlike roots that penetrated the upper 2.5 cm, but had a smaller percentage of chert fragments. The unit was conformable with Strata IIIF and IIIF, but thinned on the east face to 12 cm thick at the back.

**STRATUM IIIH, RUBBLE:** Gray brown, charcoal fragments, carbonized root casts and rootlets throughout, contained in a sandy matrix. Also, angular clasts of welded tuff 8–9 cm in diameter were scattered throughout. As much as 26 cm thick, the upper 12 to 15 cm was strongly oxidized; a 12 cm thick lens of fine-grained, faintly bedded, olive gray (5 Y 5/2) sand was underlain by 5 cm yellowish gray silt at the rear of the shelter. The sand-silt lens pinched out 1.35 m from the back face and did not appear in the south face of the exposure. Silt thickened westward to 10 cm in a distance of 1 m.

**Stratum IV**

The basal stratum contained five subdivisions. Three radiocarbon determinations are available for Stratum IV:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Date (B.P.)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>QC-294</td>
<td>5385 ± 145</td>
<td>from Stratum IVA.</td>
</tr>
<tr>
<td>UCLA-1989C</td>
<td>5430 ± 120</td>
<td>from upper part of Stratum IVC.</td>
</tr>
<tr>
<td>QC-170</td>
<td>6340 ± 160</td>
<td>from lower part of Stratum IVC.</td>
</tr>
</tbody>
</table>

The cultural affiliation for Stratum IV is unclear, but we estimate the radiocarbon age of this basal unit to be from about 5400 to 6000 years B.P.

**STRATUM IVA, GRAVEL:** Subrounded to rounded, 1.0–1.5 cm size fragments of tuff and dark-colored volcanic rocks, general color is yellowish light gray (5 Y 7/2), moderately calcareous, and fairly well cemented throughout. A few large clasts lay near the base that graded upwards slightly in a muddy matrix, with desiccation cracks, and fine rootlets at top. The unit thickened southwest from 28 to 50 cm in a lateral distance of 75 cm. This stratum appeared to be flood deposit.

**STRATUM IVB, SAND:** medium to dark pinkish gray (5 YR 7/2–5 YR 5/1), uncremented, rounded to subangular, clear quartz grains, and fragments of medium-grained dark tuff (giving macroscopic salt-and-pepper appearance), weakly calcareous, root tendrils throughout. The stratum varied in thickness from 3 to 16 cm and thickened to the southwest.

**STRATUM IVC, RUBBLE:** Silty, pale yellow-brown matrix (10 YR 6/4), strongly calcareous, a few very fine root tendrils and casts, and charcoal fragments; scattered pods or lenses of light olive gray (5 Y 5/2), moderately calcareous sand irregularly distributed throughout unit. The stratum was as much as 90 cm at east face and thinned to 58 cm in the west.

**STRATUM IVD, SAND AND SILT:** Pebbly silt in top 3 cm, graded into coarse sand in the lower 25 cm. Pebbles were contained throughout but became progressively larger near the bottom. The stratum also contained pockets of white powdery material which appeared to be decomposed roof fall (not ash). Stratum sloped gently from the north, where it draped against the cave wall.

**STRATUM IV E, RUBBLE:** Reddish rhyolite and tuff. At least 48 cm thick, it represented in situ weathering of the cave wall. The sloping cave wall cut off the basal excavation unit and the bottom was not exposed.

**PALYNOLOGY**

**ROBERT R. KAUTZ**

This section analyzes fossil pollen from the sediments of Triple T Shelter. The comparison between the pollen profiles from Gatecliff and Triple T shelters is particularly instructive because of the rather different ecological settings of the two sites (see also Thompson and Kautz, 1983). Triple T Shelter is situated at the base of welded tuff outcrops which have well-developed talus slopes hosting several stands of *Ephedra*. The south side of West Northumberland Canyon, across from Triple T Shelter, is also characterized by steep tuff outcrops and variegated talus, containing *Ephedra*, rabbitbrush (*Chrysothamnus*), sagebrush (*Artemisia* sp.), and occasional isolated juniper trees.

The Northumberland Canyon bottom vegetation is a continuation of the thin lower
sagebrush ecozone which only fringes the western slope of the Toquima Range. Unlike the Monitor Valley vegetation, which is dominated by big sagebrush (Artemisia tridentata), the vegetation of the Big Smoky Valley consists of smaller and more salt- and heat-tolerant “shadscale” types—primarily rabbitbrush, the small, stunted Artemisia spinescens, hopsage (Grayia) and saltbush (Atriplex). Annuals such as Eriogonum, Festuca, and Oenothera may be less common today due to historic grazing pressure (Billings, 1949: 97). Certain “edaphic climaxes” are also present where soil conditions permit. Depending on specific context, these may contain greasewood (Sarcobatus spp.), winterfat (Eurotia), or horsebrush (Tetradymia).

Forty-eight subsurface samples and one surface “pinch” pollen sample were collected and extracted from a single profile at Triple T Shelter. The procedures were identical to those already used and described for the Monitor Valley and Gatecliff Shelter analyses (Kautz, 1983; Thompson and Kautz, 1983).

Figure 56 is the pollen profile for Triple T Shelter. These pollen samples can be summarized in terms of the four major geological strata defined above.

**Stratum IV (4050 b.c. to 3450 b.c.)**

Six pollen samples are available for the basal stratum at Triple T Shelter, which consists of alternating sand, gravel, and rubble units. The early pollen spectrum is charac-
terized by very low arboreal pollen frequencies and correspondingly high frequencies of cheno-am, Artemisia, and low-spine composites. The dominance of shadscale zone vegetative types is certainly indicative of a moisture-poor climatic regimen.

**Stratum III (3450 B.C. to 2050 B.C.)**

This 1400-year interval is represented by 20 pollen samples extracted from the alternating sand and rubble units of Stratum III at Triple T Shelter. The pollen frequencies from the lower portion of this zone (below Stratum IIID) are virtually identical to those from Stratum IV. At Stratum IIID, however, there is a reversal of earlier trends, namely, increases in arboreal pollen and decreases of cheno-am, Artemisia, and low-spine composites. This evidence suggests that a somewhat more moist interval commenced in the vicinity of Triple T Shelter beginning ca. 3000 B.C. or so.

**Stratum II (2050 B.C. to 1550 B.C.)**

The five pollen samples available from the sand and gravel beds of Stratum II indicate little change from the trends noted in Stratum III.

**Stratum I (1550 B.C. to present)**

Seventeen pollen samples were taken from the angular cobble rubble and cemented gravel conglomerate of Stratum I; an additional pitch sample was taken from the surface of the site. The lower third of Stratum I is characterized by what appears to be increased moisture; this is the moistest interval in the Triple T pollen spectrum. Arboreal pollen is dominated by pine, which tends to mask juniper frequencies. Cheno-am frequencies are quite low during this interval. The increase in Artemisia pollen during this time may be due to increased A. tridentata stands within Northumberland Canyon, but it is also possible that decreasing cheno-am frequencies exaggerate the contribution of Artemisia. Sarcobatus pollen is decidedly less common during the deposition of Stratum IB, probably due to local edaphic factors. Eriogonum occurs with modest frequency during Stratum IB times. Near the top of Stratum IB, Betula (in the "Other AP" category) is replaced by Alnus pollen; a similar shift occurred at Gatecliff in corresponding strata.

The uppermost Stratum IA is characterized by decreasing pine frequencies relative to juniper, decreasing Artemisia, marked increase in cheno-ams, and a fluctuating increase of Ephedra pollen. These changes suggest a trend toward increasing aridity, more active talus slopes, and a lower water table within the last two millennia; very similar changes are evident in the pollen profile from Gatecliff Shelter.

The Triple T Shelter pollen profile provides a useful counterpoint to the evidence from Gatecliff Shelter because of the different ecological settings of the two sites. Whereas Gatecliff is situated at a relatively high elevation in the contemporary piñon juniper zone, Triple T occurs less than 2 km from the floor of Big Smoky Valley, which is dominated by shadscale zone vegetation. The pollen counts at Triple T indicate the presence of rather similar vegetation throughout the occupational history of the site. In addition, arboreal pollen, derived from Pinus monophylla and Juniperus, provide a crude gauge of available moisture expressed through the "total AP" and by their generally inverse frequencies through time. It is also interesting to note the relationship between the almost mutually exclusive pollen frequencies of greasewood (Sarcobatus) and buckwheat (Eriogonum). It could be that Sarcobatus expanded during periods of more cyclical precipitation, in response to salty soils near the water table. Eriogonum would seem to have expanded during periods when precipitation was fairly regular and soils were deprived of those same salts.

The climatic implications of the Triple T profile have been discussed elsewhere (Thomas, 1983b).

**FAUNAL REMAINS**

**DAVID HURST THOMAS AND ROBERT L. KELLY**

A very small sample of vertebrate remains was recovered at Triple T Shelter, despite the fact that all the excavated deposit was screened through 1/8 in. screens. All the bones were analyzed under the supervision of Donald K. Grayson, resulting in the identification of 539 bones and teeth from this site. All but one of these were mammal bones, which can be ascribed to 24 taxa (table 15). A single
### Table 15

**Numbers of Identified Small Mammal Elements per Taxon by Stratum at Triple T Shelter**

Identifications by Douglas J. Brewer (University of Washington)

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*a See text for discussion of bird elements from this site.*
carpometacarpus of a great horned owl (*Bubo virginianus*) was found in Stratum IA. Fourteen unidentified elements of passerines were also recovered.

All the identified taxa currently live in the Toquima Range or Monitor Valley. The small size of the sample, coupled with the fact that 77 percent of the identified elements came from a single stratum (IA) militates against detailed analysis of these materials.

**MATERIAL CULTURE**

Although the depositional sequence and overall appearance of Triple T Shelter are comparable to those of Gatecliff Shelter, Triple T lacks clear-cut distinction between various cultural components. The majority of cultural materials at Triple T derive from Stratum IA, ranging in age from Yankee Blade to Devils Gate times. The Stratum IA cultural deposits have clearly been mixed and combined as a result of natural and cultural activities on the site. It would also seem that deposits near the center of the shelter were more disturbed than those along the walls of the site. Packrat activity has also disturbed the westernmost deposits to some extent, and this may account for the concentration of Promontory pegs and long bone fragments found there.

The upper rubble units at both Gatecliff Shelter and Triple T contain an obvious measure of vertical mixture. We were fortunate at Gatecliff Shelter because the upper rubble unit was internally stratified by sterile silt lenses, permitting us to define distinct cultural components within the rubble. But although the upper rubble stratum at Triple T spans the same time period as the similarly placed unit at Gatecliff—roughly the last 3500 years—it lacks internal stratigraphy.

Hoping to duplicate the Gatecliff sequence during our excavations at Triple T, we divided Stratum IA into upper and lower units. This field division was made at an apparent contact separating Underdown and Reveille components. As we analyzed the materials, however, it became clear that this division had been wholly arbitrary. There was no separation of projectile point types within the deposit, and conjoined fragments of broken artifacts occur up to 60 vertical cm apart in the matrix. We also detected at least two poorly preserved habitation surfaces which crosscut the arbitrary upper/lower division within Stratum IA.

Our field division was unprofitable, but we still feel obliged to subdivide Stratum IA in some fashion. We grouped Stratum IA proveniences according to 10 cm levels (tables 16 and 17). This division is not totally satisfactory either because we know that the occupational surfaces generally are higher in the eastern half and dip somewhat toward site center, but it seems to provide the best means at hand for subdividing the massive Stratum IA.

Artifacts from Triple T Shelter were classified by criteria discussed previously (chap. 2, this volume; see also Thomas, 1981a, 1983b). The function of this chapter is to describe the material culture and its context within this site. Detailed analyses of these artifacts and features are undertaken in subsequent chapters of this monograph.

**PROJECTILE POINTS**

Ninety-seven typable projectile points were recovered in the Triple T excavations (see table 16 for stratigraphic provenience). A great deal of stratigraphic mixture has occurred within Stratum IA, but the geological units below IA are well separated and stratigraphically intact.

**DESERT SIDE-NOTCHED:** Thirteen Desert Side-notched points were found. These points are illustrated in figure 57a–m, and the attributes are listed in table 18 (at the end of this chapter).

The Desert Side-notched points from Triple T are similar to those from Gatecliff Shelter. Two points appear to be unfinished (fig. 57g, h): specimen 20.3/3045 has a pronounced step fracture which prevented adequate thinning, and 20.3/4005 is almost triangular in cross-section, with one face barely retouched. Flaking is irregular on both unfinished points, and the weight is correspondingly greater than the average for the type. The "Sierran" basal form seems to be particularly common at Triple T Shelter. The bases of two specimens are atypical of the Desert Side-notched type (fig. 57 l, m).
### Table 16

**Projectile Point Frequencies at Triple T Shelter**

Additional artifacts are listed in table endnotes.

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<td>Rosegate series</td>
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</table>

*a* Bipoint.  
*b* Triple T Concave Base point.

**Cottonwood Triangular:** Seven Cottonwood points were recovered (see fig. 57n–t and table 19). Attributes are listed in table 19.

**Rosegate Series:** Nineteen Rosegate points were recovered from Stratum IA (fig. 58 and table 20). With only one exception, these relatively small and well-made points were manufactured from locally available chert. Several exhibit the square tangs typical of Eastgate Expanding Stem points, whereas others have the more common pointed tang. One Rosegate series point (fig. 58r) has an indented base; O’Connell and Ambro (1968) refer to such points as Surprise Valley Split Stem, but for reasons outlined elsewhere (Thomas, 1981a), we do not retain that designation.

**Elko Corner-notched:** Elko Corner-notched points are the most abundant type at Triple T Shelter (fig. 59 and table 21), and all were found in Stratum IA, except for 20.3/7567, found in Stratum IVC.

This single stratigraphic exception may have some general implications for Great Basin projectile point typology. Elsewhere, one
of us has advocated a relatively short temporal span for most central and western Great Basin types, assigning a range from 1300 B.C. to A.D. 700 for the Elko series in this area (Thomas, 1981a). Finding an Elko Corner-notched point in a stratum firmly dated as older than 3450 B.C. is thus unexpected.

There is no question that this indeed is an Elko Corner-notched point (fig. 59g). Nor is there any question regarding its provenience. One is reminded of the two unusual stemmed points found in the basal levels of Gatecliff Shelter in deposits of an age similar to that of Stratum IVC at Triple T Shelter.

One could readily use these three points to support the argument that Elko Corner-notched points may be considerably more ancient than 1500 B.C.—even in the central Great Basin. The small sample size, of course, renders this argument rather tenuous—especially when contrasted with the hundreds of Elko points that appear in contexts firmly dating between 1300 B.C. and A.D. 700. But it may be that the type was in use (rarely) at such an early date. Why this is so is a matter for behavioral analysis, not typological speculation.

**Elko Eared:** Seventeen Elko Eared points were found in Stratum IA (fig. 60 and table 22). These points are somewhat larger than the Elko Corner-notched points at this site,
but the weight difference is not statistically significant. A similar trend is evident in Elko series points from Gatecliff Shelter (Thomas, 1983b), but there it was not significant either.

Given available sample sizes, we can make no stratigraphic distinction in the distribution of the two Elko series types. Moreover, since the geomorphic nature of Stratum IA tends to blur any provenience distinction, investigators should keep in mind the possibility of demonstrating this temporal relationship should the appropriate microstratigraphic sequence become available in the future.

**Gatecliff Series:** Only four Gatecliff series points turned up at Triple T Shelter (fig. 61g–j and table 23), three of them in Stratum IA. The other Gatecliff Contracting Stem point was found in Stratum IIB, associated with two radiocarbon dates: 1690 B.C. ± 85 (UCLA-1989H) and 1770 B.C. ± 95 (QC-171).

Thee dates are virtually identical to the dates for Gatecliff Contracting Stem points at Gatecliff Shelter. Although only a single such point was found in Stratum IIB, this evidence further argues that this type—formerly called Elko Contracting Stem (or
THOMAS: MONITOR VALLEY: 3

Fig. 60. Elko Eared projectile points from Stratum IA at Triple T Shelter. a. 20.3/7280; b. 20.3/3038; c. 20.3/7415; d. 20.3/7624; e. 20.3/3986; f. 20.3/3981; g. 20.3/3978; h. 20.3/7611; i. 20.3/7554; j. 20.3/7545; k. 20.3/7544; l. 20.3/4024; m. 20.3/3920; n. 20.3/7404; o. 20.3/3939; p. 20.3/4026; q. 20.3/7134.

"Gypsum Cave")—predates the Elko series proper, at least in the central Great Basin (Thomas, 1981a).³

HUMBOLDT SERIES: Five Humboldt series points were found at Triple T Shelter (fig. 61b–f and table 23). Three occurred in Stratum IA and the other two were found in Stratum IIIA, which dates between about 3000

Fig. 61. Various projectile points from Triple T Shelter. a. Triple T Concave Base; b–d. Humboldt Concave Base; e, f. Humboldt Basal-notched; g–i. Gatecliff Contracting Stem; j. Gatecliff Split Stem; k. Bipoint. a. 20.3/3912; b. 20.3/4000; c. 20.3/7608; d. 20.3/7448; e. 20.3/6477; f. 20.3/7430; g. 20.3/6470; h. 20.3/3967; i. 20.3/6505; j. 20.3/7540; k. 20.3/3037.

Provenience: b, e, f, g, i, j, k. Stratum IA/IB; h. Stratum IIB; c, d. Stratum IIIA; a. Stratum IIIIF.
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<th>STRATUM IIB</th>
<th>STRATUM IIIA</th>
<th>STRATUM IIIB&lt;sup&gt;f&lt;/sup&gt;</th>
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<th>STRATUM IIID</th>
<th>STRATUM IIIE</th>
<th>STRATUM IIIF</th>
<th>STRATUM IIIG</th>
<th>STRATUM IIIH</th>
<th>STRATUM IVA</th>
<th>STRATUM IVB</th>
<th>STRATUM IVC</th>
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</tr>
</tbody>
</table>

<sup>a</sup> Shaft smoother, 23 Promontory pegs.

<sup>b</sup> Ocher.

<sup>c</sup> 2 manos, edge ground cobble, Promontory peg, polishing stone.

<sup>d</sup> Manufactured of bottle glass.

<sup>e</sup> Scraper plane, Haliotis bead, 5 Promontory pegs, 3 foreshafts, 2 wooden cylinders, twined basket fragment, 5 pieces of cordage, shredded sagebrush cache, incised stone.

<sup>f</sup> Bone awl, 3 foreshafts, 2 Promontory pegs.

<sup>g</sup> 2 arrowshafts, 1 piece of cordage.
and 2300 B.C. We note, once again, that weight alone is an insufficient criterion with which to sort the Humboldt series in time (see Thomas, 1983b). It may be that internal differentiation is possible within the Humboldt series, but the categories “Humboldt Concave Base A” and “Humboldt Concave Base B” are not enough to accomplish such separation (Thomas, 1981a).

**Triple T Concave Base:** This type was initially defined on the basis of evidence from Monitor Valley (Thomas, 1981a) and the single specimen from Triple T (fig. 61a) is almost identical to four points from Gatecliff Shelter. The Gatecliff points occurred on a living surface (Horizon 15) firmly dated between 3400 and 3300 B.C. (Thomas, 1983b). The Triple T specimen, from Stratum IIIF, has an associated radiocarbon date of 3400 B.C. ± 100 (UCLA-1989E). While recognizing the hazards of defining a new type on the basis of five examples, the exceptional stratigraphy in the basal levels at Gatecliff and Triple T shelters warrants this departure. A more precise definition of the type and regional comparisons has been presented elsewhere (Thomas, 1981a).

**Projectile Point Preforms:** Seven preforms were found within Stratum IA at Triple T Shelter. The two triangular preforms are worked on one face only; in both cases, a distinct ridge had formed on the ventral surface of the flake, precluding further thinning. The bases of the two preforms were incompletely formed before the pieces were discarded.

### Cores

Forty-eight cores were recovered here (table 17), a relatively large number when compared to other Monitor Valley sites (especially Gatecliff Shelter where cores were quite rare). Four of the Triple T cores were a grayish brown rhyolite, and the rest were made of a low grade chert, which was typically used for large tools throughout Monitor Valley. Interestingly enough, these cores appear to be relatively late in the Triple T sequence: two of the rhyolite cores occurred on the surface; the other two were buried approximately 25 cm above datum.

There is a marked difference in raw materials between the cores and production stage bifaces. The Triple T cores are generally of poor quality material, and flakes from these cores were probably fashioned only into crude, percussion flaked tools. Those of better quality were more commonly turned into roughouts and then further reduced.

Several cores are battered along prominent ridges and flake scars. Although such edge damage could have resulted from platform preparation, abrasion on several is so heavy that they appear to have been used as hammerstones.

### Production Stage Bifaces

Nearly 300 production stage bifaces were found (table 17), and these artifacts were classified according to the technological types defined for the Gatecliff specimens (see chap. 2 and Thomas, 1983b).

Almost all roughouts still have cortex adhering to them and were of a relatively poor grade of chert. Percussion flaked blanks seem to be made of somewhat higher quality raw material, cortex being almost completely removed by this stage. As at Gatecliff, pressure flaked blanks were considerably thinner than previous stages.

### Other Chipped Stone Artifacts

Five drills were found (fig. 62a–e), as were five scraper planes and two poorly made unifaces. One of the scrapers, of green bottle glass, was recovered near the surface of the site.

---

1. Mano, hammerstone, 1 piece of cordage.
2. Bone awl, mano, metate fragment, ocher stained bone, 4 scraper planes, 2 incised stones, coiled basket fragment, sagebrush mat fragments.
3. Edge ground cobble.
5. Bone awl.
of the debitage from Triple T Shelter. Such a study would be extremely informative. The collection is stored at the American Museum of Natural History, available for future analysis.

**INCISED STONES**

Two incised limestone slates occurred in Stratum IA (fig. 63a, b).

**GROUND STONE ARTIFACTS**

Only four mano fragments were found, all within 60 vertical cm in Stratum IA (table 17); no fragment is large enough to allow determination of the overall shape. Wear varies from slight abrasion of the high points to a heavily smoothed and faceted grinding surface.

A single metate fragment was found at a depth of 65 cm below datum.

A small polishing stone was found in Stratum IA (fig. 62f). This complete specimen, measuring 35 mm in diameter, was made of a small stream cobble, deliberately shaped to form a small grinding stone, which can be held between two fingers. The grinding surface is moderately abraded; although this stone would seem well suited for grinding ocher, there are no stains on the grinding surface.

Two edge-ground cobbles were made of natural stones whose edges had been lightly ground; the ends appear to have been damaged from use.

A shaft smoother fragment was found in the upper portion of Stratum IA (see fig. 62g). Made of light and porous talc, this piece has been ground on both surfaces. The groove fits a shaft approximately 7 mm in diameter.

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**DEBITAGE**

Unmodified debitage was relatively abundant, and all flakes that did not pass through a 1/8-in. screen were saved. Table 24 presents the frequencies and gross weights of debitage recovered from Triple T Shelter (see also discussion of debitage distribution in chap. 15).

We have not conducted a detailed analysis
Fig. 64. Selected Promontory pegs from Triple T Shelter. a–aa. split-blade pegs; bb–dd. needle-nose pegs; ee. notched peg. (a, b, and c have cactus adhering to the blade.) a. 20.3/7149; b. 20.3/1290; c. 20.3/1293; d. 20.3/7152; e. 20.3/7162; f. 20.3/7157; g. 20.3/7160; h. 20.3/1285; i. 20.3/7158; j. 20.3/7161; k. 20.3/1291; l. 20.3/6548B; m. 20.3/7163; n. 20.3/6548A; o. 20.3/7151; p. 20.3/1288; q. 20.3/6550; r. 20.3/7155; s. 20.3/1283; t. 20.3/7154; u. 20.3/7165; v. 20.3/3842; w. 20.3/1282; x. 20.3/6521; y. 20.3/3946; z. 20.3/6518; aa. 20.3/1294; bb. 20.3/1292; cc. 20.3/1286; dd. 20.3/6545; ee. 20.3/1295.

Provenience: a–z, bb–dd. surface; aa, ee. Stratum IA.

Ocher nodules were buried throughout the deposits, though not in particular concentration. One unusual piece was a large cobble, approximately 150 mm in diameter. The rock itself is unmodified except for one deliberately ground surface. This heavily faceted area appears to have been ground across a harder abrasive surface, perhaps a metate. In this way, the large ocher nodule was reduced merely by drawing it across a milling stone.
wooden cutments; f. Stratum IA 4008; g. 20.3/7145.

have could to dactyl awl pegs

Shelter T whereas the table and able, the

25). Four bone cylinders. f

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functioned the 32

et al., 1957: fig. 164) and at Swallow Shelter (Dalley, 1976: fig. 29p). An isolated specimen was also found by Heizer in the Wendover area (Rudy, 1953: fig. 62c).

**MISCELLANEOUS WOODEN ARTIFACTS**

Except for Promontory pegs, wooden artifacts were relatively rare. A number of tapered wood shafts were found—apparently arrow foreshafts without stone points (fig. 65 a–e). The tips of two of these (20.3/7153 and 20.3/3991) have been burnt, probably in use as firedrill foreshafts. Another specimen (20.3/4008) still has bark on it, and also seems to have been used as a firedrill foreshaft.

Two pieces of cane with cut ends were recovered (fig. 65g, h), and these are probably arrow or atlatl dart fragments.

Two wooden cylinders occurred in Stratum IA (fig. 65i, j). Artifact 20.3/7164 is carefully trimmed on both ends, and the surface appears to have been smoothed. The other piece, 20.3/7145, is cut on only one end and only partly smoothed. Both are similar to Prom-
ontory pegs, except that they lack the characteristic sharpening on one end. They are probably snare parts.

**SQUARE HALIOTIS BEADS**

Fragments of two square *Haliotis* beads were recovered from Stratum IA. Before breakage, specimen 20.3/7281 was approximately 7 mm long, 5.6 mm wide, 0.9 mm thick, with a perforation diameter of 1.5 mm. The second specimen (20.3/7538) is badly broken; the thickness is 0.9 mm and the perforation diameter is 2.4 mm. Comparable specimens were found at Gatecliff Shelter (Bennyhoff and Hughes, 1983).

**BASKETRY**

Two basketry fragments were recovered from Stratum IA (see Adovasio and Andrews, 1983, table 60). One piece (20.3/4129) is *Artemisia* twining; this may be a fragment of a large open-twined floor mat, perhaps bedding or flooring material, or it may be merely compressed living floor debris. The other fragment is *Salix*, fashioned into close coiled, three rod bunched foundation with non-interlocking stitch (20.3/7536).

**CORDAGE**

Nine pieces of Type I (one ply, Z-spun) cordage, all made of *Artemisia*, were found. All specimens occurred in the upper part of Stratum IA (see Adovasio and Andrews, 1983).

**SHREDDED SAGEBRUSH CACHE**

A small mass of decorticated, shredded, and unmacerated sagebrush (20.3/3948) was recovered in the upper part of Stratum IA. This specimen is either untwisted construction material for the production of cordage or basketry, or the remains of a perishable artifact (see Adovasio and Andrews, 1983: 288).

**SAGEBRUSH MAT**

Several fragments of a large, open twined *Artemisia* mat were found in Stratum IA; a similar mat was recovered at Gatecliff Shelter (Adovasio and Andrews, 1983).

**HEARTHNS IN STRATUM IA**

Although the rubble of Stratum IA contained dozens of charcoal stains and zones of oxidation, it was possible to isolate 15 discrete hearths. The present section presents only basic descriptive data; in chapter 13 we plot the location of each hearth and discuss spatial patterning (see also chap. 15).

*Hearth A* (Unit A, 33 cm above datum) is a trilobed feature. The major portion, to the west, is a circular pit 60 cm diameter, surrounded by a zone of oxidation approximately 110 cm in diameter. Fill was composed primarily of ash and oxidized deposit; little charcoal was present. Immediately to the east were two additional pits, with the upper portions 6 and 16 cm above datum. These hearths contained dense charcoal concentrations and were surrounded by oxidized deposit and ash. These lobes seem to have been utilized at different times, and could just as readily have been described as three discrete features.

*Hearth B* (Unit E, +3 cm) is about 75 cm in diameter and contained abundant charcoal, burnt deposit, and ash. Although bone and chippage occurred in the hearth, the frequencies were no greater than throughout the rest of the immediate area.

*Hearth C* (Unit E, +33 cm) is a poorly defined concentration of ash and oxidized deposit, configured in almost a perfect circle 54 cm in diameter.

*Hearth D* (Unit G, +10 cm) is a pit 60 cm in diameter, filled with an ashy concentration. Ash extended across an intensely oxidized area 75 cm in diameter. Impressions of sagebrush matting occurred along the northeastern edge of the charcoal concentration, directly on the ashy halo surrounding Hearth D.

*Hearth E* (Unit C-5, −25 cm) is a rock filled hearth with an inside diameter of 50 cm. This feature was just inside the cave drip-line and contained an unusually heavy concentration of charcoal. A metate was immediately to the southeast of the fire circle.

*Hearth F* (Unit H, −12 cm) is an ashy concentration, 35 cm in diameter. Directly
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<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Width neck (mm)</th>
<th>Thickness (mm)</th>
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<td>(11.0)</td>
<td>—</td>
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<td>0.1</td>
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<td>Pink chert</td>
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</table>

$\overline{x}$ = 22.58, $\overline{S}$ = 4.96, $\overline{n}$ = 13

TABLE 18
Attributes for Desert Side-notched Projectile Points from Triple T Shelter
associated were several fragments of immature, unidentified artiodactyl long bone splinters.

Hearth G (Unit F, −25 cm) is a complex stone and charcoal feature that straddled the cave dripline. The outer portion is semicircular, roughly 75 cm in diameter. An inner rock circle had an inside diameter of 40 cm, within a pit 20 cm deep. The matrix was a charcoal-laden gray burnt silt, with ash and pebbles. A Cottonwood Triangular point was closely associated.

Hearth H (Unit B-5, −25 cm) is an extremely well-defined firepit 40 cm in diameter and roughly 10 cm deep. A Humboldt series point was found in close association, and an extension of the sagebrush mat occurred to the west of Hearth H, although the stratigraphic association is unclear.

Hearth I (Unit E, −7 cm) is a dense charcoal and ash concentration about 60 cm in diameter; no pit was evident.

Hearth J (Unit A, −20 cm) is a circular depression about 60 cm in diameter and filled with charcoal and ash.

Hearth K (Unit G, −58 cm) is a charcoal and ash scatter approximately 6 cm thick. The central portion of this hearth measures roughly 75 × 50 cm.

Hearth L (Unit G, −80 cm) rests on the very base of Stratum IA and was actually excavated into underlying IIA (Stratum IB is absent in this area). This hearth was 80 cm in diameter, and 35 cm deep. The fill contained a number of fist-sized rocks, and this concentration continues across the adjoining living surface to the north. All these stones are pieces of local Northumberland Tuff, and those found outside the hearth were discolored (apparently from heating rather than smoke blackening). The silt beneath these rocks is not oxidized, suggesting that they were removed from the pit after charring. Although a large quantity of debitage was recovered from Hearth L, the adjacent non-hearth area contained roughly similar amounts.

Hearth M (Unit B, −40 cm) is a distinctive rock and charcoal-filled pit 80 cm in diameter. Many of the rocks inside the pit were not scorched, so it is possible that they were added after the hearth M fire had been extinguished. A hammerstone found inside, however, was heat fractured in situ. Some highly decomposed bone (or antler) was also found in the hearth fill.

Hearth N (Unit C-4, −95 cm) was scooped into the underlying deposits of Stratum IIA. The well-defined pit was 65 cm in diameter and 15 cm deep. The rock lining was extremely regular, and rocks were absent from the fill, which was primarily charcoal and ash, with a few bone fragments. Radiocarbon date QC-172 was processed on large charcoal chunks contained in Hearth N: 750 B.C. ± 105 and 1080 B.C. ± 110 (two runs on same sample). Hearths L and N are probably the oldest contained in Stratum IA.

Hearth O (Unit B-3, −105 cm) is an elliptical feature 50 cm EW by 30 cm NS. The
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<td></td>
</tr>
<tr>
<td>20.3/7506</td>
<td>C</td>
<td>(37.0)</td>
<td>(35.0)</td>
<td>18.3</td>
<td>13.5</td>
<td>10.3</td>
<td>4.1</td>
<td>160</td>
<td>130</td>
<td>2.3</td>
<td>(2.5)</td>
<td>Red chert</td>
</tr>
<tr>
<td>20.3/7557</td>
<td>C</td>
<td>(44.0)</td>
<td>(44.0)</td>
<td>—</td>
<td>17.3</td>
<td>14.0</td>
<td>5.7</td>
<td>—</td>
<td>125</td>
<td>3.7</td>
<td>(5.0)</td>
<td>Black chert</td>
</tr>
<tr>
<td>20.3/7567</td>
<td>A</td>
<td>(33.0)</td>
<td>(33.0)</td>
<td>(23.0)</td>
<td>18.5</td>
<td>10.4</td>
<td>5.3</td>
<td>140</td>
<td>140</td>
<td>2.6</td>
<td>(3.0)</td>
<td>Opaque chert</td>
</tr>
</tbody>
</table>

<p>| $\bar{X}$ | 35.58 | 34.66 | 22.57 | 15.88 | 12.09 | 4.65 | 160.00 | 122.00 | 2.40 | 3.34 |
| $S$       | 8.65  | 8.48  | 3.04  | 2.63  | 2.01  | 0.89 | 11.79  | 9.88   | 1.37 | 1.27 |
| $n$       | 28    | 28    | 27    | 30    | 29    | 30   | 28     | 30     | 30   | 30   |</p>
<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length max. (mm)</th>
<th>Width max. (mm)</th>
<th>Weight actual (g)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4</td>
<td>17.6</td>
<td>14.8</td>
<td>4.3</td>
<td>Black chert</td>
</tr>
<tr>
<td>D3</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Pink chert</td>
</tr>
<tr>
<td>D5</td>
<td>16.5</td>
<td>12.4</td>
<td>4.0</td>
<td>Obsidian</td>
</tr>
<tr>
<td>D4</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
<tr>
<td>D3</td>
<td>16.5</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
<tr>
<td>A4</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
<tr>
<td>E4</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
<tr>
<td>D4</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
<tr>
<td>D4</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
<tr>
<td>D4</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
<tr>
<td>D4</td>
<td>17.0</td>
<td>12.4</td>
<td>4.0</td>
<td>Gray chert</td>
</tr>
</tbody>
</table>

**TABLE 22**

Attributes for Elko Eared Projectile Points from Triple T Shelter
TABLE 23
Attributes for Miscellaneous Projectile Points from Triple T Shelter

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Type</th>
<th>Location</th>
<th>Length axial (mm)</th>
<th>Width basal (mm)</th>
<th>Length max. (mm)</th>
<th>Width max. (mm)</th>
<th>Material</th>
<th>Frequency (g)</th>
<th>Total weight (g)</th>
<th>Average weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.3/3037</td>
<td>Bippoint</td>
<td>D3</td>
<td>34.5</td>
<td>3.0</td>
<td>12</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>11,648.7</td>
<td>1.186</td>
</tr>
<tr>
<td>20.3/3912</td>
<td>Bippoint</td>
<td>C</td>
<td>40.0</td>
<td>0.5</td>
<td>11</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>2544.8</td>
<td>0.648</td>
</tr>
<tr>
<td>20.3/3967</td>
<td>GCS</td>
<td>B5</td>
<td>39.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>252.0</td>
<td>0.497</td>
</tr>
<tr>
<td>20.3/4000</td>
<td>HCB</td>
<td>B5</td>
<td>46.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>370.6</td>
<td>0.382</td>
</tr>
<tr>
<td>20.3/4470</td>
<td>HCB</td>
<td>E</td>
<td>46.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>18.4</td>
<td>0.594</td>
</tr>
<tr>
<td>20.3/4595</td>
<td>HCB</td>
<td>E</td>
<td>46.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>4.4</td>
<td>0.293</td>
</tr>
<tr>
<td>20.3/4730</td>
<td>HCB</td>
<td>F</td>
<td>46.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>15.8</td>
<td>0.451</td>
</tr>
<tr>
<td>20.3/4748</td>
<td>HCB</td>
<td>F</td>
<td>46.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>34.7</td>
<td>1.285</td>
</tr>
<tr>
<td>20.3/7540</td>
<td>HCB</td>
<td>F</td>
<td>46.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>77.1</td>
<td>0.707</td>
</tr>
<tr>
<td>20.3/7608</td>
<td>HCB</td>
<td>D</td>
<td>46.0</td>
<td>1.0</td>
<td>10</td>
<td>3.5</td>
<td>Basalt, Purple chert</td>
<td>1.5</td>
<td>14,966.5</td>
<td>0.969</td>
</tr>
</tbody>
</table>

Seven hearths were excavated in deposits below Stratum IA. These hearths will be designated by stratum and identifying letter (e.g., Hearth IIIA-C is the third hearth recognized in Stratum IIIA).

HEARTH IB-A (Units B-4 and J, -75 cm) is a shallow hearth about 30 cm in diameter. The perimeter was surrounded by several rocks that protruded into the overlying IA deposits.

HEARTH IIIB-A (Unit C-5, -120 cm) is a diffused scatter of charcoal, ash, and oxidized silt. Two radiocarbon samples were processed on charcoal from this concentration: 1690 B.C. ± 85 (UCLA 1989H) and 1770 B.C. ± 95 (QC-171).

HEARTH IIIA-A (Unit F, -160 cm) is a very shallow pit filled with charcoal and ash; the underlying silt was barely oxidized. Two radiocarbon samples were taken from an ash scatter approximately 60 cm to the south of hearth IIIIA-A: 2930 B.C. ± 120 and 2370 B.C. ± 90 (QC-168; two runs) and 3050 B.C. ± 90 (UCLA-1989G). A Gatecliff Contracting Stem point was associated with this feature.

HEARTH IIIA-B (Unit F, -160 cm) is heavily oxidized over an area approximately 50
TABLE 25
Attributes of Promontory Pegs from
Triple T Shelter
(Measurements in Millimeters)

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Total length</th>
<th>Blade length</th>
<th>Max. diam.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.3/1282</td>
<td>58.7</td>
<td>44.7</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>20.3/1283</td>
<td>54.8</td>
<td>44.8</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>20.3/1285</td>
<td>53.3</td>
<td>38.8</td>
<td>7.6</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/1286</td>
<td>52.7</td>
<td>36.4</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>20.3/1288</td>
<td>41.5</td>
<td>31.7</td>
<td>6.4</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/1289</td>
<td>46.3</td>
<td>35.8</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>20.3/1290</td>
<td>60.3</td>
<td>44.6</td>
<td>7.6</td>
<td>Z-striations; cactus on blade; Z-striations</td>
</tr>
<tr>
<td>20.3/1291</td>
<td>54.3</td>
<td>37.0</td>
<td>5.3</td>
<td>Second notch cut</td>
</tr>
<tr>
<td>20.3/1292</td>
<td>60.1</td>
<td>46.6</td>
<td>6.7</td>
<td>Z-striations; cactus</td>
</tr>
<tr>
<td>20.3/1293</td>
<td>51.3</td>
<td>35.0</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td>20.3/1294</td>
<td>—</td>
<td>40.5</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>20.3/1295</td>
<td>52.4</td>
<td>44.0</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>20.3/3842</td>
<td>64.6</td>
<td>48.4</td>
<td>8.1</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/3946</td>
<td>—</td>
<td>—</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>20.3/6518</td>
<td>—</td>
<td>—</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>20.3/6521</td>
<td>48.4</td>
<td>34.7</td>
<td>7.0</td>
<td>Tip slightly charred</td>
</tr>
<tr>
<td>20.3/6545</td>
<td>51.3</td>
<td>40.4</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>20.3/6548A</td>
<td>55.8</td>
<td>43.4</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>20.3/6548B</td>
<td>48.4</td>
<td>33.8</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>20.3/6550</td>
<td>55.1</td>
<td>41.1</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>20.3/7149</td>
<td>67.0</td>
<td>52.8</td>
<td>8.3</td>
<td>Cactus fragment on blade; Z-striations</td>
</tr>
<tr>
<td>20.3/7151</td>
<td>53.8</td>
<td>39.3</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>20.3/7152</td>
<td>50.4</td>
<td>38.2</td>
<td>8.0</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/7154</td>
<td>47.0</td>
<td>35.4</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>20.3/7155</td>
<td>58.4</td>
<td>38.7</td>
<td>6.9</td>
<td>Tip nicked &amp; constricted</td>
</tr>
<tr>
<td>20.3/7157</td>
<td>57.3</td>
<td>46.2</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>20.3/7158</td>
<td>52.8</td>
<td>38.7</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>20.3/7160</td>
<td>50.4</td>
<td>31.7</td>
<td>10.0</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/7161</td>
<td>59.5</td>
<td>44.9</td>
<td>6.7</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/7162</td>
<td>57.8</td>
<td>43.8</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>20.3/7163</td>
<td>59.3</td>
<td>43.5</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>20.3/7165</td>
<td>48.9</td>
<td>33.4</td>
<td>7.7</td>
<td></td>
</tr>
</tbody>
</table>

cm in diameter. The charcoal concentration was restricted to a zone 25 cm in diameter. A Gatecliff Split Stem point was found nearby.

Hearth IIIA-C (Unit B, −148 cm), on the very top of Stratum IIIA, measures 90 cm E-W and 58 cm N-S. The pit, only 3–4 cm deep, was filled with a great deal of ash, associated with little oxidized silt and charcoal.

Hearth IIIIC-A (Unit F, −201 cm) is a small, ashy hearth 20 cm in diameter. Silt was only slightly oxidized in the immediate area. A radiocarbon sample was taken from the ash scatter roughly 1 m to the east: 3750 B.C. ± 100 (UCLA-1989F). The combined radiocarbon sequence for Triple T Shelter suggests that this date is probably seven centuries too ancient.

Hearth IV-C-A (Unit E, −430 cm) is an ash and charcoal concentration adjacent to the wall of Triple T Shelter. Two radiocarbon dates were processed on samples obtained from a burnt area also next to the cave wall, about 1.4 m to the northwest: 3480 B.C. ± 120 (UCLA-1989C) and 4390 B.C. ± 160 (QC-170). As explained on table 14, the laboratory report suggests that date QC-170 may be spurious due to small size. But even disregarding QC-170, the other determination, UCLA-1989C is the oldest cultural radiocarbon date obtained in the Monitor Valley project (out of 97 determinations so far available).

IMPLICATIONS

This chapter has described the geomorphology, palynology, faunal remains, and material culture of Triple T Shelter. In subsequent chapters, we shall analyze these data from multiple perspectives, and our most probable interpretation of Triple T Shelter is developed in chapter 19. To anticipate these findings slightly, we find four major characteristics worth mentioning.

1. Macrotopographic positioning: West Northumberland Canyon is one of the most important east–west corridors transecting the isolated central Toquima Range, and the archaeology of this area reflects the importance of this pathway.

2. Functional assemblage differentiation: The Triple T Shelter assemblage is functionally distinctive when compared to artifact frequencies elsewhere in Monitor Valley. Weapons are especially overrepresented (especially projectile points, foreshafts, and trapping equipment). Lithic staging at Triple T Shelter generally follows a quarry curve, except that the frequency of finished bifacial products is rather high (chap. 12); we think that this profile reflects a combination of primary artifact manufacture from local source plus the discard of broken lithic artifacts during repair.
and retooling (chap. 19). Relatively little domestic equipment was recovered here, and ceremonial items are almost absent.

3. *Distinctive drop/toss zone patterning:* Feature positioning and debris disposal show that during Stratum IA times, the enclosed rear zone probably functioned both as a sheltered workshop and a nocturnal sleep zone (chap. 15). This area was demarcated by a distinct hearthline of simple and stone-enhanced hearths. Moreover, hearth size correlates closely with intrasite positioning: The larger the corridor, the larger the hearth. Behind this hearthline was a well-heated zone of deliberate preventative maintenance, with prepared bedding and passive site furniture.

4. *An energy conservation strategy:* Intrasite patterning is heavily conditioned by a concern with energy efficiency. The southern aspect maximizes solar input during the day and heat retention during the night (chap. 18). Overall hearth technology and within-site positioning likewise enhanced the natural heat sink effect (chaps. 13 and 15).

These four factors, developed in detail later in this monograph, lead us to conclude that Triple T functioned primarily as a temporary trailside shelter. The relatively arid catchment of Triple T Shelter had several drawbacks: little available firewood, unreliable surface water, and relatively restricted interior space. On the other hand, a combination of factors made Triple T Shelter an attractive ad hoc overnight stopping place for small groups in transit: southern aspect, immediate proximity to the floor of Big Smoky Valley, natural shelter from foul weather, ease of east-west access, and potential for ambushing game that seasonally followed this corridor. In this sense, Triple T Shelter possessed greater potential utility than Gatecliff Shelter, located in the Mill Canyon cul-de-sac.

**NOTES**

1. The A.D./B.C. age estimates in this section and on table 56 are expressed as uncorrected radiocarbon years prior to A.D. 1950.

2. These faunal remains were identified at the University of Washington.

3. The Elko point in Stratum IVC remains, of course, an exception to this generalization.
CHAPTER 4. ADDITIONAL EXCAVATIONS IN MONITOR VALLEY

Having described the archaeology of Gatecliff and Triple T shelters, we now present findings from the remaining prehistoric sites excavated in our Monitor Valley research (fig. 66). This chapter is primarily descriptive; data are included in the overall Monitor Valley database (chap. 7) and analyzed on a regional basis.

Some of these sites contain sparse archaeological records. They are included here not only for completeness, but also to illustrate an important point regarding the general character of the archaeological record left by hunter-gatherers. Conventional wisdom holds that it is often necessary to test literally dozens of "dry holes" before finding a site the caliber of Gatecliff or Triple T Shelter. While this is certainly true, we wish to demonstrate that even "minimally productive" sites have potential for adding to our understanding of prehistoric cultural geography.

TOQUIMA CAVE (La1)

Toquima Cave, also known as "Potts Cave," is located in the NE¼ of Section 33, T16°N, R44°E, on the southfacing slope of Petes Summit, the major pass through the northern Toquima Range, at an elevation of 2420 m (7940 ft) above sea level (fig. 67). The cave, situated in the modern piñon-juniper zone, was formed in a fissure of the Pancake Summit Tuff, a crystal-rich rhyolite ash-flow tuff of Oligocene age (McKee, 1976: 33–35). Toquima Cave is over 25 m long and 10 m wide, the large opening facing to the south (fig. 68). A systematic site survey of the Toquima Cave 1 km catchment is discussed in chapter 6.

PREVIOUS INVESTIGATIONS

This site was first recorded by R. F. Heizer and R. K. Beardsley during their 1937 cave survey, which ranged throughout much of the Great Basin. Heizer's fieldnotes, now on file at the Archaeological Research Facility at the University of California, Berkeley, include a description of limited test excavations carried out on May 20, 1937, at Toquima Cave. The relatively few artifacts recovered in this excavation are now stored at the Lowie Museum, and we integrate Heizer's materials into the discussion below (table 28).

The archaeological site record form on file at the Nevada State Museum also indicates that Margaret Wheat and Phil Orr excavated a test pit at La1 "in 1953 or 1954." We questioned Mrs. Wheat about this, but she was unable to provide additional information regarding this excavation.

Toquima Cave is known locally for the large array of red, yellow, white, and black pictographs. This rock art has been partially described by Heizer and Baumhoff (1962: p. 38, fig. 79b–g, pl. 16a) and Thomas and Thomas (1972). As part of our overall archaeological research program in Monitor Valley, the rock art of Toquima Cave was completely recorded by Trudy Thomas in 1973 and 1974. Scale drawings and photographs are currently on file in the Laboratory of Archaeology, American Museum of Natural History (see also chap. 6).

The composition of the Toquima Cave pictograph pigments has been analyzed by X-ray diffraction (McKee and Thomas, 1973). Gypsum was used as a binder for all colors, with hematite, goethite, and carbon serving as pigmenting agents.

In addition, several incised limestone slates were found on the surface near Toquima Cave by geologist Edwin McKee; these specimens have been discussed by McKee and Thomas (1972).

EXCAVATION STRATEGY

We became involved with Toquima Cave when approached by personnel from the U.S. Forest Service. At the time, the Forest Service, which also provided partial funding for preliminary excavations, was preparing a self-guided trail from Petes Summit, and they encouraged our research at Toquima Cave in order to provide information for a permanent sign to be erected at the site.

Our excavations at Toquima Cave began
in June 1970. Considerable pothunting had obviously taken place at this site and the margins of the deposits were badly churned. Although we had heard of R. F. Heizer's previous excavations, his fieldnotes were unavailable to us at the time. Thus during the
1970 field season, we were unaware of the extent or placement of the earlier testing. We now know that Heizer's test was a relatively limited exposure on the western margin of the cave.

Ten core samples were first taken in an attempt to differentiate disturbed from undisturbed deposit. This technique did not work, and we were forced to proceed with arbitrarily positioned test pits.

Toquima Cave was then gridded into an alphanumeric system and a central datum was established on the eastern wall. Ten 1 m squares were excavated to bedrock during the summer of 1970, leaving approximately 50 percent of the culture-bearing levels unexcavated. All deposit was troweled and passed through 1/8 in. mesh screens. Excavation proceeded in arbitrary 10 cm levels, with appropriate subdivisions made for obvious stratigraphic breaks.

The site was backfilled in 1973, and the Forest Service erected a tall cyclone fence to protect the pictographs from further vandalism.

**Fig. 67.** Topographic map of the Toquima Cave vicinity and the Petes Summit vicinity; see also figure 131. Contour interval is 25 m.

**Fig. 68.** Map of the interior of Toquima Cave, showing location of various test units. The solid line at the entrance denotes the cyclone fence built by the U.S. Forest Service to protect the rock art within the cave.

**DATING THE DEPOSITS**

The stratigraphy of Toquima Cave was disappointing because of the lack of distinct bedding and because of the obvious churning. The stratigraphic profile in figure 70 is the west wall of unit K-11. Four radiocarbon samples were processed on charcoal collected from within 1 m of this exposure (table 26). These dates, in approximate stratigraphic or-
Fig. 69. Interior of Toquima Cave, prior to 1970 excavation. Note the pothunters' pits near the cave walls (1970; looking north).

Fig. 70. Profile of the west wall of square K-11 of Toquima Cave; width of section is 1 m.
TABLE 26
Radiocarbon Determinations from Toquima Cave

<table>
<thead>
<tr>
<th>Lab. no.</th>
<th>Age (B.P.)</th>
<th>Date</th>
<th>Provenience</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAK-3427</td>
<td>1040 ± 170</td>
<td>A.D. 910 ± 170</td>
<td>Charcoal from 20 cm below surface</td>
</tr>
<tr>
<td>GAK-3428</td>
<td>1500 ± 130</td>
<td>A.D. 450 ± 130</td>
<td>Charcoal from 40 cm below surface</td>
</tr>
<tr>
<td>GAK-3429</td>
<td>1500 ± 170</td>
<td>A.D. 450 ± 170</td>
<td>Charcoal from 55 cm below surface</td>
</tr>
<tr>
<td>GAK-3420</td>
<td>3420 ± 180</td>
<td>1470 B.C. ± 180</td>
<td>Charcoal from 70 cm below surface</td>
</tr>
</tbody>
</table>

*All samples taken from walls of Unit K-11 (see fig. 70).*

b All radiocarbon determinations are computed using the Libby half-life of 5568 ± 30 years.

der, range from A.D. 910 ± 170 to 1470 B.C. ± 180 radiocarbon years.

MATERIAL CULTURE

At the time, we were surprised that so few artifacts were recovered from Toquima Cave, particularly given the quantity of outstanding rock art on the cave walls. We now realize that the artifact assemblage has little behavioral relationship to the parietal art.

The following descriptions combine artifacts recovered in the Heizer-Beardsley excavation in 1937 with those from the 1970 excavations (table 27).

PROJECTILE POINTS: Only 14 typable projectile points were recovered at Toquima Cave. These points are illustrated in figure 71 and their attributes are presented in table 45, at the end of this chapter.

The point assemblage from Toquima Cave is dominated by the Elko series. This is consistent with the radiocarbon chronology of the site, three of the four C-14 determinations falling within the temporal span of the Reveille phase.

As noted above, the visual stratigraphy at Toquima Cave is unexceptional, and the projectile point sequence confirms this impression (table 27). The combination of poor stratigraphy and few artifacts precludes establishment of a reliable cultural sequence from Toquima Cave.

ADDITIONAL CHIPPED STONE ARTIFACTS: A small collection of production stage bifaces was excavated at Toquima Cave (table 28). Of special interest is RR2722 (fig. 72e), a finished bifacial knife manufactured of a very high quality chert. This artifact was broken and reworked into a disc-shaped tool. The

Fig. 71. Projectile points recovered from Toquima Cave. a. Desert Side-notched (?); b-d. Cottonwood Triangular; e-g. Elko Corner-notched; h-k. Elko Eared; l, m. Elko series; n. Gatecliff Contracting Stem. a. RR7480; b. RR4817; c. RR7483; d. RR7496; e. RR2716; f. RR2453; g. RR2710; h. RR2445; i. RR2723; j. RR7490; k. RR2460; l. RR2455; m. RR7476; n. RR7495.
base of the knife is steeply beveled, with a cross-section rather like that of an end-scraper. Several similar multipurpose tools were found at Gatecliff Shelter (Thomas, 1983b: chap. 10).

**INCISED STONE:** An isolated incised stone was found on the surface, near the mouth of Toquima Cave (fig. 73). The raw material is Roberts Mountains limestone, and the faint designs are similar to those on specimens found within the 1 km Toquima Cave catchment (chap. 6; McKee and Thomas, 1973) and also on artifacts found at Gatecliff Shelter (T. Thomas, 1983a, 1983b).

**GROUND STONE:** Only three small metate fragments were excavated in 1970 (table 28). One of these pieces (RR2713) had been heavily battered, and seems to have been reworked into a scraper plane (although the piece lacks edge attrition).

---

**TABLE 27**

**Projectile Point Frequencies at Toquima Cave**

Additional artifacts are listed in table endnotes.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Desert Side-notched</th>
<th>Cottonwood Triangular</th>
<th>Elko Corner-notched</th>
<th>Elko Eared</th>
<th>Gatecliff Contracting Stem</th>
<th>Untypable</th>
<th>Tips</th>
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<td>-</td>
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<td>4</td>
<td>1</td>
<td>2</td>
<td>7</td>
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</table>

* DSN preform.
* Elko series point.

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Fig. 72. Various lithics from Toquima Cave. a, b. cores; c, d. drills; e. finished bifacial knife/end scraper; f, g. pressure flaked bifaces; h. rough percussion blank. a. RR2714; b. RR2454; c. RR4818; d. RR2451; e. RR2722; f. RR2717; g. RR2711; h. RR2706.
TABLE 28
Miscellaneous Artifact Frequencies at Toquima Cave
Additional artifacts are listed in table endnotes.

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<th>Bifacial tools</th>
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<td>20–30</td>
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<td>80–90</td>
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</tr>
<tr>
<td>Collection</td>
<td>–</td>
</tr>
<tr>
<td>Totals</td>
<td>5</td>
</tr>
</tbody>
</table>

¹ Metate, atlatl fragment, incised stone.
² Metate.
³ Bone awl.
⁴ 2 manos, arrowshaft (?), 2 possible digging sticks.

In their 1937 reconnaissance, Heizer and Beardsley recovered two manos which the Lowie Museum catalog notes are from a "test pit at w. wall on living floor." One (1-45572) is a granitic breadloaf mano, 12.5 × 8 × 5 cm; both ends are battered, and three shaped grinding facets are visible. The second handstone (1-45573) is a poorly shaped unifacial rhyolite fragment.

**Bone Beads and Tubes:** Twenty-three bone beads and bone tubes were scattered throughout the Toquima Cave deposits (table 28). The beads ranged widely in both length and diameter. Two examples were scored, apparently for further separation (fig. 74v, w).

**Bone Awl:** A broken scapula bone awl was found at Toquima Cave (fig. 75). Although the tip has been broken off, it appears that the scapula was roughly shaped to fit the hand. The edges are highly polished, probably due to hand-wear rather than use abrasion. The Toquima Cave example is larger than the scapula bone awls from Gatecliff Shelter (Thomas, 1983b: 304–307), but the manufacturing technique seems to be similar.

**Wooden Artifacts:** An apparent atlatl fragment, carved and carefully smoothed, was recovered in the 1970 excavations (fig. 76). A central groove is evident, and one face is covered with red pigment. A faint transverse constriction occurs on the unpainted side (perhaps from the wrapping of an atlatl weight?). Similar specimens were recovered from Hogup Cave (Aikens, 1970: fig. 114a, b).

Heizer and Beardsley collected a 47-cm-long greasewood shaft, probably from an arrow (1-45583). One end is sinew-wrapped and the other is burnt (fire-hardened?) and smoothed. There is no nock or notch, and it is unclear which end is distal. The Lowie Mu-
seum collection from Toquima Cave contains a 14-cm-long fragment of conifer wood (1-45581), one end of which is battered, suggesting use as a digging stick. The other end has been whittled and a large fragment was detached. Heizer and Beardsley also recovered a 32-cm-long conifer stick, both ends of which were burnt.

HISTORIC ARTIFACTS: Several historic period artifacts were recovered in the upper levels of Toquima Cave, including cotton twine, glass fragments, a piece of lead, several pieces of paper, a bottle cap, plastic fragments, leather scraps, and several stick matches. These items were obviously discards left by very recent visitors to the cave.

DEBITAGE: More than 6000 flakes were recovered in the test excavations at Toquima Cave. The total numbers and weights of thisdebitage are plotted by depth in table 29.

FEATURES

The Toquima Cave midden contained a number of indistinct charcoal stains and ac-
TABLE 29
Debitage Frequency and Weights
at Toquima Cave

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Total no.</th>
<th>Total weight (g)</th>
<th>Average weight (g)</th>
</tr>
</thead>
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<td>55</td>
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</tr>
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<td>0–10</td>
<td>100</td>
<td>232.1</td>
<td>2.32</td>
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<td>10–20</td>
<td>447</td>
<td>499.9</td>
<td>1.12</td>
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<td>20–30</td>
<td>513</td>
<td>400.3</td>
<td>0.78</td>
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<td>30–40</td>
<td>1126</td>
<td>812.8</td>
<td>0.72</td>
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<td>885</td>
<td>578.2</td>
<td>0.65</td>
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<td>50–60</td>
<td>876</td>
<td>631.2</td>
<td>0.72</td>
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<tr>
<td>60–70</td>
<td>737</td>
<td>482.8</td>
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</tr>
<tr>
<td>70–80</td>
<td>670</td>
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<td>177</td>
<td>75.0</td>
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<tr>
<td>Totals</td>
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<td>4459.8</td>
<td>0.69</td>
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</table>

Cumulations of organic debris, and their identification as behaviorally separate cultural features is problematical. The two distinct hearths can be defined in cross-sectional profile.

*Hearth A* appears in the stratigraphic section of the west wall of unit K-11 (fig. 70). The rock-encircled, U-shaped hearth is 75 cm in diameter, with the apparent opening facing to the southwest. The shallow pit is less than 10 cm deep. Three isolated stones occur in the center of the hearth, but it does not appear to be “rock lined” as such. The associated burnt zone extends laterally for at least 1 m, varying in thickness from about 5 to 15 cm. The fill consisted of several pebble sized charcoal chunks, surrounded by white ash. A radiocarbon date, A.D. 910 ± 170 (GAK-3427), was obtained from Feature 1 charcoal.

*Hearth B* occurred at a depth of 40 cm below the surface in unit L-11 (only one-third of the feature was excavated). No pit was evident and the fill consisted of a mixture of ash and charcoal. A radiocarbon date of A.D. 450 ± 130 (GAK-3428) was obtained on charcoal in this feature.

**Palynology**

A preliminary pollen diagram for Toquima Cave has been published by Kautz and Thomas (1972). Since publication, we have learned of possible misidentifications in the analysis, and suggest that that pollen diagram should now be disregarded (Thompson and Kautz, 1983: 136).

**Faunal Remains**

Table 30 presents the number of identified elements by stratum for the Toquima Cave faunal remains. All taxa recovered from Toquima Cave are present in the Toquima Range or Monitor Valley today. As at Gatecliff Shelter, there is no way of discriminating “cultural” elements from those present strictly as a result of natural processes.

**Implications**

We were initially impressed with the quantity and variety of pictographs on the walls of Toquima Cave and felt that the Heizer and Baumhoff (1962) discussion of this site underestimated its potential (chap. 6). We approached Toquima Cave with two hopes: to find stratified deposits adequate for defining the local cultural chronology and to learn something about the archaeological structure of a major rock art site.

We were disappointed on both scores. The deposits are shallow and mixed, generally unsuited for establishing fine-grained cultural chronology. The Toquima Cave assemblage offered nothing exceptional, certainly nothing which pointed to a specialized “ceremonial” function.

Our most probable interpretation of Toquima Cave (chap. 19) can be pieced together only after several fine-grained analyses conducted in subsequent chapters. To anticipate these conclusions somewhat, we think that Toquima Cave was not a desirable place to live. The relatively high elevation brings considerably colder temperatures than at most Monitor Valley shelters, and the nearest water source is at least 2 km away.

But, more important, the deep and narrow configuration of Toquima Cave is unique in Monitor Valley. The corresponding size sorting of fauna,debitage, and artifacts defines a longitudinal axis, instead of the lateral structure common to most Monitor Valley shelters (see chap. 16). Primary workshop and hearth areas at Toquima Cave occur toward...
### TABLE 30
Numbers of Identified Elements of Small Vertebrates by Depth from Toquima Cave
(Prepared by Donald K. Grayson)

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<td>-</td>
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</tr>
<tr>
<td>Totals</td>
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<td>127</td>
<td>11</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>14</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>19</td>
<td>7</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
anthropologically differentiated from the aggregate Monitor Valley assemblage, domestic equipment is relatively abundant at Toquima Cave, but the byproducts of lithic artifact fabrication are correspondingly rare. The lithic reduction profile is curious, with both early- and late-stage byproducts relatively more common than intermediate stages.

We think that Toquima Cave was primarily a workshop. There is sparse evidence of deliberate planning for nocturnal utilization. The internal space receives little solar gain, the lateral walls are not natural heat sinks, and no effort seems to have been expended to create artificially heated corridors near the walls (chaps. 16, 18). This suggests diurnal or warm weather utilization and relatively low nocturnal utilization.

**GRENOUILLE VERTE CAVE (La1071)**

La1071 is a small alcove in the Pancake Summit Tuff formation (McKee, 1976: 33–35), located about 400 m east of Toquima Cave (fig. 66). The enclosed area is approximately 9 m$^2$, but the ceiling height is almost everywhere less than 2 m (fig. 77). The site name, French for “green frog,” derives from a local tradition referring to this alcove.

Though slightly smoke-blackened, the ceiling retains a few pictographs, mostly small white circles. The rock art extends down to the floor, and all elements have been recorded by Trudy Thomas. Scale drawings and photographs are deposited in the Laboratory of Archaeology, American Museum of Natural History.

A crew from the University of California at Davis excavated two 1 m test units at the Grenouille Verte Cave in 1970. Each square was troweled and the deposits passed through $\frac{1}{8}$ in. mesh screens.

The fill was moist yet dusty sandy silt, and a light scatter of charcoal was present throughout. A single charcoal concentration (Hearth A) was found near the center of the cave (fig. 77) at a depth of 14 cm below the surface. Several large charcoal chunks were concentrated in a circular area 20 cm in diameter; no rocks were present near Hearth A. Fist-size and larger nonlocal rocks were encountered elsewhere in the fill, but none
showed signs of burning or fire-cracking. Rodent scats occurred throughout the deposit, as did scattered concentrations of roots and grasses.

Only a single artifact, an isolated bone bead, was recovered at Grenouille Verte Cave. Thirty-eight flakes (weighing 11.9 g) were recovered in these test excavations. The very low average weight (0.31 g) obviously suggests that little or no primary lithic reduction occurred.

Grenouille Verte Cave thus shows evidence of only minimal cultural utilization. Nevertheless, in some ways, Grenouille Verte Cave is more suitable as a short-term diurnal rest stop than nearby Toquima Cave. As discussed in chapter 19, Grenouille Verte Cave was probably utilized as a trailside shelter by small groups of travelers. The interior areas are naturally cool in summer and cheap to heat in the winter. Grenouille Verte is less than 500 m from the Petes Summit corridor, the major east-west pass into central Monitor Valley.

**BUTLER RANCH CAVE (Ny303)**

Butler Ranch Cave is located on the east side of Monitor Valley in the (unsurveyed) NW¼ of Section 17, T14°N, R49°E (fig. 66). The site, a small cave located in a sheer protruding tuff cliff on the northern margin of Butler Creek (fig. 78), is approximately 1 km east of the Butler Ranch, at an elevation of 2259 m (7411 ft). The sheltered zone is ap-
proximately 5 m long and 4 m wide. The opening faces due south (fig. 79).
Butler Ranch was homesteaded by Mr. John C. Butler, who paid taxes to Nye County in 1871 for 160 acres of hay land. The next year, ownership was apparently transferred to Messrs. Bailey and Wrinzel, who called their land "the Butler and Potato Patch.
Ranch” (Nye County Tax Rolls, 1872). By 1874, Nye County Tax Rolls indicated that a Mr. Joseph Wenzel (the same as Wrinzel?) then owned the ranch.

The property was subsequently owned by Mr. Jim Butler, who was traveling south from the ranch (with his locally famous mule) when he discovered silver ore near what is now Tonopah (Hall, 1981: 17, 120; Thomas, 1982a, 1983a: chap. 7). The find was made on May 19, 1900, but according to Elliot (1973: 211-212), Butler needed to harvest hay at his Butler Creek Ranch and he was unable to file the appropriate mining claims until August 25, setting off a major mining boom in the Tonopah and Goldfield areas.

Butler Ranch Cave was brought to my attention by Mrs. Myrtle Myles, a lifelong resident of Belmont and Monitor Valley. I had asked her about caves and rock art sites in the area, and she told me of a small cave, just northeast of the Butler (or “Little Empire”) Ranch (fig. 80). Although nearly five decades had elapsed since her last visit to the site, Mrs. Myles remembered quite specifically where the cave was and what the rock art looked like. Following her explicit instructions, we had little trouble locating the site early in the summer of 1970.

Several faint pictographs are evident on both the eastern and western walls of the cave. The most conspicuous elements are a series of two dozen three-toed “bird tracks,” painted in red pigment. Several white circles have also been painted around natural depressions in the welded tuff walls. These elements were recorded by Trudy Thomas; scale drawings and photographs are deposited in the Laboratory of Archaeology, American Museum of Natural History.

**Excavation Strategy**

Field crews from the University of California (Davis) began working at Butler Ranch Cave during the summer of 1970, and the American Museum of Natural History continued these investigations during the summers of 1973 and 1976. The site was first gridded into a 1 m system, and the arbitrary datum point was established at the modern ground surface. Seventeen 1 m squares were...
Fig. 81. The interior of Butler Ranch Cave after three test pits had been excavated (1970; looking north).

excavated to an average depth of about 60 cm (fig. 79). Excavation proceeded in arbitrary 10 cm levels, except where obvious stratigraphic changes were evident, in which case the 10 cm levels were divided into sublevels. The entire deposit was troweled and passed through 1/8 in. screens.

A systematic site survey of the 1 km Butler Ranch catchment is discussed in chapter 6.

STRATIGRAPHY

The stratigraphy at Butler Ranch Cave is relatively clear-cut (fig. 82). The uppermost Zone I consists of a gray dusty silt, with packrat debris mixed throughout. The intermediate Zone II is a light tan, rather compact layer of silty sand. The underlying Zone III is a dark gray silt, with a high degree of charcoal intermixed. The basal level, Zone IV, consists of decomposing welded tuff, the bedrock of Butler Ranch Cave.

Although these four zones were more or less apparent throughout the site, the strata were insufficiently distinct to allow for absolute artifact separation, and we must discuss the material culture from Butler Ranch Cave in terms of arbitrary vertical provenience.

MATERIAL CULTURE

Artifact density is rather high—despite the small size of Butler Ranch Cave. Artifact distributions are presented on tables 31 and 32.

PROJECTILE POINTS: Eleven typable projectile points were recovered at Butler Ranch Cave...
TABLE 31

Projectile Point Frequencies at Butler Ranch Cave

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Desert Side-notched</th>
<th>Desert Triangular</th>
<th>Rose-gate series</th>
<th>Elko Corner-notched</th>
<th>Elko Eared</th>
<th>Gatecliff Contracting Stem</th>
<th>Gatecliff Split Stem</th>
<th>Humboldt Series</th>
<th>Preforms</th>
<th>Tips</th>
<th>Fragments</th>
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</thead>
<tbody>
<tr>
<td>Surface</td>
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<td>0</td>
<td>1</td>
<td>1</td>
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<td>1</td>
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<td>0-10</td>
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<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10-20</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>20-30</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<td>30-40</td>
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<td>1</td>
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<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>40-50</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>50-60</td>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No provenience</td>
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<td>1</td>
<td>0</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Totals</td>
<td>4</td>
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<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Cave. These points are illustrated in figure 83 and the attributes are listed on table 46.

Despite the small sample size, the Butler Ranch points fall into a relatively well-ordered stratigraphic sequence (table 31). Desert Side-notched points were restricted to the upper 20 cm, corresponding closely to the distribution of Shoshone ceramics (table 32). The small obsidian Humboldt series point which occurred in the 50-60 cm level is almost identical to the small points recovered from Horizon 12 at Gatecliff Shelter, which dates between 3050 and 2300 B.C. (although we should add that the Humboldt series is not generally suitable as a time-marker).

All projectile points from Butler Ranch Cave were manufactured from obsidian or high-quality chert; not a single point was made from the ubiquitous rhyolite which was apparently being quarried from the nearby streambed.

**Cores**: An extraordinary number of cores were recovered at Butler Ranch Cave, without question the highest density anywhere in Monitor Valley. All but four of these cores are of the characteristic pink purple rhyolite from the nearby streambed.

**Production Stage Blanks**: A relatively large quantity of aborted roughouts and percussion flaked blanks was also found. But,
unlike the cores, less than half of these rejected bifaces were made of high-quality chert. The higher quality raw materials were taken further along in the biface reduction sequence.

UNIFACES: A high proportion of unifacial tools was recovered, particularly in the upper levels of this site. Most seem to be ad hoc tools, made of large rhyolite flakes, crudely shaped along a single edge, and discarded after minimal use.

HAMMERSTONE: The only apparent hammerstone was made of the distinctive local pink rhyolite, but the poor quality of this material may have obscured battering on other pieces.

ADDITIONAL LITHIC ARTIFACTS: Two metamorphic fragments were found at Butler Ranch Cave, as were a complete breadloaf mano and mano fragment. One scraper plane fragment was recovered as well.

BONE BEADS: Four bone beads found at the Butler Ranch Cave were identical to specimens found at Gatecliff Shelter and Toquima Cave.

CERAMICS: Sixty-six Shoshone ware sherds were recovered at Butler Ranch Cave. The ceramics were, with few exceptions, restricted to the upper 20 cm of the deposit (their distribution corresponding to that of Desert Side-notched points).

DEBITAGE: All chippage recovered in the \( \frac{1}{8} \) in. mesh screens is inventoried in table 33. The debitage from Butler Ranch Cave is almost exclusively the distinctive, locally available pinkish welded tuff. Flake size is abnormally large, reflecting both the low quality of the raw material and the early stage of biface reduction evident at the site.

FEATURES

The midden at Butler Ranch Cave contained a number of charcoal stains and accumulations of unaltered rock. We could identify only five clear-cut cultural features. Feature I, a conspicuous semicircular rock wall, was built across the entrance to Butler Ranch Cave (fig. 84; see also chap. 16). Made of tuff boulders, this wall stands 60 cm high in places. In 1976, excavations were conducted just inside this wall to determine its nature and probable age. The bottom of the wall rests on the top of Zone II, an ill-defined occupational surface about 20 cm below the present ground surface (fig. 79). A dark organic stain, approximately 10 cm in diameter, was encountered just inside the wall. This may be a postmold, but the nature of the midden makes absolute determination impossible.

| Table 33: Debitage Frequency and Weights at Butler Ranch Cave |
|---------------------------------|----------------|--------------------|
| **Depth (cm)** | **Total no.** | **Total weight (g)** | **Average weight (g)** |
| Surface | 6 | 37.8 | 6.3 |
| 0-10 | 693 | 348.7 | 0.50 |
| 10-20 | 855 | 627.7 | 0.73 |
| 20-30 | 926 | 780.1 | 0.84 |
| 30-40 | 1311 | 1210.6 | 0.92 |
| 40-50 | 858 | 772.5 | 0.90 |
| 50-60 | 239 | 171.5 | 0.72 |
| 60-70 | 43 | 140.7 | 3.27 |
| 70-80 | 12 | 2.6 | 0.22 |
| Totals | 4943 | 4092.2 | 0.83 |
The fill piled against the wall is predominantly Yankee Blade in age, which correlates with the artifact inventory at a corresponding level throughout the rest of the site (including Hearth A, see below). Thus the rock wall seems to correlate to the Yankee Blade phase.  Although some historic debris was also found in the fill, it is unclear whether this is due to late aboriginal or extensive Euro-American activity known to have occurred nearby.

**Hearth A** is a Yankee Blade age feature toward the rear of the shelter (fig. 79). The firepit measures approximately 45 × 75 cm, and the top is about 10 cm below the present ground surface. The pit is a depression of about 10 cm, filled with a dense charcoal concentration. A relatively large collection of Shoshone ware sherds and two Desert Side-notched points were found nearby, as well as a square nail and a badly oxidized piece of metal. An Elko Corner-notched point (obviously predating the feature) was found directly beneath the hearth. Charcoal from this hearth was widely scattered over the entire rear of the shelter at a corresponding level. Most of the artifacts from the upper 20 cm of the site were found in this rear portion. **Hearth B** occurs along the western margin of the cave, about 50 cm below the surface. The actual pit seems to be about 50 cm in diameter, but it is extremely diffuse. The bottom extends nearly to bedrock, to a depth of about 70 cm. A small Humboldt series projectile point and a broken fine pressure flaked blank occurred approximately 1 m east of this hearth but no other artifacts or bones were directly associated with this feature. **Hearth C** is near the western wall of Butler Ranch Cave. The top appears about 40 cm below the surface, and the pit is about 30 cm in diameter. No firecracked rock is associated. **Hearth D** occurs at about 40 cm below the present surface. It consists of a hearth, 40 cm in diameter, scooped out to a depth of about 10 cm. No rocks were associated.

**PALYNOLGY**

Robert Kautz took seven pollen samples from a profile near the rear of the cave (fig. 82). The pollen grains in these samples were

![Fig. 84. Photograph showing rock wall in front of Butler Ranch Cave, prior to excavation (1973; looking west).](image)

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Sylvilagus cf. nuttallii</th>
<th>Spermophilus townsendii</th>
<th>Spermophilus cf. townsendii</th>
<th>Spermophilus sp.</th>
<th>Neotoma sp.</th>
<th>Canis latrans</th>
<th>Canis sp.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>2</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>10-20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>20-30</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>30-40</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>Totals</td>
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<td>2</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>23</td>
</tr>
</tbody>
</table>

**TABLE 34**

**Numbers of Identified Elements of Vertebrates by Depth from Butler Ranch Cave**

(Prepared by Donald K. Grayson)
so poorly preserved that no further analysis was attempted.

FAUNAL REMAINS

All bone fragments were saved, but relatively acidic soil conditions had apparently destroyed many of the bones originally deposited at the site. Faunal remains were examined by Donald K. Grayson, and the results are presented in table 34. Although artiodactyl long bones were present in the midden, none was sufficiently complete for identification. All taxa identified from Butler Ranch Cave are present in the Monitor Valley area today.

IMPLICATIONS

The Butler Ranch Cave assemblage is distinctive because of the relatively high density of cores and crude production stage bifaces, all made from locally available silicified rhyolite. The area extending from the apron of the cave to the streambed is littered with similar crude bifaces and large chippage fragments. The overall lithic production profile rather closely approximates a quarry curve, with all later reduction stages less common than expected. Fabrication tools and ceremonial items were totally lacking.

The stratigraphic distribution of debitage at this site correlates with the vertical distribution of artifacts. The upper 20 cm, characterized by the presence of Desert Side-notched points and ceramics, contained only a moderate amount of chippage. The largest chippage concentration was found about 30–40 cm below the modern surface in levels characterized by Elko Corner-notched points. Debitage production appears greatest during Reveille times, with less primary lithic reduction during the subsequent Underdown and Yankee Blade phases. But unifaces and grinding stones, present in the upper stratum, are lacking from the Reveille phase stratum.

In other words, the Reveille component at Butler Ranch Cave appears to be a fairly specialized occupation, characterized by quarrying and biface reduction. The later com-
ponents seem to embrace a wider range of activities, as suggested by the presence of scrapers and grinding stones.

The most probable interpretation of Butler Ranch Cave (chap. 19) depends heavily on detailed analyses developed throughout this monograph. Debris-size sorting is most pronounced in the lower stratum, both artifact and debitage distributions approximating a rear/central drop zone model, with hearths constructed near site-center (chap. 16). The largest concentration of debitage occurs in this lower stratum and the artifact assemblage is markedly skewed toward the early stage of biface reduction (chap. 11).

Addition of the weather wall, sometime during the Yankee Blade phase, minimized the problem of downcanyon cold air drainage, reduced the loss of radiant heat, and enhanced efficiency of interior hearths (chap. 16). This implies that the upper part of Butler Ranch Cave was utilized (at times) residentially, an impression reinforced by the artifact content.

The rock wall did not significantly change the rear/central drop zone pattern of the lower stratum, but hearth positioning shifted toward the rear after the wall was built. Particularly during this Yankee Blade phase occupation, Butler Ranch Cave shows ample evidence of nocturnal utilization, concern with heat retention, and apparent maximization of interior light.

LITTLE EMPIRE SHELTER
(Ny1160)

This rather large overhang is located approximately 500 m upstream from Butler Ranch Cave (figs. 66 and 85). The shelter is approximately 7 m wide, and the area enclosed between the cliff wall and the dripline is less than 20 m² (figs. 86 and 87). The shelter is named for the 19th century homestead located not far to the west.

Five test pits were excavated at Little Empire during the summer of 1970. The units were excavated in arbitrary 10 cm levels, the
deposit troweled and passed through \( \frac{1}{8} \) in. mesh screens.

Although the site provides ample protection and proximity to a flowing water source, surprisingly little archaeological debris was found inside the overhang. An Elko Corner-notched point occurred at a depth of 45 cm (fig. 88a), and an Elko Eared point (fig. 88b) rested on bedrock in the basal level of test pit 5; the attributes for these points are presented on table 46. Two bone beads, three large rhyolite cores, a rhyolite rough percussion blank, and an obsidian projectile point fragment were recovered, as well as a single Shoshone ware sherd—part of a vessel bottom.

A total of 595 flakes (weighing 1039.1 g) was recovered. Thisdebitage was predominantly large flakes of the local silicified rhyolite. Average flake weight (1.75 g) would seem to reflect primary quarrying nearby.

Hearth A is a rather large charcoal concentration and zone of discoloration. The top of the hearth occurred about 30 cm below the present surface, and the charcoal concentration measured approximately 1 m in diameter and 25 cm in depth. The hearth was merely a small pit scooped into the sandy cave floor deposit. Charcoal from the fire filled the pit and was scattered over the existing cave floor. No artifacts or bones were directly associated with this feature.

Farther to the east is Hearth B, a circular depression about 60 cm in diameter and 35 cm deep. Like Hearth A, the pit has simply been scooped out of the sand floor of the shelter. Although a large rock nearby is fire-blackened, there appears to be little deliberate preparation.

We noted a concentration of carnivore bones protruding from a crevice on the western edge when first mapping this site, and we

Fig. 87. Plan view of Little Empire Shelter.

Fig. 88. Miscellaneous projectile points from Monitor Valley excavations. a, c. Elko Corner-notched; b. Elko Eared; d. Cottonwood Triangular. a. RR7465; b. 20.3/7050; c. 20.3/4131; d. 20.3/4056.

Provenience: a, b. Little Empire Shelter; c, d. Ny1059.
proceeded to expose this portion, thinking that the bone concentration might be a dog or coyote, deliberately buried. But once the bones were exposed, it was clear that our "burial" was nothing more than a badger that had burrowed into the crevice shortly before it died.

Little Empire Shelter was obviously not as heavily utilized as Butler Ranch Cave, probably due to the open configuration. Although this site enjoyed a certain degree of solar gain (chap. 18), cold air drainage cancelled out the natural insolation; it would have been necessary to construct extensive weather walls to make this shelter relatively heat-efficient (chap. 16). Proximity to the better insulated Butler Ranch Cave further decreased the potential of Little Empire Shelter.

JEANS SPRING SHELTER
(Ny302)

Jeans Spring Shelter is located approximately 200 m southwest of Jeans Spring, a natural seep on the north fork of Wildcat Canyon (figs. 66 and 89). The site occurs at an elevation of 2219 m (7280 ft) in an outcrop of what McKee informally terms the Hoodoo Canyon tuff, a gray to white, crystal-rich quartzite latite ash-flow tuff of Oligocene age (McKee, 1976: 35–38). The surrounding vegetation is predominantly piñon-juniper woodland (fig. 90), and a lush riparian community is present in the immediate vicinity of the spring.

The systematic site survey of the 1 km Jeans Spring catchment is discussed in chapter 6. Several faint pictographs are evident on the rear wall of the overhang. These were recorded by Trudy Thomas; photographs and scale drawings have been deposited in the Laboratory of Anthropology, American Museum of Natural History.

Jeans Spring Shelter is well suited for ambush (fig. 90). Hunters can readily conceal themselves in the small shelter, yet monitor game coming to the nearby spring. In fact, several rifle cartridges scattered about the site clearly indicate such usage by contemporary deer hunters.

The site was brought to our attention by Edwin McKee of the U.S. Geological Survey. A small crew from the American Museum of Natural History excavated Jeans Spring Shelter in September 1973.

EXCAVATION STRATEGY

Jeans Spring Shelter, approximately 4 × 3 m, was entirely gridded into 1 m square units (fig. 89). All the deposit was troweled and sifted through a ⅛ in. mesh screen. Visible stratigraphy was lacking, so the excavation proceeded by 10 cm arbitrary levels. Eight 1
m square units were excavated to an average depth of about 30 cm. No radiocarbon determinations are available.

**MATERIAL CULTURE**

Although the artifact yield was rather sparse, a surprisingly high diversity of material was present. Artifact proveniences are listed in table 35.

**PROJECTILE POINTS:** Five typable projectile point fragments were found at Jeans Spring Shelter (table 47 and fig. 91). One Rosegate point occurred in the top 10 cm, and four Elko series points were found in the 10-30 cm levels. All points are manufactured of a

<table>
<thead>
<tr>
<th>Table 35</th>
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<tbody>
<tr>
<td>Miscellaneous Artifact Frequencies at Jeans Spring Shelter</td>
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<td>Additional artifacts are listed in table endnotes.</td>
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</table>

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<tr>
<th>Depth (cm)</th>
<th>Cores</th>
<th>Rough-outs</th>
<th>Rough perc.</th>
<th>Fine perc.</th>
<th>Press. flaked</th>
<th>Point preforms</th>
<th>Point tips</th>
<th>Point frags.</th>
<th>Unifaces</th>
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</thead>
<tbody>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
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<td>—</td>
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<td>10–20&lt;sup&gt;c&lt;/sup&gt;</td>
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</tr>
<tr>
<td>20–30&lt;sup&gt;d&lt;/sup&gt;</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>30–40</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Totals</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>36</td>
</tr>
</tbody>
</table>

<sup>a</sup> Wooden cylinder.

<sup>b</sup> Rosegate series point, wooden cylinder, cache of basketry raw materials.

<sup>c</sup> 2 Elko Corner-notched points, wooden cylinder, 2 worked bones, 2 arrow nocks, coiled basketry fragment.

<sup>d</sup> Elko Eared point, Elko Corner-notched point.
relatively high-quality chert. One of the Elko Eared points (fig. 91c) has been resharpened.

CORES: Two cores were recovered. One is a coarse-grained gray chert, which appears to have been discarded after it was exhausted. The other is rather high-quality brown chert, but imperfections in the stone made further reduction impractical.

PROJECTILE POINT PREFORMS: Three broken projectile point preforms were recovered. One (20.3/7011), made of obsidian, was probably destined to be an Elko series point. The tip apparently broke off, and the basal segment was reused as a small scraper. A second preform, 20.3/6880-6881, is made of a high-quality yellow chert. It was apparently broken at midsection in the process of fine pressure flaking. The size suggests that this was to be a Rosegate series point. The final preform, made of a dark red chert, is unbroken. The piece has been pressure flaked throughout, and it appears that notches were being added to the base when it was discarded or lost.

PROMONTORY PEGS: The 36 whole or fragmentary Promontory pegs recovered at Jeans Spring (fig. 92 and table 48) are heterogeneous, their diversity not unlike that evident in the Gatecliff Shelter sample (Thomas, 1983b: 297). The pegs were scattered throughout the upper 20 cm of the site, and there is no evidence that the Jeans Spring pegs were deliberately cached as a group.

MISCELLANEOUS WOODEN ARTIFACTS: Two arrow nocks come from Jeans Spring Shelter (fig. 93a, b). One (20.3/6727; fig. 93b) was painted red and was carefully trimmed and polished, although several transverse cut marks still remain. The other was rather carelessly fashioned, the nock having been formed by two rapid slices (rather than by whittling). There is no evidence of wrapping on either specimen. Similar nocks have been illustrated from Gypsum Cave (Harrington, 1933: 133) and Wilson Butte Cave (Gruhn, 1961: pl. 24).

One carved wooden cylinder (20.3/6724) was found wrapped with two-ply cordage (Adovasio and Andrews, 1983 for a description of the cordage). This piece probably functioned as a trigger mechanism for a snare or deadfall, perhaps in the manner illustrated by Elsasser and Prince (1961: fig. 1a; see also Janetski, 1979).

Two wooden cylinders were found without cordage (fig. 93c, d); similar pieces also occur at Hunts Canyon Shelter.
BASKETRY: One small fragment of coiled basketry (20.3/7010) was found at Jeans Spring Shelter. This fragment was previously described and compared with the rest of the Monitor Valley collection (Adovasio and Andrews, 1983).

WORKED BONE: Two small bone fragments were found, both in the 10–20 cm level. One seems to be an awl, while the other is probably the distal portion of a flaker.

SHELL BEADS: Two Large Olivella Saucer beads were recovered. One (20.3/6884; fig. 93e) measures 8.4 mm long, 7.8 mm wide, and 0.8 mm thick; the perforation diameter is 2.1 mm. A second specimen (20.3/6894; fig. 93f) measures 9.3 mm long, 0.7 mm thick, and has a perforation diameter of 2.1 mm. Both beads are significantly larger than the Olivella Saucers recovered at Gatecliff Shelter (Bennyhoff and Hughes, 1983).

HISTORIC ARTIFACTS: In addition to the rifle cartridges which litter the area, a square metal spike was found in the upper level of the deposits.

DEBITAGE: Over 1200 unmodified flakes were recovered at Jeans Spring; the stratigraphic distribution is presented in table 36. The chips are mostly low-grade gray chert, though red and yellow cherts are also common. Obsidian is extremely rare. Decortication flakes do occur in the Jeans Spring deposit, but they are fairly uncommon, comprising perhaps 10 percent of the debitage.

TABLE 36
Debitage Frequency and Weights at Jeans Spring Shelter

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Total No.</th>
<th>Total Weight (g)</th>
<th>Average Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>7</td>
<td>59.5</td>
<td>8.5</td>
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<tr>
<td>0–10</td>
<td>365</td>
<td>168.7</td>
<td>0.46</td>
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<tr>
<td>10–20</td>
<td>367</td>
<td>267.0</td>
<td>0.73</td>
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<tr>
<td>20–30</td>
<td>361</td>
<td>251.5</td>
<td>0.70</td>
</tr>
<tr>
<td>30–40</td>
<td>156</td>
<td>92.8</td>
<td>0.59</td>
</tr>
<tr>
<td>Totals</td>
<td>1256</td>
<td>839.5</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Features

A cache of basketry raw materials and a hearth were encountered in the Jeans Spring excavations.

Feature 1, a bundle of grass and twigs, was found nestled against a small crevice at the extreme northeastern portion of the shelter (fig. 89). The cache was buried approximately 10 cm below the present ground surface. The bundle measures ca. 30 cm long and 10 cm in diameter. Feature 1 resembles the wrapped grass bundle discovered at Gatecliff Shelter (Adovasio and Andrews, 1983).

Hearth A was located at the entrance of Jeans Spring Shelter, immediately outside the dripline of the site (fig. 89). Little more than a dense charcoal concentration, this feature was restricted to an indistinct pit approximately 75 cm in diameter. Hearth A was difficult to define vertically, but the top was probably about 10 cm below the ground surface. The firepit had been excavated to a depth of about 30 cm below the surface.

Faunal Remains

All faunal materials were examined by Donald K. Grayson. Although a number of burnt artiodactyl long bone fragments were mixed throughout the fill at Jeans Spring Shelter, none was sufficiently intact for identification. Table 37 lists the number of identified vertebrate elements by level. All taxa identified from Jeans Spring are present in the Toquima Range or Monitor Valley today.
TABLE 37
Numbers of Identified Elements of Vertebrates by Depth from Jeans Spring Shelter
(Prepared by Donald K. Grayson)

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Sylvilagus cf. nuttallii</th>
<th>Lepus sp.</th>
<th>Spermophilus Townsendii</th>
<th>Spermophilus beldingi</th>
<th>Spermophilus sp.</th>
<th>Dipodomys sp.</th>
<th>Neotoma cinerea</th>
<th>Neotoma dorsatum</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>-</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>13</td>
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<tr>
<td>10-20</td>
<td>1</td>
<td>-</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>20-30</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>30-40</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>4</td>
<td>1</td>
<td>19</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>41</td>
</tr>
</tbody>
</table>

IMPLICATIONS

This small site offers little in terms of human lifespaces, and prehistoric utilization clearly reflected this limitation. The Jeans Spring assemblage contains a disproportionate number of weapons, especially trapping tools (chap. 12). These seasonally specific artifacts were probably ad hoc caches, placed in passive storage for future anticipated use (chap. 19). Debitage is significantly size sorted, in a manner consistent with a rear/lateral drop zone model (chap. 15). The single hearth defines an easily heated, "U"-shaped sleep/work area (chap. 14).

Jeans Spring Shelter seems to have served both as a station (an information-gathering locus) and procurement location for encounter strategy hunting. Intrasite patterning and the nature of the debris are best explained as material consequences of light maintenance and repair, secondary embedded food and other resource procurement, and boredom reduction as hunters hid within the small overhang to monitor game coming to water at the nearby spring.

Jeans Spring Shelter was probably used at other times as a foul weather and nocturnal stopover by travelers following the ill-defined North Wildcat/Ikes Canyon subcorridor between Big Smoky and Monitor valleys.

Ny1059

This site is located at an elevation of 2260 m (7400 ft) near the eastern end of Northumberland Canyon, in the (unsurveyed) NE ¼ of Section 7/8, T12°N, R46°E (fig. 66). Ny1059 is a small overhang in a massive chert outcrop located approximately 12 km to the south of Gatecliff Shelter (fig. 94). In fact, the chert outcrop containing Ny1059 is strongly reminiscent of the Gatecliff formation (Melhorn and Trexler, 1983b). Ny1059 encloses an area approximately 2.3 m wide and 2.5 m deep.

Ny1059 was initially of interest because of its proximity to Ny304, the Northumberland petroglyph site (T. Thomas, 1976; see also chap. 6). We were hoping to find archaeological deposits which might shed some light on the interpretation of the Northumberland rock art site.

A small field crew from the American Museum of Natural History excavated a single test pit at Ny1059 in August 1975. This unit measured 1 m × 50 cm, reaching a depth of 60 cm. The deposits were troweled and passed through ¼ in. screen.

Natural stratification was lacking in this test pit; the deposit consisted primarily of friable dark brown silt. Included in the deposit were fragments of Ephedra branches, sagebrush parts, piñon cone pieces, and packrat scats.

Hearth A was encountered at a depth of about 11 cm below the present surface. This hearth was merely a charcoal concentration with a few associated rocks; there was no other evidence of deliberate hearth preparation.

Two projectile points were recovered from Ny1059 (fig. 88c, d). A gray chert Elko Cor-
ner-notched point was found on the surface of the site, and a small clear chert Cottonwood Triangular point occurred in the 10–20 cm level; attributes for these points appear on table 46. Either point or both could be associated with the abovementioned hearth. A fine percussion flaked blank fragment also occurred in the 40–50 cm level. Forty flakes (weighing 26.8 g) were recovered in the test excavation.

A number of small vertebrate bones from Ny1059 were examined by Donald K. Grayson (table 38). All taxa identified from this site are present in the Toquima Range or Monitor Valley today.

**NORTHUMBERLAND CAVE**

Northumberland Cave is a complex series of caverns and tubes that extend for some

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Sylvilagus cf. nuttallii</th>
<th>Lepus cf. umbrinus</th>
<th>Spermophilus townsendii</th>
<th>Spermophilus lepida</th>
<th>Neotoma cf. lepida</th>
<th>Neotoma lepida</th>
<th>Neotoma sp.</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depth (cm)</strong></td>
<td><strong>SURFACE</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0–10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>10–20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>20–30</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>30–40</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>40–50</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**TABLE 38**

Numbers of Identified Elements of Small Vertebrates by Depth from Ny1059
(Prepared by Donald K. Grayson)
distance into Mount Gooding (fig. 66). The caves are located at an elevation of 2400 m (8000 ft) on the western margin of East Northumberland Canyon, approximately 3 km southwest of the summit.

These caves have been known to local speleologists for years (e.g., Lange, 1952; Orr, 1957; Hall, 1981: 78). Heizer's 1937 field-notes mention that Harrington had previously surveyed these caverns, but we have been unable to find any information regarding that exploration.

A small field crew from the American Museum of Natural History conducted preliminary excavations at Northumberland Cave in late August 1973. A single 1 m square test pit was excavated to a depth of 190 cm near the mouth of the cave. The loose silt deposit contained abundant packrat debris and talus, but nothing of archaeological interest.

**HUNTS CANYON SHELTER**
(Ny1158)

**DAVID HURST THOMAS AND SUSAN L. BIERWIRTH**

Hunts Canyon Shelter is located approximately 1 km northeast of Hunts Ranch, in the NE ¼ of Section 31, T8°N, R46°E (fig. 66). The site consists of a low, narrow overhang in the massive tuff outcrop jutting up from the alluvial bottomland of Hunts Canyon (fig. 95). The elevation is approximately 2100 m (7000 ft). The surrounding vegetation is the typical sagebrush-grass association, locally dominated by *Artemisia tridentata*, *Chrysothamnus*, and *Grayia*. Hunts Creek flows approximately 1 km south of the shelter.

This site was brought to our attention by Bill and Kemma Lowe of Tonopah, Nevada. A striking array of rock art appears on the rear wall of the site, primarily pictographs painted in white, red, and yellow. This rock art was photographed by T. Thomas in 1977, but not completely recorded. The American Museum of Natural History obtained permission to excavate this site from the Bureau of Land Management, and test excavations were conducted in July and August 1978.

**Excavation Strategy**

There was no sign of previous excavation or disturbance at Hunts Canyon Shelter, although artifacts had obviously been collected from the surface. The site was gridded, and a base map was prepared (fig. 96). Each test unit was excavated by troweling in arbitrary 10 cm levels and all deposit was passed through ½ in. mesh screens. Six 1 m squares were excavated to an average depth of about 75 cm.

Hunts Canyon Shelter was tested in hopes of encountering a well-stratified deposit with potential for recovery of plant macrofossils. Although preservation appears to be adequate (at least in the upper levels), our limited
test excavations convinced us that the stratigraphy of this site is mediocre at best. The deposits consist primarily of dry silts, with a number of angular pieces of mostly fist-sized rock inclusions. Although an occasional charcoal lens was apparent, there are no distinct stratigraphic breaks. Organic fragments are scattered throughout the midden, particular-
**TABLE 39**

Projectile Point Frequencies at Hunts Canyon Shelter
Additional artifacts are listed in table endnotes.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Desert Side-notched</th>
<th>Rosegate series</th>
<th>Elko Corner-notched</th>
<th>Elko Eared</th>
<th>Large Side-notched</th>
<th>Preforms</th>
<th>Tips</th>
<th>Fragments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0–10a</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>10–20</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>20–30b</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>30–40c</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>40–50</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50–60</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Totals</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

\(^a\) Residual concave base point.  
\(^b\) Elko series point.  
\(^c\) Residual concave base point.

...and other artifacts were found in some abundance, and their proveniences are provided on tables 39 and 40.

**PROJECTILE POINTS:** Nineteen typable points were recovered from the test excavations at Hunts Canyon. These points are illustrated on figure 97 and their attributes are presented in table 49.

The assemblage from Hunts Canyon is unusual for Monitor Valley due to the high proportion of very late and fairly early projectile points. Particularly notable is the presence of...
Fig. 97. Projectile points from Hunts Canyon Shelter. a–e. Desert Side-notched; f, g. Residual concave base points; h, i. Rosegate series; j–m. Elko Corner-notched; n. Elko Eared; o. Elko series; p–s. Large Side-notched points. a. 20.3/9565; b. 20.3/9550; c. 20.3/9505; d. 20.3/9548; e. 20.3/9503; f. 20.3/9516; g. 20.3/9546; h. 20.3/9518; i. 20.3/9493; j. 20.3/9456; k. 20.3/9563; l. 20.3/9499; m. 20.3/9531; n. 20.3/9570; o. 20.5/5260; p. 20.5/5255; q. 20.3/9583; r. 20.3/9457; s. 20.3/9547.

four Large Side-notched points; despite this relatively small sample size, these four points constitute, to our knowledge, the largest excavated sample of Large Side-notched points in the central Great Basin.

The points from Hunts Canyon Shelter also emphasize a problem with the Monitor Valley projectile point criteria. From time to time, we encountered small concave base points that exceed the thickness requirements for the Cottonwood points, but are shorter than Humboldt points; many of these points have been resharpened. Until more such points are found in stratified contexts, and the chronology can be refined, we prefer to group these artifacts as "residual concave base" points (see fig. 97f, g and table 49).

Hunts Canyon Shelter also contained points of the Rosegate and Elko series (table 49); Gatecliff series points were conspicuously absent.

Production Stage Bifaces: More than four dozen unfinished bifaces were found (table 40). Several roughouts and rough percussion flaked blanks are made of a coarse-grained red rhyolite which is common in the wash running 100 m east of the shelter. This raw material seems best suited for manufacture of large, crude stone tools, and was rarely used for finer percussion and pressure flaked bifaces.

The relatively large proportion of unfinished stone tools leaves little doubt that ex-

Fig. 98. Miscellaneous artifacts from Hunts Canyon Shelter. a. drill (20.3/9484); b. Elko Corner-notched preform (20.3/9531); c, d. quartz crystals (20.3/927, 20.3/9425); e. Small Spire-lopped Olivella bead (20.3/9566).
tensive lithic reduction occurred at this shelter.

Cores: Three large core fragments were recovered, all of them of the locally occurring red rhyolite. Two of these have edges which appear to have been battered, perhaps from use as choppers.

Projectile Point Preform: A complete point preform (table 39 and fig. 98b) was made on a thin flake of red rhyolite. The base has been finished, but the blade portion was only very roughly shaped by pressure flaking. Had it been completed, this preform would probably have been an Elko Corner-notched point.

Quartz Crystals: Three quartz crystals occurred in Hunts Canyon Shelter (fig. 98c, d). All are rhomboid shaped in cross section, and they measure 37.5, 32.8, and 12.1 mm in length.

Grinding Stones: Only slab metates were found at this site (table 40).

Ceramics: Twenty-four Shoshone ware sherds were recovered in a localized area, all within the upper 20 cm of the deposit.

Olivella Shell Bead: A single Small Spire-lopped Olivella shell bead was recovered, at a depth of 20–30 cm (fig. 98e). The bead is 9.2 mm long and 5.8 mm in diameter. This specimen is identical to those found at Gatecliff Shelter (Bennyhoff and Hughes, 1983).

Promontory Pegs: Eighty-one Promontory pegs were found at Hunts Canyon Shelter (fig. 99 and table 50). All but three of these
pegs (20.3/9556, 20.3/9564, and 20.3/9489) were found in Feature 1, a cache located beneath a large boulder (fig. 96). Most were in the upper 5 cm of the deposit, but a few occurred as deep as 35 cm below the present surface. Although no container was found, it is clear from the context and association that these pegs were cached in a single event.

The Promontory pegs from Hunts Canyon are remarkably homogeneous; all are smaller and more carefully manufactured than those from other Monitor Valley sites. Roughly three-quarters of the pegs are needle-nosed (table 50); this form was quite rare at Gates cliff, Triple T, and Jeans Spring shelters. The Hunts Canyon pegs are also distinctive because so many are marked with Z-striations.

**HISTORIC ARTIFACTS:** Several historic period artifacts were found in the upper 30 cm of the deposit: a shotgun shell, two metal buttons, and a leather fragment. Nine glass trade beads were recovered in the upper 20 cm. All the beads are deep blue and average 3.3 mm in outside diameter.

**MISCELLANEOUS WOODEN ARTIFACTS:** One fragment of sinew-wrapped cane came from Hunts Canyon Shelter (fig. 100a). This appears to be the distal end of an arrowshaft, and similar specimens have been found at Hogup Cave (Aikens, 1970: figs. 118 and 120), Danger Cave (Jennings, 1957: fig. 170), Promontory Cave No. 1 (Steward, 1933: fig. 3), and Massacre Lake Cave (Heizer, 1942: fig. 100). The Hunts Canyon specimen appears to have been intentionally cut on both ends.

Ten carefully fashioned wooden cylinders, all associated with Feature 1, were also recovered (fig. 100b–k). Two of these (20.3/9555 and 20.3/9396) may be "blanks" for Promontory pegs, but the others seem to be finished artifacts. A number of similar wooden cylinders were found at Hogup Cave (Aikens, 1970: 171), and 55 were associated with nearly 100 Promontory pegs in the Bruneau Canyon cache (Wylie, 1974: 47).

The cylinders from Hunts Canyon were associated with the Promontory peg cache and almost certainly functioned as snare parts.

**DEBITAGE:** All unmodified flakes recovered at Hunts Canyon Shelter were saved, and their stratigraphic distribution is presented in table 41.

**FEATURES**

**Feature 1** is the Promontory peg cache, discussed above.

**Hearth A** is bilobed and located near the center of the shelter (fig. 96); only half of each portion was excavated. Each pit extended downward from a former living surface which lies approximately 10 cm below the present ground level. The hearths are each about 40 cm in diameter, and the pits are both about 30 cm deep. The hearths are full of charcoal, predominantly sagebrush. They are probably
TABLE 42
Numbers of Identified Elements of Vertebrates by Depth for Hunts Canyon Shelter
(Prepared by Donald K. Grayson)

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Sylvilagus cf. nuttallii</th>
<th>Sylvilagus sp.</th>
<th>Spermophilus townsendii</th>
<th>Spermophilus sp.</th>
<th>Neotoma lepida</th>
<th>Neotoma cf. cinerea</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>1</td>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
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<tr>
<td>10-20</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
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<td>2</td>
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</table>

contemporaneous and comprise a single feature. All the glass trade beads, most of the pottery, several biface fragments, and the drill illustrated in figure 98 occurred near the upper surface of Hearth A.

FAUNAL REMAINS

All faunal remains recovered from Hunts Canyon Shelter were examined by Donald K. Grayson. Although several artiodactyl long bone fragments occurred in the site, none were sufficiently complete for identification. Table 42 presents the number of identified elements by level for the vertebrates from Hunts Canyon Shelter. All taxa identified from this site are present in the Toquima Range or Monitor Valley today.

IMPLICATIONS

Although no radiocarbon dates are available from our test excavations at Hunts Canyon Shelter, statistical analysis of time-marker frequencies suggests that the median occupation of Hunts Canyon Shelter may be later than apparently comparable Monitor Valley shelters (particularly Toquima Cave and Jeans Spring Shelter; see chap. 9).

Our excavation strategy here was insufficient to determine the longitudinal and lateral variability within the overhang. The single excavated hearth is consistent with the workshop and sleep zone models developed in chapter 14. Debitage tends to be slightly size sorted, with smaller flakes occurring near the dripline and becoming larger toward the rear of the overhang (chap. 15). Whereas these findings might reflect reverse size sorting, we think it likely that the small, biased sample obscures such apparent trends.

The Hunts Canyon assemblage cannot be functionally differentiated from the aggregate Monitor Valley assemblage. It is clear, however, that this site contains a relative abundance of domestic equipment, and the generally adequate lifespace conditions suggest some degree of residential utilization. Hunts Canyon Shelter contains a large trap cache containing seasonally specific gear, left in passive storage for anticipated use.

BRADSHAW SHELTER (Es81)

DAVID HURST THOMAS AND CLARK SPENCER LARSEN

This small cave is about 6 km northwest of Goldfield, Nevada, in the SW¼ of Section 20, T2°S, R42°E (fig. 66). The elevation is approximately 1890 m (6200 ft). Located about 80 km south of Monitor Valley, Es81 is outside the study area addressed in this monograph. We think it appropriate, however, to describe these excavations because the motives for testing Bradshaw Shelter evolved directly from the Monitor Valley research.

Bradshaw Shelter occurs in a massive rhyolite and chalcedony formation near the northern end of the Montezuma Range. The area surrounding the site is an extensive aboriginal quarry, littered with tons of debitage and broken biface fragments. Significantly, the site is also near a contemporary chalcedony quarry, known locally as "The Gem
Field.” An intermittent wash flows in front of the shelter, but the nearest permanent water source is Indian Springs, on the westward trending branch of the main canyon. Although this spring is less than 1 km away as the crow flies, the actual travel time required would be an hour or so.

To the north, at the mouth of the canyon, is a steep, clifflike formation which contains an interesting series of petroglyphs. The area seems to be ideal for ambushing game on its way to water at Indian Springs. The rock art was recorded by T. Thomas; scale drawings and photographs are on file in the Laboratory of Archaeology, American Museum of Natural History.

Bradshaw Shelter occurs in the marginal sagebrush-grass zone, near the northern border of the creosote bush community defined by Cronquist et al. (1972: 110–114). Artemisia and Chrysothamnus are the local dominants, although Joshua trees (Yucca brevifolia) grow not far away.

The site is named after Nick and Linda Bradshaw, residents of Tonopah, Nevada. The Bradshaws, assisted by Bill and Kemma Lowe, first showed us the site and provided assistance throughout our brief fieldwork in the area.

**EXCAVATION STRATEGY**

All American Museum of Natural History fieldwork was conducted during August 1978. The shelter was first gridded and mapped, then a surface collection was made of the surrounding quarry area (fig. 102). The surface of the site appeared dry, and we wished to determine whether the deposits contained adequate stratigraphy and plant macrofossils to warrant a full-scale excavation.

Excavation was conducted in arbitrary 10 cm levels following natural surface contours. Each unit was troweled, and all deposits were sifted through 1/8 in. screens. Five 1 m square test pits were excavated to bedrock, averaging 35 cm below the surface.

Two distinct strata are apparent. The up-
Fig. 102. Plan and cross section views of Bradshaw Shelter.

The permost level consists of dark tan sandy silt, rich in organic debris (mostly animal droppings and packrat nesting materials). The lower stratum, a light tan silt, is somewhat moister, with less organic matter, consisting in places of decomposing bedrock. Most of
TABLE 44
Identified Bird and Mammal Elements per Taxon by Depth at Bradshaw Shelter
Identification by Donald K. Grayson

<table>
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the occupation debris is found in the uppermost 10 cm.

**MATERIAL CULTURE**

Bradshaw Shelter is a quarry site and its artifact assemblage is quite distinct from those of other sites discussed in this volume. Several discarded cores and roughouts were found scattered throughout the deposits. In fact, at the bottom of the excavation trench, we found a "bedrock core," a protruding piece of bedrock which had been repeatedly flaked during quarrying.

A total of 4084 flakes (weighing 7883 g) was recovered in the excavation (table 43). Over 99 percent of these flakes were of the locally occurring chalcedony. The extremely high average weight (1.93 g per flake) is likewise diagnostic of the extensive prehistoric quarrying activities.

TABLE 45
Attributes for Miscellaneous Projectile Points from Toquima Cave

<table>
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<th>Length max. (mm)</th>
<th>Length axial max. (mm)</th>
<th>Length basal max. (mm)</th>
<th>Width neck (mm)</th>
<th>Thickness (mm)</th>
<th>DSA</th>
<th>PSA</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
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<td>140</td>
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<td>(4.9)</td>
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<td>(1.3)</td>
<td>Black chert</td>
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The excavations also yielded the following artifacts made of the native local chalcedony: a projectile point tip, two fine percussion blanks, three rough percussion blanks, and one core fragment. One additional rough percussion blank was made of a high-grade chert.
Fig. 104. Plan view and cross section of Boring-as-Hell Shelter (La1073).

which may not have been indigenous to the immediate area. Two needle-nosed Promontory pegs were found on the surface, as was a whittled twig (almost certainly the byproduct of Promontory peg manufacture).

Of more interest than the excavated specimens are the quarry remains that litter both sides of the canyon onto which Bradshaw Shelter fronts. Literally hundreds (if not thousands) of quarry discards are present, and a limited sample of these was collected in conjunction with our excavation. Figure 103 shows six of these complete quarry roughouts; all are made of the relatively low-quality chalcedony indigenous to the canyon. Most of the quarry rejects are broken, and several hammerstones were noted in the surface collections.

FAUNAL REMAINS
DONALD K. GRAYSON

Bradshaw Shelter provides a small but diverse collection of mammalian fauna (table

Fig. 105. Arrow parts found in a fissure crack at Boring-as-Hell Shelter. a. (20.3/6138) is a smoothed hardwood foreshaft; b. (20.3/6140) and c. (20.3/6141) are hardwood proximal arrow fragments, with arrow nocks intact; d. (20.3/6139) is a deteriorating piece of Phragmites mainshaft; e. (20.3/6137) is an associated, unidentifiable piece of hardwood, probably also part of an arrow.
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<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Width neck (mm)</th>
<th>Thickness (mm)</th>
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<td>130</td>
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<td>4.3</td>
<td>Opaque chert</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ny1059</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.3/4056</td>
<td>CT</td>
<td>(14.0)</td>
<td>(13.2)</td>
<td>7.4</td>
<td>7.4</td>
<td>—</td>
<td>2.1</td>
<td>—</td>
<td>0.2</td>
<td>0.3</td>
<td>Clear chert</td>
<td></td>
</tr>
<tr>
<td>20.3/4131</td>
<td>ECN</td>
<td>22.8</td>
<td>(21.7)</td>
<td>20.1</td>
<td>(10.5)</td>
<td>7.4</td>
<td>3.0</td>
<td>130</td>
<td>100</td>
<td>1.2</td>
<td>(1.3)</td>
<td>Gray chert</td>
</tr>
</tbody>
</table>

* 20.2/9576 is considerably shorter than the average Humboldt series point, due to repeated resharpening over an impact fracture.
Identification of the 117 mammalian elements from this site were made according to the criteria discussed in conjunction with the small mammals from Gatecliff Shelter (Grayson, 1983). The two elements of great horned owl (\textit{Bubo virginianus}) included a nearly complete femur and a fragment of a phalanx, both highly distinctive. In addition, a single passerine element was not identified.

No survey of the modern fauna of the area surrounding Bradshaw Shelter was undertaken in conjunction with the excavation of the site, and there is no published literature on the small vertebrates of this area. As a result, it is difficult to compare the fauna from the shelter with that of the area today. However, general distributional data (American Ornithologists' Union, 1957; Hall, 1946; Hall and Kelson, 1959) suggest that all vertebrates identified from the Bradshaw Shelter deposits could be expected to occur in the vicinity of the site today.

**IMPLICATIONS**

We also conducted a systematic surface collection along the talus slope in front of, and to the south of, Bradshaw Shelter. The survey team walked a series of short transects up and down the talus slope, collecting all artifacts and artifact fragments. The purpose of this collection was to obtain an unbiased sample of the bifacial tools in this canyon.

The surface collection is interesting because it reflects the nature of bifacial technology in the vicinity of Bradshaw Shelter. Of the 44 artifacts and fragments recovered, 20 were cores, and the other 24 were roughouts. Three utilized flakes were also found. No pressure or percussion flaked blanks were

**TABLE 47**
Attributes for Miscellaneous Projectile Points from Jeans Spring Shelter

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Type</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Thickness (mm)</th>
<th>DSA</th>
<th>PSA</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
<th>Material</th>
</tr>
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<tr>
<td>20.3/6890</td>
<td>ECN</td>
<td>(40.0)</td>
<td>(38.0)</td>
<td>26.5</td>
<td>(15.5)</td>
<td>11.0</td>
<td>5.2</td>
<td>160</td>
<td>120</td>
<td>4.3</td>
<td>(5.0) Tan chert</td>
</tr>
<tr>
<td>20.3/6896</td>
<td>ECN</td>
<td>(28.0)</td>
<td>(28.0)</td>
<td>19.0</td>
<td>10.1</td>
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<td>3.4</td>
<td>130</td>
<td>110</td>
<td>0.9</td>
<td>(1.5) Gray chert</td>
</tr>
<tr>
<td>20.3/6897</td>
<td>RG</td>
<td>(22.0)</td>
<td>(22.0)</td>
<td>15.9</td>
<td>9.0</td>
<td>8.2</td>
<td>2.4</td>
<td>140</td>
<td>105</td>
<td>0.2</td>
<td>(0.8) White chert</td>
</tr>
<tr>
<td>20.3/6907</td>
<td>EE</td>
<td>24.6</td>
<td>21.4</td>
<td>16.0</td>
<td>16.0</td>
<td>12.5</td>
<td>4.0</td>
<td>180</td>
<td>125</td>
<td>1.8</td>
<td>(1.8) Pink chert</td>
</tr>
<tr>
<td>20.5/5235</td>
<td>ECN</td>
<td>(38.0)</td>
<td>(37.1)</td>
<td>(28.5)</td>
<td>14.7</td>
<td>14.5</td>
<td>5.8</td>
<td>150</td>
<td>115</td>
<td>4.3</td>
<td>(5.0) Red chert</td>
</tr>
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</table>

**TABLE 48**
Attributes of Promontory Pegs from Jeans Spring Shelter

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Total length (mm)</th>
<th>Blade length (mm)</th>
<th>Max. diameter (mm)</th>
<th>Remarks</th>
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</thead>
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<td></td>
</tr>
<tr>
<td>20.3/179b</td>
<td>51.1</td>
<td>34.0</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>20.3/179c</td>
<td>48.5</td>
<td>35.2</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>20.3/179d</td>
<td>57.9</td>
<td>38.2</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>20.3/6702</td>
<td>40.6</td>
<td>34.2</td>
<td>6.5</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/6703</td>
<td>—</td>
<td>—</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>20.3/6704</td>
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<td>57.1</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>20.3/6705</td>
<td>51.7</td>
<td>36.5</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>20.3/6706</td>
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<td>34.6</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>20.3/6707</td>
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<td>—</td>
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<td></td>
</tr>
<tr>
<td>20.3/6708</td>
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<td>(27.5)</td>
<td>7.7</td>
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</tr>
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<td>20.3/6709</td>
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<td>32.6</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>20.3/6710</td>
<td>47.8</td>
<td>28.8</td>
<td>(6.5)</td>
<td>Ochre stain?</td>
</tr>
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<td>—</td>
<td>6.4</td>
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</tr>
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<td>(10.5)</td>
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</tr>
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<td>—</td>
<td>7.1</td>
<td></td>
</tr>
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<td>20.3/6714</td>
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<td>—</td>
<td>7.2</td>
<td></td>
</tr>
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<td>5.3</td>
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</tr>
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<td>33.1</td>
<td>8.7</td>
<td>Z-striations</td>
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<td>—</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td>20.3/6718</td>
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<td>24.1</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>20.3/6719</td>
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<td>34.0</td>
<td>8.9</td>
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</tr>
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<td>38.7</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
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<td>44.1</td>
<td>7.8</td>
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</tr>
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<td>52.9</td>
<td>36.3</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>20.3/6731</td>
<td>46.7</td>
<td>32.1</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>20.3/6732</td>
<td>30.9</td>
<td>15.6</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>20.3/6733</td>
<td>56.0</td>
<td>37.6</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>20.3/6734</td>
<td>56.8</td>
<td>39.2</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>20.3/6735</td>
<td>55.7</td>
<td>38.8</td>
<td>8.0</td>
<td>Z-striations</td>
</tr>
<tr>
<td>20.3/6736</td>
<td>57.0</td>
<td>39.8</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td>20.3/6737</td>
<td>—</td>
<td>—</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>20.3/6738</td>
<td>—</td>
<td>—</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>20.3/6739</td>
<td>52.3</td>
<td>33.7</td>
<td>8.5</td>
<td>Z-striations</td>
</tr>
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<td>35.2</td>
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</tr>
<tr>
<td>20.3/7030</td>
<td>—</td>
<td>—</td>
<td>6.8</td>
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</tr>
</tbody>
</table>
found at all, and finished artifacts were similarly absent. This sample has been discussed and statistically analyzed elsewhere (Thomas, 1983b: chap. 20).

The Bradshaw Shelter quarry site—both inside the shelter and on the nearby talus slope—reflects a situation not encountered in Monitor Valley proper. The Bradshaw Shelter area contains lithic raw materials in profusion, but lacks suitable subsistence potential for even a short-term habitation. The evidence indicates that aboriginal stone workers visited the area to obtain raw materials but stayed only long enough to produce roughouts for transport elsewhere.

**BORING-AS-HELL SHELTER**  
(La1073)

This site, named at the end of a very long field season, is located near modern Highway 50, about 100 m south of the access road to the BLM picnic area at Hickson Summit. The elevation is approximately 2010 m (6600 ft). We came upon it during a survey of the area surrounding La9, approximately 2 km to the southeast of Boring-as-Hell Shelter (Heizer and Baumhoff, 1962: 38–40; T. Thomas, 1976; see also chap. 6, this volume). The small shelter is in a massive welded tuff boulder, a short distance away from the main rimrock.

A single 1 × 50 cm test pit was excavated in this shelter by a small crew from the American Museum of Natural History in the summer of 1975. The matrix consists of dry silt, ash, and packrat debris. The frequency of organic debris decreased toward the bottom of the 1 m deep test unit; charcoal was found scattered throughout.

Hearth A was encountered at a depth of 35 cm below the present ground surface. The distinct firepit is approximately 15 cm deep, and at its maximum extent, covers an area roughly 35 cm in diameter. The fill was primarily charcoal and ash, with little soil. No firecracked rock was associated. Over 50 small chips were recovered from the hearth area.

The only artifact found in the excavation was a hammerstone, at a depth of 30 cm. A total of 736 flakes (weighing 372.1 g) was recovered. Several pieces of red ochre were scattered throughout the lower levels.

Only three identifiable bones were recovered: one *Sylvilagus cf. nuttallii* element on the surface of the site, a *Sylvilagus* sp. bone...
TABLE 50—(Continued)

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Total length (cm)</th>
<th>Blade length (cm)</th>
<th>Max. diameter (cm)</th>
<th>Remarks</th>
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<td>4.7</td>
<td>striations</td>
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<td>5.9</td>
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<td>—</td>
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</tr>
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<td>28.9</td>
<td>4.5</td>
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</tr>
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</table>

in the 10–20 cm level, and a Neotoma sp. bone in the 20–30 cm level.

A low arc-shaped rock wall along the eastern margin of the site, well within the small shelter (fig. 104), appears to have been constructed to provide cover and shelter for those inside. The wall is not visible from the outside.

Roughly 2 m from the enclosed area is a fissure crack that contained a small cache of five arrow shafts (fig. 105). One piece (fig. 105a) is a carefully smoothed hardwood fore-
shaft, gently tapering to a point at the distal end; the proximal end has been broken off. Two other hardwood pieces (fig. 105b, c) retain the original nock. A piece of deteriorating reed (fig. 105d) probably once served as an arrow mainshaft.

**Implications**

Boring-as-Hell Shelter is situated along Hickison Summit, the major pathway around the northern periphery of the Toquima Range. We think that this site functioned as a prehistoric way station (chap. 19). In this sense, this small alcove is similar to Hidden Cave, allowing travelers to avoid the heat of the day. Boring-as-Hell Shelter is also similar to Hidden Cave in that both sites functioned as tool caches.

**Notes**

1. The other major Monitor Valley excavation, Alta Toquima Village, will be described in the next volume in this series (see Thomas, 1982c).


3. We should note that, in addition to the rock wall at the mouth of the cave, there is a second, very well constructed wall about 100 m to the west. This wall begins near a massive tuff rock on the canyon floor and extends perpendicularly up the cliff face. Fenceposts are embedded in the wall, and we think that it was undoubtedly built as part of the Butler Ranch homestead, constructed sometime after 1870.

4. See chapter 6 for a discussion of the surface archaeology surrounding the Butler Ranch area.
CHAPTER 5. SATELLITE SITES IN MONITOR VALLEY

We have repeatedly stressed the importance of transcending the obvious archaeological site to examine sources of information slighted by traditional archaeological perspectives. This broad-based approach requires that archaeologists investigate not only the residential base camp, but also the subsidiary aspects of adaptive technology: the house ring, bedrock grinding feature, quarry, prehistoric trail, rock cairns and walls, etc. Elsewhere (Thomas and McKee, 1974), we have referred to such logistic zones as satellite sites, areas of archaeological significance too commonly overlooked in regional research because of the difficulties of establishing chronological and functional associations.

This chapter presents data from a number of satellite sites in the Monitor Valley area (fig. 106). In the terminology of Wagner (1960: 94), such satellite sites contain a special kind of facility known as a barrier: a stationary, intentionally positioned object whose function is to contain or restrain motion. Archaeologists are only beginning systematically to deal with barriers in the Desert West, and even the more recent archaeological literature betrays the preliminary nature of such inquiry (e.g., Hoffman, 1878: 473–474; Muir, 1894; Steward, 1941: 219; Rudy, 1953: 18–20; Wetherill, 1954; Heizer and Baumhoff, 1962: 18–20, 38–40, 41–45, 52–56; Euler, 1966; Rogers, 1966; Reichman, 1966; Thomas and McKee, 1974; Nissen, 1974; Sullivan, 1974; Wallace, 1976; Brook, 1980; Pendleton et al., 1982; Pendleton and Thomas, 1983).

TABLE MOUNTAIN ROCK ALIGNMENTS

The primary rock alignment on Table Mountain (Ny831) was first described to me by C. Glade Quilter, U.S. Forest Service Ranger for the Tonopah District. The site is located at an elevation of 2710 m (8900 ft). This area, currently closed to all vehicular traffic, is accessible only by horseback or on foot.

The Table Mountain rock feature consists of a complex network of low-lying stone walls. It was first visited by an American Museum of Natural History crew in September 1976 (fig. 107). We were conducting a preliminary horseback reconnaissance of Table Mountain and, at Quilter's suggestion, we rode to the vicinity of the rock walls. Several rich artifact scatters were noted, and it was immediately clear that detailed mapping would be required before any interpretation was possible.

FIELD STRATEGY

We visited the Table Mountain alignments subsequently in July 1977 and again in July 1979. Provisions and equipment were transported by packhorse for approximately 10 km from the trailhead at Barley Creek. Thirty person-days were spent mapping and collecting the rock alignments.

In 1977, a detailed 1:1000 plane table/alidade map was prepared of the entire rock feature (fig. 107). Alidade shots were taken along each segment of the wall at 10 m intervals, or wherever a wall intersected another alignment. The overall map is accurate to approximately 1 m in 500 m (0.2% accuracy). Later that summer, we chartered a light fixed wing plane to obtain oblique aerial photographs (figs. 108 and 109).

The Table Mountain upland was completely surveyed for archaeological remains that might be associated with the rock walls. The survey crew walked at 10 m intervals, criss-crossing in both north–south and east–west transects. Individual artifacts were piece-plotted, and chipping concentrations were noted on the base map. The outlying area was surveyed less intensively, but we think that all significant artifact concentrations, features, and barriers were recorded within a 1 km catchment of the primary alignments.

THE ROCK WALLS

The Table Mountain rock alignment sits astride a massive volcanic flow zone. The mesa extends for several hundred meters east–west and about 300 m north–south. The ground surface is littered with thousands of rhyolitic slabs ranging from handball to boulder size.
Artemisia is the dominant vegetation, and several sparse stands of mountain mahogany (Cercocarpus ledifolius) grow on the northern and western margin of the mesa. A dense stand of quaking aspen (Populus tremuloides) grows immediately downslope from the

Fig. 106. Map showing the major satellite sites in the Monitor Valley area. The Alta Toquima complex is considered in the next volume of this series.
rhyolitic caprock that forms the southern margin of the mesa.

Several dozen stone walls run in all directions over this area. Their course is sometimes straight, but more commonly serpentine. The walls intersect repeatedly, and no single wall runs for more than about 50 m.

The walls are most distinct in the vicinity of Blind A (see fig. 110), where the stones have been collected for about 1 m on each side of the main wall. Slabs were piled up on top of one another in several places; elsewhere, they were placed leaning inward to form an inverted V (fig. 110).

Blind A is an almost perfectly circular rock ring near the eastern margin of the rock alignment. This blind is 2.7 m in diameter, constructed of rather large rhyolite slabs. The smallest is about 25 cm across, but several exceed 80 cm in length. Before the circular walls caved in, the structure probably stood about 60 cm tall. Three walls converge on Blind A, two of these each leaving a small "gate" between the wall and the blind. A concentration of a dozen chert flakes was found 1 m west of the blind, and several of these flakes had been utilized.

Blind B is a circular rock feature 3.5 m in diameter. The stone slabs average 50 cm in length and appear to have been arranged into a single upright course. Three distinct walls converge on Blind B, but all walls stop about 50 cm from the blind, leaving several small "gates" similar to those at Blind A.

Blind C is a semicircular feature with the opening facing toward the north; it is made of several large rocks piled one atop another. The blind is roughly 3 m in diameter and 85 cm long. Blind C is unusual because a large, decaying juniper stump appears to have grown between the rhyolite slabs; it is possible, however, that the slabs were placed against the area of artifact concentration

Fig. 107. Composite map of the Table Mountain rock alignments. Diagram 1 shows the plan view of the major rock alignment, Ny831; diagram 2 shows the smaller feature, Ny832, located due east.
Fig. 108. Oblique aerial photograph showing the Table Mountain rock alignment (1977; looking northwest).

Fig. 109. Oblique aerial photograph showing the serpentine rock walls on Table Mountain (1977; looking southwest).
tree while it was still standing. Several additional dead junipers stand in relatively well-watered areas throughout the mesa area, but no other trees occur in direct association with the rock features.

One dozen rock cairns were scattered among the Table Mountain rock walls (fig. 107). Some cairns were made by regularly piling up several flat slabs, whereas others were simply haphazardly stacked stone mounds. The cairns average 40-50 cm in height, although one stands nearly 80 cm high. They are most distinct at the western end of the site, and several cairns are not directly attached to the walls.

**Material Culture**

A large sample of artifacts was systematically collected from the Table Mountain area. All typable projectile points have been illustrated on figure 112, and artifact frequencies are listed on table 51. Projectile point attributes appear on table 54, at the end of this chapter.

Many artifacts were recovered close to the rock walls. But extreme caution is required when analyzing such patterns. One must resist the temptation automatically to assign behavioral significance to facility and artifact simply because they were observed to be near each other. Individual sites almost invariably suffer from inadequate archaeological association; progress in interpreting satellite sites will occur only when recurrent patterns and trends are recognized over a large number of similar features (Pendleton and Thomas, 1983).

The projectile points found near the Table Mountain rock walls are a relatively consistent lot, representing a limited temporal span (chap. 9). Gatecliff and Humboldt series points are particularly common (21 of 36 typable points recovered).

The temporal span of the Gatecliff series is 2500-3000 B.C. (Thomas, 1983b: chap. 9), and if one were to postulate a be-
havioral association between artifacts and features, then the Table Mountain rock alignment probably dates to the Devils Gate phase, approximately 3000 to 1300 B.C.

After examining a number of these satellite hunting features, we have come to expect a rather high proportion of Humboldt points (Thomas, 1981a). And this is precisely the case with the Table Mountain alignments. We think that Humboldt series points are functionally linked to areas of prehistoric intercept strategy hunting.

A couple of additional observations can be made: fabricators, ornaments, and grinding stones were completely absent from the Table Mountain assemblage (chap. 8). In addition, most discards are in relatively advanced stages of reduction (table 51). Only a single core and five roughouts were found. Blanks and pressure flaked bifaces, on the other hand, were
particularly abundant; unifacial tools and retouched flakes were well represented, and five incised stones were recovered (fig. 113). Although analysis remains hampered by inadequate associational data, this relatively large, yet limited-function tool kit would seem to derive from logistic rather than residential associations (the implications of this patterning are explored in more detail in chap. 16).

**TABLE MOUNTAIN EAST (Ny832)**

A second, much smaller rock alignment occurs about 1.3 km due east of the major complex of serpentine alignments (fig. 107). Despite intensive survey, only a single artifact was found at Ny832, about 100 m north of the walls, a white chert projectile point fragment. Obvious downslope wash has continuously displaced items along this surface, and artifacts could easily have been buried beneath the accumulating colluvium.

**GEOLOGICAL OR CULTURAL PATTERNING?**

Before integrating data from the Table Mountain features with those available from the rest of Monitor Valley, it is necessary to consider whether these rock alignments could have been created by geological rather than cultural processes.

James Benedict and Jonathan O. Davis (personal commun.) have warned that geologically derived patterned ground could easily be mistaken for man-made rock structures. Superficially, the overall patterning evident in figure 107 is indeed reminiscent of large “ice-wedge polygons” formed under thermal contraction and cracking of frozen soil (e.g., Black, 1976: figs. 1, 2, and 4). Although the so-called *patterned ground phenomenon* is best known from the Arctic Coastal Plain, nonsorted, rock-bordered ice-wedge polygons occur throughout the Colorado Rocky Mountains (Benedict, 1979b), and in Nevada as well (Piegat, 1980).

With this possible confusion in mind, we considered the patterned ground hypothesis more closely. The Table Mountain alignments are large, but not beyond the range of known patterned ground phenomena. Ice-wedge polygons sometimes exceed 40 m in diameter, particularly in mild periglacial climates where thermal stresses are insufficient to cause finer subdivisions in the polygonal network (Benedict, personal commun.).

I know of only one definite patch of patterned ground in the central Great Basin, that at Mt. Jefferson in the Toquima Range (Piegat, 1980; Thomas, 1982c: 80–81). Located at an elevation of about 3475 m (11,400 ft), the Mt. Jefferson patterned boulder field is approximately 100 m square. The polygons vary in size, reaching a maximum of about 10 m across.
The Mt. Jefferson formation unquestionably resulted from purely geological processes. The differences between the Table Mountain and Mt. Jefferson features are striking and obvious. Not only is the Mt. Jefferson patterned ground considerably higher than the alignments on Table Mountain, but the geological polygons are highly irregular and spacing is wholly haphazard. At Mt. Jefferson, numerous rocky zones and irregular scatters exist both inside and outside the polygons; such unpatterned scatters are absent on Table Mountain. Whereas the Table Mountain walls are consistently two or three stones wide, those on Mt. Jefferson range in width from two stones to several dozen. The Table Mountain walls are made from tabular rhyolite slabs that are remarkably similar in size and shape; on the other hand, the naturally patterned ground throws up rocks of all shapes and sizes. The Mt. Jefferson polygons are commonly depressed, forming a "river of rocks" in places; all Table Mountain features are elevated above the ground surface forming true walls.

Finally, it is clear that the Mt. Jefferson feature would serve absolutely no useful hunting function. The alignments, such as they are, serve neither to funnel game nor to conceal hunters. Aboriginal artifacts are lacking in the vicinity of this feature.

The surface aspect of the Mt. Jefferson patterned ground is thus very different from that at Table Mountain. But to erase any lingering doubt, we conducted excavations specifically designed to determine whether or not the Table Mountain alignments were of natural or cultural origin.

Geologically patterned ground is created by thermal contraction and cracking of frozen soil or by extreme desiccation, creating polygons with a marked, distinctive subsurface structure (Black, 1976: figs. 8–16; Benedict, 1979b: 175–176).

Stacking up boulders to function as a hunting barrier, on the other hand, creates strictly a surface disturbance, and should be totally lacking a subsurface component. If any excavation does take place—as in the case of well-designed hunting blinds—this subsurface modification should be distinctly human in character.

The test excavations at Table Mountain were designed to see (1) whether these walls had a distinctive subsurface structure, or (2) whether the rocks were merely piled on the existing ground surface.

Six trenches were excavated, each 30 cm wide and 1 m long. Two control trenches (III and VI) were placed well away from the rock walls to determine the character of the subsurface in clearly undisturbed contexts. Few subsurface rocks were encountered in Trench III. But in Trench VI, several large and flatlying slabs were found to a depth of about 40 cm, at which point bedrock was encountered.

A third control trench (I) was excavated across the lip of Blind A, a context of unquestionably cultural origin. The subsurface structure of trenches I and IV were identical. That is, the cultural modifications at Blind A changed only the surface appearance—there was no subsurface component.

Finally, we excavated three additional trenches across the rock walls, attempting to determine whether these walls were of natural or cultural origin. Two of these trenches were identical to the control unit III in that no subsurface rocks were encountered above bedrock. The profile of the final trench contained a number of unaligned, deeply imbedded rocks but lacked subsurface structuring.

The test trenches were thus deliberately excavated in three different microenvironments: (1) at Blind A, unquestionably a cultural feature, (2) in two undisturbed geological contexts, and (3) across the walls in question in the Table Mountain feature.

There is absolutely no subsurface difference between the natural and cultural contexts. The occurrence of subsurface rocks is an apparently random event. Subsurface structure or patterned cracking is wholly lacking at Table Mountain. There is no sign of radial heaving of stones, no subsurface evidence of the humus-rich silty soil that commonly underlies geological polygons (Benedict, 1979b: 177).

Test trenching and comparison with the Mt. Jefferson features thus confirm that the Table Mountain rock alignments result from cultural rather than geological processes.

**Implications**

The Table Mountain rock alignment is clearly a labor-intensive facility, requiring
rather high construction costs and certainly implying a relatively predictable, high-bulk return (Thomas, 1983a: 41–42, 153–155). The most probable interpretation is that the Table Mountain rock walls were constructed and utilized for intensive harvesting of sage grouse, probably during the late winter–early spring booming season. This interpretation is suggested by several lines of evidence.

First of all, we know that grouse were a readily available resource in this area during both protohistoric and modern times. Grouse occur today in the Toiyabe, Toquima, and Monitor ranges (Linsdale, 1936), and Simpson (1876: 46, 75) reported that sage grouse were commonly sighted on Monitor Valley during his crossings in 1859. According to Johnsgard (1973: 157) sage grouse were found during the first part of this century virtually wherever sagebrush occurred, throughout many of the western and intermontane states.

We also know that grouse were available in the prehistoric Great Basin. Several blue grouse elements were recovered from nearby Gatecliff Shelter (Mead et al., 1983); grouse bones also occur in the earliest strata of Hogup Cave (Parmalee, in Aikens, 1970: 264–265) and at Birch Creek Valley Cave, Idaho. Grouse feathers were also identified in the prehistoric levels of both Danger Cave (Jennings, 1957: 305) and Hogup Cave (Baldwin, in Aikens, 1970: 267–269).

Techniques of protohistoric grouse procurement have been detailed elsewhere (Thomas, 1983a: chap. 4). Bird nets were commonly used to procure sage grouse “which were caught in the morning when the roosters ‘danced’” (Steward, 1941: 222; see also DeSmet, 1905: 1033 and Lowie, 1924: 195). Long, low sagebrush walls were sometimes arranged in a V-shape, leading the birds into a tunnel-like enclosure.

Contemporary sage grouse could easily be taken by this modified intercept strategy hunt. Speaking of birds in the neighboring Big Smoky Valley, Linsdale (1938: 54) lamented the rapidity with which grouse become accustomed to human beings; “this makes killing of them by hunters too easy and results in much waste” (see also Johnsgard, 1973: 172).

Sage grouse procurement is most efficiently and predictably conducted at traditional “strutting grounds” (Thomas, 1983a: chap. 4; Steward, 1941: 222; Patterson, 1952; Dalke et al., 1963; Johnsgard, 1973: 164–165). In severe winters, flock size can reach as high as 1000 birds, particularly on windswept ridges and saddles with relatively open ground cover.

U.S. Forest Service personnel have detailed records of sage grouse populations in the Table Mountain area, and these observations provide important input to our interpretation of the prehistoric rock alignment. The rock walls are situated in the midst of a contemporary wintering ground for sage grouse, supporting an annual average of 150 adults and pouls (C. Glade Quilter, District Ranger, U.S. Forest Service, personal commun.). Sage grouse prefer such areas because the winter winds sweeping across ridges and knolls like Table Mountain keep snow cover to a minimum (Edminster, 1954; Rogers, 1964).

Sage grouse appear near the Table Mountain rock alignment as early as February and commonly remain until April, which is the peak booming season. The birds then move to a springy area north of the rock walls to nest during the spring. This movement is necessary because the diet of newborn pouls consists almost exclusively of insects and forbs, resources absent from the barren booming ground but plentiful in such mountain meadows (Johnsgard, 1973: 162–163). A second movement is required not long thereafter when young sage grouse shift their diet to sagebrush; at this point, the entire flock moves to the higher, sagebrush-covered swales. The grouse remain in the uplands until the following winter when snowfall forces them downslope onto the relatively snow-free mesa top with the curious serpentine rock alignments.

These natural historical considerations suggest how the Table Mountain rock feature was used by prehistoric hunters. The largest alignment occurs on the primary sage grouse wintering and strutting ground. During the mating season, the birds could be driven with relative ease; modern sage grouse merely scurry away when pursued (provided that they are not frightened into flight). The rock alignments and blinds not only conceal hunters, but the walls also provide directional barriers
to the movement of the strutting birds. The primary objective in such hunting is to move slowly among the grouse, gradually driving them toward concealed hunters or into awaiting snares. Dozens of the large, strutting birds could be taken during the spring booming season.

The smaller rock walls at Table Mountain East were built on a sloping hillside, in topography considerably less desirable as a strutting ground. While this area may possibly have functioned as a limited, tertiary booming area, it is more likely to have served as a summer/fall foraging area for grouse (Quilter, personal commun.).

The relatively high construction costs of the Table Mountain feature imply both predictable and high-bulk yields. Once constructed, this hunting alignment would remain available year after year, and literally dozens of birds could be taken each spring without adversely affecting flock size.

We emphasize that there is no a priori reason to assume that the rock features and the archaeological assemblages from Table Mountain are behaviorally associated, but subsequent analysis of these assemblages suggested that they might be.

In chapter 9, we consider the question of temporal variability among and between the various assemblages discussed in this volume. Relative to the overall Monitor Valley patterning, the temporal profile for the Table Mountain assemblage is decidedly "early" in character, similar to the ideal "early Site A" profile in figure 154. The Table Mountain profile also compares favorably with the pooled Devils Gate curve (Horizons 8 and 9) at Gatecliff Shelter.

The time-markers collected in association with the Table Mountain feature are thus temporally unique in Monitor Valley. This tendency does conform to an Early Neoglacial temporal trend noted at other labor-intensive hunting features in the Great Basin (Pendleton and Thomas, 1983; see also similar sites discussed by Pendleton et al., 1982).

If one is willing to assume that the assemblage is indeed associated with the rock features—invariably a difficult assumption when based on a single surface site—then the Table Mountain rock alignment would appear to be a Devils Gate period phenomenon.

### TABLE 52

<table>
<thead>
<tr>
<th>Artifact Type</th>
<th>Frequency</th>
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<tr>
<td>Projectile points</td>
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</tr>
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<tr>
<td>Rosegate series</td>
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<tr>
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<td>Elko Eared</td>
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</tr>
<tr>
<td>Elko series</td>
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</tr>
<tr>
<td>Gatecliff Contracting Stem</td>
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</tr>
<tr>
<td>Gatecliff Split Stem</td>
<td>3</td>
</tr>
<tr>
<td>Humboldt Concave Base</td>
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</tr>
<tr>
<td>Humboldt Basal-notched</td>
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</tr>
<tr>
<td>Unidentified Concave Base</td>
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<td>Large Side-notched</td>
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<tr>
<td>Point preforms</td>
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<tr>
<td>Cores</td>
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<tr>
<td>Fine percussion blanks</td>
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<tr>
<td>Pressure flaked blanks</td>
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<td>Drills</td>
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</tr>
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<td>Unifaces</td>
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<td>Percussion scrap</td>
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<td>Pressure scrap</td>
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### BOX SPRING FEATURES

The Box Spring features, located at the northern end of Monitor Lake, consist of a series of soldier cairns situated along the discontinuous ridge that lies to the north of the spring proper and forms a western margin of the marshy area (fig. 114). Each cairn is constructed of several boulders, one piled on top of another; the average height of these cairns is about 50 cm. Box Spring is used today as a pasture and cattle corral, and a mantle of recent historic debris occurs throughout the area. Artifact frequencies from the Box Spring sites are provided on table 52; projectile point attributes are listed on table 54, at the end of this chapter.

Three prehistoric surface sites were found in spatial association with the rock cairns (fig. 114). Ny1237 is located near the small pass immediately to the north of the upper row of cairns. Several unmodified obsidian nodules were collected here, together with several unworked obsidian flakes. This obsidian derives from the Box Spring source, an unlocalized float (Thomas, 1983b: chap. 19). Ny1238 lies in the saddle between the two
rows of cairns. Although a few bifacially worked tools occurred here, no chippage was found on this site.

The major site at Box Spring, Ny1239, occurs along the ridge top, parallel to the southern series of rock cairns (fig. 114). A dense
artifact scatter was found on the eastern side of the hill, facing the marshy area. The most commonly recovered point types are Elko Corner-notched and Humboldt series artifacts (figs. 115 and 116).

Several other kinds of artifacts occurred, especially broken pressure flaked bifaces. Most of these seem to be projectile point fragments, but the pieces are too badly fragmented to be certain.

Since our work at Box Spring, these same sites have been variously recorded by other
Fig. 116. Projectile points from Box Spring drive site. a–c. Gatecliff Contracting Stem; d–f. Gatecliff Split Stem; g–j. Humboldt Concave Base; k–t. Humboldt Basal-notched; u–w. Large Side-notched; x–aa. Residual concave base. a. 20.3/268; b. 20.3/4898; c. 20.3/720; d. 20.3/4830; e. 20.3/4892; f. 20.3/9676; g. 20.3/715; h. 20.3/4895; i. 20.3/4844; j. 20.3/706; k. 20.3/899; l. 20.3/862; m. 20.3/853; n. 20.3/703; o. 20.3/4821; p. 20.3/717; q. 20.3/867; r. 20.3/737; s. 20.3/724; t. 20.3/718; u. 20.3/848; v. 20.3/4803; w. 20.3/749; x. 20.3/728; y. 20.3/750; z. 20.3/881; aa. 20.3/923.
Provenience: a. Ny1238; o, r, v, w. Ny1239; all other points from Ny1237.

investigators (see chap. 7). The 1980 MX missile survey lumped the various Box Spring sites as Ny2492 (field no. MX-140-15-PI), noting a "very thin dispersed lithic scatter, linear configuration" (Basin Research Associates, 1980). The Bureau of Land Management also has records pertaining to the Box Spring sites (as discussed in chap. 7).

**IMPLICATIONS**

As discussed in chapter 19, we think that the most probable interpretation of the Box Spring feature is that it functioned as a prehistoric antelope trap, positioned so that herds could be driven either from the north (i.e., from Dianas Punch Bowl) or from the Monitor Lakebed area to the south. Antelope still live on the Monitor Valley floor, and the Box Spring facility exhibits all individual elements required for a successful antelope drive (see Thomas, 1983a: 48–51). So employed, this facility provides for the three basic tactics of classic intercept hunting: monitoring herd location, funneling game into restricted space, then artificially changing their pace so they could be harvested (perhaps at leisure).

The site itself is situated at a perennial lowland spring, a constant attraction for game—and particularly so in arid years when Monitor Lake was dry. The low surrounding ridges provided both elevation and cover for hunters monitoring game movements. The microtopography is such that game could easily be driven between the sheer cliffs and the low ridges.

The ridges to the west provide no such barrier, and this is where artificial cairns were erected, probably as "soldier rocks" (Binford, 1978a: 235–236), dummy hunters framed against the skyline to the west of the marsh. Steward (1933: 253) has described how the
Owens Valley Paiute constructed such “rock men” to assist intercept hunting during the protohistoric period in the Great Basin, and Muir (1894: 322) has noted how the Northern Paiute built “rows of dummy hunters out of stones, along the ridge-tops which they wished to prevent the sheep from crossing. And, without discrediting the sagacity of the game, these dummies were found effective; for, with a few live Indians moving about excitedly among them, they could hardly be distinguished at a little distance from men, by anyone not in the secret. The whole ridgetop then seemed alive with hunters.” The soldier rocks would thus have complemented the low ridges to the east, together providing the funneling factors necessary for successful intercept strategy hunting.

An ad hoc change of pace factor could easily have been constructed toward the center. The springy meadow provides an excellent area for a game corral, and the cliff face on the eastern margin is a natural barrier to game movement.

Artifacts and debitage concentrate along the western margin of the meadow, immediately downslope from the cairn alignments. If these artifacts are truly “associated” with the stone...
facilities, then the ambush took place on the slopes rather than in the meadow proper (although the marshy meadow environment might obscure artifacts discarded in this area).

The relatively high frequency of Humboldt series points may also be significant. Elsewhere (Thomas, 1981a), I suggest that the shoulderless Humboldt series point may be functionally related to intercept strategy hunting. If the artifact-feature association is valid, then the Box Spring site would seem to support this suggestion. At least two of the Humboldt points (20.3/853 and 20.3/718) were resharpened while still hafted, pointing to utilization as both projectiles and skinning knives.

Subsequent statistical analysis indicates that the Box Spring assemblage is skewed toward the “late” stage of bifacial reduction, closely approximating the repair model of bifacial production. General utility tools are rare, and domestic equipment is totally absent. Fabrication and processing byproducts are relatively overrepresented in the Box Spring assemblage (table 52).

BOB SCOTT ROCK WALLS

Two rock alignments, designated as La601, have been described elsewhere (Thomas and McKee, 1974), and will be mentioned only briefly here. These alignments occur south-east of Austin, about 3 km south of U.S. Highway 50, near Bob Scott Summit (figs. 117 and 118).

The eastern wall extends about 100 m from the canyon bottom, traveling up a moderately steep hillside, and ending about 3 m below a clffy rock outcrop. The wall averages about 75 cm in height and about 50 cm in breadth. The stones are of the same rock type as the nearby outcrops and many exceed 50 cm in diameter. Some weigh over 30 kg. The eastern wall is about two-thirds intact, the smallest stones having fallen throughout most of its length. In a few places, the entire wall has collapsed for distances up to 3 m.

The western wall also commences in a ravine, extending about 175 m up the opposite side of the same ridge, stopping about halfway to the crest (fig. 118). Construction is similar to that of the eastern wall, with no trace of wood as support or superstructure.

No signs of nails, wire, or any other historic materials have been found in this area. Five projectile point fragments were recovered near the walls (Thomas and McKee, 1974: fig. 5). Two of these are small Humboldt series points and a third is probably a broken Rosegate point.

Thomas and McKee (1974: 11–16) have considered the possible hunting strategies behind the Bob Scott rock feature; these hypotheses are considered below.

AUSTIN SUMMIT ROCK WALL

A well-made rock wall is visible immediately to the south of Highway 50, approximately 5 km east of Austin, Nevada (fig. 119). This wall, designated as La1070, was constructed on the west-facing slope of a steep ravine, approximately 1 km south of the highway, northwest of the Bob Scott complex. Built of fairly large boulders, the wall commences about halfway down the hillside, continuing 250 m to the canyon bottom (fig. 120).

Today the rock wall supports a modern fenceline, and one cannot ignore the possibility that this feature dates from the historic ranching period. But construction is identical to other (presumably aboriginal) rock features in the area, and we think that it was initially built during the prehistoric period (with subsequent, independent historic usage). Despite intensive surface investigations, we
could find neither historic nor prehistoric artifacts associated with the Austin Summit rock wall.

**MT. PROMETHEUS ROCK WALL**

Another rock wall, La1069, occurs about 3.2 km due north of the Austin Summit feature (fig. 121). This wall is about 50 m long (fig. 122) and has a distinctive L-shape. There is a small historic structure in the canyon bottom about 150 m east of the rock wall, but no artifacts of any kind were associated with La1069.

**BOB SCOTT/AUSTIN SUMMIT BARRIER WALLS: IMPLICATIONS**

For purposes of discussion, we will combine our consideration of several rock features near Austin, Nevada. Previously (Thomas, 1983a; Pendleton and Thomas, 1983: 25–34), we considered the difficulties in interpreting such facilities. Foremost is the problem of chronology. In no case can we be certain of the construction date, but the combined evidence from positioning and technology strongly suggests that each was begun prehistorically, at times with historic modification. Analysis must proceed under this assumption until more adequate methods of dating become more widely available.

Second is the matter of archaeological association: are the artifacts in true behavioral “association” with the feature, or are we monitoring simply the spatial association resulting from multiple, palimpsest utilization? This problem, of course, exists in excavated assemblages as well (Thomas, 1983b: chap. 19), but lack of stratigraphic context exaggerates the temporal scales involved for surface features.

Despite these difficulties, the consistent overall positioning of the various Bob Scott/Austin Summit features strongly suggests prehistoric utilization as barriers for intercept strategy hunting (Binford, 1978a; Thomas, 1983b). Although there will always be dif-
difficulties in interpreting individual surface features, an overall pattern emerges when several such features can be considered simultaneously.

Intercept procurement is best implemented at established, commonly reused locales. The successful intercept strategy hunt begins by monitoring game movements, then channels the agglomerated game toward prearranged areas of intercept, where ambush actually occurs. These strategic implications are so critical that intercept facilities take on certain positioning characteristics: "ready access to a game lookout, a funneling factor to increase game density temporarily and artificially, and a change of pace factor to assist the hunter in temporarily modifying the herd's ability to flee" (Thomas, 1983a: 41; see also Binford, 1978a). There are times when the natural landscape is so structured that artificial modifications are unnecessary. But more commonly, enabling facilities must be constructed.

Intercept facilities need not always be per-
manent. There are times when ad hoc brush and wooden walls are fully sufficient to the task at hand, and such temporary hunting features are employed in both encounter and intercept strategy hunting. But relatively expensive, long-term facilities—especially rock barrier walls—are almost invariably associated with an intercept procurement strategy.

The Bob Scott/Austin Summit facilities are prime examples of such relatively high cost, labor-intensive structures. Assuming that construction occurred prehistorically, it is extremely likely that each facility produced a sufficiently high bulk, predictable, easy-to-procure return to justify initial costs of construction and upkeep.

If so, then which animals were being procured? We previously considered this question with regard to the Bob Scott features (Thomas and McKee, 1974: 11–16). Today, this area hosts a sizable deer herd, but there is good reason to suspect that the influx in deer population is a relatively recent (if not historic) occurrence (as reviewed by Thomas, 1983a: 51–53). Historic deer fences are known for ethnographic groups throughout North America, and they are especially common in the western states. Linsdale (1938: 199) records a significant annual migration of deer that occurs between the Toiyabe Range and the adjoining Big Smoky Valley. Although the archaeological walls are relatively short, they would have been sufficient to modify game behavior. Linsdale and Tomich (1953: 294), for instance, noted that barbed fences even lower than a meter were "seldom a barrier to the deer, although they nearly always modify the behavior of an animal encountering them. A deer may hesitate at a fence and follow it for many yards before attempting a 'crossing.'"

It is also possible that these walls were used for ambushing antelope although the site elevations approach the upper limits of today's antelope habitat. Bighorn seem a more likely prey species. Elsewhere (Thomas, 1983a: 42–48; Pendleton and Thomas, 1983: 26–27), we have reviewed the available relevant evidence regarding bighorn behavior in the central Great Basin. Bighorn procurement has a relatively high degree of archaeological visibility, and the consequences are rather clearcut. In areas of high mountains and few dis-
REESE RIVER ROCK BLINDS

Two additional aboriginal hunting features were discovered in the course of the systematic random sampling of the Reese River Valley (Thomas, 1971a, 1973). Approximately 1.5 km upstream from the head of Devils Gate Canyon, at an elevation of 2070 m (6800 ft), we located a small hunting blind, designated as La1068 (fig. 123). The rock structure is located in the canyon bottom, a few dozen meters north of the intermittent stream that flows down Devils Gate Canyon. Although parts of the structure have collapsed, it is clear that the blind was initially U-shaped, with the opening facing downstream (fig. 123). The walls were constructed with large flat rocks, averaging about 50 cm long and about 35 cm wide. These rocks were laid flat, one on top of another, and often chinked with smaller, fist-size stones. The highest course stands about 1.3 m above the present ground level. The surrounding area was surveyed, but no artifacts were found with the blind.

A second rock blind, designated as Ny924, occurs in San Juan Canyon, on the eastern side of the Reese River Valley at an elevation of 2800 m (9200 ft). The blind is situated next to a major access route through the Toiyabe Range. A stream flows year-round down San Juan Canyon, about 25 m north of the streambed. Apparently the blind was once U-shaped, with the opening directed downstream. Although the walls are now collapsed, they were probably somewhat lower than those in Devils Gate Canyon. There were no associated artifacts.

The San Juan and Devils Gate blinds are similar in setting and construction. Both are located near reliable water sources, near major game migration routes; both are U-shaped, with the open end facing downstream. Although artifact associations are lacking, we think that both were used in prehistoric game procurement (see chap. 16).

MONITOR HILLS ROCK WALL

Ny927 is located in the Monitor Hills area, south of Monitor Valley proper at approximately T2°N, R46°E (fig. 124). The elevation is roughly 1710 m (5600 ft). The archaeolog-
ical feature occurs in a low rimrock area, covered with greasewood, *Artemisia*, and *Ephedra*.

The surrounding low hills drain between these two rocky cliffs. The major feature is about 10 m long and 1 m high (fig. 125). The wall is well made, running perpendicular to the clffy outcrop; it is possible that this wall once extended completely across the canyon mouth.

A number of prehistoric artifacts occurred nearby: one large chert roughout, two rough percussion blanks, three fine percussion blanks, three pressure flaked blanks, two fragments of the same finished bifacial "knife," and two unifaces.

Directly across the canyon from the rock wall is a small rock-shelter where literally hundreds of small red chert pressure flakes were found. Also on the surface of the shelter were two obsidian projectile point fragments (one probably a Desert Side-notched), a pink chert roughout, two fine percussion blanks (one complete), three pressure flaked blank fragments, and a red chert utilized flake; a grinding stone fragment was also found near the shelter.
The central wash (evident on fig. 124) poses a major problem, since it precludes locating artifacts in situ. Moreover, the local rock is a low-grade chert that fractures in a highly suggestive manner. We were forever finding “maybe-facts” in the wash and on the slopes.

The wall is very carefully constructed and, at first glance, appears to be a historic corral; there is, in fact, a modern cow path leading directly in front of it. But the total absence of historic debris and the abundance of prehistoric artifacts anddebitage seem to suggest a prehistoric construction date (chap. 15).

A WORD OF CAUTION ABOUT ABORIGINAL HUNTING FEATURES

This chapter presents primary data for a number of rock structures in the woodland and valley floor zones of the Monitor Valley area.1 Despite a growing number of cases, we remain a long way from understanding the function of such facilities. We hope to encourage other investigators to record similar structures.

But extreme caution is in order, because it is very difficult to distinguish aboriginal hunting features from historic ranching structures. We will briefly discuss two additional examples to highlight the problem.

In 1973, we discovered a curious wooden fence in Ikes Canyon, on the western side of Monitor Valley. A large number of piñon trunks and branches had been piled into a long linear feature that rims the Ikes Canyon basin. The wooden fence is at least 3 km long, in places reaching 1 m in height (fig. 126). We revisited the site a number of times over the next decade and, although several axe marks were found on the stumps, we could not decide whether this feature was a historic period aboriginal hunting fence or part of the Euro-American homestead not far away in the Ikes Canyon bottomland.

Finally, in the summer of 1984, we followed the wooden fence for its entire length, and near the eastern end we found our answer, a faded sign attached to a piñon tree:

NOTICE

The Area Behind This Sign Is
CLOSED TO
SHEEP GRAZING
Do Not Trespass
U.S. Forest Service

The wooden fence had been constructed as a historic period enclosure to keep sheep away from the Ikes Canyon cattle ranch.

While this explanation had been one of those being considered all along, a nagging doubt would have remained had we not found the sign. A rather similar, if much smaller, wooden fence occurs south of Ikes Canyon, along the eastern toe of the Toquima Range, roughly 1.5 km north of the entrance to Mill Canyon (fig. 106). This fence is about 100 m long, reaching 1 m in height. It is constructed of juniper snags and runs east–west, roughly perpendicular to the valley floor. No historic debris is associated with the fence, and it is remarkably similar to the stone walls at Bob

Fig. 126. Photograph of Ikes Canyon drift fence (1984; looking east).

Fig. 127. Historic cattle drift fence near Table Mountain rock alignment (1977; looking south).
Scott Summit, Austin Summit, Mt. Prometheus, and Monitor Hills. The use of wood to construct aboriginal drift fences is amply documented for the protohistoric period (Thomas, 1983a; Pendleton and Thomas, 1983). But lacking firm evidence, we do not feel sufficiently confident to define the function or chronology of this structure.

Another episode illustrates the same problem. While mapping a large rock alignment at Table Mountain (see above), we encountered a series of a dozen or so well-made rock walls, each perched on an escarpment transected by modern game trails. Superficially, these walls seemed identical to those blinds found in Devils Gate and San Juan canyons (above). We spent some time mapping and photographing the alignments (fig. 127).

Only when we had prepared our final regional topographic map of the area did we realize that our “hunting blinds” were in fact historic fencelines. By following the direction...
ANTHROPOLOGICAL PAPERS AMERICAN MUSEUM OF NATURAL HISTORY

338

VOL. 66

TABLE 54

Attributes for Projectile Points from the Box Spring Features
Length Length Width Width Width Thickmax. axial max. basal neck ness
Spec.

no.

20.3/268
20.3/414
20.3/417
20.3/702
20.3/703
20.3/706
20.3/711
20.3/714
20.3/715
20.3/716
20.3/717
20.3/718
20.3/719
20.3/720
20.3/721
20.3/724
20.3/725
20.3/728
20.3/737
20.3/738
20.3/740
20.3/744
20.3/749
20.3/750
20.3/752
20.3/753
20.3/848
20.3/853
20.3/862
20.3/863
20.3/865
20.3/867
20.3/871
20.3/879
20.3/881
20.3/887
20.3/889
20.3/890
20.3/893
20.3/899
20.3/921
20.3/923
20.3/2441
20.3/4802
20.3/4803
20.3/4821

Weight Weight
actual total

Type

(mm) (mm) (mm) (mm) (mm) (mm) DSA PSA

(g)

GCS
DSN
RG
ES
HBN
HCB
RG
ECN
HCB
ECN
HBN
HBN
ECN
GCS
ECN
HBN
ECN
RCB
HBN
RG
EE
ES
LSN
RCB
CT
CT
LSN
HBN
HBN
ECN
ECN
HBN
ECN
ECN
RCB
DSN
CT
ECN
ECN
HBN
ECN
RCB
ECN
RG
LSN

(44.0) (44.0) 26.6
(20.0) (17.5) (13.0)
(33.0) (33.0) 20.0
(29.0)
(44.0) (40.3) (13.4)
(30.2) (27.8) 14.4
(30.0) (30.0) 15.8
(37.7) (37.0) (22.0)
12.5
31.7
31.0
(33.0) (32.0) (26.0)
(34.0) (32.5) (13.5)
(32.5) (29.5) (15.5)
(43.0) (43.0) 25.0
(36.0) (36.0) (22.5)
(30.0) (30.0) (22.0)
(32.0) (28.0) (14.3)
(36.5) (34.4) (25.0)
(25.0) (22.0) 12.5
(34.0) (30.6) (11.5)
(28.0) (28.0) 14.9
(37.0) (34.0)
(24.0)

4.2
0.2
1.4
2.7
2.8
1.2
1.0
1.7
2.3
2.0
1.7
1.7
5.6
3.6
1.7

(23.2) (21.5)
(18.7) (18.7)

(20.0)
(39.5)
30.8
(31.5)
(44.0)
(33.0)
(33.5)
(38.0)
(34.0)
(28.0)
(18.0)
(23.0)
(30.0)
(30.0)
(34.0)
(39.0)
21.6
(40.0)
(27.5)
(40.0)
HBN (37.0)
(36.0)
20.3/4823 EE
20.3/4830 GSS (31.5)
(30.0)
20.3/4837 ES
20.3/4839 ECN (33.0)
(29.5)
20.3/4840 EE
20.3/4844 HCB (30.5)

(20.0)
(38.1)
26.0
(30.0)
(43.9)
(33.0)
(31.0)
(36.0)
(33.0)
(26.7)
(16.5)
(21.9)
(28.2)
(28.5)
(30.5)
(39.0)
20.8
(40.0)
(27.5)
(40.0)
(35.1)
(33.5)
(30.0)
(29.7)
(31.0)
(27.5)
(29.4)

-

14.5
9.4

9.5
4.1
(13.0) (7.6)
7.8
8.9
(15.0) 13.7
(13.4)
(12.8)
8.3
9.3
15.7
10.1
10.1
(14.1) 12.3
(13.5)
(15.5)
19.2
16.0
10.3
10.0
8.9
(10.2)
(14.3)
(20.8) (12.0)
12.5
(11.5)
6.7
(8.0)
(15.1) (12.0)
(13.0) 11.8
(22.0) (12.0)
14.5
9.4

(11.1) (11.1)
23.6
23.6

-

11.6

16.7
12.5

16.7
12.5

-

(22.0)
18.7
(16.4)
(24.0)
(24.0)
13.5
11.0
(14.6)

(18.8)

11.4
13.5

15.1

(16.4)
11.4
16.2
(14.0) 12.2
13.5
9.6
11.0
(14.6)
(20.0) (12.0)
10.6
18.2
(17.8) (17.8)
(19.6) 15.2 10.3
6.7
10.6
9.6
20.6
6.4
6.8
(18.1)

5.6
(2.0)
2.9
6.0
5.1
4.7
3.4
5.2
5.7
4.0
6.1
5.9
5.1
5.0

4.3
4.6
4.4
4.6
5.9
4.4
3.8
5.5
(6.0)
4.3
2.7
3.1
5.5
5.6
5.3
5.9
5.2
6.0
4.6
4.7
4.3
2.6
3.0
3.5

(4.2)

-

21.6

16.0

15.5

(15.5)

-

4.3
4.9
7.4
4.0
4.5
5.1
6.3

-

18.1

15.0

(4.0)

8.0
12.9
10.9
12.8

4.5
4.0

(17.5) (8.3)
(20.0) (14.0)
(16.0)
(21.0) 14.1
13.8

8.8

-

(3.5)
5.4
4.8

185
-

130
160
150
-

70
180
110
115

110
120

150

130

170
190
150

125
80
120

200

150

170

105
125
105
170

1.8

-

140
-

165

160

190

140
120

150
150

125
120

200

140

-

-

-

130
140

190

130

150
140

115
100
160

(190)
-

155
170
-

-

110

100
115
130
130

1.0
0.7
2.1
1.1
0.8
1.8

1.2
0.7
0.4
0.4
3.6
2.5
1.7
3.5
2.2
2.1
2.2
1.8
0.9
0.4
0.8
0.4
0.2
0.8
1.8
1.5
2.7
1.1
2.0
2.5
1.0

2.2
0.9
0.4

2.1
1.3

(g)

Material
(5.3) White rhyolite
(0.5) White chert
(1.7) Brown chert
(3.3) Gold chert
(3.0) Pink quartzite
(1.8) Pink chert
(1.3) White chert
(3.0) Green chert
2.3 Rust quartzite
(3.3) Mauve chert
(2.4) Tan chert
(2.2) White chert
(7.0) Basalt
(3.9) Basalt
(2.5) Brown chert
(2.0) Red chert
(3.0) Pink chert
(1.1) Clear chert
(3.5) Gray chert
(1.5) Mauve chert
(3.0) Red chert
(3.0) Brown chert
(3.0) Obsidian
(1.4) Obsidian
(0.5) Obsidian
(0.5) Obsidian
(4.0) White rhyolite
2.5 Gold chert
(2.1) Gold chert
(4.0) Brown chert
(3.2) Gray chert
(2.6) White chert
(3.1) Red chert
(3.0) Red chert
(1.3) Gold chert
(0.6) White chert
(1.0) Pink chert
(2.0) Gold chert
(2.8) White chert
(2.3) Gray chert
(3.5) Basalt
1.5 Obsidian
(3.5) Gray chert
(1.3) Tan chert
(4.0) Pink chert
(3.5) White chert
(3.0) Orange chert
(3.0) Tan rhyolite
(2.0) Amber chert
(3.0) Orange chert
(3.2) Gold chert
(2.0) Gold chert


of the alignments for some distance, we discovered a recent Forest Service barbed wire fence. Because of the difficulty of stringing barbed wire along the escarpment, small rock barriers had been constructed instead. Although the steep cliff usually prevented cattle from drifting uphill, occasional passes existed, and this is where the rock structures were built. It was with some embarrassment that we later met the Forest Service personnel who had actually constructed our "hunting blinds."

These parenthetical parables are not designed to discourage research on rock blinds and features. Rather, we simply feel obliged to inject an appropriate note of caution. Rock walls can be constructed for a number of purposes, and one must carefully consider the historic and contemporary land-use patterns before hastily assigning a particular feature to the aboriginal period. The distinction between aboriginal and Euro-American features can be subtle indeed, requiring careful documentation of the available evidence.

### NOTES

1. Several dozen additional stone barriers and facilities have been recorded on Mt. Jefferson, on the western margin of Monitor Valley (Thomas, 1982c: 74–88). Detailed consideration of these (and other) summit crest hunting evidence will be postponed until the next volume in this series.

### TABLE 54—(Continued)

<table>
<thead>
<tr>
<th>Spec. no.</th>
<th>Type</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Thickness (mm)</th>
<th>DSA</th>
<th>PSA actual (g)</th>
<th>Weight total (g)</th>
<th>Material</th>
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<td>(41.7)</td>
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<td>8.8</td>
<td>3.8</td>
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<td>1.0</td>
<td>(2.5)</td>
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<td>—</td>
<td>(20.7)</td>
<td>(11.5)</td>
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<td>4.6</td>
<td>155</td>
<td>130</td>
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<td>17.0</td>
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<td>(3.8)</td>
<td>—</td>
<td>120</td>
<td>0.5</td>
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<td>3.6</td>
<td>170</td>
<td>95</td>
<td>0.7</td>
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<tr>
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<td>(21.2)</td>
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<td>160</td>
<td>110</td>
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<td>13.1</td>
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<td>(22.3)</td>
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<td>175</td>
<td>130</td>
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<td>(36.4)</td>
<td>(29.3)</td>
<td>20.2</td>
<td>13.6</td>
<td>4.1</td>
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<td>EE</td>
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<td>(29.8)</td>
<td>—</td>
<td>(18.0)</td>
<td>15.8</td>
<td>3.2</td>
<td>130</td>
<td>110</td>
<td>1.0</td>
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<td>EE</td>
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<td>(38.3)</td>
<td>22.4</td>
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<td>6.6</td>
<td>140</td>
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<td>11.0</td>
<td>4.3</td>
<td>170</td>
<td>100</td>
<td>1.2</td>
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</tbody>
</table>
CHAPTER 6. ROCK ART SITE CATCHMENTS IN MONITOR VALLEY

DAVID HURST THOMAS AND TRUDY THOMAS

Nissen (1982) has observed that Great Basin rock art sites are commonly treated as unique, as phenomena somehow removed from the rest of the archaeological record. This assessment is unfortunately true, and from the outset of the Monitor Valley research, one priority was to meld data from rock art sites with comparable data from survey and excavation in the same area.

Specifically, we framed three objectives for the rock art analysis in Monitor Valley:

1. to determine how and why rock art elements and motifs are positioned within specific petroglyph and pictograph sites;
2. to determine how and why rock art sites are positioned within the overall mosaic of prehistoric cultural geography;
3. to determine what, if any, is the relationship between rock art sites and the spatially "associated" archaeological assemblages.

The initial objective—to explore microtopographic rock art positioning strategies—is discussed elsewhere (T. Thomas, 1976). The present volume addresses the remaining two objectives.

Only four rock art sites were known in the Monitor Valley area before we began working there in 1970. Since that time, teams from the American Museum of Natural History turned up an additional 10 petroglyph and pictograph sites (fig. 128).

Each rock art site discussed in this chapter has been recorded by Trudy Thomas; scale drawings and photographs are on file at the Laboratory of Anthropology, American Museum of Natural History (see also T. Thomas, 1976, 1983b; Thomas and Thomas, 1972).

This chapter attempts to present the primary locational information from various Monitor Valley rock art localities. We also discuss the nature of archaeological sites and assemblages spatially associated with several petroglyph and pictograph sites (tables 55 and 56). Both the initial rock art survey and the attendant search for associated assemblages were conducted along traditional, site-oriented lines (i.e., we lack the locus-control imposed on the upland spring catchment surveys; see chap. 1). Subsequent chapters integrate these data into the broad-based Monitor Valley framework.

HICKISON SUMMIT (La9)

This important site is located north of U.S. Highway 50, in a narrow pass dividing the Toquima Range (on the south) from the Simpson Park Range (fig. 128). The petroglyph panels occur at an elevation of 2010 m (6600 ft).

PREVIOUS RESEARCH

The Hickison Summit rock art site was first recorded by a field party from the University of California in July 1958 (Heizer and Baumhoff, 1962: 38–40). In addition to documenting the petroglyphs, these investigators found nearby several abandoned 5 gallon cans, which suggested to them that this area might have been used as a pine nut camp (Site Inventory Form La9, on file at the Nevada State Museum).

The Berkeley team recorded and collected two other surface sites in the area. La10 is in the saddle between Hickison Summit petroglyph site and Ackerman Spring; fieldnotes prepared by M. A. Baumhoff describe a surface litter of chipped stone, accompanied by two gray basalt manos and a metate of pink scoria basalt. La11 is described as an occupation site surrounding Ackerman Spring with "large amount of chipping, several rock piles . . . blades, fragments."

In 1971, D. R. Tuohy and Amy Dansie of the Nevada State Museum conducted a powerline survey through the area, noting several sites within a 1–2 km catchment of the petroglyph panels. They revisited La11, recovering abundant flakes and artifacts along the canyon and basin area (and an especially heavy concentration near a little spring). The
### TABLE 55

**Projectile Point Frequencies at Monitor Valley Rock Art Localities**  
Additional artifacts are listed in table endnotes.

<table>
<thead>
<tr>
<th>Site</th>
<th>Desert series</th>
<th>Rosegate series</th>
<th>Elko series</th>
<th>Gatecliff series</th>
<th>Humboldt series</th>
<th>Preforms</th>
<th>Tips</th>
<th>Fragments</th>
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</table>

*a* 3 Silver Lake points (?).

*b* Residual concave base.

*c* Residual concave base.

*d* 2 Residual concave base.

Artifact inventory was “2 knives, 2 scrapers, 2 PP blanks, 2 PP frags.” One of these points is a basalt Large Side-notched point. This specimen is of interest because it falls into the overall Monitor Valley pattern: basalt is very frequently used to make Large Side-notched points, and nearly all Large Side-notched points are made of basalt.

La22 is located 1/8 mile north-northeast of Ackerman Spring, on the west slope overlooking the water source. Artifacts recovered include flakes, scrapers, a projectile point fragment, gray chert debitage, and corrugated pottery (an unusual occurrence in this area; see chap. 19).

La23 is a scatter of flakes and scrapers found at the Bureau of Land Management Hickison Summit campsite, roughly 3 km northwest of Ackerman Spring. A chert knife and a thin metate fragment were collected here.

La25 is a site roughly 750 m north of Ackerman Spring, containing “moderately rich chipping debris . . . 1 pointed knife fragment, 2 preforms, 3 square scraper ends.”

**American Museum Research**

This site has been taken as archetypical of the functional association between rock art and potential game ambush, a hypothesis discussed in detail by Heizer and Baumhoff (1962). In fact, Hickison Summit was the site that initially suggested this hypothesis (M. A. Baumhoff, personal commun.).

In light of the extensive research already conducted in this area, we decided to skip our standard 1 km catchment survey and simply explore the more obvious sites relevant to our own goals. T. Thomas completely recorded the elements at the rock art site...
proper, as well as other previously documented panels in the vicinity (T. Thomas, 1976). We also made a series of surface collections from the several loci at the Hickison Summit site proper, especially from the large open site in immediate proximity to the new-
TABLE 56
Miscellaneous Artifact Frequencies at Monitor Valley Rock Art Localities
Additional artifacts are listed in table endnotes.

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<th>Site</th>
<th>Rough-outs</th>
<th>Rough perc.</th>
<th>Fine perc.</th>
<th>Press. flaked</th>
<th>Knives</th>
<th>Drills</th>
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<td>a Mano, metate, 5 cores, worked obsidian nodule, abrader, 2 quartz crystals.</td>
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ly discovered petroglyph panels. We also mapped and tested Boring-as-Hell Shelter (as described in chap. 4).¹

HICKISON SUMMIT PETROGLYPH SITE (La9)

This dense artifact and debitage scatter occurs in the small flat, on the southern margin of the petroglyph clusters (near clusters 4, 5, 6, and 7, as defined by T. Thomas, 1976: fig. 2). Much of the La9 assemblage is manufactured from a locally available indurated rhyolite. This rock fractures naturally, and we have several "maybe-facts" in the collection; these borderline cases have been excluded from the present analysis. Several seemingly naturally fractured pieces had been utilized as ad hoc implements.
The Hickison Summit assemblage is also characterized by a rather high frequency of well-made, heavily utilized end-scrapers. The artifact inventory of La9 is presented on tables 55 and 56; projectile point attributes on table 57.

**UPPER ACKERMAN SPRING SITE (La627)**

A dense concentration of 385 Shoshone ware sherds was found along a ridge top about 1200 m south of Upper Ackerman Spring area (fig. 129), at an elevation of about 2010
Fig. 130. Projectile points found at Hickison Summit (La9). a–d. Desert series; e, f. Cottonwood Triangular; g–l. Rosegate Series; m–o. Elko Corner-notched; p–r. Elko Eared; s, t. Elko series; u–w. Gatecliff Contracting Stem; x. Gatecliff Split Stem; y–bb. Humboldt Concave Base; cc–ee. Silver Lake. a. 20.2/9782; b. 20.3/48; c. 20.3/1206; d. 20.3/1197; e. 20.3/1024; f. 20.2/9816; g. 20.2/9737; h. 20.3/1190; i. 20.3/1096; j. 20.3/1009; k. 20.3/1134; l. 20.2/9824; m. 20.3/1188; n. 20.3/1228; o. 20.3/1193; p. 20.3/1130; q. 20.2/9731; r. 20.3/1098; s. 20.2/9661; t. 20.3/1184; u. 20.3/1231; v. 20.3/1191; w. 20.3/1224; x. 20.3/1177; y. 20.3/1088; z. 20.3/1112; aa. 20.3/1075; bb. 20.3/1199; cc. 20.3/1078; dd. 20.3/1137; ee. 690584.

m (6600 ft). The sherds, almost certainly from a single vessel, were crushed and heavily indurated.

TOQUIMA CAVE (La1)

The rock art of Toquima Cave (also known as “Potts Cave”) was briefly discussed by Heizer and Baumhoff (1962: 38). Thomas and Thomas (1972) considered selected motifs. The archaeological record of Toquima Cave is discussed in chapter 4. To monitor surface records of the area, a 1 km catchment was completely surveyed and documented (fig. 131). The sites are discussed below and artifact frequencies are summarized on tables 55 and 56.

La675 (field nos. LRW1–4)

Four stone circles—almost certainly house foundations—cluster within a radius of about
75 m and they have been arbitrarily grouped together as La675. This "site" has no particularly diagnostic criteria; it is defined strictly for bookkeeping purposes.

Feature 1 is a complex structure consisting of two concentric and superimposed stone circles (inside diameter of inner ring: 1.30 m N-S by 1.20 E-W; inside diameter of outer ring: 3.70 m N-S by 3.60 E-W). A small circular cache feature (inner diameter: 1.0 m) is appended to the southwestern side of the outer ring. A large, natural rock outcrop occurs about 5 m to the southeast of Feature 1. Neither artifacts nor debitage was present; historic debris occurs not far away.

Feature 2 is an isolated stone circle (inside
diameter: 2.60 m), roughly 40 m to the southeast of the first ring. A massive rock outcrop occurs 20 m due west of Feature 2.

**Feature 3** is a stone circle (inside diameter: 3.10 m N-S by 3.70 m E-W). The ring has two tiers on the northern side. Like the others, Feature 3 is situated near a large rock outcrop, roughly 25 m to the north. Debitage occurs around the perimeter and historic debris is lacking.

**Feature 4** is a small stone circle (inside diameter: 1.75 m N-S; 2.20 E-W), located about 3 m south of a large outcrop. A broken pressure flaked blank was found inside the ring.

No additional artifacts were recovered from La675.

**La676 (field nos. LRW5–7)**

This site consists of three discrete stone circles. An incised stone found here has been previously described (McKee and Thomas, 1972: fig. 4), and no additional artifacts were recovered in subsequent survey. Only a small quantity ofdebitage was noted. No historic period artifacts were encountered.

**Feature 1** is an isolated stone circle on the eastern margin of a slight plateau. Three distinct concentric stone rings are evident (inside diameter of the outside ring: 3.06 m N-S by 3.18 E-W). The distinctive doorway on the southeastern margin indicates that Feature 1 is a house ring.

**Feature 2** is a single tiered stone circle (inside diameter: 2.42 m N-S by 2.73 E-W) located about 100 m to the west of the first ring. A small chippage concentration occurred about 10 m to the southeast. This structure is on the northern margin of the plateau, with a rock outcrop roughly 5 m to the north. A doorway is evident on the southeastern margin.

**Feature 3** is a small stone circle, probably a house foundation (inside diameter: 2.0 m N-S by 2.50 E-W), located to the south of Feature 2. The two structures are approximately 50 m apart, separated by a large stone outcrop.

**La677 (field nos. LRW8–10)**

This site consists of three stone circles within a radius of about 90 m. The artifact scatter was extremely light, and historic debris absent.

**Feature 1** is a semicircular structure (inside diameter: 3.02 m N-S; 2.80 E-W), with a stone rimmed “foyer” on the southeastern corner. A banded rhyolite uniface was found 2 m outside the northern wall, and a limited scatter ofdebitage occurred nearby.

**Feature 2** is a collapsed stone circle, probably a house ring (inside diameter: 2.65 m) situated 150 m due west of Feature 1. The original structure appears to have been three tiers high, and the doorway faces east. The backside (northwest margin) of the ring abuts a large rock outcrop.

**Feature 3** is another collapsed rock ring (inside diameter: 2.10 m N-S; 1.80 E-W). This feature is located on the southwestern margin of the large plateau that contains both La677 and La676. A poorly defined doorway opens to the southeast. A very light debitage scatter was associated.

**La678 (E-1016)**

A light artifact and chippage scatter occurs in an area roughly 35 m in diameter. Situated on a slope, La678 is bordered on the northern margin by steep rimrock. Four grinding stones were found here and a single incised stone had been recovered previously (McKee and Thomas, 1972: fig. 6). La678 also contains two house rings. Historic debris is scattered throughout the area.
La679 (E-1017)

This small scatter is less than 10 m in diameter. Six incised stones were found in the artifact cluster; obsidiandebitage was relatively common.

GRENouille VERTE CAve (La1071)

This tiny cave, discovered in 1970, contains a few faint pictographs, as discussed in chapter 4 (fig. 128). Grenouille Verte Cave is located approximately 400 m east of Toquima Cave, also at an elevation of about 2420 m (7940 ft).

GaTeclIFF ShelTer (Ny301)

The pictographs inside Gatecliff Shelter were first discovered by us in 1970, and they have been completely described and discussed by T. Thomas (1983b; see also Thomas and Thomas, 1972). The 1 km catchment surrounding Gatecliff Shelter was previously surveyed as part of the streamside survey design (chap. 2). Not a single archaeological site was found within 1 km of Gatecliff Shelter, although it is quite possible that additional deeply stratified sites are buried nearby.

NorthumberLaND PETROGLYPH SITe (Ny304)

This extensive petroglyph site was initially discovered by American Museum of Natural History survey crews in 1973 (fig. 128). The rock art occurs on several welded tuff boulders on the northern side of East Northumberland Canyon, at an elevation of 2225 m (7300 ft). The microtopographic motif distribution and implied hunting strategy at this important site have been discussed by T. Thomas (1976; see also chap. 19).

A catchment area 500 m in diameter was surveyed using Ny304 as the focal point (fig. 134). The major site in this catchment is in direct association with the rock art, as described below. Artifacts recovered from this catchment survey are described in tables 55, 56, and 59. A small rock shelter (Ny1059) is
located directly across Northumberland Canyon from Ny304; it was tested and results are described in chapter 4.

A dense artifact scatter, directly associated with the petroglyph-covered tuff boulders (Ny304), extends approximately 200 m north-south by 400 m east-west. This site was collected in 11 intrasite zones, but for present purposes, we lump these divisions within a single artificial unit (Ny304, table 59, figs. 135 and 140).

Ny918 (E-1018)

This small artifact scatter (roughly 20 m in diameter) occurs on a rather steeply sloping saddle to the south of Ny304 (fig. 134).²

BUTLER RANCH CAVE (Ny303)

We first recorded the rock art inside Butler Ranch Cave in 1970 (chap. 4). A 1 km catchment surrounding Butler Ranch Cave was to-
Ny920 (E-1012)

Ny920 occurs on a steep hillside to the north of Butler Creek. The rather small artifact and debris scatter is limited to a fan-shaped distribution, roughly 40 × 30 m. A limited amount of obsidiandebitage was found, as well as a single pressure flaked obsidian nodule.

Ny921 (E-1013)

This medium sized site (roughly 100 × 15 m) occurs along the toe of a ridge south of Butler Creek. Two distinct rock rings (Features 1 and 2) occur in the middle of the artifact scatter. Historic debris is also present. The rather abundant obsidian nodules, debitage, and scatter suggest that a source may be nearby (perhaps a continuation of the Box Spring source, roughly 10 km to the west).

Ny922 (E-1014)

This site straddles the crest and toe of a ridge north of Butler Creek. The dense artifact and debitage scatter is spread over an area roughly 50 × 20 m. Feature 1 is a single rock house foundation. Historic debris is common, and Feature 2, a rock wall (probably constructed during the historic period), stands near the prehistoric scatter. Obsidiandebitage is relatively common at this site, and three metates were found.

Ny923 (E-1015)

A very light artifact and chippage scatter (roughly 30 m in diameter) was found on a gently sloping hillside south of Butler Creek. The restricted artifact inventory consists of a single point fragment and four grinding stones. Tin cans and broken glass also occur nearby.

BARLEY CREEK PETROGLYPH SITE (Ny924)

This site was unrecorded prior to the American Museum of Natural History survey of Monitor Valley. The locality consists of...
THOMAS: MONITOR VALLEY:

Fig. 136. Map of sites associated with Butler Ranch Cave (Ny303).

of a massive welded tuff outcrop covered with a large series of petroglyphs. This clifffy formation is immediately south of Barley Creek on the eastern side of Monitor Valley (fig. 128). The elevation is about 2225 m (7300 ft). Ny924 was completely photographed and drawn to scale by Trudy Thomas.

Three distinct petroglyph panels flank a dry wash. A small box canyon, immediately to the north, would have provided an excellent drive/ambush location. On one side, a 10 m drop-off is defined by a sheer rock cliff; the other side of the box canyon is flanked by massive boulders. The positioning of the Bar-
ley Creek petroglyph panels is similar to Hickison Summit and East Northumberland (T. Thomas, 1976; chap. 19). All three sites contain the key elements for an intercept strategy hunting locus.

No archaeological survey was conducted at Barley Creek, although artifact concentrations were noted nearby.

WHITE ROCK CANYON SITE (Ny22)

Several petroglyph-embellished boulders occur near the mouth of White Rock Canyon on the extreme southeastern margin of Monitor Valley (fig. 128). The elevation is about 2255 m (7400 ft). These boulders, standing
in the ephemeral wash, create a natural ambush area for game moving either up- or down-canyon. Both the name and distinctive appearance of this canyon are due to the brilliant white welded tuff formation that crops out here; it is visible from across Monitor Valley, a distance of at least 20 km.

The White Rock Canyon site was first described by Steward (1929: 145) and that description was repeated by Heizer and Baumhoff (1962: 57–58). None of these investigators actually visited the site. T. Thomas completely recorded the petroglyphs during the summer of 1975.

No archaeological survey was conducted in this area.
ERN end of Monitor Valley (fig. 128). The elevation is approximately 2160 m (7100 ft). Artifacts recovered from this catchment survey are described in tables 55, 56, and 61.

Ny1 was first reported by Mallery (1893: 94): "Eight miles below Belmont, in Nye County, Nevada, an immense rock which at some time has fallen into the canyon from the porphyry ledge above it has a patch of marks nearly 20 feet square. It is so high that a man on horseback can not reach the top." This site was also recorded as Steward's (1929) rock art site 215, and as Ny1 by Heizer and Baumhoff (1962: 57).

There has been some confusion about the location of this site. We think that Heizer and Baumhoff's sites Ny1 and Ny21 probably refer to the same locality. The description for Ny21 (Heizer and Baumhoff, 1962: 58) fits the East Bald Mountain Wash site, described by them as Ny1. Steward (1929) likewise described this site twice, as sites 213 and 214.

A 1 km catchment surrounding the rock art at Ny1 was completely surveyed. Only a single archaeological site was found in this area.

Ny925 (E-1009)

This major site is situated on a low ridge, roughly 200 m west of the East Bald Mountain Wash petroglyph boulder. A very dense artifact and chippage concentration occurs on a flattened area near the end of the ridge
Fig. 141. Map of sites associated with Jeans Spring Shelter (Ny3O2).

(roughly 30 × 20 m); the actual site continues for at least 100 m along the top of the ridge. Feature 1 is a rock cairn and Feature 2 is an isolated stone house ring.

A large concentration of Shoshone ware ceramics was collected at Ny925. Sherds from at least five vessels were recovered, and rim profiles are presented in figure 46. Vessel 1 is a medium sized pot (roughly 25 cm in diameter at the lip) with a flaring rim profile; the exterior had been deliberately roughened by brushing while still wet. Vessel 2, a very large plain Shoshone ware vessel with a slightly flaring lip, appears to have a fugitive
TABLE 57
Attributes for Projectile Points from the Hickson Summit Petroglyph Site (La9)

<table>
<thead>
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<th>Spec.</th>
<th>Type</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Thickness neck (mm)</th>
<th>DSA</th>
<th>PSA</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
<th>Material</th>
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<td>70</td>
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<sup>a</sup>This artifact, provided through the courtesy of Mr. Brian Hatoff, has been cataloged into the collections of the University of California, Davis. It keys out as an Elko Eared point according to the Monitor Valley criteria (Thomas, 1981a, 1983b).

<sup>b</sup>This artifact keys out as an Elko Corner-notched point according to the Monitor Valley criteria (Thomas, 1981a, 1983b).

<sup>c</sup>This artifact keys out as a Gatecliff Contracting Stem point according to the Monitor Valley criteria (Thomas, 1981a, 1983b).

TABLE 58
Attributes for Projectile Points from Toquima Cave Survey Catchment

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<thead>
<tr>
<th>Spec.</th>
<th>Type</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Thickness neck (mm)</th>
<th>DSA</th>
<th>PSA</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
<th>Material</th>
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<td>(41.5)</td>
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red slip. Vessel 3 has a straight lip, represented by five rimsherds. Vessel 4 is a well-made brown plainware pot with very thin walls.

**HUNTS CANYON SHELTER**

(Ny1158)

A striking set of pictographs is present inside Hunts Canyon Shelter, a site first recorded by American Museum of Natural History crews in 1977. The shelter is located in the extreme southern portion of Monitor Valley (fig. 128) in a low, narrow overhang within a massive tuff outcrop that juts up from the surrounding alluvial bottomland (chap. 4). No additional archaeological survey was conducted in the immediate area of Hunts Canyon Shelter.

Ny926

A few isolated petroglyph motifs were found on a boulder located at the summit of

**TABLE 59**

Attributes for Projectile Points from Northumberland Rock Art Survey Catchment

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Type</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Width neck (mm)</th>
<th>Thickness (mm)</th>
<th>DSA</th>
<th>PSA</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
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<td>125</td>
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McCann Canyon, approximately 8 km east of Hunts Canyon Shelter (fig. 128). This previously unrecorded rock art was first visited by American Museum of Natural History crews in 1975.

The boulder is on the northern side of the canyon, immediately before the road drops into Stone Cabin Valley to the east, at an elevation of approximately 2255 m (7400 ft). The canyon is tightly constricted in this area, and an isolated rock cairn was discovered on the south side of the canyon, approximately 200 m from the petroglyph boulder. Thinking that this stone pile might mark a recent mine claim, we excavated the entire cairn, but nothing was contained within. This feature is probably a soldier cairn constructed to enhance the already favorable conditions for intercept/ambush hunting in McCann Canyon.

### Table 60

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<th>Spec.</th>
<th>Type</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
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TABLE 61
Attributes for Projectile Points from Ny925, in the East Bald Mountain Wash Survey Catchment

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<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Width neck (mm)</th>
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<th>Weight actual (g)</th>
<th>Weight total (g)</th>
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<td></td>
</tr>
<tr>
<td>20.3/4499 CT</td>
<td>21.5 (19.5)</td>
<td>11.4 (11.4)</td>
<td>2.9 (2.9)</td>
<td>220 (140)</td>
<td>0.3 (0.4)</td>
<td>Gray chert</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.3/4504 DSN</td>
<td>15.2 (13.0)</td>
<td>10.9 (10.9)</td>
<td>6.1 (6.1)</td>
<td>220 (140)</td>
<td>0.3 (0.3)</td>
<td>White chert</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.3/4507 CT</td>
<td>12.7 (14.4)</td>
<td>11.7 (11.7)</td>
<td>1.9 (1.9)</td>
<td>220 (170)</td>
<td>0.4 (0.5)</td>
<td>White chert</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.3/4509 DSN</td>
<td>27.8 (14.8)</td>
<td>140 (140)</td>
<td>5.5 (5.5)</td>
<td>220 (170)</td>
<td>1.7 (1.7)</td>
<td>Brown chert</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.3/4572 RCB</td>
<td>29.9 (28.6)</td>
<td>12.3 (12.3)</td>
<td>3.8 (3.8)</td>
<td>220 (140)</td>
<td>0.6 (0.6)</td>
<td>Obsidian</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

JEANS SPRING SHELTER (Ny302)

Several faint pictographs survive on the interior of Jeans Spring Shelter, which is on the west side of the Toquima Range, near the north fork of Wildcat Canyon (fig. 128). This previously unrecorded rock art site was mapped and partially excavated by American Museum of Natural History crews in 1973 (chap. 4). Artifacts recovered from this catchment survey are described in tables 55, 56, and 62.

Jeans Spring Shelter is roughly 1 km from Spring 22 (one of the randomly selected spring catchments); since much of this area was surveyed previously, only a rather informal archaeological survey was conducted to the west of Jeans Spring Shelter (fig. 141).

Ny828 (“Collection Area F”)

Several artifacts were found concentrated within 25 m of the actual seep at Jeans Spring.

Ny829 (“Collection Areas A, B, C, & D”)

A series of three ridges was collected as a single site. The scatter is approximately 50

TABLE 62
Attributes for Projectile Points from the Jeans Spring Shelter Survey Catchment

<table>
<thead>
<tr>
<th>Spec.</th>
<th>Length max. (mm)</th>
<th>Length axial (mm)</th>
<th>Width max. (mm)</th>
<th>Width basal (mm)</th>
<th>Thickness (mm)</th>
<th>Weight actual (g)</th>
<th>Weight total (g)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.3/0181 DSN (24.0)</td>
<td>(22.0)</td>
<td>12.8</td>
<td>12.8</td>
<td>6.8</td>
<td>2.7</td>
<td>170</td>
<td>170</td>
<td>0.6 (1.0)</td>
</tr>
<tr>
<td>20.3/6933 GCS (45.0)</td>
<td>(45.0)</td>
<td>30.7</td>
<td>8.2</td>
<td>12.7</td>
<td>5.6</td>
<td>160</td>
<td>75</td>
<td>5.8 (6.5)</td>
</tr>
<tr>
<td>20.3/6934 DSN (27.6)</td>
<td>26.0</td>
<td>12.8</td>
<td>12.8</td>
<td>7.6</td>
<td>3.6</td>
<td>200</td>
<td>185</td>
<td>1.2 (1.2)</td>
</tr>
<tr>
<td>20.3/6938 CT (25.0)</td>
<td>(23.8)</td>
<td>14.8</td>
<td>14.8</td>
<td>3.0</td>
<td>0</td>
<td>80</td>
<td>180</td>
<td>0.6 (1.0)</td>
</tr>
<tr>
<td>20.3/6939 EE (40.0)</td>
<td>(36.8)</td>
<td>–</td>
<td>(23.0)</td>
<td>(11.0)</td>
<td>(4.0)</td>
<td>130</td>
<td>0.4 (3.0)</td>
<td>White chert</td>
</tr>
<tr>
<td>20.3/6950 ECN (34.0)</td>
<td>(34.0)</td>
<td>(30.0)</td>
<td>(23.0)</td>
<td>14.4</td>
<td>5.0</td>
<td>150</td>
<td>140</td>
<td>3.3 (5.0)</td>
</tr>
<tr>
<td>20.3/6951 GSS (42.5)</td>
<td>(39.2)</td>
<td>26.6</td>
<td>10.1</td>
<td>11.6</td>
<td>4.6</td>
<td>155</td>
<td>80</td>
<td>2.0 (4.0)</td>
</tr>
<tr>
<td>20.3/6953 ECN (35.0)</td>
<td>(34.7)</td>
<td>(23.0)</td>
<td>(12.5)</td>
<td>11.1</td>
<td>4.6</td>
<td>160</td>
<td>110</td>
<td>2.9 (3.5)</td>
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<tr>
<td>20.3/6958 CT (29.0)</td>
<td>(27.9)</td>
<td>15.3</td>
<td>15.3</td>
<td>–</td>
<td>3.4</td>
<td>–</td>
<td>–</td>
<td>0.9 (1.5)</td>
</tr>
<tr>
<td>20.3/6960 CT 23.5</td>
<td>21.4</td>
<td>15.9</td>
<td>15.9</td>
<td>–</td>
<td>3.2</td>
<td>–</td>
<td>–</td>
<td>1.0 (1.0)</td>
</tr>
<tr>
<td>20.3/6961 CT 17.0</td>
<td>17.0</td>
<td>14.0</td>
<td>14.0</td>
<td>–</td>
<td>3.1</td>
<td>–</td>
<td>–</td>
<td>0.7 (0.7)</td>
</tr>
<tr>
<td>20.3/6963 CT (20.0)</td>
<td>(18.5)</td>
<td>(12.2)</td>
<td>(12.2)</td>
<td>–</td>
<td>2.6</td>
<td>–</td>
<td>–</td>
<td>0.5 (0.7)</td>
</tr>
</tbody>
</table>
m in diameter, separated from the Jeans Spring area proper by a deep dry wash. Features 1 and 2 are stone house rings at the extreme northern end of this concentration, not far from a dense scatter of Shoshone ware ceramics.

Ny830 ("Collection Area E")

This small, discrete site occurs approximately 50 m to the west of Jeans Spring Shelter, along a protected hollow. Historic debris is common in this area, and artifacts have been somewhat displaced by slopewash.

KINGSTON CANYON ROCK ART SITE NO. 1 (Ny831)

A small rock art locality was recorded in 1975 as part of the regional rock art reconnaissance. Although this site lies outside Monitor Valley proper, it deserves mention because of its interesting topographic location and because it is in danger of destruction. Several faint pictographs were noted on the bottom side of a large chert boulder, located immediately to the north of the present Kingston Canyon road at an elevation of 2100 m (7000 ft). The pictographs are barely visible beneath a slight overhang on the south side of the boulder; in fact, part of this boulder was blasted away during recent road construction. Kingston Canyon is quite narrow in this area; the small creek flows immediately to the south of Ny831.

KINGSTON CANYON ROCK ART SITE NO. 2 (Ny832)

A second rock art site was discovered here by American Museum of Natural History crews in 1975. Two extremely faint red pictographs were detected in an overhang on the northern side of the canyon, almost directly across the road from the Kingston Canyon public campground, at an elevation of about 2290 m (7500 ft). This small shelter occurs in a steep talus slope, approximately 25 m above the valley floor. A grinding stone was found on the surface, and there seems to be sufficient deposit inside the shelter to warrant excavation (the site was not tested as part of the 1975 survey).

Both Kingston Canyon rock art sites are in danger of destruction due to the extensive recreational, mining, and construction activities in the area.

NOTES

1. More recently, several additional sites have been recorded in the Hickison Summit catchment (see reports on file at the Battle Mountain District Office of the Bureau of Land Management: 6-242, 6-274).

2. Ms. Marsha Cardinale of the U.S. Forest Service has done considerable archaeological reconnaissance in the Northumberland Canyon area (see chap. 7).

3. The locations of the newly found and unsurveyed rock art sites are deliberately vague. Our intent is merely to provide sufficient information for a consideration of rock art positioning strategies. Because of the extensive vandalism on several well-known Great Basin rock art sites, we hesitate to provide exact directions for finding these sites. Qualified investigators can obtain additional information by writing to the Laboratory of Anthropology, American Museum of Natural History.
CHAPTER 7. THE REGIONAL MONITOR VALLEY
SAMPLE: ANALYSIS OF BIAS

To this point, we have considered the context and content of the various components in the regional Monitor Valley sample: the nonsite catchment surveys, the deep stratigraphic excavation of Triple T Shelter, additional cave and shelter excavations, plus data from the various satellite and rock art catchment assemblages. If we include the previously described research at Gatecliff Shelter, this fieldwork has involved excavation of about 760 cu m of archaeologically relevant deposits, roughly 10,500 ha (26,000 acres) of systematic surface survey and collection. As explained in chapter 1, we also searched several thousand additional hectares, looking for the “rare archaeological event.”

This chapter bridges the chasm between these empirical explorations and the multiple pattern recognition studies to follow. We must first meld data from the disparate episodes of Monitor Valley fieldwork into a comprehensive regional sample suitable for analysis.

It is especially critical that we understand how well the Monitor Valley sample represents the archaeological record of this area. Without question, we have introduced bias into the data discussed in this volume. Survey results were heavily biased by the way in which we chose to collect the various sites and catchments. The artifact classification reflects my personal biases regarding typology. Absolute and relative chronologies reflect both the typological decisions and the way in which we chose to collect our radiocarbon samples. Overall perception of the Monitor Valley data is shaped to some degree by the way I have chosen to describe, illustrate, and discuss the raw data.

The overall impact of such biasing factors is poorly understood, but there is no escaping the fact that the findings and implications of the regional study are heavily influenced by procedural and philosophical decisions made at every step along the way.

Bias is inescapable. But it should not be ignored. In this chapter, we evaluate two especially critical distorting forces: the influence of regional geomorphological processes and the biases introduced by the specific sampling design employed in Monitor Valley.

NATURE OF THE REGIONAL SAMPLE

Our analysis of Monitor Valley prehistory began with an exposition of relevant epistemology (Thomas, 1983a). Epistemology is, of course, that body of theory underlying contemporary knowledge, with special emphasis on the limits and validity of that body of knowledge. Only by understanding “how we know what we know” can we determine which questions are most appropriate to the extant archaeological record. With these epistemological guidelines in mind, it is also possible to more effectively select relevant field and laboratory techniques to answer these questions.

The analytical process began at Gatecliff Shelter, the major stratified site in Monitor Valley. The geological record at Gatecliff consisted of 56 natural strata, containing 16 cultural horizons. The 10 m of stratigraphy produced an archaeological assemblage of 2046 artifacts, over 100,000 pieces of debitage, more than 15,000 identifiable bones, and roughly 50 features (Thomas, 1983b).

In this monograph, we consider an independent regional data set from Monitor Valley. The first six chapters discuss various recovery strategies and describe the archaeological items encountered. We have elected to analyze the regional data separately from the information collected at Gatecliff Shelter, not only to facilitate physical presentation of results, but also so that we may compare and contrast the internal structuring of Gatecliff Shelter with the regional data. Each analysis stands on its own, and each will be compared with the overall epistemological expectations.1

Analysis follows the sequential framework developed earlier (Thomas, 1983a):
(1) define the nature of the Monitor Valley landscape,
(2) explore the basic empirical characteristics of the archaeological record,
(3) relate those two structures to one another, and then
(4) array our perception of prehistoric cultural geography against midrange anticipatory statements.

VERTICAL ZONATION IN THE MONITOR VALLEY LANDSCAPE

Although modern biogeographic zonation has previously been taken as a rough indicator of the late prehistoric habitat (e.g., Thomas, 1969b, 1973; Thomas and Bettin-ger, 1976), there are certain disadvantages to this procedure, especially in light of known historic and late prehistoric period vegeta-tional shifts. We prefer now to partition the Monitor Valley landscape according to the absolute elevational criteria developed earlier (Thomas, 1983a: chap. 8):
The summit crest is landscape higher than 2750 m (9025 ft). Today, this high country is dominated by relatively barren sagebrush-covered slopes, sedge and grass-dominated tundra, and dense patches of limber pine.
The upland slope is the landscape between 2500 and 2750 m (8200 and 9020 ft). This upland zone is dominated by a sagebrush-grass community. The lower margin often includes mountain mahogany as overstory.
The woodland is landscape between 2250 and 2500 m (7400 and 8200 ft). This arbitrarily designated zone includes the major mountainside communities: piñon-juniper overstory, linear riparian associations, and a rather diverse understory, largely defined by local elevation, aspect, drainage, and nature of overstory.
The lowland slope is landscape between 2100 and 2250 m (6900 and 7400 ft). This intermediate zone generally consists of active alluvial slopes and the low foothills of the Toquima and Monitor Valley ranges. The lowland slope is dominated by sagebrush-grass associations, although junipers occasionally finger into the upper margins of the lowlands.
The valley bottom is landscape below 2100 m (6900 ft). This bottomland is dominated by shadscale vegetation near Monitor Lake; a sagebrush-grass association blankets the higher parts of the valley bottom.

HORIZONTAL DIFFERENTIATION WITHIN MONITOR VALLEY

The first volume in this series stressed the verticality of the central Great Basin land-scape, emphasizing the elevational differential between Monitor Valley and its sur-roundings (Thomas, 1983a: 140–144). In effect, Monitor Valley is a high-altitude topographic isolate, a full 300 m higher than the valley floor of adjacent Big Smoky Valley, to the west, and connected to neighboring valleys by a very few east-west montane pathways.

Specifically, we suspected that this macro-topography conditioned seasonal migrations of both game animals, and the human foragers and collectors who hunted them. Potential routes of migration between Monitor Valley and the surrounding lowlands are tightly circumscribed by the natural passes that cut the Toquima and Monitor ranges.

To control for this geographic variability in the subsequent analysis, we subdivided the archaeological evidence from Monitor Valley into two major isolated montane blocks separated by well-demarcated natural corridors (fig. 143).

THE TOQUIMA RANGE

The western margin of Monitor Valley is defined by the 125-km-long Toquima Range. The archaeological evidence from the Toquima Range will be grouped into the following subdivisions (table 63): the Hickison Corridor: The northernmost access into Monitor Valley occurs through Hickison Summit. Approach from both east and west is relatively gradual, and the elevation at Hickison Summit proper is only 2010 m. Extensive archaeological research has been conducted in the Hickison Summit area.

The Toquima Range North: The next 15 km south of Hickison Summit is an archaeologically little-known and relatively inaccessible stretch of the Toquima Range. Although the approach from Monitor Valley is relatively gradual, that from Big Smoky Valley is short and steep. We conducted no archaeological reconnaissance in this area.
Fig. 143. Map showing the major routes of access from Monitor Valley to the west (additional such corridors exist in the southern Toquima and Monitor ranges, as discussed in chap. 19).

The Central Toquima Corridor: At the southern end of this isolated block is another major conduit between Big Smoky and Monitor valleys. Today, naturally defined cross-
roads funnel people and game through Petes Summit and Clipper Gap, two roughly parallel montane passes. The corridor at Petes Summit has a maximum elevation of 2408 m, with gradual access from both sides. Seven km to the south is Clipper Gap, a somewhat less satisfactory breach in the northern Toquima Range. Clipper Gap summit is about 50 m higher than Petes Summit, but access from the west is both steep and narrow.

**Middle Toquima Block:** South of the well-defined Petes Summit/Clipper Gap corridor is a relatively impenetrable montane block extending roughly 15 km, and broken on the southern margin by Northumberland Canyon. One winding and very steep route of access starts from the North Fork of Wildcat Canyon in the west, passes across the Stoneberger Basin (at an elevation of 2873 m), and drops into Monitor Valley through Ikes Canyon. An alternative but minor access route from Big Smoky Valley is through the South Fork of Wildcat Canyon, skirting Wildcat Peak (at a minimum elevation of about 2650 m) and then dropping into Monitor Valley through Mill Canyon. But other than these two tortuous routes, access through the Middle Monitor Block is virtually nonexistent. Considerable archaeological excavation and survey has taken place in this isolated upland zone.

**The Northumberland Corridor:** A significant access route is found at Northumberland Canyon, roughly 30 km to the south of Petes Summit. The highest point here is 2652 m above sea level. Access from Big Smoky Valley, through the relatively wide West Northumberland Canyon, is steep; but the route along East Northumberland Canyon is considerably more gradual. Several important archaeological sites have been examined along this corridor.

Another relatively serviceable access exists through the Moores Creek drainage, 10 km to the south of Northumberland Canyon, but little archaeological research has occurred here.

**Toquima Range South:** Although it is cut by a few serviceable passes (particularly East Bald Mountain Wash), we discuss the remaining southern portion of the Toquima Range under one heading; note that the results from our Alta Toquima/Mt. Jefferson research is excluded from this discussion.

**The Monitor Range**

The Monitor Range flanks the eastern margin of Monitor Valley and extends approximately 150 km. The archaeology of this area is rather poorly known, due in large part to the difficulty of access and lack of permanent roads on the eastern side of Monitor Valley. American Museum research was restricted to excavation and limited survey work in the middle and southern Monitor Range.

**Characterizing the Archaeology of Monitor Valley**

Table 63 enumerates the various archaeological sites and catchment assemblages according to both the vertical and horizontal criteria summarized above. Arrayed in this fashion, it becomes possible to pool assemblages across the Monitor Valley landscape, regardless of the nature of each site or nonsite and the strategy of recovery. This first step is necessary to transform the Monitor Valley assemblages into a workable regional data set.

But it remains to translate these site- and catchment-specific inventories into viable units for analysis. Elsewhere, we considered at length the strategies used to procure selected Great Basin resources during the protohistoric period (Thomas, 1983a). These varied procurement strategies conditioned the overall cultural geography (and hence the archaeological visibility) of all foraging and collecting groups, whether protohistoric or prehistoric. To generate relevant empirical data from the prehistoric period, we then addressed the rather poorly resolved problem of linkage between specific behavioral events and their archaeological consequences. Although midrange theory can provide an overarching framework to bridge this gap, such theory must first be translated into concrete, observable, testable archaeological categories.

As a step in this direction, the epistemo-
logical analysis modified Winters' (1969: chap. IV) terminology and criteria to fit the specifics of Great Basin technology (Thomas, 1983a: 72–73). This framework facilitated analysis of Gatecliff Shelter assemblages and will do the same for assemblages from the regional Monitor Valley data.

The 5130 artifacts in the regional sample are sorted into functional categories (table 64). While the list is not exhaustive and the divisions hardly perfect, this classification does provide a workable, if coarse-grained, method to assess assemblage variability at the regional level.

BIAS IN THE MONITOR VALLEY SAMPLE

Archaeologists are becoming increasingly sensitive to so-called post depositional factors that disrupt the archaeological record. Although it may be convenient, at times, to ignore such processes, it is clear that once deposited, artifacts (and ecofacts) are subject to many significant biological, chemical, and mechanical depredations. Foley (1981b) provides a useful discussion of the way such processes impact the surface archaeological record. Below, we consider briefly how specific fluvial, alluvial, and colluvial processes conspire to disrupt the archaeological record of Monitor Valley.

A second major distorting force grows out of our research strategy. Because of limited and erratic funding, we attempted to minimize the survey expense by concentrating on areas judged a priori to have the greatest research potential. These decisions were heavily conditioned by epistemology: although we randomized our search whenever possible, we concentrated on areas where we thought the most relevant data were. We obviously did not look everywhere in Monitor Valley with equal intensity.

This is a common situation in archaeological sampling at the regional level. Using a variable sampling fraction is not, in itself, a biasing factor—provided differential survey intensities are taken into account during the analytical phase. In fact, differential sampling fractions provide a way to maximize survey efforts, particularly in multistage sampling designs. In chapter 1, we noted that one shortcoming of our Reese River sampling strategy was a slavish adherence to a uniform sampling fraction (see also Cowgill, 1975). In the Monitor Valley research we attempted to improve on previous efforts by judiciously adjusting sampling fractions to epistemological realities.

We also decided to vary our search and collection strategies in Monitor Valley. Unfortunately, the analytical problems created by differential sampling are magnified when projected across a complex, multifaceted regional sample. Had we restricted attention to surface sites for instance, comparability could have been assured by either equalizing survey intensity between zones or applying appropriate correction factors in the analysis phase. But including the arbitrarily selected water-tethered catchments, the stratified enclosed sites, and the various satellite sites raises the question of how to deal with patently rare elements. This situation is complex and requires more consideration than merely adjusting for differential sampling fractions.

In the rest of this chapter, we critically assess the degrees of distortion in each elevational zone of the Monitor Valley study area. This analysis of bias projects our Monitor Valley data against an independent data set generated by a multitude of cultural resource management (CRM) projects conducted after we completed our Monitor Valley fieldwork. We fully agree with Renfrew (1983) that so-called "academic archaeologists" have done a very poor job of gleaning data from the spate of recent CRM efforts. Although the data are not always collected or reported in adequate fashion, CRM surveys provide a critical (and largely untapped) source of independent confirmation for strictly research-oriented projects.

In this case, we have the opportunity to assess the efficacy of our Monitor Valley research strategy against an independent data set that we simply could not afford to generate ourselves. As we demonstrate, the two efforts are complementary.

Table 65 (at the end of this chap.) brings together the available CRM data from the Monitor Valley study area. To my knowl-
## TABLE 63
The Regional Monitor Valley Sample

<table>
<thead>
<tr>
<th>Archaeological manifestation</th>
<th>Elevation</th>
<th>Geographical location</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMMIT CREST (over 2750 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Juan Canyon rock blind (Ny924)</td>
<td>2800</td>
<td>9200</td>
</tr>
<tr>
<td>UPLAND SLOPE (2500–2750 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table Mountain rock alignments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Ny31 and Ny832)</td>
<td>2713</td>
<td>8900</td>
</tr>
<tr>
<td>Sage Hen Spring (no. 9) catchment</td>
<td>2500</td>
<td>8200</td>
</tr>
<tr>
<td>White Rock Springs catchment (nos. 17 and 18)</td>
<td>3048</td>
<td>10,000</td>
</tr>
<tr>
<td>Spring 20 catchment</td>
<td>2579</td>
<td>8460</td>
</tr>
<tr>
<td>Spring 23 catchment</td>
<td>2710</td>
<td>8900</td>
</tr>
<tr>
<td>Sawlog Ridge Springs (nos. 24/25) catchment</td>
<td>2650-2758</td>
<td>8650-9050</td>
</tr>
<tr>
<td>Copper Mine Spring (no. 28) catchment</td>
<td>2682</td>
<td>8800</td>
</tr>
<tr>
<td>WOODLAND (2250–2500 m)</td>
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<td></td>
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<tr>
<td>Gatecliff Shelter (Ny301)</td>
<td>2319</td>
<td>7607</td>
</tr>
<tr>
<td>Toquima Cave (Lal)</td>
<td>2420</td>
<td>7940</td>
</tr>
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<td>Toquima Cave catchment</td>
<td>2420–2525</td>
<td>7940–8285</td>
</tr>
<tr>
<td>Grenouille Verte Cave (Lal071)</td>
<td>2420</td>
<td>7940</td>
</tr>
<tr>
<td>Butler Ranch Cave (Ny303)</td>
<td>2259</td>
<td>7411</td>
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<tr>
<td>Butler Ranch Cave catchment</td>
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<td>Little Empire Shelter (Ny1160)</td>
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<td>7415</td>
</tr>
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<td>Ny1059</td>
<td>2255</td>
<td>7400</td>
</tr>
<tr>
<td>Kingston Canyon rock art site no. 2 (Ny832)</td>
<td>2290</td>
<td>7500</td>
</tr>
<tr>
<td>Northumberland Cave</td>
<td>2400</td>
<td>8000</td>
</tr>
<tr>
<td>Austin Summit rock wall (Lal070)</td>
<td>2260</td>
<td>7415</td>
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<tr>
<td>Bob Scott rock walls (La601)</td>
<td>2316</td>
<td>7600</td>
</tr>
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<td>Willow Canyon Spring (no. 15) catchment</td>
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<td>7450</td>
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<td>Johnny Potts Spring (no. 16) catchment</td>
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<td>7300</td>
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<td>2271</td>
<td>7450</td>
</tr>
<tr>
<td>Ny926</td>
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<td>7400</td>
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<td>Mill Canyon streamside catchment</td>
<td>2255–2438</td>
<td>7400–8000</td>
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<td>Ikes Canyon streamside catchment</td>
<td>2316–2438</td>
<td>7600–8000</td>
</tr>
<tr>
<td>Stoneberger streamside catchment</td>
<td>2195–2487</td>
<td>7200–8160</td>
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<td>Randomized quadrat survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad C2</td>
<td>2470</td>
<td>8100</td>
</tr>
<tr>
<td>Quad D1</td>
<td>2317</td>
<td>7600</td>
</tr>
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<td>Quad F2</td>
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<td>Quad G1</td>
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<td>7500</td>
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<td>Quad J1</td>
<td>2285</td>
<td>7500</td>
</tr>
<tr>
<td>Quad K1</td>
<td>2315</td>
<td>7600</td>
</tr>
<tr>
<td>LOWLAND SLOPE (2100–2250 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple T Shelter</td>
<td>2178</td>
<td>6640</td>
</tr>
<tr>
<td>Jeans Spring Shelter (Ny302)</td>
<td>2220</td>
<td>7280</td>
</tr>
<tr>
<td>Jeans Spring catchment</td>
<td>2220</td>
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</tr>
<tr>
<td>Hunts Canyon Shelter (Ny1158)</td>
<td>2134</td>
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</tr>
<tr>
<td>Mt. Prometheus rock wall (Lal069)</td>
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</tr>
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<td>Northumberland petroglyph Site (Ny304)</td>
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<td>7300</td>
</tr>
<tr>
<td>Ny918</td>
<td>2225</td>
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<tr>
<td>Barley Creek petroglyph site (Ny924)</td>
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<tr>
<td>White Rock Canyon petroglyph site (Ny22)</td>
<td>2250</td>
<td>7400</td>
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TABLE 63—(Continued)

<table>
<thead>
<tr>
<th>Archaeological manifestation</th>
<th>Elevation</th>
<th>Geographical location</th>
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<tr>
<td>East Bald Mountain Wash petroglyph site (Ny1)c</td>
<td>2160</td>
<td>Southern Toquima Range</td>
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<td>Ny925</td>
<td>2250</td>
<td>Southern Toquima Range</td>
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<tr>
<td>Kingston Canyon rock art site no. 1 (Ny831)c</td>
<td>2100</td>
<td>Big Smoky Valley</td>
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<td>Petes Spring (no. 2) catchment</td>
<td>2121</td>
<td>Central Toquima Corridor</td>
</tr>
<tr>
<td>Deer Spring (no. 5) catchment</td>
<td>2195</td>
<td>Central Toquima Corridor</td>
</tr>
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<td>Spring 22 catchment</td>
<td>2219</td>
<td>Middle Toquima Block</td>
</tr>
<tr>
<td>Randomized quadrat survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad A2</td>
<td>2195</td>
<td>Central Toquima Corridor</td>
</tr>
<tr>
<td>Quad F1</td>
<td>2135</td>
<td>Central Toquima Corridor</td>
</tr>
<tr>
<td>Quad G2</td>
<td>2135</td>
<td>Central Toquima Corridor</td>
</tr>
<tr>
<td>Quad H1</td>
<td>2159</td>
<td>Central Toquima Corridor</td>
</tr>
<tr>
<td>Quad J2</td>
<td>2225</td>
<td>Middle Toquima Block</td>
</tr>
<tr>
<td>VALLEY BOTTOM (below 2100 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box Spring rock feature catchment</td>
<td>2080</td>
<td>Monitor Valley Floor</td>
</tr>
<tr>
<td>Hickson Summit (La9)c</td>
<td>2010</td>
<td>Hickson Corridor</td>
</tr>
<tr>
<td>La627c</td>
<td>2010</td>
<td>Hickson Corridor</td>
</tr>
<tr>
<td>Boring-as-Hell Shelter (La1073)c</td>
<td>2012</td>
<td>Hickson Corridor</td>
</tr>
<tr>
<td>Bradshaw Shelter (Es81)c</td>
<td>1890</td>
<td>Near Goldfield, Nevada</td>
</tr>
<tr>
<td>Monitor Hills rock walls (Ny927)c</td>
<td>1710</td>
<td>East of Tonopah, Nevada</td>
</tr>
<tr>
<td>Devils Gate Canyon blind (La1068)c</td>
<td>2080</td>
<td>Reese River Valley</td>
</tr>
<tr>
<td>Disaster Spring (no. 6) catchment</td>
<td>1978</td>
<td>Middle Toquima Block</td>
</tr>
<tr>
<td>Monitor Lakebed site (Ny1228)</td>
<td>2073</td>
<td>Monitor Valley Floor</td>
</tr>
<tr>
<td>Dianas Punch Bowl catchment</td>
<td>2010</td>
<td>Monitor Valley Floor</td>
</tr>
<tr>
<td>Potts Ranch Spring catchment</td>
<td>2036</td>
<td>Monitor Valley Floor</td>
</tr>
<tr>
<td>White Sage Spring catchment</td>
<td>2024</td>
<td>Monitor Valley Floor</td>
</tr>
<tr>
<td>Randomized quadrat survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad A1</td>
<td>2012</td>
<td>Central Toquima Corridor</td>
</tr>
<tr>
<td>Quad B1</td>
<td>2195</td>
<td>Central Toquima Corridor</td>
</tr>
<tr>
<td>Quad B2</td>
<td>2010</td>
<td>Middle Toquima Block</td>
</tr>
<tr>
<td>Quad C1</td>
<td>1920</td>
<td>Middle Toquima Block</td>
</tr>
<tr>
<td>Quad D2</td>
<td>2045</td>
<td>Middle Toquima Block</td>
</tr>
<tr>
<td>Quad E1</td>
<td>1950</td>
<td>Middle Toquima Block</td>
</tr>
<tr>
<td>Quad E2</td>
<td>2075</td>
<td>Middle Toquima Block</td>
</tr>
</tbody>
</table>

- The 1981 and 1983 Alta Toquima excavations and the Mt. Jefferson survey are not included in this discussion.
- The spring catchments were ranked into elevational zones according to where most of the archaeological debris was found, rather than by the actual elevation of the spring.
- Although this site is technically located outside the Monitor Valley drainage, we will include it in the Monitor Valley database (e.g., table 64).
- Gatecliff Shelter is placed here only for reference. With the exception of chapter 8, the artifact totals from Gatecliff are not included in the regional Monitor Valley sample analyzed here (e.g., table 64).

edge, all relevant reports have been consulted. The CRM data are grouped by elevational zone, and the remainder of this chapter compares the regional Monitor Valley and CRM samples to determine relative degrees of bias. Subsequently, the CRM artifact inventories in table 65 are pooled to provide ancillary information about artifact and assemblage level spatial distribution (chap. 10).

ANALYSIS OF BIAS: THE SUMMIT CREST

This volume touches the summit crest only peripherally (table 63). Roughly 440 ha (1090 acres) were intensively surveyed in the White Rock Springs catchments, and we recorded the San Juan Canyon rock blind as part of the 1970 Reese River systematic survey.

In 1981 and 1983, we also excavated
roughly 70 m$^3$ of archaeological deposits at Alta Toquima and conducted an intensive survey of the Mt. Jefferson area, covering roughly 1580 ha (3900 acres); see Thomas (1982c) for a preliminary report on the 1981 field season. Detailed consideration of the Mt. Jefferson summit crest is presented in the fourth volume in this series; for now, we sidestep the fascinating high-altitude archaeology of Monitor Valley.

**Analysis of Bias: The Upland Slope**

**The Regional Sample**

American Museum crews surveyed the landscape between 2500 and 2750 m (8200 and 9020 ft) on both sides of Monitor Valley. A horseback survey was conducted in the high country of the Monitor Range (chap. 1). We found the density of archaeological materials to be very low through this portion of the Monitor Range; surface materials were heavily clustered around permanent water sources. This 1976 survey was also our first visit to the rock alignments at Table Mountain, which were mapped and collected in 1977 and 1979 (chap. 5).

The upland slope of the Toquima Range was examined primarily by spring catchment survey. Six of the 15 randomly selected springs occur in this elevational zone (chap. 2). Although the Toquima uplands were included in the universe of the systematic quadrat sampling, none of the random quadrats fell into this area.

**The CRM Sample**

*U.S. Forest Service Project*: Northumberland Canyon is currently being extensively mined for gold and barite, with a significant degree of site destruction. Forest Service personnel have been recording sites and monitoring this activity on a periodic basis. Between 1979 and 1981, Ms. Marsha Cardinale conducted a prolonged survey of the Northumberland Canyon upland slope, recording 22 prehistoric sites (table 65).

*Environmental Applications, Inc. Project*: As part of the mineral development of the Toquima Range, Cyprus Mines Corporation initiated a massive stripping operation at the summit of Northumberland Canyon (Environmental Applications, Inc., 1979). The survey team examined 688 ha (1700 acres) during the summer of 1979, dividing the project zone into seven parcels:

I. a 25 m wide strip of land adjacent to and including East Northumberland Canyon Road and a zone 750 m long by 430 m wide, 400 m south of Northumberland Pass.

II. a parcel 525 m long by 425 m wide, near the previously worked Northumberland mine (described in Thomas, 1983a: chap. 7).

III. an area 850 m long by 125 m wide, east of East Northumberland Canyon Road.

IV. a zone 600 m long by 100 m wide on the west side of the East Northumberland Canyon Road.

V. an area 850 m long by 125 m wide, east of East Northumberland Road.

VI. right-of-way ca. 4 km long over Northumberland Pass.

VII. an area ca. 4.0 km$^2$, 3 km from the west entrance to Northumberland Canyon.

Six prehistoric sites were recorded in this survey, and five of them fall into the upland slope of the Monitor Valley study area.

*Science Applications, Inc.:* Limited field testing on the above sites was initiated in 1980 by Science Applications, Inc. (Crew, 1981).

Ny2849 is a large, moderately dense lithic scatter located at 2707 m (8880 ft) on a southwestern extending ridge of Mount Goding. Intensive surface collection produced eight points; from the report, these appear to be Gatecliff, Elko, and Humboldt series (Crew, 1981: fig. 10). The remaining assemblage consists of 43 bifacially worked artifacts, 14 scrapers, one preform, six manos, six metates, and over 800 flakes. Crew concluded that the site was multicomponent, involving primary lithic reduction at available chert outcrops.

At Ny2846, Crew recovered 15 surface artifacts and roughly 60 pieces of debitage. The three projectile points appear to be Elko Corner-notched, Humboldt series, and Large Side-notched, respectively (Crew, 1981: fig. 14). Four bifaces, four scrapers, and one drill were also recovered.
DEGREE OF BIAS

American Museum crews covered approximately 1830 ha (4521 acres) of the Monitor Valley upland slope in intensive, close interval, systematic survey. Several thousand additional hectares were surveyed in extensive fashion for rare elements.

The only systematic CRM fieldwork was the 688 ha (1700 acres) survey conducted in conjunction with the Cyprus Mines development. Forest Service survey was conducted on an ad hoc basis throughout much of the East and West Northumberland Canyon areas, and on a more limited basis in Water, Perkins, Wood, Ella Mae, Hoodoo, Three Mile, and Mill canyons. We have no way of estimating the degree of coverage represented in these data.

Our fieldwork on the upland slope was restricted to six water-tethered catchment surveys, and subsequent CRM research has recorded rather similar materials (table 65). Because all the randomly selected quadrats fell outside the Toquima upland slope, a bias toward water-related assemblages was introduced into the American Museum sample.

Since American Museum crews did not intensively survey the arid uplands, the regional Monitor Valley sample does not adequately describe the nature of assemblages more than 1 km from water. Subsequent CRM fieldwork provides a measure of this bias. All sites recorded by Environmental Applications, Inc. were located near Northumberland Pass. Spring water is rather abundant here, and these sites were found an average distance of 670 m from spring water \( (S = 127 \text{ m}, n = 5) \). Similarly, the two Mill Canyon sites recorded by the Forest Service are located an average of 400 m from water.

Northumberland Pass is now known to contain many relatively large lithic assemblages. Although the Forest Service site forms record only approximate distances to water, it is clear that most such assemblages in this area are not water-tethered. The mean distance to water of the Forest Service sites on the upland slope of Northumberland Canyon is 2548 m \( (S = 1520 \text{ m}, n = 22) \). The two small sites in Perkins Canyon are about 2400 m from water.

In other words, although the American Museum sample from the upland slope is exclusively water-tethered, we know from CRM sampling that large, diverse assemblages also occur away from water sources. But a second, critical factor may also be involved. Most of the Forest Service survey was related to contemporary mining impacts along the present Northumberland Canyon road. Because of this, the CRM data on table 65 are heavily weighted toward sites near the Northumberland Pass. Today, this pass provides the major access between Monitor and Big Smoky valleys. As explained elsewhere (chap. 19, this volume; see also Thomas, 1983a: 46, 163–164), such areas provide a natural funneling factor that may often be associated with distinctive archaeological assemblages. The CRM data from the upland slope are superficially rather similar to artifact and feature samples encountered in the intensive sampling of Petes Summit, the next major access route to the north (chap. 2). It may be that disparity between the upland slope Monitor Valley sample and CRM samples (summarized in table 65) is accentuated by relatively intensive utilization of the Northumberland area as a zone of access between valley systems.

ANALYSIS OF BIAS: THE WOODLAND

Before examining sampling biases in the Monitor Valley woodland, it is necessary to emphasize once more the degree to which geomorphic processes condition our perception of the archaeological record in this area. One need look no further than Gatecliff Shelter to realize the importance of postdepositional factors. Most of the 10 m of cultural and natural debris was deposited by sediment-laden and extremely turbulent water, filtered from the toes of upslope and upcanyon debris flows.

Davis (1983) analyzes the depositional sequence at Gatecliff Shelter in terms of five debris flow processes. These were observed in dramatic action during the summer of 1977, when a tropical storm not far from Triple T Shelter created several large, destructive debris flows that ripped through Northumberland Canyon (Davis, 1983: 68–
69). The access road was buried beneath thick sediments, and when the toes of these debris flows were removed with a road grader, they exhibited a cross section reproducing the stratigraphy at Gatecliff Shelter in detail. This was, in effect, geomorphic midrange theory in action.

Ironically, in another 500 years, the very processes that created the Gatecliff stratigraphic column would have buried both deposits and rock art beneath a massive talus cone. That is, we think that Gatecliff Shelter was about to become invisible.

A similar stratigraphic profile has been observed at Triple T Shelter (chap. 3, this volume). Because of significant geographic, altitudinal, and geological differences between Gatecliff and Triple T shelters, we think the two sites provide an important regional baseline to climatic and sedimentologic patterning throughout the central Great Basin.

The stratigraphic columns at Gatecliff and Triple T shelters have dramatic implications for the surface archaeology of the Monitor Valley woodland. All canyon bottomlands in the study area support ephemeral to perennial streams, the channels of which vary considerably (depending in part on the size and composition of the bordering alluvial fans). These upcanyon areas are subject to short-term, often violent geomorphic deposition, and the character of the archaeological record can change literally overnight.

The cumulative long-term effects of such upcanyon processes are a mixed archaeological blessing: the same processes that created the superb stratigraphic columns at Gatecliff and Triple T shelters have doubtless destroyed (or at least disturbed) countless archaeological accumulations in this area.

It comes as small surprise, therefore, that prehistoric archaeological sites were rare in the canyon bottomlands of Monitor Valley. With the exception of a few deep stratified sites, the archaeological record in this part of the woodland is invariably confined to isolated finds in obviously disturbed contexts.

For this reason, locational explanations of ridgetop and saddle locales (e.g., Thomas and Bettinger, 1976) must be weighed against the knowledge that geomorphic factors can, and demonstrably do, seriously modify the bottomland landscape. These biasing effects are most pronounced in the side canyons of the upland slope and woodland zones.

**The Regional Sample**

The Monitor Valley woodland received close scrutiny. Five sheltered sites were tested and/or excavated in the woodland of the Toquima Range: Gatecliff Shelter, Toquima Cave, Grenouille Verte Cave, Northumberland Cave, and Ny1059. Two additional sites—Butler Ranch Cave and Little Empire Shelter—were excavated in the Monitor Range woodland. Roughly 600 m³ of deposit were excavated at Gatecliff Shelter; excavations at the other six sites totaled only 25.7 m³.

The woodland of the Toquima Range was explored in several randomized and systematic surveys: three 1 km spring survey catchments, eight randomized 500 m² quadrats, and three streamside surveys in Stoneberger, Ikes, and Mill canyons. The Toquima Cave rock art survey catchment also falls into this zone.

The Monitor Range woodland was systematically surveyed only in the Butler Ranch Cave catchment survey, although extensive reconnaissance was conducted in the upland reaches of this woodland (chap. 1). But because of limited systematic survey, we do not deal with the archaeological record of the Monitor Range.

In sum, 4775 ha (11,800 acres) were examined in close-order systematic survey in the Monitor Valley woodland, and several thousand hectares were examined in more cursory fashion in the search for rare element sites.

Such detailed coverage reflects to some extent our previously stated position about the behavioral potential of the woodland (Thomas, 1983a). This survey strategy has undoubtedly biased the archaeological sample to some degree in favor of the woodland zone of the Toquima Range.

**The CRM Sample**

**U.S. Forest Service Projects:** Forest Service records show 27 prehistoric archaeological sites in the woodland zone of the Monitor Valley study area (table 65). Most sites are
located in Northumberland Canyon, and limited survey was conducted in Water, Jet Spring, and Mt. Ziggurat canyons.

*Environmental Applications, Inc.*: One additional woodland site, Ny2851, was discovered in the survey previously discussed for the upland slope.

**DEGREE OF BIAS**

Table 65 provides few surprises. Roughly half of the systematic survey undertaken by us in Monitor Valley occurred in the woodland zone. Furthermore, including research at Gatecliff Shelter, over 80 percent of the stratigraphic excavations in Monitor Valley occurred in the woodland zone.

As noted above, Northumberland Canyon is the primary east-west pathway through the middle Toquima Range, and several archaeological phenomena might be expected in such circumstances: rock art, high site density, relatively high frequency of ground stone and incised limestone artifacts, and cave and rock-shelter occupation. Our own Monitor Valley research has encountered all of these phenomena, and the Forest Service data, while limited, are consistent with these trends (table 65). The detailed artifact lists from the CRM sites were considered as an independent, qualitative control on findings of the regional Monitor Valley survey.

We view this segment of the Monitor Valley sample as a large, relatively unbiased picture of the prehistoric archaeological record in this area. Geomorphic biases, to be sure, color our perception of this archaeology, but sampling biases are not a significant problem. If any bias is present, it is in the overemphasis on the archaeology of the Monitor Valley woodland.

**ANALYSIS OF BIAS: THE LOWLAND SLOPE**

Severe postdepositional geomorphic processes have disrupted the archaeological record on the alluvial aprons that fringe the Toquima and Monitor ranges. Melhorn and Trexler (1983b) have discussed the alluvial processes of Monitor Valley, with particular reference to the fans on the eastern flanks of the Toquima Range. SKYLAB photography documents a distinct progression in tonal pattern of the compound alluvial fans moving northward in Monitor Valley. Whereas the prominent compound fans of East Northumberland, Water, and Willow canyons are of about the same uniform dark intensity (Melhorn and Trexler, 1983b: fig. 19), fans at Mill and Ikes canyons are distinctly lighter, of an intermediate tone. The June Canyon fan, further to the north, has an almost white coloration and can be seen to overlap the Mill Canyon fan.
### TABLE 65

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Elevation</th>
<th>Recorded by</th>
<th>Description</th>
<th>Material culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>N3711</td>
<td>Northumberland Pass</td>
<td>2530 ft</td>
<td>USFS</td>
<td>Roseate point, metate, utilized flakes, debitage</td>
<td>Large sandstone (r) scraper, 3 bifaces, 3 flake cores, debitage</td>
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<td>N3712</td>
<td>Northumberland Pass</td>
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<td>USFS</td>
<td>2 rock overhang, cave</td>
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</tr>
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<td>N3713</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
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</tr>
<tr>
<td>N3714</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3715</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3716</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3717</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
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<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
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<td>Northumberland Pass</td>
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<tr>
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<td>Northumberland Pass</td>
<td>2524 ft</td>
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<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3721</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3722</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3723</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3724</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3725</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3726</td>
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<tr>
<td>N3727</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
<tr>
<td>N3728</td>
<td>Northumberland Pass</td>
<td>2524 ft</td>
<td>USFS</td>
<td>2 rock overhang, cave</td>
<td>Red chert scraper, historic debris</td>
</tr>
</tbody>
</table>

Additional Prehistoric Sites Recorded in the Monitor Valley Study Area

Additional site features are listed in table endnotes.
### TABLE 65—(Continued)

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Elevation</th>
<th>Recorded by</th>
<th>Description</th>
<th>Material culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ny2849b</td>
<td>East Northumberland</td>
<td>2707</td>
<td>8880</td>
<td>EAI, SAI</td>
<td>Moderately dense lithic scatter</td>
</tr>
<tr>
<td>Ny2950</td>
<td>East Northumberland</td>
<td>2621</td>
<td>8600</td>
<td>EAI, SAI</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3735</td>
<td>Water Canyon</td>
<td>2742</td>
<td>9000</td>
<td>USFS</td>
<td>Open small site</td>
</tr>
<tr>
<td>Ny3737</td>
<td>Water Canyon</td>
<td>2640</td>
<td>8660</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3744</td>
<td>Water Canyon</td>
<td>2548</td>
<td>8360</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3746</td>
<td>Saddle in Mill Canyon</td>
<td>2658</td>
<td>8720</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3750</td>
<td>Slope in Mill Canyon</td>
<td>2585</td>
<td>8450</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3756</td>
<td>Perkins Canyon</td>
<td>2694</td>
<td>8840</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3757</td>
<td>Perkins Canyon</td>
<td>2646</td>
<td>8680</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3688</td>
<td>June Canyon</td>
<td>2511</td>
<td>8240</td>
<td>USFS</td>
<td>Isolated find</td>
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</tbody>
</table>

**WOODLAND (2250–2500 m)**

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Elevation</th>
<th>Recorded by</th>
<th>Description</th>
<th>Material culture</th>
</tr>
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<tbody>
<tr>
<td>Ny3790</td>
<td>Northumberland Canyon</td>
<td>2304</td>
<td>7560</td>
<td>USFS</td>
<td>Open lithic scatter</td>
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<td>Ny3791</td>
<td>Northumberland Canyon</td>
<td>2292</td>
<td>7520</td>
<td>USFS</td>
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</tr>
<tr>
<td>Ny3792</td>
<td>Northumberland Canyon</td>
<td>2270</td>
<td>7450</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3793</td>
<td>Northumberland Canyon</td>
<td>2292</td>
<td>7520</td>
<td>USFS</td>
<td>Small lithic scatter</td>
</tr>
<tr>
<td>Ny3794</td>
<td>Northumberland Canyon</td>
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<td>7720</td>
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<td>Ny3795</td>
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<td>2347</td>
<td>7700</td>
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<td>Several iso. finds</td>
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<td>Ny3731</td>
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<td>7650</td>
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<td>Ny3732b</td>
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<tr>
<td>Ny3733</td>
<td>Northumberland Pass</td>
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<td>7880</td>
<td>USFS</td>
<td>Very small lithic scatter</td>
</tr>
<tr>
<td>Ny3710</td>
<td>Northumberland Pass</td>
<td>2298</td>
<td>7540</td>
<td>USFS</td>
<td>Small lithic scatter</td>
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<td>Ny3738</td>
<td>Northumberland Pass</td>
<td>2457</td>
<td>8040</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3741</td>
<td>Northumberland Pass</td>
<td>2256</td>
<td>7400</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Site</td>
<td>Location</td>
<td>Elevation m</td>
<td>Elevation ft</td>
<td>Recorded by</td>
<td>Description</td>
</tr>
<tr>
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<tr>
<td>Ny2908</td>
<td>Northumberland Canyon SW of Stand. Slag Mine #2</td>
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<td>8180</td>
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<tr>
<td>Ny2909</td>
<td>Northumberland Canyon W of Stand. Slag Mine #3</td>
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<td>7800</td>
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<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny2910</td>
<td>Northumberland Canyon W of Stand. Slag Mine #4</td>
<td>2328</td>
<td>7640</td>
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<td>Open lithic scatter</td>
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<td>Ny3752</td>
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<td>8020</td>
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<td>Ny3717</td>
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<td>8200</td>
<td>USFS</td>
<td>Open lithic scatter</td>
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<tr>
<td>Ny3755</td>
<td>Northumberland Canyon</td>
<td>2487</td>
<td>8160</td>
<td>USFS</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny2851</td>
<td>East Northumberland Canyon</td>
<td>2292</td>
<td>7520</td>
<td>EAI</td>
<td>Open lithic scatter</td>
</tr>
<tr>
<td>Ny3745</td>
<td>Northumberland Canyon drill site #2</td>
<td>2408</td>
<td>7900</td>
<td>USFS</td>
<td>Open lithic scatter</td>
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<td>Ny3747</td>
<td>Water Canyon</td>
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<td>Ny3748</td>
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<td>Ny3749</td>
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<td>7400</td>
<td>USFS</td>
<td>Open lithic scatter</td>
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<td>Ny3750</td>
<td>Water Canyon</td>
<td>2407</td>
<td>7900</td>
<td>USFS</td>
<td>Light lithic scatter</td>
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**LOWLAND SLOPE (2100–2250 m)**

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Elevation m</th>
<th>Elevation ft</th>
<th>Recorded by</th>
<th>Description</th>
<th>Material culture</th>
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<tbody>
<tr>
<td>Ny2841</td>
<td>Ella May/Wood canyons</td>
<td>2188</td>
<td>7180</td>
<td>BLM</td>
<td>Isolated find</td>
<td>Rhyolite core</td>
</tr>
<tr>
<td>Ny2842</td>
<td>S of Wood Canyon</td>
<td>2179</td>
<td>7150</td>
<td>BLM</td>
<td>Isolated find</td>
<td>White chert utilized flake</td>
</tr>
<tr>
<td>Ny2843</td>
<td>N of mouth of East Northumberland Canyon</td>
<td>2176</td>
<td>7140</td>
<td>BLM</td>
<td>Open lithic scatter</td>
<td>Gray Rosegate point, thin triangular biface, 2 point tips, debitage</td>
</tr>
<tr>
<td>Ny3739</td>
<td>Northumberland Canyon</td>
<td>2207</td>
<td>7240</td>
<td>USFS</td>
<td>Open lithic scatter</td>
<td>Mano, metate, core, biface, 2 utilized flakes, 2 flakes</td>
</tr>
<tr>
<td>Ny3740</td>
<td>Northumberland Canyon</td>
<td>2231</td>
<td>7320</td>
<td>USFS</td>
<td>Open lithic scatter</td>
<td>Utilized flakes, 100+ flakes</td>
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<tr>
<td>La1686</td>
<td>6 km NW of Monitor Ranch</td>
<td>2109</td>
<td>6920</td>
<td>USFS</td>
<td>Bedrock mortar site</td>
<td>Scrapper, 3 bifaces, metate (?), mano, utilized flakes, debitage</td>
</tr>
<tr>
<td>La1687</td>
<td>6.5 km NW of Monitor Ranch</td>
<td>2114</td>
<td>7000</td>
<td>USFS</td>
<td>Open lithic scatter</td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Location</td>
<td>Material culture</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>N37906</td>
<td>Northumberland Canyon</td>
<td>Stone circle, hearth (?)</td>
<td></td>
<td></td>
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<tr>
<td>N37707</td>
<td>Hoodoo Canyon area</td>
<td>Stone circle, hearth (?)</td>
<td></td>
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</tr>
<tr>
<td>N37708</td>
<td>Hoodoo Canyon area</td>
<td>Stone circle, hearth (?)</td>
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<tr>
<td>N37698</td>
<td>Near Monitor Lake</td>
<td>Stone circle, hearth (?)</td>
<td></td>
<td></td>
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<tr>
<td>N37699</td>
<td>Near Monitor Lake</td>
<td>Stone circle, hearth (?)</td>
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<tr>
<td>N29799</td>
<td>Box Spring/Monitor Lake</td>
<td>Stone circle, hearth (?)</td>
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<tr>
<td>N2942</td>
<td>Box Spring</td>
<td>Stone circle, hearth (?)</td>
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<td></td>
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</tr>
<tr>
<td>N12491</td>
<td>4 km SE Diana's Punch Bowl</td>
<td>Stone circle, hearth (?)</td>
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<tr>
<td>N12489</td>
<td>Within White Sage Spring</td>
<td>Stone circle, hearth (?)</td>
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<tr>
<td>N13704</td>
<td>5 km S White Sage Spring</td>
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<tr>
<td>N1389</td>
<td>9 km NW White Sage Spring</td>
<td>Stone circle, hearth (?)</td>
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<tr>
<td>N2484</td>
<td>6 km NW Ports Ranch</td>
<td>Stone circle, hearth (?)</td>
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</tbody>
</table>

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**TABLE 65—Continued**

<table>
<thead>
<tr>
<th>TABLE 65—Continued</th>
<th>Elevation</th>
<th>ft by</th>
<th>Description</th>
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<tbody>
<tr>
<td>N37906</td>
<td>1935</td>
<td>6530</td>
<td>USFS</td>
</tr>
<tr>
<td>N37707</td>
<td>1936</td>
<td>6530</td>
<td>USFS</td>
</tr>
<tr>
<td>N37708</td>
<td>1923</td>
<td>6530</td>
<td>Rock-shelter</td>
</tr>
<tr>
<td>N37698</td>
<td>2073</td>
<td>6800</td>
<td>Isolate</td>
</tr>
<tr>
<td>N37699</td>
<td>2070</td>
<td>6790</td>
<td>Isolate</td>
</tr>
<tr>
<td>N29799</td>
<td>2073</td>
<td>6800</td>
<td>BLM</td>
</tr>
<tr>
<td>N2942</td>
<td>2080</td>
<td>6825</td>
<td>MXP</td>
</tr>
<tr>
<td>N12491</td>
<td>2073</td>
<td>6800</td>
<td>MXP</td>
</tr>
<tr>
<td>N12489</td>
<td>2027</td>
<td>6650</td>
<td>MXP</td>
</tr>
<tr>
<td>N13704</td>
<td>2080</td>
<td>6825</td>
<td>BLM</td>
</tr>
<tr>
<td>N1389</td>
<td>1981</td>
<td>6500</td>
<td>MXP</td>
</tr>
<tr>
<td>N2484</td>
<td>2003</td>
<td>6380</td>
<td>MXP</td>
</tr>
</tbody>
</table>

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Note: Numbers in parentheses refer to specific entries in the original table.
Conventional geomorphological interpretation suggests that weathering processes are, at least in part, responsible for the observed differentiation in tonality: the older a fan, the darker the color tone. If the dark-colored, deeply patinated Holocene alluvial fans in East Northumberland, Water, and Willow canyons do indeed antedate the lighter, less weathered fans of Mill and Ikes canyons, there are implications for the archaeological record of the Monitor Valley lowland slope: all else being equal, the Mill Canyon fan should produce a younger archaeological record than the Northumberland Canyon fan to the south. Similarly, the light-colored June Canyon fan might be expected to produce the most recent archaeological record of all.

There is evidence, however, that observed tonal variations on alluvial fans of Monitor Valley could result from original differences in geological composition rather than from temporal variability. It is possible that darker fans may be veneered primarily with volcanics and fragments of the dark-colored argillite and cherts that exist in limited distribution in the upcanyon areas (Melhorn and Trexler, 1983b). Similarly, lighter toned fans seem to be dominated by light-colored carbonate cobbles that characterize their upcanyon catchment areas.

But even disregarding the possibility that the fans are of different ages, it is clear that alluvially active slopes will *ceteris paribus* contain a more disturbed surface archaeological record than will areas not subjected to such repeated sedimentologic processes.

Considerably more geomorphic research is required before one can associate the Monitor Valley archaeological assemblages with geomorphic surfaces on which they lie. Elston (personal commun.) and his associates are making strides in this direction in the Gund Ranch project (Grass Valley, Nevada), and the increased availability of remote sensing data (e.g., Wandsnider and Ebert, 1983) make this an exciting area of future research. At present, we simply point out the potentially biasing impact of differential geomorphology on the surface archaeological record.

**The Regional Sample**

We excavated both Triple T and Jeans Spring shelters, stratified archaeological sites on the lowland slope of the Toquima Range. Hunts Canyon Shelter, located at the extreme southern end of Monitor Valley, was also tested.

The surface archaeology of the lowland slope was examined in several ways: four randomized 1 km spring catchment surveys, five additional fully recorded rock art localities (two of which were examined in 1 km catchment surveys), one hunting barrier, two 100 m wide transects across the lowland slope south of Mill Canyon, and five randomized 500 m quadrats (table 63).

We estimate that 62 m$^3$ of stratified deposits were excavated from sites on the lowland slope, and approximately 1780 ha (4400 acres) were examined in systematic archaeological survey. A much larger area was extensively surveyed for rare elements.

**The CRM Sample**

Cultural resource data for the lowland slope are limited because most construction projects occur in the upland canyon areas or further downslope, on the valley bottom.

**BLM Project 6-203**: An archaeological survey examined several tracts near the mouth of Water Canyon and the north–south road cutting through the upper fan (Crabtree, 1979). Thirty-four areas were proposed as soil pits, 11 of these falling within the lowland slope as defined here. Target areas were intensively examined by walking transects 3 m apart in an area about 15 by 15 m (225 m$^2$). Project 6-203 surveyed a total of 0.25 ha (0.61 acres), and no archaeological remains were located.

**BLM Project 6-204**: The Bureau of Land Management conducted a clearance survey for a mining haul road right-of-way on the upper alluvial fans between Water and Northumberland canyons (McGonagle, 1979). The slope in the area varied between 10 and 20 percent. The right-of-way was about 18 m long, and two transects were walked approximately 6 m on either side of the flagged center line. A total of 5.1 ha (12.7 acres) was examined; two isolated artifacts (Ny2841 and Ny2842) were found, and one large lithic scatter (Ny2843) was recorded.

**Ertec Northwest (BLM Project 6-352)**: This survey examined proposed valley fill aquifer sources by conducting 10 m interval transect
sampled in two areas: a 61 × 305 m potential well zone, and a 30 × 305 m area for vehicle access (Ertec Northwest, 1981). Eleven such areas were surveyed in the Monitor Valley study area, and one of these occurred on the lowland slope, covering a total of 2.8 ha (6.9 acres). No archaeological sites were located.

**U.S. Forest Service Projects: Reconnaissance by the Forest Service is discussed above.** Four archaeological sites have been recorded on the lowland slope of the Monitor Valley study area (table 65).

**Degree of Bias**

The regional Monitor Valley survey involved a reasonable degree of coverage on the lowland slope: approximately 1780 ha (4400 acres) were examined systematically and an additional 62 m3 of stratified deposits was excavated.

Most of the surface record encountered in spring catchment and randomized quadrat survey was clustered in discrete sites located along the upper margin of the sloping alluvial fans. The survey by R. L. McGonagle disclosed another such site on the alluvial fan to the north of East Northumberland Canyon. The BLM surveyed somewhat less than 8.1 ha (20.1 acres) on the lowland slope; yet two isolates and a rather large site, Ny2843, were located.

In all, we see no major sampling bias for the lowland slope, but we do note the distinct possibility of significant postdepositional factors. The geomorphological biasing noted earlier may be less a factor toward the upper reaches of the lowland slope. Limited transect sampling to the south of East Northumberland Canyon (chap. 2) failed to disclose any archaeological materials at all in the lowland fan zone, but current sampling is not sufficient to determine whether this absence is due to natural or cultural factors.

**Analysis of Bias: The Valley Bottom**

We were uneasy about the sampling procedures employed on the Monitor Valley bottomland. Although we covered a reasonable area on the valley bottom, most of the sites examined in this survey consisted of rare elements. It is true that one random spring catchment and seven randomly selected quadrats fell into the valley bottom zone, but the randomized aspect of the survey was restricted to the extreme western margin of the valley floor.

As discussed in chapter 1, we discounted large areas of the valley bottom as potentially unproductive when compared to the woodland and upland slope. The valley bottom would, we reasoned, contain relatively little material culture and whatever there was should be concentrated near known, established sources of water (Thomas, 1983a: 166–172). Accordingly, we limited our survey efforts on the valley bottom to perennial water sources, and this strategy did indeed produce a fruitful archaeological record (chap. 2). Economically, the survey paid off.

But how badly did our survey strategy bias the sample? This is a burdensome issue since we desire to combine effective, efficient field methods with the production of undistorted, theoretically viable results.

**The Regional Sample**

The surface archaeology of the valley bottom was examined in several ways: one randomized 1 km spring survey (Disaster Spring), seven randomly selected 500 m2 quadrats, and three arbitrarily selected 1 km spring catchment surveys (Dianas Punch Bowl, Potts Ranch Spring, and White Sage Spring). In addition, rock features were mapped at Box Spring, the Monitor Hills, and Devils Gate Canyon (in Reese River Valley). Surface materials were also mapped and collected at the Monitor Lakebed site and at the Hickson Summit rock art site.

There was distressingly little to excavate on the floor of Monitor Valley. Bradshaw and Boring-as-Hell shelters, were the only sites tested on the valley bottom; both lie outside the study area proper.

Only 2.5 m3 of archaeological deposit were excavated on the Monitor Valley bottomland, and approximately 1753 ha (about 4332 acres) were systematically surveyed.

**The CRM Sample**

Eight systematic archaeological surveys have recently been conducted in this portion of the Monitor Valley bottomland. Results of this fieldwork provide an independent data
set against which to view our work. Methods and objectives varied widely, data are sufficiently well reported to be useful for purposes other than those intended at the time of collection.3

BLM Project 6-125: Several proposed drill sites were examined on foot in overlapping transects, and Ny2099 was recorded in this survey (Ball, 1977). Approximately 0.8 ha (2 acres) was extensively surveyed and an additional 0.4 ha (1 acre) was examined intensively.

BLM Project 6-203: The survey strategy is described above in the section on lowland slope archaeology (Crabtree, 1979). Twenty-three of the proposed soil pits which occurred in the valley bottom of the Monitor Valley study area, totaling 0.5 ha (1.28 acres), were so examined, and no archaeological sites were located.

BLM Project 6-275: A small area was examined to determine whether the expansion of an existing fenceline south of Monitor Lakebed would impact any archaeological sites (Ball, 1980). An area of 2.2 ha (5.5 acres) was examined in detail but no archaeological materials were encountered.

Fugro Northwest, Inc. (BLM Project 6-277): This survey was conducted as part of feasibility evaluation studies for the siting of the MX missile (Fugro Northwest, Inc., 1980). At the proposed location of an observation well, an area 61 × 30.5 m was examined, and a second area 15.2 × 30.5 m—to permit vehicle access—was also surveyed. The survey teams made 5 to 10 walking passes through the test areas at intervals of about 6 m.

At seismic/resistivity test sites, survey proceeded in long (182.9 m), straight line transects where the seismic line was to be run. Then a return transect about 7.6 m was walked. Seven such surveys were conducted in the Monitor Valley study area, totaling 0.23 ha (0.57 acres). No archaeological remains were encountered.

Basin Research Associates, Inc. (BLM Project 6-316): This survey was also conducted in conjunction with the proposed MX missile deployment (Basin Research Associates, 1980). Four-person survey teams conducted reconnaissance in straight line parallel transects, spaced 25 m apart, inspecting 0.8 × 0.4 km (½ mile by ¼ mile) rectangular units. Fifteen such survey units were examined within the Monitor Valley drainage, and five of these occurred in our study area. Of these five, three were deliberately located near the major valley bottom water sources—Box Spring and Dianas Punch Bowl.

This survey covered a total of 160 ha (395 acres) in the regional Monitor Valley study area. Only three archaeological sites were located, two of them very small lithic scatters (table 64). The third site, Ny2492, had been recorded six years previously by American Museum crews.

Northland Research, Inc. (BLM Project 6-343): This survey required coverage of 13 seismic exploration lines (Seelinger, 1981). The survey lines totaled 222 km, and of this, 63.1 km fell within our survey area. The survey was conducted by walking zigzag transects across a 3 m impact zone. Thus 189.3 ha (468 acres) was examined within the study area. Two lithic scatters were recorded (table 65).

Ertec Northwest (BLM Project 6-352): The survey strategy is discussed above. Ten blocks occurred on the valley bottom, covering a total of 28.1 ha (69 acres). No archaeological sites were located.

Northland Research, Inc. (BLM Project 6-397): Three seismic exploration grids, totaling 139 km in length (with an impact zone 30 m in width) were surveyed in Monitor Valley (Dechambre et al., 1981). A total of 45.2 km of this exploration grid fell into the Monitor Valley study area; the coverage was 135.6 ha (335 acres). No archaeological sites were found.

Degree of Bias

The regional Monitor Valley survey systematically surveyed approximately 1753 ha (4332 acres) of the valley bottom. Although some remains were found in randomized survey of the western valley bottom, the most significant assemblages occurred near semi-permanent water sources (both valley springs and the Monitor Lakebed area).

CRM surveys covered 517.1 ha (1278 acres) in the same area. Although some of this work duplicated previous surveys by the American
Museum, the CRM sample undoubtedly provides a valuable test of our lowland research strategy.

The CRM sample clearly demonstrates that all major assemblages on the Monitor Valley lowland are distinctly water-tethered (table 65). Ny3698, Ny3699, and Ny2099 occur within 100 m of the Monitor playa, and are more or less continuous with the Monitor Lakebed site (Ny1228), discussed in chapter 2.

Ny2492, the Box Spring site collected by Basin Research Associates, was previously recorded, mapped, and extensively collected by American Museum crews (chap. 5). Similarly, Ny2491, was recorded and mapped as part of our earlier catchment survey of White Sage Spring (chap. 2).4

Two of the three sites in Hoodoo Canyon are water tethered. Ny3707 and Ny3709 occur at a distance of 400 and 800 m from water, respectively.

The valley bottom does, however, contain a few sites some distance from extant water supply. The third Hoodoo Canyon site, Ny3708, is over 7 km from a water source. Ny3706 is a scatter of 40 flakes roughly 5 km from the nearest spring. Ny2491 is a very small flake scatter 4 km from Dianas Punch Bowl.

The CRM projects obviously detected a few small sites not in proximity to modern water sources, which the Monitor Valley research design did not examine, introducing a possible sampling bias.

But it is entirely fair to conclude that the archaeological record of the Monitor Valley bottomland consists of predominantly large, diverse, water-tethered assemblages. The regional Monitor Valley sample concentrated on these spring and lakebed catchments, and the CRM sample supplements these data to some extent. In sum, we see no major bias in the bottomland survey procedures employed in this volume.

NOTES

1. For the same reason, we separate the description and analysis of data from Alta Toquima and the other high-altitude zones in Monitor Valley; that study is the fourth monograph in the Monitor Valley series.

2. We gratefully acknowledge the assistance of Mr. Robert Crabtree (Bureau of Land Management), the late Dr. Harvey Crew (Ann S. Peak and Associates), Dr. Colin I. Busby (Basin Research Associates, Inc.), Mr. Jack Fitzwater and Ms. Arnie Turner (U.S. Forest Service), Dr. Roberta McGonagle (BLM), Ms. Alice Becker (Nevada State Office of Historic Preservation and Archaeology), Ms. Lorann S. A. Pendleton (American Museum of Natural History), and Ms. Evelyn Seelinger (Nevada State Museum) for assistance in obtaining these recent, unpublished data.

3. Additional survey work in Monitor Valley, to the south of the present research area, was conducted in 1976 by McGonagle and Waski (1978). This was a cultural resource inventory of lowland spring sites, designed as input into an environmental impact statement on livestock grazing between May and September 1976. Although their survey focused on the area immediately to the north and east of Tonopah, they recorded seven prehistoric sites in Monitor Valley (McGonagle and Waski, 1978: fig. 3): Corcoran Spring (Ny663; CrNv-06-260), Ny664 (CrNv-06-261), Ny665 (CrNv-06-262), Ny666 (CrNv-06-263), Trail Canyon (Ny667; CrNv-06-264), Ny668 (CrNv-06-265), and Ny669 (CrNv-06-266). Detailed artifact inventories for these sites were not provided, but it seems that diagnostic time-markers, as expected, ranged from the Devils Gate through Yankee Blade phase.

4. It is a shame that archaeologists do not make a more thorough effort to find out what related investigation has already been conducted. Thousands of dollars were wasted in Monitor Valley alone by those who didn’t bother to inquire about previous research (see also Renfrew, 1983).
CHAPTER 8. PATTERN RECOGNITION: QUANTITATIVE VARIABILITY IN ASSEMBLAGE SIZE AND DIVERSITY

Now that the Monitor Valley regional sample has been described and analyzed for bias, we shall undertake a series of six independent pattern recognition studies (chaps. 8–13). We begin by finding out how much of the variability in the Monitor Valley data must be attributed to sample size effects. After the relationship between assemblage size and diversity is better understood, we can study the nature of that variability.¹

MIDRANGE THEORY

Within the past decade, systematic, regional approaches have become de rigueur in American archaeology. An increasingly wide range of exacting field techniques has been proposed in the attempt to extract relatively unbiased samples of archaeological items at a regional level. Probabilistic research designs are today commonly employed by both “academic” and “contract” archaeologists.

Despite these significant and far-reaching changes in field strategy, methods for analyzing the regional data obtained have changed surprisingly little from the good old “single site” days. The truth is that many regional studies continue to rely on simplistic, impressionistic, and often unrealistic analytical methods.

Bridging the gap between behavioral models and the archaeological record remains a major headache. In the case of hunter-gatherer studies, many archaeologists, myself included, find it worthwhile to view regional patterning in terms of a forager-collector continuum, a spatially integrated strategic network consisting of discrete settlement components—base camps, field camps, procurement locations, hunting stations, and so forth (sensu Binford, 1980).

But even granted this relatively workable framework, contemporary archaeology has enjoyed decidedly limited success in operationally defining these behavioral constructs in the archaeological record. How, for instance, does one empirically distinguish prehistoric base camps from task-specific field camps? Unless we can make such baseline distinctions with some certainty, the strategic decision-making behind the mosaic of prehistoric cultural geography will remain elusive.

We know that residential positioning among hunter-gatherers is generally conditioned by exigencies of adequate lifespace, protection from the elements, and a location sufficiently central to key survival resources. Base camps inhabited for several months are closely tied to such factors. Short-term field camps are less heavily patterned by lifespace considerations. Areas of strictly diurnal resource extraction (“locations”) are selected without reference to lifespace.

To date, the most reliable archaeological signatures for detecting residential areas derive from structural consequences. Residential areas tend to have service centers (sensu Wagner, 1960: 170); many base camps tend to have patterned areas of sleeping, maintenance, and discard; some base camps (particularly those involved in logistic systems) tend to have visible storage facilities, etc. Analysis of faunal utility indices likewise provides clues as to relative settlement positioning (Binford, 1978a; Speth, 1983; Thomas and Mayer, 1983; but see Grayson, 1988).

But site-structural and ecofactual data are usually preserved in only a few selected sites within a region, and serious bias results when we define overall cultural geographic patterning from such a limited and obviously distorted sample. The bulk of the regional archaeological record often consists of relatively sparse surface lithic assemblages. Assemblage level signatures remain ill-defined and the available base camp diagnostics are notoriously difficult to apply to such surface remains (e.g., Binford, 1979a, 1979b; Gould, 1980: 126; Thomas, 1983a: 78–79). It is critical that we integrate the diverse evidence from both surface survey and deep site excavation into a single, coherent, interpretive framework.

The temptation is to equate the degree of absolute diversity in such assemblages with the behavioral settlement components discussed above. Smaller, less diverse assem-
Assemblages are commonly taken to be areas of diurnal extraction ("locations"). Larger, more diverse assemblages are often equated with residential utilization ("base camps"). Assemblages of intermediate size and diversity are conventionally viewed as logistic settlements ("field camps"). Although rarely expressed as such, the tacit equation of absolute assemblage diversity with discrete settlement types underlies many so-called behavioral interpretations in contemporary hunter-gatherer studies.

This line of reasoning is incorrect. In many (if not most) archaeological assemblages, sample diversity is a direct, linear function of sample size. Grayson (1984) and Jones et al. (1983) have convincingly demonstrated the "treacherous" relationship between class richness and sample size in archaeological assemblages (see also Beck, 1984).

Assemblage diversity is not, of course, unrelated to site function, but the exact nature of that relationship can be appreciated only by focusing on the relative (rather than absolute) degree of diversity.

Overall assemblage diversity—the relationship between the number of tool classes and the number of individual tools—is influenced by several ecological, technological, informational, and scheduling factors, and attempts at such hologetic theory building are just beginning. Torrence (1983), for instance, has shown the intercorrelation of tool-kit diversity with latitude: high-latitude technologies are demonstrably more diverse than those employed in tropical areas.

But concern here is not with absolute degree of global assemblage diversity, but rather with the relative degree of diversity within a given system. Long-term residential areas (base camps) are where the greatest variety of artifact- and byproduct-producing activities occur; they are the so-called "hub" of hunter-gatherer cultural geography and should generally be characterized by technologically and typologically diverse assemblages—relative to the overall technoeconomic systemic matrix.

Logistic encampments (field camps) are typically task-specific, single-sex, short-term, and ephemeral. Field camp activities are behavioral subsets of what occurs at the base camp, and tool inventories at logistic settle-ments are material cultural subsets of base camp assemblages. Rarely can logistic assemblages be defined in terms of specific artifact-level signatures. Rather, the field camp can only be expected to contain a more homogeneous assemblage than the mean base camp inventory.

Daytime use areas (locations) involve even more task-specific technology. Assemblages associated with locations should be the most homogeneous produced within a given system.

These general expectations regarding relative technological diversity can be arrayed in conventional size/diversity fashion (fig. 144); the horizontal X-axis represents absolute assemblage size, and the vertical Y-axis scales absolute assemblage diversity. Within a given system, long-term residential base camps will generally be characterized by a steep profile: assemblage diversity increases rapidly relative to sample size. Assemblages generated from strictly diurnal activities will commonly define a flatter profile: assemblage diversity increases slowly relative to sample size. Logistic assemblages describe an intermediate profile: assemblage diversity is expected to increase moderately with increasing sample size.

Figure 144 is a general model, and exceptions will occur, even within a single technoeconomic system. The base camp occupied for 10 months per year will be expected to contain a more diverse assemblage than the residence lived in for only two months a year. Some procurement locations are known to involve more heterogeneous assemblages than others, depending on the resources exploited, the size of the foraging radius, and the specific tool kits, byproducts, and use-lives of artifacts involved. Certain procurement loci will generate more diverse assemblages than some short-term, task-specific field camps. The degree of intra-assemblage level variability merits detailed study per se (Thomas, 1983a: 12–17).

The degree of observable assemblage diversity is also significantly blurred in the translation from behavioral to archaeological contexts. Hunter-gatherer cultural geography tends to be redundant: abandoned base camps are reoccupied as temporary field camps; functionally different field camps are reestab-
lished at the same camp site; diurnal exploitative areas overlap spatially as seasonally restricted resources ripen. Given sufficient time, residential assemblages commonly become physically comingled with various logistic assemblages. Discrete logistic assemblages accumulate in certain favorable loci, one behavioral accumulation inextricably mixing with another. Rarely is a given location utilized in only one way, and the palimpsest accumulation is an archaeological fact of life.

But as a coarse-grained model, figure 144 adequately describes the variable nature of assemblage size and assemblage diversity across an idealized archaeological landscape. In effect, it defines a continuum grading from the highly diverse assemblages produced in areas of predominantly residential utilization to assemblages of low relative diversity generated from mostly diurnal activities. Logistic zones fall toward the middle.

These postulated relationships require midrange support. But assuming that such validation will be forthcoming, the graded residential-logistic-diurnal continuum provides a necessary first step toward bridging the gap between the observable archaeological record and the behavior that produced it.

SAMPLE SIZE BIASES AT GATECLIFF SHELTER

This chapter explores how much observed assemblage diversity must be attributed to sample size effects. Only after the relationship between sample size and absolute diversity is understood, can one hope to explain the behavioral nature of that variability.

We previously examined the sample size effect operating among the various horizon assemblages at Gatecliff Shelter (Thomas, 1983b: 428–430). This exploration began by defining “sample size” as raw artifact count per horizon; the sample sizes varied from \( n = 2 \) (for Horizons 11 and 16), to \( n = 399 \) for Horizon 5. Our first measure of “sample diversity” was simply the summation of the typological categories used as primary artifact description. This approach decidedly magnified the absolute degree of assemblage diversity in terms of 88 different categories: Desert Side-notched points were tallied separately from Elko Eared points; splinter bone awls were distinguished from scapula bone awls; block metates were differentiated from slab metates.

The resulting plot (Thomas, 1983b: fig. 218) was log-linear with a correlation coefficient of \( r = 0.98 \) (df = 13, \( p < 0.001 \)). In statistical terms, this means that more than 95 percent of the variability in density and diversity across the Gatecliff horizons can be accounted for strictly in terms of sample size. As expected, the artifact-rich horizons at Gatecliff Shelter manifest the greatest absolute diversity. It likewise comes as small surprise that sparse living surfaces contain a very narrow range of artifact categories. Given only sample size, one can closely predict the degree of assemblage diversity.

HOW IMPORTANT IS CLASSIFICATION?

One might observe that “number of artifacts” and “number of artifact types” are subjective measures. This is entirely true because, in practice, no two archaeologists classify their artifacts in the same way. Does the assemblage size/diversity problem plague only Thomas’s categories?

To explore the typological effect, we modified the definitions of both “sample size” and “sample diversity” for the Gatecliff Shelter data: the size of the sample was increased to include unmodified debitage counts and sample diversity was remeasured in a typological scheme employing only 30 (rather than 88) categories. But despite these major definitional modifications, the overall degree of interaction was not significantly lowered (Thomas, 1983b: 428–431). Demonstrably different definitions of basic variables produced remarkably similar profiles: Regardless of how size and diversity were measured at Gatecliff Shelter, size effects never accounted for less than 70 percent of the observed variability in absolute diversity.

Considerably more such experimentation is required before one can confidently conclude that sample size effects transcend all typological considerations; but our first step surely suggests this to be the case.
HOW IMPORTANT IS DIFFERENTIAL FRAGMENTATION?

The Gatecliff analysis, cited above, took each individual artifact as computationally equivalent to every other artifact: one projectile point = one metate fragment = one bone bead = one potsherd. On the face of it, this would seem to be comparing apples, oranges, and hubcaps. Although these initial size/diversity studies must make certain simplifying assumptions, it is necessary to have some assurance that relative degree of fragmentation and use-life are constant across all artifact classes.

We find that, in the context of Desert West archaeology, potsherds pose a particular problem. Chipped and ground stone artifacts generally break into relatively few pieces; rarely would a projectile point or a metate break into more than half a dozen fragments. But a broken ceramic vessel commonly fractures into dozens of sherds. Subsequent trampling by humans and bovines can easily inflate the sherd count from a single artifact into the hundreds.

Although pottery is not particularly common in Monitor Valley, it is clear that the ceramic fragmentation ratio is considerably higher than that for lithics. This common sense observation points up unfortunate problems created when the raw sherd counts are pooled with lithic totals. The resulting distributions are heavily skewed toward the ceramic component.

At Upper Ackerman Spring, for instance, we collected 385 Shoshone ware sherds (chap. 6, this volume). We probably all agree that only a single artifact class is present (Shoshone ware ceramics), but how large is the sample size? One could justifiably record the assemblage size as \( n = 385 \). On the other hand, these sherds almost certainly derive from a single pot drop, so one could just as justifiably score assemblage size as \( n = 1 \).

Here is yet another reincarnation of Galton’s notorious problem (as interpreted by Thomas, 1976: 449–456): To what degree can individual anthropological observations be considered to represent statistically independent events?

Ceramics are hardly the only problem (see also Grayson, 1984: 179). The closer we look at size/diversity issues, the greater will loom the disparities between fragmentation ratios, curation rates, use-lives, postdepositional breakage, and so forth. What biases are in-
roduced by lumping ground stone and chipped stone counts? If 50 bone beads are found strung on a single necklace, should they be tallied as \( n = 50 \) or \( n = 1 \)?

We lack compelling solutions to this and other versions of Galton’s problem. But the fact that we have uncontrolled variables does not make sample size bias disappear, and we must come to grips with size/diversity interactions. To avoid total entanglement, the computations below will proceed in three different ways. We begin with the raw assemblage total (sherd counts included). We then dampen the skewing effect of differential ceramic fragmentation by using a corrected assemblage total (defined by the quick-and-dirty convention of dividing the sherd totals by 10 prior to pooling with lithic frequencies). Finally, we derive a nonceramic assemblage total by dropping sherd frequencies altogether, relying strictly on worked stone and bone counts. We hope that this multiple index approach will satisfactorily counterbalance the skewing effects of any single class of material culture. This is yet another topic requiring thoughtful middle range theoretical research.

**HOW PERVERSIVE IS SAMPLE SIZE BIAS IN MONITOR VALLEY?**

These cautions in mind, we can expand the scope of diversity analysis by adding the 10 additional excavated Monitor Valley sites to the Gatecliff Shelter data. We begin in figure 145 by considering the total artifact assemblages (including ceramic totals), so “sample size” is defined as raw artifact count per horizon. Sample diversity ranges from \( n = 1 \) for Grenouille Verte Cave to \( n = 88 \) at Gatecliff Shelter. The log-log plot of this relationship has a correlation coefficient of \( r = 0.98 \) (df = 9, \( p < 0.001 \)). Over 96 percent of the variability in these 11 archaeological assemblages from 11 Monitor Valley sites can be accounted for by sample size alone.

It is desirable to replicate the definitional experiment on the sample of 11 excavated sites from Monitor Valley. Instead of using 88 artifact categories, we can group the artifacts into fewer, more generalized types. Rather than distinguishing, say, between Desert Side-notched and Elko Eared types, we simply call all of them “projectile points.” Similarly, block and slab metates are merely called “metates.” Splinter and scapula bone awls are tallied simply as “awls,” and so forth. In effect, the initial “splitter” typology of 88 categories has been lumped into 30 more general artifact groupings.

Although the operational definition of one variable was changed markedly, the relationship remains virtually unchanged. The correlation coefficient remains high, \( r = 0.97 \) (df = 8, \( p < 0.001 \)): sample size still accounts for 94 percent of the observed diversity.

Similar experiments have been performed with the rest of the Monitor Valley data set, with similar results. Although additional experiments could (and should) be performed using other typologies and data from other areas, we can safely conclude that size effects have a marked influence on absolute assemblage diversity, regardless of how the two variables are measured.

The data in figure 145 can be combined in somewhat different fashion, but with similar results. When sherd counts are removed, and sample size computed only for the aceramic artifact assemblage, the correlation coefficient remains high, at \( r = 0.98 \); the same correlation coefficient results when sherd frequencies are dampened by division by 10.

In these calculations, sample size varies between \( n = 1 \) at Grenouille Verte Cave to \( n = 2046 \) for Gatecliff Shelter. These disparate values can be partially equalized by splitting the overall Gatecliff Shelter assemblage into its component 15 horizons, thereby increasing the data set from 11 to 25 points. The value of \( r \) decreases slightly to 0.97 (df = 22, \( p < 0.001 \)).

Regardless of how we compute size/diversity relationships among the 11 excavated sites in Monitor Valley, the sample size effect never accounts for less than 94 percent of the observed variability.

Exploration of the sample size/diversity relationship can be expanded by supplementing the 11 excavated sites with the rest of the archaeological assemblages recovered from throughout Monitor Valley, inventories associated with spring catchments, lowland lacustrine zones, rock art localities, drift fences, hunting blinds, rock ambushes, and soldier cairns (fig. 146). This scattergram plots the pooled assemblages with both variables de-
fined as before and Gatecliff tallied as independent horizons. The correlation coefficient remains quite high ($r = 0.88, df = 80, p < 0.001$).

La627 is a significant outlier in this relationship. The Upper Ackerman Spring Site (La627), is a concentration of 385 Shoshone ware sherds in the Hickison Summit catchment (fig. 129). These heavily crushed and indurated sherds are almost certainly from a single vessel. Here is a prime example of the differential fragmentation effect, discussed above. The extreme position of this outlier is determined strictly by the spurious comparison of lithic and ceramic frequencies. When outlier La627 is dropped, the correlation increases to $r = 0.94 (df = 79, p < 0.001)$ for the remaining 81 data points.

Regardless of which specific algorithm is imposed on the data, there can be no question that the correlation between sample size and diversity is very high for the aggregate Monitor Valley assemblage. Despite the differential sampling strategies and the variety of postdepositional factors, sample size accounts for much, if not most, of the overall variability in the Monitor Valley database.

Extreme caution is in order when interpreting the behavioral meaning of absolute diversity in archaeological assemblages. Large accumulations will almost always be diverse; small assemblages will almost invariably contain very few artifact types—regardless of which types are present and irrespective of what behavior actually produced the assemblages.

DIVERSITY WITHIN DISCRETE MONITOR VALLEY ASSEMBLAGES

Having examined the overall picture, we will explore how sample size bias operates within individual segments of the regional Monitor Valley data. We begin by looking at diversity within the various assemblages; later in this chapter, we will partition the same Monitor Valley data according to various elevational and contextual criteria. The elevational categories are defined in chapter 7; the contextual groupings—such as Montane Spring Assemblages—are rigorously defined in chapter 12.

THE MONTANE SPRING ASSEMBLAGES

Figure 147 plots the size/diversity regression for total artifact assemblages recovered in the montane spring catchments. Although 15 such 1 km catchments were surveyed, only 12 data points appear because springs 17/18...
and 24/25 have been combined, and Spring 28 contained no artifacts (chap. 2).

As expected, the montane survey data are heavily conditioned by sample size effects. The correlation coefficient is \( r = 0.95 \) (df = 10, \( p < 0.001 \)); the correlation between assemblage size and assemblage diversity accounts for over 90 percent of the observed variability on figure 147. There are no significant outliers.

When sherd counts are removed from the figure 147 totals, the correlation coefficient drops slightly to \( r = 0.93 \) (a value still significantly different from zero). Ceramics were not particularly common in the montane spring assemblages and differential fragmentation effects seem to be minimal.

**The Valley Floor Assemblages**

Figure 148a plots the size/diversity regression for total assemblages from the three valley floor spring catchments (Dianas Punch Bowl, Potts Ranch, and White Sage springs) and the Monitor Valley Lakebed site. The correlation coefficient is only \( r = 0.62 \), a value decidedly below statistical significance.

This unexpectedly low correlation results both from the effects of differential fragmentation and widely variant sample sizes. In particular, this curve illustrates how correlation and regression can be heavily determined by extreme values. In figure 148a, the form and strength of the relationship is primarily the result of the more than 500 items recovered from the Monitor Lakebed site; sample sizes were notably smaller at the three spring sites.

When this outlier is removed, a radically different relationship emerges. The correlation coefficient for the three lowland spring sites is a surprising \( r = -0.95 \) (fig. 148b). Although the strength of this relationship is not significantly different from \( r = 0.0 \) (df = 1, \( p = 0.202 \)), the form of the regression curve is almost the opposite of that in figure 148a. In this case, the sample size effect is reversed: *assemblage diversity decreases as sample size increases*.

This result can be partially attributed to differential fragmentation. Whereas the Dianas Punch Bowl and Potts Ranch Spring assemblages comprised strictly stone tools, a large proportion of the White Sage Spring assemblage consists of Shoshone ware sherds. Because of this, White Sage Spring itself has become a major outlier in figure 148a. But, significantly, when only nonceramic artifacts...
are considered for the three Monitor Valley bottomland springs, the correlation coefficient shifts to \( r = -0.47 \) (df = 1, \( p = 0.320 \)), a value still not significantly different from zero.

Taken as a set, the three valley floor springs are not heavily conditioned by sample size. But, then again, three datum points are insufficient to define a satisfactory relationship using these methods.

**THE CAVE AND SHELTER ASSEMBLAGES**

Figure 145 has already graphed the size/diversity regression for the 11 excavated caves and shelters in the Monitor Valley area; the correlation coefficient of this relationship, \( r = 0.98 \), indicates that the regression accounts for all but about 4 percent of the variability.

Ceramic counts are low in these samples, and differential fragmentation is not a distorting factor. Figure 145 also lacks major outliers.

**THE STREAMSIDE CATCHMENT ASSEMBLAGES**

Figure 149 plots the size/diversity regression for seven sites recorded in the streamside catchment surveys of Ikes, Stoneberger, and Mill canyons. The correlation coefficient describing this relationship is \( r = 0.98 \) (df = 5, \( p < 0.001 \)).

**THE ROCK ALIGNMENT CATCHMENT ASSEMBLAGES**

Figure 150 shows size/diversity relationship for the four rock alignment-associated assemblages documented in the Monitor Valley survey (chap. 5). The correlation coefficient here is \( r = 0.97 \) (df = 2, \( p = 0.031 \)). The Monitor Hills assemblage exhibits a slightly greater diversity than the others.

**THE ROCK ART CATCHMENT ASSEMBLAGES**

Figure 151 presents the size/diversity regression for the 16 discrete rock art catchment assemblages in the Monitor Valley area (as discussed in chap. 6). Although the correlation coefficient is only \( r = 0.68 \), this value is significantly different from zero (df = 14, \( p = 0.004 \)).

La627, the Shoshone ware sherd concentration at Upper Ackerman Spring, is once again an outlier here. As discussed above, the differential fragmentation effect causes this site to manifest an extremely low diversity because of the spurious comparison of lithic
regression function involving two variables and two constants:

$$\log Y' = \log a + b \log X$$

where $X$ is the independent variable and $Y'$ is an estimate of the dependent variable. Sample size is usually taken to be the independent variable in order to explore the effects of variable assemblage size on apparent diversity. The constant $a$ is the $Y$-intercept and $b$ is the coefficient of regression, commonly called slope.

The regression format allows one to examine size/diversity interactions on a site-by-site basis, and the analysis of slope permits one to scale these data points along a more behaviorally relevant settlement continuum.

To illustrate, the highly correlated linear relationship on figure 145 is described by the simple equation:

$$\log Y' = 0.08 + 0.57(\log X)$$

where $X =$ assemblage size (the raw number of artifacts recovered) and $Y' =$ estimated assemblage diversity (the number of artifact types present).

Regression equations permit projection, within a definable degree of error, of the expected values of $Y$. At least in Monitor Valley, sample size and assemblage diversity are known to be heavily dependent on one another: Given the raw number of artifacts present, one can predict—with a high degree of accuracy—the number of types at that archaeological site.

Consider the case of Toquima Cave, where we recovered a total of 92 artifacts, classified into 22 artifact classes. This is an “observed,” “known,” “empirical” relationship. But to what extent can this relationship be attributed to sample size effects?

Since assemblage size is $X = 92$, we project the following:

$$\log Y' = 0.08 + 0.57(\log 92)$$

$$Y' = 15.8$$

Rounding the results, the regression relation predicts that—all else being equal—Toquima Cave should contain about 16 artifact types. As it turns out, the observed value ($Y = 22$ types) is within the 95 percent confidence in-

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**A REGRESSION APPROACH TO SAMPLE SIZE EFFECTS**

The assemblage size/diversity relationship is commonly described by the log-linear...
interval surrounding each $Y'$. In other words, the observed value cannot be distinguished statistically from that predicted strictly from the sample size.

Similar relationships hold for the other sites on figure 145: the closer the observed point to the line, the better the prediction. Ten artifacts were found, for instance, at Little Empire Shelter. Linear regression predicts that $Y' = 4.47$ artifact types should be recovered. Six types occurred at Little Empire, well within the 95 percent confidence intervals surrounding $Y'$.

At Jeans Spring Shelter, $X = 78$, and the predicted number of artifact classes is $Y' = 14.4$. This result easily falls with the 95 percent confidence intervals around the observed value of $Y = 16$ typological categories. These results underscore the dangers of interpreting results expressed in terms of absolute assemblage diversity.

This is not a remote concern; sample size bias influences the everyday business of archaeological interpretation. It is convenient and comfortable to assume that the kinds of artifacts found at any given site should directly reflect the activities that went on there.

We now know that this assumption is usually incorrect: the absolute degree of assemblage diversity at, say, Toquima Cave is almost totally conditioned by the number of artifacts recovered in the excavations.

We also know that very small sites will almost invariably display limited absolute diversity. The same is true of very small samples from large sites: When the assemblages are set out on a lab table, one cannot distinguish between the completely recovered small site and the incompletely tested large site. Absolute diversity depends on the sample size recovered, not the potential sample remaining in the ground.

So long as site function is assessed on the basis of absolute diversity, our conception of prehistoric cultural geography will depend heavily on our field strategy. Dig all of a large site, and you might get a base camp; dig half of the same site, and you’ve got a field camp; take a surface collection, and it will look like a location.

The more intensively we investigate, the more the apparent diversity that we discover. There must be a better way.

**REGRESSION AND SLOPE RECONSIDERED**

The regression constant $b$ offers a way of assessing relative assemblage diversity independent of absolute sample size—so long
Fig. 153. Size/diversity regression profiles for Monitor Valley site and nonsite assemblages, partitioned by catchment (see also table 66).

Assemblage size and diversity are found to be highly correlated.

Slope measures the rate of change in Y per unit change in X. In the case of perfect correlation ($r = 1.00$), a slope of 1.0 shows that one unit of change in the dependent variable Y is expected to correspond to one unit of change in the independent variable X. A slope of $-1.0$ shows that $Y$ decreases one unit for each unit increase in $X$. The predictive value of $b$ decreases as $r$ decreases.

This elementary statistical relationship provides an operational measure of relative assemblage diversity (see also Grayson, 1984). As the regression lines become steeper (i.e., as diversity increases), the regression constant ($b$) becomes greater (fig. 144). As assemblage diversity decreases, the slope approaches the horizontal (i.e., $b$ approaches zero). This is so, regardless of what the sample sizes may be.

Given sufficient experimentation, we may someday find that the magnitude of $b$ is directly correlated with specific components within a settlement system. But we presently lack adequate midrange theory, and this analysis is restricted to posited scaling along a residential-logistic-diurnal axis (fig. 144).

Residential activities produce, in the long run, the greatest relative diversity within a given behavioral system. This diversity will be apparent in those assemblage groupings characterized by a relatively steep slope (as measured by increasing values of $b$). By contrast, relatively low-diversity assemblage groupings commonly result from diurnal procurement activities. Such homogeneous assemblages are characterized by a nearly horizontal slope (a value of $b$ approaching zero). Intermediate values of $b$ occur for assemblages in the middle range of the residential-logistic-diurnal continuum.

There will be exceptions. Whenever a series of unrelated, homogeneous nonresidential assemblages co-occur at a single locus, one complex and diverse palimpsest accumulation will result. The nonresidential character of such assemblages will be apparent only from supra-assemblage data such as positioning relative to resources, presence of on-site facilities and structures, or ecofactual evidence. Similarly, among low-latitude groups with relatively little overall technological diversity, base camp accumulations will sometimes be relatively homogeneous, even when compared with strictly diurnal assemblages. Relative assemblage diversity is doubtless conditioned by multiple behavioral and post-depositional factors; the proportional contribution of each factor must be considered in each case (see also Beck, 1984: 187–189).

But for most mid-latitude assemblages, relative assemblage diversity is demonstrably graded along a residential-logistic-diurnal continuum. The operational challenge is to perceive such diversity independently from the biasing effects of differential sample size, and the regression coefficient $b$ is one way to do this.

Consider figure 153, a size/density plot showing the variability among the various pooled assemblages from Monitor Valley (listed on table 66). Although the curves are superficially rather similar, the differential slopes provide a means of monitoring relative assemblage variability.

First of all, figure 153 demonstrates the valley floor spring catchment assemblages are...
markedly different from the other assemblages, and from each other. Whereas the Dianas Punch Bowl sample is rather small \((X = 36)\), it is also relatively diverse, with \(Y = 11\) types present. Conversely, the White Sage Spring assemblage contains \(X = 188\) items (when ceramic frequencies are included), but only \(Y = 7\) types are present. In this rather distorted case, assemblages become less diverse as sample size increased; as discussed above, the differential fragmentation between lithics and ceramics makes the heterogeneous assemblages difficult to compare.

For reasons discussed earlier, the valley spring curve differs radically from the others (and it is included on fig. 153 for approximate comparison only); the remaining slopes are all positive. The slope of the pooled Monitor Valley assemblages is \(b = 0.58\), and individual assemblage values vary between \(b = 0.49\) to \(b = 0.64\). The overall impression conveyed by figure 153 is one of invariant, size-dependent relationships, a characteristic of Monitor Valley assemblages in general.

### DIVERSITY WITHIN THE ELEVATIONAL ZONES OF MONITOR VALLEY

This chapter has explored relative diversity in archaeological assemblages using the Monitor Valley data, partitioned according to conventional criteria (montane spring catchments, streamside catchments, excavated caves and shelters, and so forth). Substantive conclusions based on these findings are integrated into an overarching analysis of Monitor Valley settlements in subsequent chapters.

But it is desirable to reanalyze the same Monitor Valley data, partitioned differently (as discussed in chap. 7). Specifically, survey and excavation data from Monitor Valley will now be partitioned by arbitrary elevational zone (an alternative geographical partition is discussed below). The vertical approach is of particular interest because the initial middle range projections for the archaeological record of Monitor Valley were expressed according to specific elevational zones (Thom, 1983a: 141-151). Only four of five elevational zones are utilized to examine size and diversity within the Monitor Valley survey; the summit crest zone is considered in the next volume of this series (see also chap. 9, this volume).

### THE UPLAND SLOPE SUBSAMPLE

The montane uplands encompass sites and loci between 2500 and 2750 m. The following subset is isolated as the upland slope subsample: the Table Mountain assemblages, plus material from all sites and loci found within the following eight spring catchment surveys: Springs 9, 17, 18, 20, 23, 24, 25, and 28. The upland subsample has an overall correlation coefficient of \(r = 0.92\) (df = 3, \(p = 0.024\)); the slope of this subsample is only \(b = 0.33\), the lowest value observed in the Monitor Valley research.

**TABLE 66**

<table>
<thead>
<tr>
<th>Assemblage</th>
<th>Slope (b)</th>
<th>Correlation (r^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooled Monitor Valley total ((n = 81))</td>
<td>0.56</td>
<td>0.94(^c)</td>
</tr>
<tr>
<td>Streamside catchments ((n = 7))</td>
<td>0.49</td>
<td>0.98</td>
</tr>
<tr>
<td>Montane spring catchments ((n = 12))</td>
<td>0.48</td>
<td>0.95</td>
</tr>
<tr>
<td>Valley floor spring catchments ((n = 3))</td>
<td>-0.22</td>
<td>-0.95(^d)</td>
</tr>
<tr>
<td>Rock alignment catchments ((n = 4))</td>
<td>0.55</td>
<td>0.97</td>
</tr>
<tr>
<td>Excavated caves and shelters ((n = 11))</td>
<td>0.57</td>
<td>0.98</td>
</tr>
<tr>
<td>Rock art catchments ((n = 15))</td>
<td>0.64</td>
<td>0.98</td>
</tr>
<tr>
<td>Pictograph catchments ((n = 11))</td>
<td>0.59</td>
<td>0.98</td>
</tr>
<tr>
<td>Petroglyph catchments ((n = 4))</td>
<td>0.57</td>
<td>0.92(^c)</td>
</tr>
</tbody>
</table>

\(^a\) \(n\) denotes the number of discrete assemblages within each site or catchment type.

\(^b\) \(r\) significantly different from zero (at \(p < 0.001\)) unless otherwise stated.

\(^c\) Outlier La627 removed.

\(^d\) Approximate value for comparison only.

\(^e\) Correlation coefficient not significantly different from zero.
TABLE 67
Regression Coefficients (b values) for the Major
Pooled Assemblages in Monitor Valley

<table>
<thead>
<tr>
<th>Assemblage</th>
<th>Slope (b)</th>
<th>Correlation (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montane Upland subsample (n = 6)</td>
<td>0.38</td>
<td>0.95</td>
</tr>
<tr>
<td>Pooled Woodland subsample (n = 31)</td>
<td>0.58</td>
<td>0.98</td>
</tr>
<tr>
<td>Woodland Excavated Assemblages (n = 6)</td>
<td>0.58</td>
<td>0.99</td>
</tr>
<tr>
<td>Woodland Surface Assemblages (n = 26)</td>
<td>0.58</td>
<td>0.97</td>
</tr>
<tr>
<td>Pooled Lowland subsample (n = 45)</td>
<td>0.58</td>
<td>0.92*</td>
</tr>
<tr>
<td>Lowland Excavated Assemblages (n = 5)</td>
<td>0.60</td>
<td>0.97d</td>
</tr>
<tr>
<td>Lowland Surface Assemblages (n = 36)</td>
<td>0.57</td>
<td>0.89</td>
</tr>
<tr>
<td>Toquima Assemblages Grouped Geographically</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Northern Toquima Corridor (n = 3)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Central Toquima Corridor (n = 22)</td>
<td>0.61</td>
<td>0.97</td>
</tr>
<tr>
<td>Middle Toquima Block (n = 22)</td>
<td>0.56</td>
<td>0.98</td>
</tr>
<tr>
<td>Northumberland Corridor (n = 4)</td>
<td>0.59</td>
<td>0.98</td>
</tr>
<tr>
<td>Western Toquima Flank (n = 14)</td>
<td>0.61</td>
<td>0.97</td>
</tr>
<tr>
<td>Eastern Toquima Flank (n = 38)</td>
<td>0.57</td>
<td>0.83</td>
</tr>
</tbody>
</table>

* n denotes the number of discrete assemblages within each site or catchment type.
* All values of r significantly different from zero (at p < 0.001).
* Gatescliff Shelter tallied as single datum point.
* Significant at p = 0.005.

THE LOWLAND SLOPE SUBSAMPLE

For present purposes, the lowland slope can be combined to create a subsample containing 16 discrete assemblages (table 63), characterized by a correlation coefficient of r = 0.99 (df = 14, p < 0.001); the correlation between assemblage size and assemblage diversity accounts for nearly all of the observed variability. The slope is 0.59.

THE VALLEY BOTTOM SUBSAMPLE

The valley bottom contains 14 assemblages, characterized by a correlation coefficient of r = 0.95 (df = 12, p < 0.001); the slope of this relationship is 0.57.

DIVERSITY WITHIN THE MAJOR GEOGRAPHICAL CLUSTERS OF MONITOR VALLEY

We have also divided the Monitor Valley regional sample into geographical sections. These predominantly horizontal topographic divisions are defined in chapter 7 (and will be considered in more detail in chap. 12); individual sites are assigned in table 63.

Table 67 presents the findings of the size-diversity analysis. Fourteen of these assemblages occur on the western flank of the Toquima Range, and this subsample is characterized by a relatively steep slope of 0.61; the 38 assemblages in the east-facing Toquimas are only slightly less diverse, with a slope of 0.57. Similarly, the assemblages of the middle Toquima block and the major corridors manifest slopes ranging between 0.56 and 0.61.

SUMMARY AND IMPLICATIONS: ASSEMBLAGE SIZE AND DIVERSITY

This chapter began on a decidedly pessimistic note. Archaeologists have been sorely tempted to view larger sites as representing
"base camps," and to interpret thin lithic scatters as "chipping stations" or as "task-specific field camps." Graphic analysis forcefully demonstrates why that temptation must be resisted. We now know that sample size heavily biases our perception of the artifact level diversity evident in the Monitor Valley assemblage.

But once the sample size effect is recognized, it may be possible to control the bias to some degree. Analysis of regression constants effectively holds sample size constant and allows one to examine the relative degree of assemblage diversity (assuming that the correlation coefficients remain high).

Although relative measures of diversity cannot be used to classify specific assemblages as base camps, field camps, and so forth, it might be possible to rank these assemblages along a sliding scale of relative residential intensity. Middle range theoretical assumptions outlined above (esp. fig. 145) further allow us to breathe a measure of behavioral life into such pattern recognition.

But we caution against oversimplification. Regression constants most assuredly do not mean that specific woodland assemblages necessarily derive from base camps or that the artifacts found in montane spring catchments result from only diurnal procurement. But diversity analysis has provided a necessary first step in approaching the regional geographic objectives set out in the first volume of this series (Thomas, 1983a).

NOTE

1. An abbreviated version of this discussion appears elsewhere (Thomas, 1988).
CHAPTER 9. PATTERN RECOGNITION: THE TEMPORAL STRUCTURE OF MONITOR VALLEY

In chapter 8, we explored the pervasive and significant interactions between the size of the Monitor Valley assemblages and the diversity contained therein. It was the first of six pattern recognition studies designed to expose the nature of regional diversity in Monitor Valley. Although much of this observed variability must be ascribed to sample size effects, we now begin to explore that diversity which is due to behavioral causes.

We will now consider variability emanating from underlying temporal structure. From the outset, it is clear that the level of temporal resolution varies considerably within the Monitor Valley samples. At Gatecliff Shelter, we defined a relatively fine-grained natural and cultural sequence, using several independent dating techniques (Thomas, 1983b). In this volume, we discuss the deposits of Triple T Shelter, which can also be reasonably well dated due to their favorable geomorphic context (chap. 3).

But the prehistoric archaeological record of Monitor Valley also contains hundreds of unstratified surface scatters, and we have gone to some lengths collecting relatively unbiased samples from these surface assemblages. Many (if not most) surface samples retain only coarse-grained temporal structure. But even this low level of temporal resolution requires us to look closely to impose the necessary controls warranted by the data.

Imprecise chronology is hardly a new problem in archaeology. We faced the same problem of coarse-grained temporal structure in our earlier research at Reese River. Analyzing the 1969-70 field data, we were forced to conclude that “no significant change occurred in the settlement pattern at Reese River . . . . This is not to imply stagnation, since subtle, phase-level settlement shifts can be noted, but rather to assert that no violence is committed to the data by considering the entire Medithermal period (ca. 2500 B.C. to A.D. 1850) as an analytical unit” (Thomas, 1974: 15).

That is, we were unable to monitor any degree of systematic settlement and subsistence change within the Medithermal period because suitable temporal controls were simply lacking. We ran into similar difficulties in the second phase of the Reese River Valley survey, and analysis was once again conducted in terms of a relatively gross, 4500 year long “Medithermal period” (Williams et al., 1973; Thomas and Bettinger, 1976).

I am convinced that there is indeed variability within the past 4500 years at Reese River, but the available field and analytical procedures were insufficiently precise—and the samples too small—for us to resolve change at a more satisfactory level.

The Reese River studies underscore the general problem of assessing temporal variability in surface assemblages. Two critical factors are involved: (1) the degree of unknown, parametric change through time, and (2) the size of the sample necessary to detect those changes. To date, archaeological procedures almost exclusively address this first factor, ignoring the second equally critical condition.

Few archaeologists directly confront the matter of sample size, and those who do generally accept the nebulous and short-sighted strategy of using the largest samples possible (Kerlinger, 1973: 127).

But even when reasonably large sample sizes are available, the question remains of how best to scrutinize these samples for meaningful, substantive information. Far too often we find analysts—apparently anxious to get on with the business of archaeological interpretation per se—simply ignoring sample size considerations once the field data have been collected.

Sample size problems do not evaporate so readily. A primary analytical question remains: “Is the sample size large enough to give confidence that the big associations will indeed show up, while being small enough so that trivial associations will be excluded from significance?” (Hays, 1973: 424). That is, how does one define the strength of inference permissible for a given sample? While some samples are sufficiently robust so that one can derive definitive answers to research questions, other samples simply lack the potential
for such answers, no matter how tediously manipulated.

To see how this problem is played out in the archaeological context, consider the relatively simple, day-to-day operation of assessing the chronological relationship between two surface assemblages. Data from the Monitor Valley spring catchment survey were presented in chapter 2. Even assuming that the spring catchments were utilized at different times, how do we know if our field data are sufficiently robust to allow detection of such differences?

What, for instance, is the temporal relationship between the Johnny Potts Spring assemblage and that found in the Spring 22 catchment? Is the Johnny Potts assemblage earlier, later, or about the same age as the Spring 22 sample?

By Desert West standards, both spring catchment samples are relatively "rich" (see tables 1 and 2). But because these assemblages are surface scatters, only a few artifact categories are relevant to temporal analysis—those types previously established to be somehow time-diagnostic.

The two best time-markers in Great Basin archaeology are projectile points and potsherds, and the two spring samples contained a relatively large number of such temporal diagnostics. At Spring 22, we found four Desert series points, two Rosegate points, three Elko points, and one Gatecliff point. Seventeen time-markers occurred in the Johnny Potts Spring catchment: one Desert series point, four Rosegate points, 11 Elko points, and a single Gatecliff point.

Conventionally, one would simply inspect the point frequencies and then impressionistically weigh the relative proportions of each type: Nearly half (4 of 10) of the Spring 22 time-markers are relatively late (Desert series), whereas two-thirds (12 of 17) of the Johnny Potts Spring points are Elko series or older. Given these differences, one is tempted to conclude that the Johnny Potts assemblage is older than the Spring 22 sample. According to general archaeological wisdom, this is an obvious and reasonable conclusion—after all, we had more than two dozen time-markers to work with.

But are the samples large enough to warrant this conclusion? We will argue that this commonplace procedure—weighing relative proportion and totally ignoring the absolute sample sizes involved—is wrong and misleading.

Or consider the less-than-ideal (if more typical) case provided by the much smaller sample sizes in the Spring 26 and Sawlog Ridge assemblages (table 1). Our survey teams found only two Desert series points at Spring 26; one Elko point and a single Gatecliff point were recovered at the Sawlog Ridge Springs.

Despite skimpy sample sizes, archaeologists might be tempted to conclude that the Spring 26 assemblage is later than that from the Sawlog Ridge Springs. After all, one site contained only "late" artifacts, while the other had only "early" time-diagnostics.

Literally dozens of wholly similar inferences are scattered throughout the contemporary archaeological literature. The fact is that archaeologists almost invariably ignore the issue of sample size when analyzing areal data sets. It is time to search for a more satisfactory method of relating relative sample sizes to the strength of implied inference.

THE TEMPORAL PROFILE

When analyzing the Gatecliff Shelter data, we relied heavily on a simple method of computing and comparing bifacial lithic trajectories (Thomas, 1983b: chap. 20). A series of ordinarily scaled production stages were plotted in the common ogival format and then compared statistically with the standard Kolmogorov-Smirnov two-sample test (as discussed in Thomas, 1976: 322). This straightforward comparative method allows one to decide—given available sample sizes—whether two assemblages differ with respect to bifacial lithic staging. Samples judged to be "statistically distinct" can be operationally considered as drawn from different statistical populations. Samples found to be "statistically indistinguishable" are operationally defined as having been derived from the same statistical population. These samples are "pooled" in further analysis.

Beyond the obvious advantages of simplicity and objectivity, this technique provides a way to assess the adequacy of available samples to answer the questions one is asking. If available samples are too small, the
Kolmogorov-Smirnov test will not allow rejection of the null hypothesis. Properly employed, cumulative curves eliminate the need for vague impressionistic decision-making with respect to sample sizes. Either the samples are sufficiently large to allow discrimination between two samples, or they are not.

**Ideal Temporal Profiles**

Bifacial technology profiles can be converted into a tool for assessing temporal variability (see also Thomas, 1985). Consider three hypothetical archaeological sites, each providing a sample of 25 time-markers, distributed across five sequential phases (table 68). Site A is a single component assemblage, all time-markers belonging to the earliest period (denoted as Phase I). Site B, also a single component assemblage, contains 25 time-markers from the latest episode, Phase V. The third sample, from Site C, is a multi-component assemblage with time-markers equally representative of all five occupational phases.

Figure 154 arrays these data in characteristic temporal profiles. Like all ogives, the Y-axis displays cumulative proportions, and the X-axis is scaled according to a specified ordinal-level variable. In this case, the vertical dimension plots the cumulative percentage of time-markers per site, and the horizontal axis scales time along a five-step (phase level) ordinal scale.

The temporal structure of each site is evident from the distinctive profile. The curve for Site A, the earliest assemblage, rises abruptly during Phase I, then continues horizontally across the top of the ogive.

Site B, a late assemblage, has a characteristic profile rising on the right-hand side of the ogive. Since the entire assemblage consists of Phase-V-diagnostic time-markers, the profile climbs from 0 to 100 percent at the Phase V interval.

Site C is a temporally mixed assemblage, with equal proportions of time-markers throughout the five-phase sequence. Phase I contains one-fifth of the entire assemblage (5 of 25), so the first point on figure 154 is plotted at 20 percent. Each point on an ogive represents the cumulative percentage, so the next plot occurs at 40 percent (since Phases I and II account for 10 of the 25 artifacts at Site C). The cumulative proportion for Phases I–III is 60 percent, and so on.

Because Sample C contains an equal distribution of time-markers from all five phases, the temporal profile becomes a straight line, rising uniformly from 0 to 100 percent.

Cumulative curves, such as those on figure 154, graphically characterize the distribution of time-markers between archaeological assemblages. But more important than this, the ogive provides a first step toward a statistical determination of which samples are "different" and which are "similar." Before considering these computations, we must translate the ideal, hypothetical case into a more empirically relevant format.
TEMPORAL PROFILES FOR GATECLIFF SHELTER

Table 69 lists the distribution of time-sensitive projectile points from the cultural horizons at Gatecliff Shelter. Previously (Thomas, 1983b), we used other chronometric techniques to determine the absolute chronology of Gatecliff Shelter. The Gatecliff case can now be used to demonstrate how ogives reflect this same fine-grained temporal structure.

Cumulative curves operate at an ordinal level, so it is necessary to characterize the 6000 year occupational history of Gatecliff Shelter in terms of discrete, ordinal steps. That is, the B.C./A.D. time estimates must be reduced to a series of five, phase-level temporal categories based on the conventional central Great Basin cultural phases (after Thomas, 1981a, 1983a):

- Clipper Gap phase (prior to 3000 B.C.)
- Devils Gate phase (ca. 3000 B.C. to 1300 B.C.)
- Reveille phase (1300 B.C. to A.D. 700)
- Underdown phase (A.D. 700 to 1300)
- Yankee Blade phase (A.D. 1300 to ca. 1850)

These five phases are plotted along the X-axis of figure 155a. The Y-axis, as before, represents the cumulative proportion of time-sensitive artifacts (as discussed in Thomas, 1983b: chap. 20; Thomas, 1985: chap. 26). Keep in mind that in ordinal scaling, the size of the interval is irrelevant.

Figure 155a arrays 10 assemblages from Gatecliff Shelter, one profile for each horizon containing time-diagnostics (table 69). The curve at the far left represents Horizon 14. This profile is identical to the ideal “Site A” curve on figure 154 and, based strictly on this temporal profile, we would assign Horizon 14 as among the earliest of the horizons under consideration.

This conclusion is correct. Horizon 14, a living surface dating from the Clipper Gap phase, is among the earliest at Gatecliff Shelter, independently and securely dated by the radiocarbon method at between 3300 and 3150 B.C. (Thomas, 1983b).

At the other extreme is Horizon 1, the curve on the right-hand edge of figure 155a. The Horizon 1 curve is nearly identical to the

<table>
<thead>
<tr>
<th>Table 69</th>
<th>Distribution of Time-sensitive Projectile Points from Gatecliff Sheltera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon</td>
<td>Yankee Blade Phase</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
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<td>-</td>
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<td>-</td>
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<tr>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>-</td>
</tr>
</tbody>
</table>

*After Thomas, 1983b: table 41.*

“Site B” profile on figure 154, leading one to conclude that Horizon 1 is the latest of the 10 Gatecliff floors under consideration. This conclusion is also correct: Horizon 1 is the uppermost cultural occupation at Gatecliff, radiocarbon dated as post-A.D. 1300.

The stratigraphic evidence from Gatecliff Shelter readily illustrates how temporal profiles graphically characterize the temporal structure of archaeological assemblages.

COMPARING TEMPORAL PROFILES

Temporally intermediate curves on figure 155a are also of interest because of the distinctive way in which they cluster. Note that Horizons 8 and 9 have almost identical temporal profiles, rising dramatically during the Devils Gate phase. Horizons 4, 5, 6, and 7 similarly cluster at the Reveille phase interval; Horizons 2 and 3 are almost identical, their primary inflection occurring during the Underdown phase.

This graphic result should come as small surprise, since the same clustering is clearly evident on table 69. But once counts are converted to cumulative proportions, a simple quantitative method allows one to decide which horizons are statistically “the same”
Fig. 155. a. Temporal profiles for time-diagnostics from the 10 major cultural horizons at Gatecliff Shelter (data from Thomas, 1983b: table 41). b. Pooled temporal profiles for the major occupations at Gatecliff Shelter.

(with respect to time) and which samples must be considered to be "statistically different."

Take the case of Horizons 9 and 14. Are the samples of time-markers from these two horizons drawn from the same or different statistical populations?

This statistical issue can be resolved by the nonparametric Kolmogorov-Smirnov two-sample test (as discussed by Thomas, 1976: 322–327; see also Thomas, 1983b: chap. 20). The null hypothesis states that the cumulative proportions of the first sample (Horizon 14) are statistically identical to the cumulative proportions of the second sample (Horizon 9). The larger the maximum absolute differences between the proportions, the less likely becomes the null hypothesis.

The distribution of the Kolmogorov-Smirnov statistic \( D \), is known, and the critical value can be computed as:

\[
D_{0.05} = 1.36 \sqrt{\frac{n_1 + n_2}{n_1 n_2}}
\]

This statistic is strictly a function of sample size and alpha level; the size of the ordinal intervals is irrelevant.

One can routinely determine whether the greatest difference between proportions exceeds this critical value, at the 0.05 level. Curves are judged to be statistically distinct whenever the value of \( D_{0.05} \) is exceeded. If the actual \( D \) is less than \( D_{0.05} \), the curves are not considered distinct. When the observed value of \( D \) exceeds the predetermined \( D_{0.01} \), the difference is said to be "highly significant."

Table 70 provides a sample worksheet for computing the Kolmogorov-Smirnov two-sample comparisons. To compare profiles for Horizons 14 and 9, one must first find the value of \( D_{0.05} \). Since \( n_1 = 4 \) and \( n_2 = 16 \), the
cut-off value of $D_{0.05}$ is 0.760. This means that two curves are "different" only when the observed Kolmogorov-Smirnov statistic $D$ exceeds 0.760.¹

Table 70 shows that the maximum difference between cumulative proportions is $D = 1.00$ (for the initial ordinal category representing the Clipper Gap phase). Since this value of $D$ is greater than the computed value of $D_{0.05}$, the profiles for Horizons 14 and 9 are judged to be "different" (i.e., the samples were probably drawn from different statistical populations). This computation tells us only about statistical significance; the anthropological significance is somewhat different.

We have thus determined, in a relatively objective fashion, that Horizons 9 and 14 represent different cultural phases: the modal occupation date of Horizon 14 is demonstrably older than that of Horizon 9—even taking into account the relatively small sample sizes involved.

**Pool**ing **Temporal** Profiles

Consider now the case of Horizons 8 and 9. These curves are remarkably similar—both horizons belonging to the Devils Gate phase—but are they statistically identical?

Keep in mind that the critical value of the Kolmogorov-Smirnov statistic depends only on the predetermined alpha level and the absolute size of the two samples. Since the sample sizes are 16 and 38, the critical value is computed to be $D_{0.05} = 0.405$. The maximum observed difference between the cumulative proportions in Horizons 8 and 9 is $D = 0.254$. Since the empirical $D$ fails to exceed $D_{0.05}$, the null hypothesis is not rejected.

In statistical terms, this means that the Horizon 8 and 9 samples were probably drawn from the same statistical population. It remains possible, of course, that the two samples were actually drawn from different populations; but if so, the samples at hand are too small to detect that difference (at the confidence level of 0.05).

Either way, the temporal structure of Horizons 8 and 9 must be considered to be "operationally contemporary"—at this level of resolution. It is useful to combine (or "pool") these contemporary horizons into a single data set representing the total Devils Gate phase occupation at Gatecliff Shelter. Pooling is done by recomputing the cumulative portions based on the total artifact frequencies from both horizons.

Figure 155b arrays the pooled horizon totals for the various Gatecliff occupational surfaces. Horizons 8 and 9 are combined into a single Devils Gate profile, and because Horizons 4, 5, 6, and 7 are likewise statistically indistinguishable, they are pooled into a single profile diagnostic of the Reveille phase. Horizons 2 and 3 are also "the same," so they have been pooled into a single Underdown phase profile.

The pooled curves on figure 155b concisely and accurately represent the temporal structure of Gatecliff Shelter (as reflected by time-diagnostic artifacts). The neat, ladder-like arrangement of the profiles, unique in my experience, results primarily from the unusual geomorphic processes operating at that site. Each phase is represented by a single temporal profile, and each profile is statistically distinct from all others.

**Temporal Profiles for Monitor Valley Assemblages**

Ogival comparison is a simple and flexible tool for defining temporal structure of prehistoric archaeological data of all sorts. To illustrate how this technique works on surface assemblages, we return to the Spring 22 and Johnny Potts Spring catchment data dis-

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Fig. 156. a. Sample temporal profile for the Monitor Valley nonsite survey, comparing time-diagnostic from the catchment survey at Johnny Potts Spring with that at Spring 22 (data from table 1). b. Temporal profile comparing time-diagnostic from the Sawlog Ridge Springs with those from Spring 26 (data from table 1).

cussed earlier (fig. 156a). In this case, the observed Kolmogorov-Smirnov (K-S) statistic \( D = 0.341 \) does not exceed the critical value of \( D_{0.05} = 0.542 \). In statistical terms, the null hypothesis cannot be rejected (at the 0.05 level); the two samples could easily have been drawn from the same statistical population.

We conclude that, in anthropological terms, the temporal structure of Spring 22 does not differ significantly from that of the Johnny Potts Spring assemblage. This substantive interpretation is, of course, limited by the degree to which projectile points actually reflect age of occupation and by the relatively small sample sizes involved.

A larger sample—even in the same proportions—might easily produce a significant outcome, enabling the investigator to define distinct temporal structures for the two spring catchments. It is probably also true that the larger the available sample of time-markers, the greater will be the apparent diversity (for reasons discussed in the last chapter). But the K-S procedure provides a way of determining whether there is any demonstrable temporal difference in the samples at hand; conclusions about the parent populations from which these samples are drawn will always be the subject of inference.

Earlier, we compared the Sawlog Ridge and Spring 26 assemblages. The extremely small sample sizes—only two time-markers from each catchment—render this example rather typical of the surface archaeological record throughout the Desert West.

The ogives for these spring catchments are plotted on figure 156b. The two curves are superficially very different (and strongly re-
semble the horizon-specific curves from Gatecliff Shelter; (fig. 155b). Such ogives reflect only the differing relative proportions, and from inspecting such gross relationships, one might be tempted to conclude that the Sawlog Ridge sample represents a significantly earlier date of occupation.

But are the samples large enough to justify that conclusion? The Kolmogorov-Smirnov two-sample method of comparison is appropriate here because it considers both the strength of the underlying temporal relationship and the size of the samples available to monitor that difference.

Taking into account the small sample sizes ($n_1 = 2$ and $n_2 = 2$), the critical value of $D$ is found to be $D_{0.05} = 1.36$. Since any observed value of $D$ cannot exceed $D = 1$, we arrive at an interesting conclusion: no matter how different the distribution of time-markers may be—and no matter how disparate the ogives may appear—sample sizes of $n_1 = 2$ and $n_2 = 2$ are insufficient to monitor that difference.

This result has implications for all archaeological surface assemblages: even apparently radical differences in time may be misleading when viewed from the perspective of very small samples. Much of the literature of regional archaeology proceeds as if one or two time-markers could be used to date surface sites. This is simply untrue, and these impressionistic procedures do nothing but muddle an already complex situation.

THE POOLED TEMPORAL PROFILE

Temporal controls have been approached so far only in terms of discrete archaeological assemblages: two springs here, 10 horizons there. But a more expeditious technique is required to cope with the diverse data from the regional Monitor Valley sample, and it will be necessary to trade off some degree of resolution to insure that the available sample sizes are adequate to monitor change (if, in fact, such change has occurred).

Setting aside data from Gatecliff Shelter and the Mt. Jefferson fieldwork, the Monitor Valley sample contains a total of 538 time-diagnostic projectile points (table 71). This pooled sample produces the master temporal profile illustrated on figure 157.

The master point profile clearly does not precisely mimic the ideal multicomponent curve (Site C on fig. 154) because time-markers from the two earliest phases (Clipper Gap and Devils Gate) are underrepresented in Monitor Valley. This discrepancy between ideal and empirical will be duly weighted in the computations below.

Turning to another example, let us examine the following question: Do the lowland slope assemblages differ significantly in time from the overall Monitor Valley assemblage? (fig. 158a).

One must initially determine the appropriate sample sizes. In all cases considered to this point, the sample sizes have been totally independent; the size of the assemblage at, say, Johnny Potts Spring had no influence on the assemblage size from Spring 22. The Kolmogorov-Smirnov two-sample test could readily be computed using conventional sample sizes of $n_1 = 27$ and $n_2 = 17$.

But by comparing a discrete assemblage (time-markers recovered from the lowland slope) with the aggregate Monitor Valley totals, we are asking a somewhat different question. Although it might be tempting to array these results on a cumulative curve, then assess goodness-of-fit between the two ogives with a Kolmogorov-Smirnov two-sample test, this computation would violate a critical assumption of the Kolmogorov-Smirnov test. The null hypothesis ($H_0$) states that cumulative proportions of the first population are identical to those of the second population: the larger the absolute differences between cumulative proportions of the samples, the less likely becomes $H_0$. Statistical significance is assessed relative to critical values of the Kolmogorov-Smirnov statistic $D$, the magnitude of which depends only on the two sample sizes $n_1$ and $n_2$ (fig. 158a).

In the lowland slope example, the same artifacts appear twice—the 192 time-markers from the lowland slope are tallied in both the master artifact tally ($n = 538$) and the individual class total ($n_1 = 192$). This condition renders the two samples interdependent because a change in the size of the lowland slope sample automatically changes the size of the pooled sample.

Effective sampling independence can be introduced by removing the smaller, specialized sample from the pooled assemblage total within each elevational zone. A degree of
TABLE 71
Distribution of Projectile Point Types in the Regional Monitor Valley Sample

<table>
<thead>
<tr>
<th></th>
<th>Summit crest</th>
<th>Upland slope</th>
<th>Piñon-juniper woodland</th>
<th>Lowland slope</th>
<th>Valley floor</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESERT SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desert Side-notched</td>
<td>—</td>
<td>3</td>
<td>10</td>
<td>32</td>
<td>13</td>
<td>58</td>
</tr>
<tr>
<td>Cottonwood Triangular</td>
<td>—</td>
<td>2</td>
<td>10</td>
<td>22</td>
<td>12</td>
<td>46</td>
</tr>
<tr>
<td>Subtotals</td>
<td>0</td>
<td>5</td>
<td>20</td>
<td>54</td>
<td>25</td>
<td>104</td>
</tr>
<tr>
<td>ROSEGATE SERIES</td>
<td>—</td>
<td>6</td>
<td>26</td>
<td>35</td>
<td>40</td>
<td>107</td>
</tr>
<tr>
<td>ELKO SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elko Corner-notched</td>
<td>1</td>
<td>14</td>
<td>40</td>
<td>56</td>
<td>48</td>
<td>159</td>
</tr>
<tr>
<td>Elko Eared</td>
<td>—</td>
<td>16</td>
<td>11</td>
<td>29</td>
<td>18</td>
<td>74</td>
</tr>
<tr>
<td>Elko series, type unknown</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Subtotals</td>
<td>1</td>
<td>30</td>
<td>53</td>
<td>86</td>
<td>73</td>
<td>243</td>
</tr>
<tr>
<td>GATECLIFF SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gatecliff Contracting Stem</td>
<td>1</td>
<td>15</td>
<td>9</td>
<td>6</td>
<td>14</td>
<td>45</td>
</tr>
<tr>
<td>Gatecliff Split Stem</td>
<td>—</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Gatecliff series, type unknown</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Subtotals</td>
<td>1</td>
<td>21</td>
<td>15</td>
<td>15</td>
<td>25</td>
<td>77</td>
</tr>
<tr>
<td>HUMBOLDT SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humboldt Concave Base</td>
<td>—</td>
<td>5</td>
<td>10</td>
<td>6</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>Humboldt Basal-notched</td>
<td>—</td>
<td>13</td>
<td>4</td>
<td>9</td>
<td>12</td>
<td>38</td>
</tr>
<tr>
<td>Subtotals</td>
<td>0</td>
<td>18</td>
<td>14</td>
<td>15</td>
<td>24</td>
<td>71</td>
</tr>
<tr>
<td>OTHER TYPES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual Concave Base</td>
<td>—</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Large Side-notched</td>
<td>—</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Types older than Gatecliff</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Additional types</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>Grand totals</td>
<td>2</td>
<td>85</td>
<td>135</td>
<td>219</td>
<td>202</td>
<td>643</td>
</tr>
</tbody>
</table>

Freedom is lost here because the master profile is computed from the pooled sum of all individual assemblages (including the lowland slope sample). The aggregate sample size is \( n = 538 \) and the sample size from the lowland slope is \( n_1 = 192 \). Because these 192 lowland slope time-markers are included in the 538 total for Monitor Valley, the aggregate total must be adjusted by subtracting the subsample of lowland slope diagnostics. For purposes of the Kolmogorov-Smirnov test, the respective sample sizes are \( n_2 = 538 - 192 = 346 \), with \( n_1 = 192 \).

The Kolmogorov-Smirnov two-sample statistics are computed as before. The critical value is \( D_{0.05} = 0.122 \); the largest observed difference is \( D = 0.137 \). In statistical terms, the null hypothesis of no difference is rejected at the 0.05 level. That is, given the sample sizes and the absolute magnitude of the differences, the null hypothesis of no association cannot be sustained.

In substantive terms, this means that—relative to the distribution of other artifacts in Monitor Valley—time-markers are distributed differentially on the lowland slope; the available samples are sufficient to demonstrate a significant difference in age of occupation between the lowland survey assemblage and the remaining Monitor Valley assemblages.

THE CONCEPT OF EXPECTATION

Although discovering such a differential distribution is a useful first step, it is now necessary to assess the nature of that non-
random distribution. Figure 158a compares the master Monitor Valley temporal profile with the elevational distribution of time-markers recovered from the lowland slope. One can readily observe that the lowland slope assemblage has a "later" profile than the overall Monitor Valley total.

But how, exactly, does the temporal structure of the lowland slope differ from the rest of Monitor Valley? Which phases are overrepresented on the lowland slope? And which time-markers are rare?

Although the ogival technique is useful for general comparisons between temporal profiles, the cumulative proportions employed in the Kolmogorov-Smirnov two-sample statistic are, in themselves, insufficient to determine such category-by-category differences.

Here, we need a way to compute a series of a priori expected frequencies (to be ultimately compared with frequencies observed archaeologically). Not only will this expected/observed comparison smoothly pave the road to subsequent computation of cross-tabulations, but the concept of expectation is an especially important pattern recognition technique in its own right. A few remarks are in order regarding the meaning and computation of expected frequencies.

In the present example, we are evaluating the distribution of time-markers across the various elevational zones of Monitor Valley. The regional Monitor Valley assemblage contains 538 time-markers: 7 Clipper Gap diagnostics, 77 Devils Gate time-markers, 243 Reveille phase time-markers, 107 from the Underdown phase, and 104 Yankee Blade diagnostics; the frequencies for the lowland slope are a subset of these totals. The ogive showing the distribution of time-markers across elevational zones can readily be computed (fig. 158a). But as they stand, these profiles are of limited use because they tell nothing of differential sampling strategies and biasing sample size effects. Obviously, had we surveyed a larger area in, say, the lowland slope, the frequency of time-markers would have increased in this one elevational zone.

This problem is vitiated by analysis of the expected proportions within each elevational zone. Consider the following question: What is the spatial meaning of 15 Gatecliff points on the lowland slope?

This statement can be rationally assessed only in terms of an observed value projected against an expected value for occurrence. The observed value is obviously 15, but what is the expected value?

The expected value of a discrete random variable is given by

Expected value = \( p(N) \)

where \( p \) = the probability of occurrence of a given outcome, and \( N \) = the number of Bernoulli trials (Thomas, 1976: 142). That is, to find the expected value, we thus need to determine (1) the associated probability and (2) the appropriate sample size.

We begin by assessing probability. How do we determine the probability of a given outcome? Ideally, we would be able to equate
Fig. 158. Temporal profiles comparing the frequencies of time-markers from lowland and upland slopes to the master Monitor Valley temporal profile (fig. 157).

probability with ideal objects (a "fair" coin, an unbiased die, a perfectly circular dart board, etc.). But here (as in most practical applications of statistical theory), it is necessary to link theoretical, axiomatic probabilities with their real world equivalents through use of the concept of the theoretical limit.

Sidestepping the details of Bernoulli's Theorem (Thomas, 1976: 103–104), we will simply accept the practical definition of probability as expressed by the ratio of successful and unsuccessful trials:

\[ \text{probability} = p(A) = \frac{s}{s + f} \]

where \( s \) denotes the frequency of event A and \( f \) denotes the frequency of \( \bar{A} \) (read as "not A"). The sum of the frequencies of \( A + \bar{A} \) —the same as \( s + f \)—must equal \( N \), the total number of trials. When the events are theoretical, as in rolling a die or tossing an ideal coin, then the ratio \( s/(s + f) \) is a formal probability (Thomas, 1976: 105). But when actual successes and failures are enumerated, the probability is a relative frequency ratio.

It is in the "relative frequency" sense that we will employ probability for analyzing the variability within various Monitor Valley assemblages. A "success" is defined as the frequency of event A, in this case, the finding of any Devils Gate phase time-marker; table 71 indicates that event A happened exactly 77 times in the Monitor Valley survey. So defined, \( s = 77 \).

We take "failure" to be the frequency of \( \bar{A} \) ("not A"), the frequency of finding a time-marker from any other phase. Table 71 shows that the survey and excavation in Monitor Valley recovered a grand total of 7 Clipper Gap diagnostics, 243 Reveille phase time-
markers, 107 Underdown time-markers, and 104 diagnostics of the Yankee Blade phase. The frequency of failure thus becomes $f = 7 + 243 + 107 + 104 = 461$.

Employing the relative frequency definition of probability, we find

$$\text{probability} = \frac{p(A)}{s} = \frac{f}{s} = \frac{104}{278} = 0.143$$

In other words, the probability of finding a Devils Gate time-marker anywhere in Monitor Valley is $p = 0.143$.

Now we need only determine $N$ in order to compute the expected number we seek. For our purposes, $N$, the number of trials, is equated with the total number of time-markers recovered on the lowland slope. $N$ in this case is known to be 192.

It now becomes possible to compute the expected number for Devils Gate phase diagnostics on the lowland slope by multiplying the probability of finding a Devils Gate time-marker by the total number of artifacts found on the lowland slope.

$$E(X) = p(N) = 0.143(192) = 27.46$$

This becomes the expected value with which to compare the archaeological observed frequency.

The 15 Devils Gate diagnostic points actually recovered from the lowland slope is nearly twice the number one would expect to find, given the overall size of the lowland slope and aggregate Monitor Valley assemblages.

Using similar procedures, it is possible to compute expected numbers for the other time periods on the lowland slope.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Expected Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clipper Gap</td>
<td>2.50</td>
</tr>
<tr>
<td>Reveille</td>
<td>86.78</td>
</tr>
<tr>
<td>Underdown</td>
<td>38.21</td>
</tr>
<tr>
<td>Yankee Blade</td>
<td>37.06</td>
</tr>
</tbody>
</table>

We now have a valid method to derive expected numbers against which to compare our archaeologically observed values.

### NOMINAL LEVEL COMPARISONS

But how to conduct such projections? To resolve this question, we must augment the statistical procedures still further. Although temporal relationships remain ordinal (by definition), we are now asking a question at only the nominal level: Are Underdown phase-markers rare/overrepresented on the lowland slope? Are Reveille phase-markers rare/overrepresented on the lowland slope? And so forth. Accordingly, ordinal-level statistics must be replaced by statistical methods relevant to nominal data.

In this case, the standard R by C (row by column) chi-square test is useful and appropriate (Thomas, 1976: 264–284). The underlying statistical model holds that the chi-square probability distribution changes in proportion to changes in the number of degrees of freedom (df), where $df = (R - 1)(C - 1)$. A region of rejection can be computed based on a predetermined alpha level: if the observed chi-square value does not exceed the expected value, then there is no reason to question any of the underlying assumptions (including the validity of $H_0$). But when an observed chi-square statistic falls into the critical region under the appropriate probability distribution, we must search for an invalid assumption.

Fortunately, the chi-square technique makes relatively few assumptions: a nominal level of measurement, independent randomized sampling, and appropriate sample size. If these assumptions are valid, then the culprit is most likely the null hypothesis of equiprobability.

In the Monitor Valley example, the number of time-markers must be cross-tabulated by elevation to determine zone-by-zone relative frequency. We tabulated five rows (one for each phase) by two columns (lowland slope vs. the rest of the Monitor Valley time-markers). There are thus 10 observed/expected comparisons involved in each chi-square computation.

To illustrate how these computations are actually performed, let us return to the example of time-markers on the lowland slope (table 72). For tabular purposes, both rows and columns are arrayed vertically (following Thomas, 1976: 278). In the first row, we compare the observed frequency of Clipper Gap diagnostic points on the lowland slope ($O_1 = 2$), with the expected frequency of the same event (computed above to be $E_1 = 2.50$). The third column shows the difference between
"observed" and "expected" to be \( (O_1 - E_1) = -0.50 \). This difference is squared in column 4, \( (O_1 - E_1)^2 = 0.25 \). and the final column shows this product divided by the initial expectation, \( (O_1 - E_1)^2 / E_1 = 0.1000 \).

The other nine rows are computed similarly, and their sum is taken to be chi-square. In this case, table 72 indicates that chi-square \( \chi^2 = 21.3287 \), with the number of degrees of freedom computed to be \( (R - 1)(C - 1) = (5 - 1)(2 - 1) = 4 \). The exact probability associated with this value is \( p = 0.0005 \). In statistical terms, the chi-square testing tells us that the null hypothesis of no difference (between time-marker distributions on the lowland slope and the rest of Monitor Valley) must be rejected at the 0.05 level.

This outcome agrees with that obtained from the Kolmogorov-Smirnov test: sample sizes are \( n_2 = 538 - 192 = 346 \), with \( n_1 = 192 \) and the critical value is \( D_{0.05} = 0.122 \); the largest observed difference is \( D = 0.137 \) (fig. 158a).

Both statistical techniques suggest that the available samples are sufficient to demonstrate a significant difference in age of occupation between the lowland survey assemblage and the remaining Monitor Valley assemblages. Both methods have certain advantages. The ordinal-level Kolmogorov-Smirnov two-sample test is particularly useful because the results can be readily arrayed as a temporal profile (fig. 158a, discussed earlier).

But the nominal-level chi-square technique allows one to determine exactly which category of time-markers is nonrandomly distributed, and which occurs as expected. In the present example, table 72 shows exactly which cells contributed to the significant result. Consider lines 3 and 4, each representing the Devils Gate phase. Whereas the expected number of Devils Gate diagnostics for the lowland slope was computed to be 27.48, only 15 such points were actually found there. The standard chi-square computation determines that \( (O_3 - E_3)^2 / E_3 = 5.6678 \). This relatively large value contributes roughly one-quarter of the total observed chi-square value.

Similarly, the expected number of Devils Gate diagnostics found in the other four elevational zones of Monitor Valley was computed to be 49.52; 62 such diagnostic points were actually recovered. Table 72 computes that \( (O_4 - E_4)^2 / E_4 = 3.1452 \), another hefty contribution to the total chi-square value. Entries 9 and 10 show another important trend, which inflates the computed value of \( (O_9 - E_9)^2 / E_9 = 7.6760 \) and \( (O_{10} - E_{10})^2 / E_{10} = 4.2604 \).

Taken together, these four totals contribute more than 97 percent \( (20.7494/21.3287) \) of the overall variability reflected in the chi-square statistic.

From these deviations, we can draw two substantive conclusions:

1. The lowland slope contains a relative abundance of Yankee Blade time-markers.
2. The lowland slope also contains an unexpectedly low frequency of Devils Gate time-markers.

These two categories each contributed the inflated observed/expected differences that determine the overall high value of the chi-square statistic. This is how the chi-square statistic permits us to pinpoint the significant sources of variability obscured by the Kolmogorov-Smirnov test.

Before proceeding directly with the pattern recognition study, a couple of further methodological cautions are in order. Keep in mind that chi-square is not designed to measure the degree of association. Chi-square tests only measure whether the observed departure from expectation is more than what random probability would suggest (Thomas, 1976: 284). The chi-square statistic is computed as the summation (not the average) of a set of squared deviations. The magnitude of chi-square is hence a function of sample size: the larger the sample, the greater the chance for significant results. This means, among other things, that an identical association might well appear significant in a large sample, but not significant in a small sample.

Further, chi-square can be judged for significance only relative to a previously determined level of significance. In general, it is irrelevant whether the computed value is \( p < 0.001 \) or \( p < 0.000,000,001 \) (Thomas, 1976: 284). The one important thing about a chi-square statistic is whether the previously set alpha level was exceeded or not. Statistical devices other than chi-square
TABLE 72
Worksheet Comparing Temporal Distribution of Lowland Slope Sample
Against the Aggregate Monitor Valley Assemblage

<table>
<thead>
<tr>
<th>Elevational zone</th>
<th>O_i</th>
<th>E_i</th>
<th>(O_i - E_i)</th>
<th>(O_i - E_i)^2</th>
<th>(O_i - E_i)^2/E_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clipper Gap phase, Lowland slope</td>
<td>2</td>
<td>2.50</td>
<td>-0.50</td>
<td>0.25</td>
<td>0.1000</td>
</tr>
<tr>
<td>2. Clipper Gap phase, rest of Monitor Valley</td>
<td>5</td>
<td>4.50</td>
<td>0.50</td>
<td>0.25</td>
<td>0.0556</td>
</tr>
<tr>
<td>3. Devils Gate phase, Lowland slope</td>
<td>15</td>
<td>27.48</td>
<td>-12.48</td>
<td>155.75</td>
<td>5.6678</td>
</tr>
<tr>
<td>4. Devils Gate phase, rest of Monitor Valley</td>
<td>62</td>
<td>49.52</td>
<td>12.48</td>
<td>155.75</td>
<td>3.1452</td>
</tr>
<tr>
<td>5. Reveille phase, Lowland slope</td>
<td>86</td>
<td>86.72</td>
<td>-0.72</td>
<td>0.52</td>
<td>0.0060</td>
</tr>
<tr>
<td>6. Reveille phase, rest of Monitor Valley</td>
<td>157</td>
<td>156.28</td>
<td>0.72</td>
<td>0.52</td>
<td>0.0033</td>
</tr>
<tr>
<td>7. Underdown phase, Lowland slope</td>
<td>35</td>
<td>38.19</td>
<td>-3.19</td>
<td>10.18</td>
<td>0.2665</td>
</tr>
<tr>
<td>8. Underdown phase, rest of Monitor Valley</td>
<td>72</td>
<td>68.81</td>
<td>10.18</td>
<td>10.18</td>
<td>0.1479</td>
</tr>
<tr>
<td>9. Yankee Blade phase, Lowland slope</td>
<td>54</td>
<td>37.12</td>
<td>16.88</td>
<td>284.93</td>
<td>7.6760</td>
</tr>
<tr>
<td>10. Yankee Blade phase, rest of Monitor Valley</td>
<td>50</td>
<td>66.88</td>
<td>-16.88</td>
<td>284.93</td>
<td>4.2604</td>
</tr>
<tr>
<td>Totals</td>
<td>538</td>
<td>538.00</td>
<td></td>
<td></td>
<td>chi-square = 21.3287</td>
</tr>
</tbody>
</table>

should be used if one is interested in the strength of association (Thomas, 1976: chap. 12).

Throughout this volume, we employ the $p < 0.05$ level to denote statistical significance; the $p < 0.01$ level is termed highly significant. I feel considerably more sanguine about results which exceed $p = 0.01$.

Because of the importance of size in chi-square computations, it is wise to adopt a series of consistent guidelines as to when chi-square results can be trusted. In general, we will follow the following recommendations (after Thomas, 1976: 298). The chi-square is appropriate whenever:

a. all expected values ($E_i$) are greater than 5; or
b. not more than 20 percent of the cells have expected values less than 5, and no single $E_i$ is less than 1; or
c. more than 20 percent of the cells have $E_i$ less than 5, and no $E_i$ is less than 2.

These are not hard-and-fast rules, but rather flexible guidelines that help one judge the significance (or lack of it) in the Monitor Valley data. The meaning of these associations is considered subsequently.

Whereas ordinal-level statistics, like the Kolmogorov-Smirnov family of tests, offer some advantages (especially by employing higher quality data and the ability to portray the results graphically), the chi-square test is useful because the expected frequencies allow us to determine relative frequency on a zone-by-zone basis.

The obvious question arises: What happens if the two statistical tests do not agree? Although there is some controversy over which test is more powerful—"power" being the probability of rejecting $H_0$ when $H_0$ is actually false—statisticians generally feel that the Kolmogorov-Smirnov test is more powerful than the chi-square test in most situations (e.g., Siegel, 1956: 136; Slakter, 1965; Conover, 1971: 295).

As a practical matter, we will follow a rather conservative procedure in dealing with variability within Monitor Valley: In any particular case, the null hypothesis ($H_0$) of no association will not be rejected unless both the chi-square and K-S statistics agree. This procedure means that we slightly inflate the probability of a Type II error—in the long run, we will end up not rejecting $H_0$ in some cases when $H_0$ is actually false (Thomas, 1976: 212–213); simultaneously, we are slightly decreasing the probability of committing a Type I error (rejecting a true $H_0$). In practice, this makes the alpha level of 0.05 slightly conservative. But considering the overall assumptions involved with the Monitor Valley sample design, these distortions are minimal and create no practical problems.

TEMPORAL VARIABILITY POOLED BY ELEVATION

We now return to the specifics of the regional Monitor Valley sample by examining variability from three independent perspec-
tives—elevation, geography, and context. The assemblage-by-assemblage consideration of these questions will define, in a fairly objective manner, the degree of temporal variability (or redundancy) among and within the various Monitor Valley artifact sets.

We begin by looking at temporal structure from an elevational perspective. Artifacts from the various survey and excavation contexts within Monitor Valley are grouped into the six elevational categories employed in chapter 6; we can now determine whether there is a significant difference between pooled contextual assemblages and the aggregate assemblage of all Monitor Valley time-markers.

Do summit crest assemblages differ significantly in time from the overall Monitor Valley assemblage? Excluding the work on Mt. Jefferson, we found only two time-markers in the survey of the Monitor Valley summit crest. No statistical analysis is feasible because of the small sample.

Do upland slope assemblages differ significantly in time from the overall Monitor Valley assemblage? Pooled time-marker frequencies for the upland slope appear on table 71. The aggregate Monitor Valley sample size is \( n = 538 \) and the pooled upland slope sample size is \( n_1 = 62 \) (fig. 158b). In order to retain statistical independence, the aggregate total must be adjusted by subtracting the subsample of upland slope diagnostics; adjusted aggregate assemblage size becomes \( n_2 = n - n_1 = 538 - 62 = 476 \).

The critical values are computed to be \( D_{0.05} = 0.184 \) and \( D_{0.01} = 0.220 \). The largest difference for the observed Kolmogorov-Smirnov statistic is \( D = 0.253 \) (chi-square = 28.0777, df = 4, \( p = 0.0001 \)), so the null hypothesis of no temporal difference is rejected at the 0.01 level.

The available samples demonstrate a highly significant difference in temporal structure between the pooled upland slope sample and the remaining Monitor Valley assemblages. Specifically, the upland slope contains a relative abundance of Devils Gate time-markers (\( n = 21 \); expectation = 8.87). Underdown phase (\( n = 6 \); expectation = 12.33) and Yankee Blade time-markers (\( n = 5 \); expectation = 11.99) are correspondingly relatively rare.

Do piñon-juniper woodland assemblages differ significantly in time from the overall Monitor Valley assemblage? Survey and excavation recovered 114 time-markers from the woodland. The appropriate sample sizes for the Kolmogorov-Smirnov test are thus \( n_1 = 114 \) and \( n_2 = 538 - 114 = 424 \). The critical value is \( D_{0.05} = 0.143 \); the largest observed difference is \( D = 0.031 \) (chi-square = 2.93136, df = 4, \( p = 0.5722 \)). The null hypothesis of no difference cannot be rejected at the 0.05 level.

The observed samples are insufficient to establish a significant difference in distribution between time-markers in the piñon-juniper woodland and those found elsewhere in Monitor Valley.

Do the lowland slope assemblages differ significantly in time from the overall Monitor Valley assemblage? The largest sample of time-markers came from the lowland slope, and these diagnostics were used above to illustrate the statistical procedures employed (fig. 158a). To recap, the Kolmogorov-Smirnov sample sizes are \( n_2 = 538 - 192 = 346 \), with \( n_1 = 192 \). The critical value is \( D_{0.05} = 0.122 \); the largest observed difference is \( D = 0.137 \) (chi-square = 21.3287, df = 4, \( p = 0.0005 \)). The null hypothesis of no difference is rejected at the 0.05 level.

The available samples demonstrate a significant difference in age of occupation between the lowland survey sample and the remaining Monitor Valley assemblages. Specifically, the lowland slope contains a relative abundance of Yankee Blade time-markers (\( n = 54 \); expectation = 37.12), with Devils Gate diagnostics underrepresented (\( n = 15 \); expectation = 27.48).

Do valley floor assemblages differ significantly in time from the overall Monitor Valley assemblage? The valley floor sample contains 168 time-markers. The sample sizes are thus \( n_2 = 538 - 168 = 370 \), with \( n_1 = 168 \). The critical value is \( D_{0.05} = 0.127 \); the largest observed difference is \( D = 0.065 \) (chi-square = 9.87292, df = 4, \( p = 0.0426 \)). Once again, the Kolmogorov-Smirnov and chi-square results fail to agree; accordingly, we will not reject the null hypothesis.

We judge the observed samples insufficient to establish a significant difference in distri-
bution between time-markers in the valley bottom and those found elsewhere in Monitor Valley. We must note, however, that the chi-square analysis of the valley bottom contains a slightly inflated frequency of Underdown time-markers \( n = 40; \) expectation = 33.41, with Yankee Blade diagnostics \( n = 25; \) expectation = 32.48) somewhat under-represented.

**TEMPORAL VARIABILITY POOLED BY GEOGRAPHY**

We can also analyze temporal variability from the perspective of the geographic criteria introduced in chapter 6 (and discussed in considerably more detail in chap. 10). Keep in mind that a subset of the 538 time-markers discussed above is now being reanalyzed here.

*Do assemblages from the major corridors through the Toquima Range differ significantly in time from the overall Monitor Valley assemblage?* Each assemblage associated with corridors cutting through the Toquima Range was compared with the master Monitor Valley temporal profile, with the following results:

**Hickison Corridor:** \( n_1 = 27, n_2 = 538 - 27 = 511.\) The critical value is \( D_{0.05} = 0.269\) and the observed difference is \( D = 0.108\) (samples too small to compute chi-square).

**Central Corridor:** \( n_1 = 36, n_2 = 538 - 36 = 502.\) The critical value is \( D_{0.05} = 0.235\) and the observed difference is \( D = 0.122\) (chi-square = 4.16367, \( df = 4, p = 0.3854\)).

**Northumberland Corridor:** \( n_1 = 105, n_2 = 538 - 105 = 433.\) The critical value is \( D_{0.05} = 0.147\) and the observed difference is \( D = 0.111\) (chi-square = 9.07471, \( df = 4, p = 0.0591\)).

In no case can the null hypothesis of no temporal difference be rejected at the 0.05 level.

All three corridors were then pooled for comparison with the master Monitor Valley temporal profile: \( n_1 = 168, n_2 = 538 - 168 = 370.\) The critical value is \( D_{0.05} = 0.127\) and the observed difference is \( D = 0.054\) (chi-square = 8.8186, \( df = 4, p = 0.0656\)). Once again, the null hypothesis could not be rejected at the 0.05 level.

*Do assemblages from the Middle Toquima block differ significantly in time from the overall Monitor Valley assemblage?* The critical value is \( D_{0.05} = 0.133 (n_1 = 141, n_2 = 538 - 141 = 397)\) and the observed difference is \( D = 0.038\) (chi-square = 3.07586, \( df = 4, p = 0.5478\)). The null hypothesis cannot be rejected at the 0.05 level.

The pooled corridor assemblage can also be compared to the sample from the Middle Toquima block: \( n_1 = 141, n_2 = 168.\) The critical value is \( D_{0.05} = 0.155\) and the observed difference is \( D = 0.065\) (chi-square = 5.66477, \( df = 4, p = 0.2253\)). The null hypothesis could not be rejected at the 0.05 level.

*Do assemblages from the eastern Toquima flank differ significantly in time from the overall Monitor Valley assemblage?* The critical value is \( D_{0.05} = 0.126 (n_1 = 172, n_2 = 538 - 172 = 366)\) and the observed difference is \( D = 0.055\) (chi-square = 4.37111, \( df = 4, p = 0.3588\)). The null hypothesis cannot be rejected at the 0.05 level.

*Do assemblages from the western Toquima flank differ significantly in time from the overall Monitor Valley assemblage?* The critical value is \( D_{0.05} = 0.131 (n_1 = 148, n_2 = 538 - 148 = 390)\) and the observed difference is \( D = 0.143\) (chi-square = 10.6664, \( df = 4, p = 0.0307\)). The Kolmogorov-Smirnov two-sample and chi-square tests both suggest that null hypothesis should be rejected at the 0.05 level.

The available samples demonstrate a significant difference in age of occupation between the samples from the western Toquima flank and the remaining Monitor Valley assemblages. Specifically, the western flank contains a relative abundance of Yankee Blade time-markers \( n = 38; \) expectation = 28.61, with Devils Gate diagnostics under-represented \( n = 12; \) expectation = 21.18.

**TEMPORAL VARIABILITY POOLED BY CONTEXT**

Finally, we will determine whether there is a significant difference between the various
Fig. 159. Temporal profiles comparing time-marker frequencies from a. excavated caves and shelters in Monitor Valley and b. assemblages recovered in proximity to rock alignments with the master Monitor Valley temporal profile derived in figure 157 (the shaded line). Note that the artifacts from Gatecliff Shelter are excluded from a.

recovery contexts (discussed in chap. 7, and more rigorously defined in chap. 12) and the aggregate assemblage of all Monitor Valley time-markers.

**Do montane spring assemblages differ significantly in time from the overall Monitor Valley assemblage?** The aggregate sample size remains \( n = 538 \) and the pooled montane spring sample size is \( n_1 = 119 \). The aggregate total is adjusted by subtracting the subsample of montane spring diagnostics: \( n_2 = n - n_1 = 538 - 119 = 419 \). The critical value is computed to be \( D_{0.05} = 0.141 \), and the largest difference for the observed Kolmogorov-Smirnov statistic is \( D = 0.073 \) (chi-square = 3.30081, df = 4, \( p = 0.5112 \)). The null hypothesis of no temporal difference cannot be rejected at the 0.05 level.

The available samples do not indicate any difference in temporal structure between the pooled montane spring samples and the remaining Monitor Valley assemblages.

**Do valley floor assemblages differ significantly in time from the aggregate Monitor Valley assemblage?** The subsample size is \( n_1 = 92 \) and, as before, the grand aggregate total is adjusted: \( n_2 = 538 - 92 = 446 \). The critical value is \( D_{0.05} = 0.156 \) and the observed difference is only \( D = 0.076 \). But in this case, the chi-square test discloses a significant result (chi-square = 11.4148, df = 4, \( p = 0.0225 \)).

A similar outcome occurred when the valley bottom elevational sample was considered above; once again, the Kolmogorov-Smirnov and chi-square results fail to agree,
and we will adhere to the conservative course and not reject the null hypothesis. We judge the observed samples insufficient to establish a significant difference in distribution between time-markers in the valley bottom and those found elsewhere in Monitor Valley.

We must note, however, that the chi-square analysis of the valley bottom indicates a slightly inflated frequency of Underdown time-markers (208; expectation = 201.45) and underrepresentation of Yankee Blade diagnostics (n = 12; expectation = 17.78) and Reveille time-markers (n = 35; expectation = 41.55).

**Do cave and rock-shelter assemblages differ significantly in time from the overall Monitor Valley assemblage?** The pooled sample size is n = 127, so the aggregate total becomes n = 538 - 127 = 411. The critical value is D_{0.05} = 0.138 and the maximum observed difference is D = 0.143 (chi-square = 18.0651, df = 4, p = 0.0016). Both statistical techniques suggest that the null hypothesis of no temporal difference should be rejected at the 0.05 level (fig. 159a).

The available samples disclose a significant difference in age of occupation between shelter/cave assemblages and the remaining assemblages in Monitor Valley. Figure 159a shows that early time-markers are relatively rare in the excavated caves and shelters of Monitor Valley. Specifically, the cave and shelter samples contain a slight overrepresentation of Reveille phase (n = 69; expectation = 57.36) and Yankee Blade (n = 30; expectation = 24.55) time-markers; Devils Gate phase diagnostics (n = 5; expectation = 18.18) are underrepresented.

To the extent that projectile point types are adequate to detect time-specific archaeological occupations, we conclude that (with the exception of Gatecliff Shelter) the rock-shelters of Monitor Valley were, in general, occupied significantly later than were the open sites.

The earliest levels of Triple T Shelter are also exceptions; but the Triple T data have been pooled with other excavated sites, so this difference is not apparent on the temporal profile.

We also tested each of the unpoolecave and shelter samples against the overall Monitor Valley profile; in each case, the results did not permit rejection of the null hypothesis. Since we know from the pooled results that such differences do indeed exist, we must conclude that the small point samples at individual sites have obscured site-by-site temporal differences.

**Do rock-alignment-associated assemblages differ significantly in time from the overall Monitor Valley assemblage?** Sixty-seven time-markers were found here (fig. 159b), so n = 67 and n = 538 - 67 = 471. The critical value is D_{0.05} = 0.178, and the greatest ogival difference is D = 0.209 (chi-square = 14.0617, df = 4, p = 0.0076). Both statistical procedures suggest that the null hypothesis of no temporal difference be rejected at the 0.05 level.

The available samples disclose a significant difference in age of occupation between rock-alignment-associated assemblages and the remaining sample from Monitor Valley. Specifically, rock alignments had an abundance of Devils Gate phase (n = 15; expectation = 9.59) and Reveille phase time-markers (n = 38; expectation = 30.26). Underdown projectile points (n = 5; expectation = 12.33) were correspondingly underrepresented.

**Do pictograph-associated assemblages differ significantly in time from the overall Monitor Valley assemblage?** As discussed in chapter 6, several sites were surveyed and collected within 1 km catchment zones at several Monitor Valley rock art sites. The current statistical methods allow us to explore whether the assemblages associated with both pictograph and petroglyph sites define a unique temporal structure within Monitor Valley.

Fifty-seven temporal diagnostics were found near pictograph sites, so n = 57 and n = 538 - 57 = 481. The critical values are D_{0.05} = 0.191 and D_{0.01} = 0.111 (chi-square = 3.9631, df = 4, p = 0.5875). The null hypothesis of no temporal difference cannot be rejected for the pictograph-associated assemblages.

The available samples are insufficient to disclose any significant differences in age of occupation between pictograph-associated assemblages and the remaining sample of Monitor Valley.
Do the petroglyph-associated assemblages differ significantly in time from the overall Monitor Valley assemblage? A total of 49 temporal diagnostics were found in these contexts, so \( n_1 = 49 \) and \( n_2 = 538 - 49 = 489 \). The critical values are \( D_{0.05} = 0.191 \) and \( D_{0.01} = 0.111 \) (chi-square = 15.772, df = 4, \( p = 0.0039 \)). The Kolmogorov-Smirnov and chi-square results fail to agree. Accordingly, we will not reject the null hypothesis. The observed samples are insufficient to establish a significant difference in distribution between time-markers associated with petroglyph sites and those found elsewhere in Monitor Valley.

It is worth noting, however, that the chi-square test shows slightly inflated frequencies of Clipper Gap (\( n = 3 \); expectation = 0.64) and Yankee Blade diagnostics (\( n = 15 \); expectation = 9.47); Reveille phase time-markers (\( n = 15 \); expectation = 22.13) are somewhat underrepresented.

Do the aggregate rock art-associated assemblages differ significantly in time from the overall Monitor Valley sample? We now pool the pictograph- and petroglyph-associated sites, and examine the joint distribution of time-markers. The sample sizes are \( n_2 = 538 - 106 = 432 \), with \( n_1 = 106 \). The critical value is \( D_{0.05} = 0.147 \); the largest observed difference is \( D = 0.123 \) (chi-square = 11.3601, df = 4, \( p = 0.0230 \)). The null hypothesis of no difference is not rejected at the 0.05 level.

The available samples fail to demonstrate a significant temporal differentiation for the rock art-associated assemblages.

Do the streamside assemblages differ significantly in time from the overall Monitor Valley sample? The temporal curve for the pooled streamside contexts has sample sizes of \( n_2 = 538 - 22 = 516 \), with \( n_1 = 22 \). The critical value is \( D_{0.05} = 0.296 \); the largest observed difference is \( D = 0.077 \); the samples are too small for valid computation of chi-square. The null hypothesis of no difference cannot be rejected at the 0.05 level.

The available sample sizes fail to demonstrate any significant temporal differentiation between the streamside contexts and the rest of the Monitor Valley time-markers.

**SUMMARY AND IMPLICATIONS: TEMPORAL STRUCTURE OF PREHISTORIC MONITOR VALLEY**

This chapter highlights several traditional problems in defining the temporal placement of archaeological assemblages, particularly those recovered in nonstratified contexts. Rather than relying merely upon traditional, intuitive techniques, we have attempted to define a relatively objective, generalized method to compare temporal structuring between surface and excavated assemblages. Provided that adequate external controls are available, the relative frequency of time-markers can be taken as an indirect index to monitor temporal variability. Although this procedure has obvious limitations, the method provides a serviceable, first-order approximation of how land-use patterns changed through time.

**Pattern I:** The single most important finding is the high degree of spatial redundancy evident in the prehistoric archaeological record of Monitor Valley. Most sites and catchment areas were periodically reused over long periods of time, and much of the prehistoric archaeological debris occurs in multicomponent palimpsest aggregations. At this level of resolution, it is very difficult to distinguish significant change through time. This finding cannot be overemphasized.

**Pattern II:** Despite this overriding lack of temporal change, a few trends did emerge in Monitor Valley. Most striking is the extraordinary temporal definition within the deep stratigraphic section at Gatecliff Shelter. Five distinctive and statistically independent temporal profiles emerge—one characteristic curve for each cultural phase.

But one must not read too much into the stratigraphic column of Gatecliff Shelter. Grain size of buried archaeological assemblages is generally determined by natural rather than cultural processes. Gatecliff Shelter contains an extremely well-defined archaeological record, temporally segregated by complex, interfingering, sterile, and cultural lenses. The stratigraphy of Gatecliff Shelter can be divided into 16 cultural horizons because of the unique geomorphology of Mill Canyon, not because of the unique behavior...
of the prehistoric human occupants. Gatecliff Shelter notwithstanding, the temporal structure of Monitor Valley is best characterized in terms of long-term stability.

**Pattern III:** Three assemblages proved to be significantly later than the overall Monitor Valley sample: the lowland slope, the western Toquima flank, and the cave and shelter sample. In all three cases, Yankee Blade time-markers were relatively abundant, and Devils Gate diagnostics were underrepresented.

But remember that each assemblage has resulted from a different axis of variability: the lowland slope is an elevational grouping, the western Toquima flank is a geographic category, and the cave/shelter assemblage is pooled on contextual grounds.

When examined in detail, we see that these mutually nonexclusive categories are each dominated by the Triple T Shelter assemblage (and, to a much lesser extent, that from Jeans Spring Shelter). Although the projectile point sample from Triple T is indeed rather skewed toward later types, the radiocarbon chronology of Triple T Shelter follows this trend only in part. Although Triple T contains noteworthy later-phase components, it was initially occupied much earlier. The earliest date at Triple T Shelter is 4390 B.C. ± 160, and although this date is questionable, a cluster of four other radiocarbon dates firmly establishes the initial occupation of Triple T Shelter as prior to 3400 B.C. (table 14). Although the relatively fine-grained context of this site permits, of course, finer temporal discrimination than that available for the more common surface assemblages, we attribute no major significance to the fact that the projectile point sample contains a relatively larger proportion of later types.

**Pattern IV:** The rock alignment and upland slope assemblages were shown to be significantly earlier than the overall Monitor Valley sample. In both cases, Devils Gate diagnostics were relatively abundant, with later types underrepresented. But as noted above, these assemblages had resulted from classifications reflecting different axes of variability. Each is dominated by a single common denominator, the relatively large sample associated with the Table Mountain rock alignment.

This finding is important, because it highlights the only truly single-component assemblage in Monitor Valley. If the Table Mountain assemblage is behaviorally associated with the serpentine rock alignment—a rather large assumption—then it follows that this labor-intensive facility probably was constructed during the Devils Gate phase (ca. 3000 to 1300 B.C.).

The Table Mountain rock alignment is unique in Monitor Valley. But this site may belong to a widespread regional pattern since several high-cost hunting facilities in the central and western Great Basin seem to be associated with Devils Gate assemblages (Pendleton and Thomas, 1983). This regional patterning would seem to support an assumption that the assemblage and the facility at Table Mountain are behaviorally associated.

These are the major temporal changes evident in the prehistoric archaeological record of Monitor Valley. But this analysis demonstrates that—with certain notable exceptions—the prehistoric archaeological record of Monitor Valley consists largely of long-term, multicomponent, palimpsest accumulations. Although temporal discontinuities can be detected among and between some Monitor Valley assemblages, demonstrable change through time is not characteristic. We find the overall degree of temporal variability to be quite low (or, equally likely, the available sample sizes are insufficient to monitor that variability). In any case, the temporal structure shows a high degree of locational redundancy, with most catchments periodically reused over the past four or five millennia.

**NOTES**

1. There is a special case of the Kolmogorov-Smirnov two-sample test that simplifies the computations. Whenever \( n_1 = n_2 \) and both values are smaller than 40, a simple table provides the critical values of the Kolmogorov-Smirnov statistic. In this and subsequent chapters, the short-cut table (supplied in Thomas, 1976: table A.8a) will be consulted wherever applicable.

2. Because of the overwhelming sample size, the five pooled curves from Gatecliff Shelter will not be added to the general Monitor Valley comparisons.
3. These early samples can, perhaps, be augmented when we find the true temporal relationship of Large Side-notched and other relatively early points. For now, these types are excluded from the temporal profiles. In addition, Humboldt series points are not considered to be temporally diagnostic, and are excluded from all calculations.

4. It may be that the sample size/sample diversity problem is operating here (as discussed in chap. 9; see also Thomas, 1983b: chap. 20): as the sample size becomes larger, so does the probability that early remains will be contained therein. The Gatecliff and Triple T Shelter assemblages are the largest in the cave and shelter sample from Monitor Valley. The smaller sites seem consistently to date later, at least in part because of the smaller assemblage sizes.

5. This is not strictly true. In the next volume of this series, we discuss the Alta Toquima complex, an unusual high-altitude utilization of Monitor Valley (Thomas, 1982c). The archaeological record of the Alta Toquima/Mt. Jefferson area likewise reinforces the temporal patterning of high-cost hunting facilities. Because we have not yet presented the primary data for the Alta Toquima complex, we will postpone such comparisons for a subsequent volume in this series.
CHAPTER 10. PATTERN RECOGNITION: VARIABILITY BY ELEVATION

In the last chapter we explored the temporal structure of the various Monitor Valley assemblages. Among other results, we detected some significant, if subtle, differences within the temporal structure of Monitor Valley. When the assemblages were grouped by elevational criteria—presumably reflecting vertical vegetational zonation—we found the upland slope to contain an inordinate quantity of early time-markers, specifically Gatecliff series points which date to the Devils Gate phase (ca. 3000–1300 B.C.). Conversely, the lowland slope was characterized by a relative abundance of Underdown phase (ca. A.D. 700–1300) and Yankee Blade (ca. A.D. 1300–1850) diagnostics. While these findings cannot be interpreted in isolation, they do provide some clues toward understanding the prehistoric cultural geography of Monitor Valley.

It may be disturbing to some that so much effort was expended in analyzing a single artifact category—projectile points. After all, typable projectile points comprise less than 15 percent of the total Monitor Valley assemblage.

The apparent preoccupation with projectile points follows from a basic procedural assumption, namely, that relatively gross, regional patterns of temporal variability are most readily defined by a deliberately simplified, modal perception of culture:

... when archaeologists set out to monitor chronological changes, most of the cultural complexity can (provisionally) be ignored. So long as one merely attempts to partition the archaeological record into manageable segments of temporal and spatial variability, ... the cultural system can be momentarily overlooked. Time-space divisions are most clearly reflected in shared, modal cultural behavior. (Thomas, 1979: 159)

By focusing directly on selected, time-sensitive products of modal behavior—material culture shared by most participants—one can more readily monitor cultural changes along the spatial/temporal axis. This is how archaeologists have defined basic temporal units for decades, and for good reason.

But the modal perception is severely limited to bald statements about time-space regularities. To define patterns of prehistoric cultural geography, it is necessary to embrace a considerably broader empirical and epistemological spectrum—not just the rest of the artifact assemblage, but also the available ecofacts, features, structures, locational data, intrasite patterning, and so forth.

As we expand empirical horizons, it is necessary simultaneously to shift the theoretical frame of reference. Although the eclectic modal perspective assisted in fleshing out the time-space framework, it is wildly inappropriate for addressing the more anthropological objectives of this project (as detailed in Thomas, 1983a).

We shift at this point to a more systemic approach. Rather than dealing with the aggregates of “cultural traits” that happen to be shared, a systemic approach attempts to embrace the suite of structural elements basic to the human ecological condition (as discussed by Thomas, 1979: 102–107).

This conceptual shift requires attendant procedural changes. Archaeologists concerned only with monitoring material change through time are free to analyze a purposefully limited artifact set using deliberately simplified techniques. But when the data set embraces the entire range of potential archaeological inputs, the procedural framework must be accordingly expanded. The remaining pattern recognition studies proceed through sequential levels of analysis: the artifact, the assemblage, internal site structure, and settlement. Finally, in chapter 19, we attempt to explain these correlations and trends by recourse to relevant middle range theory.

THE ELEVATIONAL ZONES OF MONITOR VALLEY

The elevational divisions of Monitor Valley were previously set out in terms of five zones (Thomas 1983a: 141–145; see also fig. 160). These partitions clearly reflect the floristic and geomorphic structure of Monitor Valley. The nature of archaeological inves-
tigation and relative degree of resulting bias have been assessed elsewhere (chaps. 1 and 7, this volume).

The Summit Crest: Monitor Valley landscape higher than 2750 m (9025 ft). Today, this high country is characterized by relatively barren sagebrush-covered slopes, sedge and grass-dominated tundra, and dense patches of limber pine. This volume deals with the summit crest only peripherally (table 63). Roughly 440 ha (1090 acres) were intensively surveyed in the White Rock Springs catchments, and we recorded the San Juan Canyon rock blind as part of the 1970 Reese River systematic survey. Note that the excavations at Alta Toquima Village and the intensive survey of the Mt. Jefferson area, covering roughly 1580 ha (3900 acres) are excluded from this analysis (see Thomas, 1982c).

The Upland Slope: Monitor Valley landscape contained between 2500 and 2750 m. This upland zone is dominated by a sagebrush-grass community; the lower margin often includes mountain mahogany as overstory. Controlled Surface Survey in the Monitor Range. A horseback survey was initially conducted in the high country of the Monitor Range in 1976 (chap. 1), and we found the density of archaeological materials to be low, with the surface assemblages tightly clustered around permanent water sources. The Table Mountain rock alignment was examined in some detail as a result of this preliminary reconnaissance. Controlled Surface Survey in the Toquima Range. The upland slope of the Toquima Range was examined primarily by spring catchment survey; 6 of the 15 randomly selected springs occur here. Although the Toquima uplands were included in the universe of the systematic quadrat sampling, none of the random quadrats fell into this area.

The Piñon-Juniper Woodland: Monitor Valley landscape contained between 2250 and 2500 m. This arbitrarily designated zone includes the major mountainside communities: piñon-juniper overstory, linear riparian associations, and a rather diverse understory. Five archaeological sites were excavated in the Monitor Valley woodland, and 4775 ha (11,800 acres) were examined in close-order systematic survey. Excavation. Five sheltered sites were tested and/or excavated in the woodland of the Toquima Range: Gatecliff Shelter, Toquima Cave, Grenouille Verte Cave, Northumberland Cave, and Ny1059. Two additional sites—Butler Ranch Cave and Little Empire Shelter—were excavated in the Monitor Range woodland. Roughly 600 m³ of deposit were excavated at Gatecliff Shelter; excavations at the other six sites totaled approximately 25.7 m³. Gatecliff Shelter is excluded from the analysis in this chapter. Controlled Surface Survey in the Toquima Range. This woodland zone was explored in three 1 km spring survey catchments, eight randomized 500 m square quadrats, and three streamside surveys in Stoneberger, Ikes, and Mill canyons. The Toquima Cave rock art survey catchment also falls into this zone. Controlled Surface Survey in the Monitor Range. This woodland area was systematically surveyed only in the Butler Ranch Cave catchment survey, although extensive reconnaissance was conducted in its upland reaches (chap. 1).

The Lowland Slope: Monitor Valley landscape contained between 2100 and 2250 m. This intermediate zone generally consists of active alluvial slopes and the low foothills of the Toquima and Monitor Valley ranges. The lowland slope is dominated by sagebrush-grass associations. Three archaeological sites were excavated and approximately 1780 ha (4400 acres) were examined in close order systematic survey. Excavation. We estimate that 62 m³ of stratified deposits were excavated from sites on the lowland slope. We excavated both Triple T and Jeans Spring shelters, stratified archaeological sites on the lower slope of the Toquima Range. Hunts Canyon Shelter, located at the extreme southern end of Monitor Valley, was also tested. Controlled Surface Survey. The surface archaeology of the lowland slope was examined in several ways: three randomized 1 km spring catchment surveys, four fully recorded rock art localities (two of which were examined in 1 km catchment surveys), one hunting barrier, two 100-m-wide transects across the lowland slope south of Mill Canyon, and five randomized 500 m quadrats (table 63).

The Valley Bottom: Monitor Valley land-
scape below 2100 m. This bottomland is dominated by a shadscale vegetation near Monitor Lake; a sagebrush-grass association blankets the higher parts of the valley bottom. *Excavations.* We found little to excavate on the floor of Monitor Valley. Bradshaw and Boring-as-Hell shelters were the only sites tested; both lie outside the study area proper. Only 2.5 m$^3$ of archaeological deposit were excavated. *Controlled Surface Survey.* Approximately 1753 ha (about 4332 acres) were systematically surveyed: one randomized 1 km spring survey (Disaster Spring), seven randomly selected 500 m$^2$ quadrats, and three arbitrarily selected 1 km spring catchment surveys (Dianas Punch Bowl, Potts Ranch Spring, and White Sage Spring). Rock features were mapped and collected at Box Spring, and in the Monitor Hills. Surface materials were also mapped and collected at the Monitor Lakebed site and at the Hickison Summit rock art site.
Valley elevational zones. Zonal ogives can potentially take on a number of distinctive profiles, and three such ideal curves are shown on figure 161.

1. The elevationally undifferentiated curve: A straight line results whenever artifacts are evenly distributed across the elevational zones in a given landscape.
2. The lowland curve: This characteristic ogive rises rapidly and reaches the upper asymptote whenever artifacts are restricted to the lowest elevations.
3. The upland curve: The profile remains on the horizontal axis and then rises steeply whenever artifacts are restricted to the highest elevations.

These cumulative curves represent the extremes among an infinite number of possibilities that could describe empirically observed assemblage frequencies.

In actual application, one must adjust the theoretical distributions to account for the number of elevational zones and the differential sample sizes available from each zone. Figure 162a plots the pooled artifact distribution for the regional Monitor Valley assemblage (n = 4260). This empirical curve rises rapidly, reflecting the relatively larger sample sizes from the valley bottom and the lowland slope. The profile then gradually approaches the asymptote at the upper axis. Given this valley-wide distribution pattern, it is now possible to partition the master profile to assess the spatial distribution of individual artifact categories.

Let us briefly recap the methods employed. Suppose that one wishes to evaluate the elevational distribution of metates across Monitor Valley. The regional Monitor Valley assemblage contains 63 metates, recovered in four of the five elevational zones (table 73): 6 metates from the valley bottom, 25 from the lowland slope, 25 from the woodland, 7 from the upland slope, and none on the summit crest.

The ogive for these 63 metates is computed as before. Although the ogival technique allows us to make some general comparisons between elevational profiles, the Kolmogorov-Smirnov two-sample statistic is insufficient to determine precise category-by-category differences (fig. 162b).

As before, we must compute a series of a

All assemblages discussed in this volume can be assigned to one of these five elevational divisions, analyzed below.

HOW TO ASSESS ELEVATIONAL VARIABILITY

We now address a deceptively simple question: Are the 4260 artifacts in the regional Monitor Valley sample differentially sorted by elevation?

The cumulative curve technique can be modified to see how the prehistoric assemblages in Monitor Valley are arrayed spatially. Figure 162 plots several cumulative artifact frequencies across the five Monitor Valley landscape.

Fig. 161. Theoretical distributions of artifact assemblages across the Monitor Valley landscape. The vertical axis arrays cumulative proportions of artifact classes; the horizontal axis divides Monitor Valley into five ordinal elevational zones (as defined by Thomas, 1983a: 141–144).
priori expected frequencies, not only as a first step for the subsequent chi-square computations, but the concept of expectation provides a critical pattern recognition technique in its own right.

Consider the expected number of metates on the valley floor. "Expectation" is governed by two frequencies, and the distribution of any particular artifact (metates) within a given elevational zone (valley bottom) is given by

\[ \text{Expected value} = p(N) \]

where \( p \), the probability of any artifact showing up on the particular elevational zone, is given by \( s/(s + f) \). \( N \) is the total number of artifacts in question.

In this case, a success \( (s) \) is the recovery of any artifact on the valley bottom. Table 73 indicates that exactly 1122 successes occurred in Monitor Valley bottom. A "failure" \( (f) \) is the frequency of finding an artifact anywhere else in Monitor Valley; the survey and excavation recovered 13 artifacts on the summit crest, 494 artifacts on the upland slope, 909 from the woodland, and 1722 artifacts on lowland slopes. The frequency of failure thus becomes \( f = 13 + 494 + 909 + 1722 = 3138 \).

The specific probability of success is given by

\[ \text{probability} = \frac{s}{s + f} \]
\[ = \frac{1122}{1122 + 3138} \]
\[ = 0.263 \]

\( N \) is taken to be the total number of metates recovered in Monitor Valley, so \( N = 63 \).
TABLE 73
Elevational Distribution of Artifacts in the Regional Monitor Valley Sample

<table>
<thead>
<tr>
<th></th>
<th>Summit crest</th>
<th>Upland slope</th>
<th>Piñon-juniper woodland</th>
<th>Lowland slope</th>
<th>Valley bottom</th>
<th>Totals</th>
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<td>—</td>
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TABLE 73—(Continued)

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<th>Upland slope</th>
<th>Piñon-Juniper woodland</th>
<th>Lowland slope</th>
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<th>Totals</th>
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<td></td>
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<tr>
<td>Drills/Gravers</td>
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<td>26</td>
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<td>27</td>
<td>62</td>
<td>136</td>
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<td>274</td>
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<td>–</td>
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<td>75</td>
<td>193</td>
<td>95</td>
<td>451</td>
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<td>298</td>
<td>920</td>
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<td>111</td>
<td>173</td>
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<td>280</td>
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<td>5</td>
<td>24</td>
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<td>Whittling debris from promontory pegs</td>
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<td>–</td>
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<td>+</td>
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<td>487</td>
<td>942</td>
<td>729</td>
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<tr>
<td>Incised stones</td>
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<td>5</td>
<td>33</td>
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<td>–</td>
<td>+</td>
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<td>33</td>
<td>63</td>
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<td>1210</td>
<td>2196</td>
<td>1774</td>
<td>5710</td>
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<td>Adjusted grand totals</td>
<td>(13)</td>
<td>(494)</td>
<td>(909)</td>
<td>(1722)</td>
<td>(1122)</td>
<td>(4260)</td>
</tr>
</tbody>
</table>

It now becomes possible to compute the expected number of metates on the valley bottom:

\[
E(X) = p(N) \\
= 0.263 \times 63 = 16.57
\]

This becomes the expected value against which to compare the archaeologically observed frequency.

We can now see that the 6 metates actually recovered from the valley bottom are only one-third the number one would expect to find given the overall distribution and size of the valley bottom and aggregate Monitor Valley assemblages.

Using similar procedures, it is possible to compute expected numbers for the other elevational zones:

summit crest: \((13)(63)/4260 = 0.19\) metates
upland slope: \((494)(63)/4260 = 7.31\)

woodland: \((909)(63)/4260 = 13.44\)
lowland slope: \((1722)(63)/4260 = 25.47\)

These expectations will be used in subsequent chi-square calculations; they also provide a direct means for assessing exactly which subsets of the Monitor Valley assemblage are nonrandomly distributed by elevation.

FUNCTIONAL VARIABILITY ACROSS ELEVATIONAL ZONES

We begin the analysis of elevational variability by returning to the complete regional Monitor Valley assemblage, consisting of a (corrected) total of 4260 artifacts (table 73). Results of the regional fieldwork conducted by the American Museum can be compared and contrasted with data from two additional sources. Survey data from the Monitor Valley woodland must, of course, be
### TABLE 74
The Nonperishable Assemblage from Gatecliff Shelter

<table>
<thead>
<tr>
<th>Artifact category</th>
<th>Functional category</th>
<th>Frequency</th>
</tr>
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<td>Projectile points</td>
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<td>Typable points</td>
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<td>405</td>
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<tr>
<td>Untypable points</td>
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<td>561</td>
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<tr>
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<td>biface</td>
<td>byproducts</td>
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<td>Roughouts</td>
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<td>Fine percussion</td>
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<td>120</td>
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<td>Point preforms</td>
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</table>

*Summarized from Thomas, 1983b, chaps. 9, 10, 11, 13, and 14.*

considered in light of the excavations at Gatecliff Shelter (Thomas, 1983b), and to facilitate comparison with the predominantly surface remains in the regional sample, the nonperishable Gatecliff assemblages are pooled on table 74. Relative frequencies of the additional 1903 lithic and ceramic artifacts will amplify information from the woodland zone of the regional Monitor Valley sample.

A third set of independent data derives from the cultural resource inventories (elaborated in chap. 7). Nearly 100 prehistoric sites were recorded in subsequent CRM surveys of the Monitor Valley study area (table 65). These site forms generally contain assemblage in-
ventories which provide approximate zonal artifact distributions. The CRM assemblage consists of 359 artifacts, distributed across four of five elevation zones in Monitor Valley (table 75). Although table 75 suffers from sometimes inadequate recording and typological imprecision, the CRM assemblage provides a valuable counterpoint to our own research. Most of this third assemblage derives from the Northumberland Pass/Northumberland Canyon area, an area very significant in the overall prehistoric cultural geography of Monitor Valley (chap. 19). The CRM sample supplements patterns observed initially in the regional Monitor Valley survey and excavations.

ARE PREHISTORIC GENERAL UTILITY TOOLS DIFFERENTIALLY DISTRIBUTED?

We earlier modified the terminology and criteria of Winters (1969: chap. IV) to fit the specifics of the Great Basin (chap. 8; see also Thomas, 1983a: 72–73). This terminology was invoked in the analysis of Gatecliff Shelter assemblages (Thomas, 1983b), and the same categories are relevant here. General utility tools have been defined as artifacts "of such generalized nature that they could have been used in connection with a variety of activities . . . [an] admittedly unsatisfactory term" (Winters, 1969: 32). Great Basin assemblages of general utility tools include knives, scrapers, choppers, hammerstones, and cordage (Thomas, 1983a: 72). A total of 116 general utility tools were recovered in this aspect of the project (table 73).

We now compare the distribution of general utility tools to that of the remaining artifacts in Monitor Valley.3 As before, an ordinal-level Kolmogorov-Smirnov two-sample test will be used to determine whether these two samples are statistically independent. In this case, \( n_2 = 4260 - 116 = 4144 \) and \( n_1 = 116 \). The observed value of \( D = 0.050 \) fails to exceed the critical value of \( D_{0.05} = 0.128 \). The null hypothesis cannot be rejected at the \( p = 0.05 \) level.

A 5 row by 2 column chi-square test can also be used to examine this relationship in detail by viewing each variable at the nominal level. The number of degrees of freedom is computed to be \((5 - 1)(2 - 1) = 4\), and the critical value of chi-square (at the 0.05 level) is 4.35493. Because the probability associated with this observed value of chi-square for the general utility tools is only \( p = 0.3608 \), the null hypothesis of no association cannot be rejected. The nominal and ordinal level statistical procedures agree (but this need not always be the case, since the same data are being compared in two rather different ways).

Simply stated, the distribution of general utility tools in Monitor Valley—finished bifacial knives, unifaces, scraper planes, hammerstones, and cordage—does not depart significantly from the elevational distribution of the regional Monitor Valley assemblage.4

ADDITIONAL RELEVANT DATA

THE UPLAND SLOPE: Cultural resource management data from this area represent an extremely restricted subset of general utility tools (table 75). It may be that this "assemblage" is artificially restricted due to the typological systems employed in the CRM survey, but we will proceed as if the categories were comparable. Table 75 indicates an unusually high number of unifaces, inflating the overall proportion of general utility tools on the upland slope to nearly 15 percent (28 of 192 upland slope artifacts). By contrast, the upland slope assemblage of our regional sample contains only 3.2 percent (16 of 494) of the general utility tools (table 64).

THE WOODLAND: The regional Monitor Valley data contain a comparable quantity of general utility tools in the woodland zone (1.9%: 17 of 909). At Gatecliff Shelter, general utility tools comprise 10.8 percent (206 of 1903) of the nonperishable assemblage (table 74). The woodland segment of the CRM sample contains 16.4 percent (19 of 116) general utility artifacts.

THE LOWLAND SLOPE: General utility tools comprise 2.7 percent (47 of 1722) of the regional sample recovered on the lowland slope. The CRM sample contains only one general utility artifact (of 14) on the lowland slope.

THE VALLEY BOTTOM: The CRM sample from the valley floor contains relatively more general utility tools (4 of 37) than does the regional Monitor Valley sample (36 of 1122 artifacts).
ARE PREHISTORIC WEAPONS DIFFERENTIALLY DISTRIBUTED?

This inclusive artifact category has been previously defined (Thomas, 1983a: 72). Weapons are "any implement designed primarily for the killing or procurement of fauna . . . . The basic criterion is the possession of properties appropriate to the effecting of an untimely demise of some member of the faunal community . . . ." (Winters, 1969: 37): bows, arrows, fishing equipment, nets, snares, traps, nooses, rabbit and reptile hooks, disguises, decoys, rabbit clubs. Table 73 summarizes the distribution of weapons across Monitor Valley, and figure 163 arrays the weapon profile against the pooled Monitor Valley assemblage.

More than one-quarter of the artifacts in the Monitor Valley sample are weapons, and a Kolmogorov-Smirnov two-sample test indicates that unlike general utility tools, weapons are differentially distributed by elevation ($p < 0.05; D = 0.064; D_{0.05} = 0.047; D_{0.01} = 0.056; n_2 = 3095; n_1 = 1165; \text{chi-square} = 23.1553, \text{df} = 4, p = 0.0003$). The null hypothesis of no association is rejected at the 0.05 level.\(^5\)

In general, we find weapons to be especially common on the lowland slope ($n = 525; \text{expectation} = 470.92$). They are relatively rare on the valley bottom ($n = 253; \text{expectation} = 306.84$) and on the upland slope ($n = 125; \text{expectation} = 135.10$). This elevational profile is plotted on figure 163a.

COMPARING ARTIFACT-LEVEL DISTRIBUTIONS

Examining the specific artifact-level distributions, further clarifies the distribution of weapons in Monitor Valley.

Gatecliff series projectile points clearly occur in a nonrandom distribution across elevational zones (K-S two-sample test: $p < 0.05; D = 0.170; D_{0.05} = 0.156; n_2 = 4183; n_1 = 77; \text{chi-square} = 28.9085, \text{df} = 4, p < 0.0001$). Gatecliff points are especially common on the upland slope ($n = 21; \text{expectation} = 8.93$) and relatively rare on the lowland slope ($n = 15; \text{expectation} = 31.13$; see fig. 163b).

Projectile point tips are also nonrandomly distributed across elevational zones (K-S two-sample test: $p < 0.05; D = 0.135; D_{0.05} = 0.129; n_2 = 4146; n_1 = 114; \text{chi-square} = 15.7133, \text{df} = 4, p = 0.0040$). Tips are especially common in the woodland ($n = 36; \text{expectation} = 24.33$) and rare on the valley bottom ($n = 15; \text{expectation} = 30.03$; see fig. 163b).

Projectile point fragments are similarly distributed (K-S two-sample test: $p < 0.05; D = 0.142; D_{0.05} = 0.093; D_{0.01} = 0.112; n_2 = 4036; n_1 = 224; \text{chi-square} = 51.1416, \text{df} = 4, p < 0.0001$). As with tips, point fragments are especially common in the woodland ($n = 85; \text{expectation} = 47.77$) and underrepresented on the valley bottom ($n = 29; \text{expectation} = 58.97$; see fig. 163b).

Statistical analysis of Rosegate series projectile points provides ambiguous results. The Kolmogorov-Smirnov test shows a randomized occurrence across elevational zones (K-S two-sample test: $p > 0.05; D = 0.113; D_{0.05} = 0.133; n_2 = 4153; n_1 = 107$), but the chi-square test suggests a certain degree of patterning by elevation (chi-square = 10.8794, $\text{df} = 4, p = 0.0281$). In accordance with the criteria set out in the last chapter, we will not reject the null hypothesis of no association. But we do note that Rosegate series points are rather common on the valley floor ($n = 40; \text{expectation} = 28.18$) and relatively rare on the upland slope ($n = 6; \text{expectation} = 12.41$).

Similarly, the two statistical procedures differ with respect to Humboldt series projectile points (K-S two-sample test: $p > 0.05; D = 0.137; D_{0.05} = 0.163; n_1 = 4189; n_2 = 71; \text{chi-square} = 20.2692, \text{df} = 4, p = 0.0007$). We will not, based on this evidence, reject the null hypothesis. But there is a trend for Humboldt points, like those of the Gatecliff series, to be common on the upland slope ($n = 18; \text{expectation} = 8.23$) and relatively rare on the lowland slope ($n = 15; \text{expectation} = 28.70$). Humboldt points also occur relatively frequently on the valley bottom ($n = 24; \text{expectation} = 18.70$).

ADDITIONAL RELEVANT DATA

THE UPLAND SLOPE: The only weapons recovered in the CRM surveys were projectile points. CRM sites contained fewer than 10 percent (14 of 192) weapons. This frequency
 contrasts markedly with the high proportion of weapons (25.3%) in the upland slope portion of the regional sample (125 of 494).

The Woodland: The regional sample also contains a high frequency of weapons (28.4%) in the woodland zone (258 of 909 artifacts). Similarly, at Gatecliff Shelter, weapons comprise 29.5 percent (561 of 1903) of the non-perishable assemblage (table 74). The woodland segment of the CRM sample contains only 12.1 percent (14 of 116) weapons.

The Lowland Slope: The regional sample from the lowland slope comprises 30.5 percent (525 of 1722) weapons. The CRM sites had only two weapons (of 14 artifacts) on the lowland slope.

The Valley Bottom: The CRM sample contains a relatively high proportion of weapons (27.0%) on the valley bottom (10 of 37 artifacts). Similarly, 22.5 percent of the valley floor portion of the regional Monitor Valley sample consisted of weapons (253 of 1122).

Comparing Time-markers at the Type Level

The temporal and functional significance of projectile points—a subclass of weapons—leads us to explore their spatial distribution in more detail. Except for the Rosegate series, each time-sensitive point series contains two apparently synchronous morphological variants, and this patterning has yet to be satisfactorily explained. Desert series projectile points, for instance, seem to occur consistently in contexts dating between A.D. 1300 and 1850.

Why is there a Desert Side-notched form
and a Cottonwood Triangular form which are apparently synchronous? Why does the Elko series contain both eared and corner-notched forms? Why is the Gatecliff series made up of split-stem and contracting stem forms?

We approach this question with an additional pattern recognition analysis, designed to determine the empirical distribution of the subseries groupings listed previously on table 71.

Are Desert Side-notched and Cottonwood Triangular points differentially distributed by elevation? Table 71 plots the differential distribution of Cottonwood and Desert Side-notched points by elevation. There is no significant difference in distribution between these two contemporary types \((D = 0.037; D_{0.05} = 0.269; n_1 = 58; n_2 = 46; \text{chi-square } = 0.8597, \text{df } = 3, p = 0.8368)\).

Are Elko Corner-notched and Elko Eared points differentially distributed by elevation? Table 71 suggests that Elko Eared points are relatively more common on the upland slope than Elko Corner-notched points. The statistical procedures produce conflicting results. The K-S two-sample test shows no statistical significance in their distribution across the elevational zones \((D = 0.122; D_{0.05} = 0.191; n_1 = 74; n_2 = 159)\). But a chi-square comparison suggests that an elevation difference exists \((\text{chi-square } = 9.6933, \text{df } = 3, p = 0.0214)\).

Although we will not reject the null hypothesis of no association, it is necessary to note that Elko Eared points are more common than Elko Corner-notched on the upland slope \((n = 16; \text{expectation } = 9.57)\). Relative to Elko Corner-notched points, the Elko Eared type is underrepresented in the woodland \((n = 11; \text{expectation } = 16.27)\).

Are Gatecliff Contracting Stem and Gatecliff Split Stem points distributed differentially by elevation? Table 71 shows that Gatecliff Split Stem points are less common, in terms of absolute frequency, on the upland slope than Gatecliff Contracting Stem points. But statistical analysis indicates that this relationship is not statistically significant \((D = 0.156; D_{0.05} = 0.321; n_1 = 45; n_2 = 30; \text{chi-square } = 3.2269, \text{df } = 3, p = 0.3588)\).

These distributions indicate that—at the type-specific level—projectile points are not differentially sorted across the elevational zones in Monitor Valley. These results could be interpreted in several ways. There may indeed be valid functional differences between the types, and the present sample size may simply be insufficient to detect such differences (despite the fact that the Monitor Valley sample is among the largest systematically collected regional assemblages currently available from the Great Basin). Or it may be that the type-level variants represent true stylistic groupings. But the lack of spatial differentiation certainly does not enhance that interpretation.

These results would seem to point up the artificial nature of Great Basin morphological types in general. Elsewhere (Thomas, 1981a), I have expressed my general mistrust of morphological classification of projectile points into types. In the Monitor Valley classification scheme, for instance, we threw out the conventional categories, Eastgate Contracting Stem and Rose Spring Corner-notched; the two contemporaneous types were simply merged into the Rosegate series. The current results could also be taken as support of the contention that morphological types merely follow as a consequence of the typological process, not reflecting any significant degree of behavioral variability.

IS PREHISTORIC HARVESTING EQUIPMENT DIFFERENTIALLY DISTRIBUTED?

This category has been previously defined (Thomas, 1983a: 72). Harvesting equipment includes "any implement designed primarily to facilitate the untimely demise of some member of the floral community" (Thomas, 1983a: 72): seed knives, piñon hooks, digging sticks, seed beaters, seed fans, seed baskets, sickles.

Only two harvesting items were recovered in this part of the Monitor Valley research: a probable digging stick fragment from Toquima Cave, and a piñon hook encountered at Ny878. Both of these artifacts occurred in the modern woodland zone of Monitor Valley. A few harvesting implements were also

**IS PREHISTORIC DOMESTIC EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

This category has been previously defined (Thomas, 1983a: 72–73). Domestic equipment includes "any items designed for use in processing, consuming, or storing food, or whose normal function would be concerned with the maintenance of dwelling or clothing, and items of household equipment" (Winters, 1969: 61): milling equipment (manos, metates, mortars, pestles), cooking equipment (bowls, basketry containers, mush stirrers), woodworking tools, firemaking equipment, items of clothing, spoons and dippers, dishes, water jugs, sleeping mats, ornaments, pipes, blankets, cradles.

In this part of the Monitor Valley research, we encountered 1768 pieces of prehistoric domestic equipment. But as explained previously, this total has been adjusted to 318 to compensate for the effects of differential ceramic fragmentation.

The distribution of domestic equipment is presented on table 73 and the relevant ogive is plotted on figure 164a. When compared to the remaining artifacts recovered in the Monitor Valley sample, it is clear that domestic equipment is indeed differentially distributed with respect to elevation ($p < 0.05$; $D = 0.0814$; $D_{0.05} = 0.079$; $n_2 = 3952$; $n_1 = 318$; chi-square = 43.0425, df = 4, $p < 0.0001$). The null hypothesis of no association is rejected.
Domestic equipment is especially common in the woodland \((n = 100; \text{ expectation } = 67.85)\) and relatively uncommon on the upland slope \((n = 10; \text{ expectation } = 36.88)\).

### Comparing Artifact-level Distributions

*Metates*, as noted above, are nonrandomly distributed across elevational zones (K-S two-sample test: \(p < 0.05; D = 0.178; D_{0.05} = 0.173; n_2 = 4197; n_1 = 63;\) chi-square = 17.1657, \(df = 4, p = 0.0023;\) see fig. 162b). The null hypothesis of no association is rejected. As reflected in the overall distribution of domestic equipment, metates are abundant in the woodland \((n = 25; \text{ expectation } = 13.44)\). They are also rare on the valley floor \((n = 6; \text{ expectation } = 16.59)\).

*Ceramics* are likewise nonrandomly distributed across elevational zones (K-S two-sample test: \(p < 0.05; D = 0.191; D_{0.05} = 0.109; D_{0.01} = 0.131; n_1 = 4099; n_2 = 161;\) chi-square 56.5694, \(df = 4, p < 0.0001\)). As figure 164b shows, ceramics are especially common on the valley floor \((\text{corrected } n = 72; \text{ expectation } = 42.40)\) and totally absent from the upland slope \((\text{expectation } = 18.67)\). Sherd frequency is also rather low for the lowland slope \((\text{corrected } n = 53; \text{ expectation } = 65.08)\).

### Additional Relevant Data

The Upland Slope: Domestic assemblages here are composed strictly of grinding stones. The CRM sites contain an unusually high number of ground stone artifacts (table 75), leading to an overall proportion of domestic items of 24.0 percent \((46 \text{ of } 192 \text{ items})\). The upland slope portion of the regional sample contains only 2.0 percent \((10 \text{ of } 494 \text{ artifacts})\) reflecting domestic usage (table 75).

The Woodland: The three samples from the Monitor Valley woodland reflect radically different functional proportions. Eleven percent \((100 \text{ of } 909)\) of our regional sample consists of domestic equipment, and most of this total consists of Shoshone ware sherds. By contrast, the CRM sites contain 26.7 percent domestic equipment, a surprisingly high proportion \((31 \text{ of } 116 \text{ items})\); no pottery at all was reported. Although 160 grinding stones were recovered from Gatecliff Shelter, the overall proportion of domestic equipment is extremely low, only 9.9 percent \((189 \text{ of } 1903 \text{ artifacts})\).

The Lowland Slope: The two samples available for the lowland slopes are hardly comparable. The regional Monitor Valley sample consists strictly of potsherds, and the overall proportion of domestic equipment is 6.9 percent \((119 \text{ of } 1722)\). The CRM sample contains four grinding stones from the lowland slope, reflecting the proportion of domestic equipment to be 28.6 percent \((4 \text{ of } 14)\).

The Valley Bottom: The CRM sample contains no domestic equipment from the valley floor. Relatively few domestic items were recovered in this part of the regional survey \((86 \text{ of } 1122 \text{ total artifacts})\).

### ARE PREHISTORIC FABRICATING AND PROCESSING TOOLS DIFFERENTIALLY DISTRIBUTED?

This tool class has been defined previously (Thomas, 1983a: 73). *Fabricating or processing tools* are "any implements utilized primarily in the alteration or assembling of raw materials for use in the various stages of manufacture of other implements or equipment" (Winters, 1969: 47): flakers, perforating tools, sewing implements, weaving tools, edge-abraded cobbles. Byproducts of fabrication and processing are also included here: cores, roughouts, production stage blanks, preforms, and whittling debris.

Only 51 fabricating and processing implements were recovered in this aspect of the Monitor Valley research (table 73). We find no significant difference between the distribution of fabricating/processing implements and the overall Monitor Valley assemblage \((D = 0.102; D_{0.05} = 0.192; n_2 = 4209; n_1 = 51;\) chi-square = 5.9843, \(df = 4, p = 0.1999)\).

By contrast, there is a highly significant difference between the *byproducts* of fabricating/processing implements and the remainder of the Monitor Valley assemblage \((D = 0.068; D_{0.05} = 0.042; D_{0.01} = 0.507; n_2 = 1759; n_1 = 2501;\) chi-square = 58.7136, \(df = 4, p < 0.0001)\). The null hypothesis is rejected.
In general, byproducts of fabrication activities are relatively common on the upland slope \((n = 337; \text{expectation} = 290.02)\) and valley floor \((n = 729; \text{expectation} = 658.71)\). These artifacts are relatively uncommon in the woodland \((n = 487; \text{expectation} = 533.66)\) and on the lowland slope \((n = 942; \text{expectation} = 1010.97)\).

**Comparing Artifact-level Distributions**

Such highly significant results might be expected from the rather large sample sizes involved, and it is worthwhile to explore spatial distributions of specific byproduct categories. Distributions of individual artifact types are presented on figure 165. Looking at the specific, artifact-level distributions, several trends are clear:

*Cores and roughouts* are nonrandomly distributed across elevational zones (K-S two-sample test: \(p < 0.05; D = 0.095; D_{0.05} = 0.085; n_2 = 3986; n_1 = 274; \text{chi-square} = 15.8262, df = 4, p = 0.0038\)). Cores and roughouts are relatively abundant on the lowland slope \((n = 136; \text{expectation} = 110.76)\) and uncommon on the valley floor \((n = 48; \text{expectation} = 72.17)\).

*Rough percussion blanks* are nonrandomly distributed across elevational zones (K-S two-sample test: \(p < 0.05; D = 0.087; D_{0.05} = 0.068; D_{0.01} = 0.081; n_1 = 3809; n_2 = 451; \text{chi-square} = 40.0636, df = 4, p < 0.0001\)). These early-stage byproducts are particularly common on the upland slope \((n = 88; \text{expectation} = 52.30)\). They are relatively rare in the woodland \((n = 75; \text{expectation} = 96.23)\) and valley floor \((n = 95; \text{expectation} = 118.78)\).
TABLE 75
Zonal Distribution of the Pooled CRM Assemblage from Monitor Valley

<table>
<thead>
<tr>
<th>Tool type</th>
<th>Summit crest</th>
<th>Upland slope</th>
<th>Piñon-juniper woodland</th>
<th>Lowland slope</th>
<th>Valley bottom</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>General utility tools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unifaces</td>
<td>—</td>
<td>28</td>
<td>18</td>
<td>1</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>Hammerstones</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Weapons</td>
<td>—</td>
<td>14</td>
<td>14</td>
<td>2</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>Fabricating/processing tools and byproducts</td>
<td>—</td>
<td>4</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>7</td>
</tr>
<tr>
<td>Drills/gravers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cores</td>
<td>—</td>
<td>8</td>
<td>16</td>
<td>5</td>
<td>9</td>
<td>38</td>
</tr>
<tr>
<td>Production stage bifaces</td>
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<td>89</td>
<td>28</td>
<td>2</td>
<td>14</td>
<td>133</td>
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<td>Domestic equipment</td>
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<tr>
<td>Milling equipment</td>
<td>—</td>
<td>46</td>
<td>31</td>
<td>4</td>
<td>—</td>
<td>81</td>
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<td>Ceremonial equipment</td>
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</tr>
<tr>
<td>Incised stones</td>
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<td>3</td>
<td>5</td>
<td>—</td>
<td>—</td>
<td>8</td>
</tr>
<tr>
<td>Totals</td>
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<td>192</td>
<td>116</td>
<td>14</td>
<td>37</td>
<td>359</td>
</tr>
</tbody>
</table>

Fine percussion blanks are nonrandomly distributed across elevational zones (K-S two-sample test: $p < 0.05$; $D = 0.077$; $D_{0.05} = 0.051$; $D_{0.01} = 0.054$; $n_1 = 3340$; $n_2 = 920$; chi-square = 24.2342, df = 4, $p = 0.0002$). These byproducts are abundant on the valley floor ($n = 298$; expectation = 242.31) and relatively less common on both the lowland slope ($n = 339$; expectation = 371.89) and in the woodland ($n = 172$; expectation = 196.31).

Pressure flaked bifaces are nonrandomly distributed across elevational zones (K-S two-sample test: $p < 0.05$; $D = 0.098$; $D_{0.05} = 0.090$; $D_{0.01} = 0.063$; $n_1 = 3443$; $n_2 = 817$; chi-square = 51.8794, df = 4, $p < 0.0001$). These later stage byproducts are abundant on both the valley floor ($n = 280$; expectation = 215.18) and the upland slope ($n = 111$; expectation = 94.74). They are relatively less common on the lowland slope ($n = 250$; expectation = 330.25).

Additional Relevant Data

The Upland Slope: CRM sites on the upland slope contain a large number of production stage bifaces (table 75) and the overall proportion of fabricating and processing tools and byproducts is correspondingly high (101/192 × 100 = 52.6%). This portion is exceeded by the assemblage from the upland slope of the regional sample, likewise reflecting an abundance of production stage bifaces.

The Woodland: Over half (499 of 909) of the woodland assemblage in the regional sample consists of fabricating and processing tools and byproducts, a figure contrasting with those for other woodland assemblages. At Gatecliff Shelter, fabricating/processing tools and byproducts comprise 26.7 percent (516 of 1903) of the nonperishable assemblage (table 74). The woodland segment of the CRM sample contains 40.5 percent (47 of 116) fabricating and processing tools and byproducts.

The Lowland Slope: The two lowland slope samples are similar in this respect. The regional sample contains 56.2 percent (968 of 1722) fabricating and processing tools and byproducts; the CRM sites contain 50 percent such artifacts (7 of 14).

The Valley Bottom: The valley floor assemblages are likewise very similar. The CRM sites contain 62 percent (23 of 37) fabricating/processing tools and byproducts, and the regional sample contains 66.0 percent (741 of 1122).

Variability in Lithic Staging Behavior

To this point, we have examined the pooled Monitor Valley assemblage at two levels: at the artifact and the functional levels. It is
desirable to examine the fabricating and processing byproducts from yet another perspective by determining the degree of internal variability with respect to bifacial staging behavior. To do this, the pooled regional assemblage is partitioned into component catchments, which are then compared and contrasted with the remaining assemblages.

The Bifacial Staging Profile: Elsewhere, we have employed a rather simple, straightforward technique for defining and comparing lithic staging behavior across diverse archaeological assemblages (Thomas, 1983b: chap. 20). This analysis began with Muto’s (1971) concept of the blank-preform-product continuum. The bifaces from Monitor Valley were then classified into correlative categories of technological progression: cores and roughouts, rough percussion blanks, fine percussion blanks, pressure flaked blanks and preforms, and finished products (this volume, chaps. 2–6). In the strictly technological sense, function and actual utilization of the bifacial artifacts is irrelevant, since this continuum is conceived strictly in terms of bifacial lithic staging behavior.

Relative proportions of each reduction stage can readily be translated into a series of bifacial staging profiles (fig. 166). The horizontal X-axis is scaled along the ordinal level technological types, and the Y-axis expresses the cumulative percentage frequency of each category in an assemblage. All such curves commence at 0 percent and end at 100 percent.

Figure 166 illustrates the behavioral correlates for three hypothetical configurations. The ideal bifacial reduction curve, a perfectly straight line, defines the profile of assemblages containing equal proportions of all five reduction stages. The ideal quarry curve consists strictly of rejected cores and roughouts. This profile results when artifacts are initially shaped, then transported offsite for further reduction. The ideal repair curve remains horizontal throughout reduction stages I–IV, then skyrockets at the right-hand margin of the continuum; this curve results when only lithic tool maintenance occurs on site. A standard Kolmogorov-Smirnov two-sample test can be applied to cumulative data to assess the degree of similarity and difference between the empirical assemblages of bifacial artifacts.

Lithic Staging Variability in Monitor Valley Assemblages: The following comparisons analyze the various Monitor Valley assemblages described in this volume. A total of 3546 bifacially modified lithic artifacts are included in this total (see fig. 167a), and this pooled assemblage provides the master profile against which the various catchment assemblages can be arrayed; computational procedures are explained in chapter 9.

Are lithic assemblages discarded on the upland slope staged differently from other Monitor Valley assemblages? The technological profile for the upland slope assemblages can be statistically compared with that for the aggregate Monitor Valley assemblage. According to the Kolmogorov-Smirnov two-sample test, the null hypothesis of no difference should not be rejected ($p < 0.05$; $D = 0.049$; $D_{0.05} = 0.068$; $n_1 = 3081$; $n_2 = 465$).
But the chi-square test suggests that a degree of nonrandom patterning by elevation is present when viewed along a nominal scale (chi-square = 21.4107, df = 4, \( p = 0.0005 \)). In accordance with the criteria set out in the last chapter, we will not reject the null hypothesis of no association. But we do note that on the upland slope, rough percussion blanks (\( n = 88 \); expectation = 59.14) are relatively overrepresented; cores and roughouts (\( n = 27 \); expectation = 35.93), fine percussion blanks (\( n = 109 \); expectation = 120.64) and finished products (\( n = 130 \); expectation = 142.15) are underrepresented on the upland slope.

However, overall, we judge that available samples are insufficiently distinct to establish any significant difference in bifacial staging behavior between the upland slope assemblages and the rest of the aggregate Monitor Valley assemblage.

**Are lithic assemblages discarded in the woodland staged differently from other Monitor Valley assemblages?** The technological profile for the woodland lithic assemblages is statistically and graphically (fig. 167b) compared with that for the aggregate Monitor Valley assemblage. The null hypothesis of no difference is rejected (K-S two-sample test: \( p < 0.05; D = 0.077; D_{0.05} = 0.056; D_{0.01} = 0.067; n_1 = 2786; n_2 = 278; \) chi-square = 21.9624, df = 4, \( p < 0.0001 \)).

Available samples establish significant differences in bifacial staging behavior between the woodland assemblages and the rest of the aggregate Monitor Valley assemblage. Finished bifacial products are especially common in the woodland (\( n = 278 \); expectation = 232.33).

**Are lithic assemblages discarded on the lowland slope staged differently from other Monitor Valley assemblages?** The technological profile for the lithic assemblages recovered on the lowland slope can be compared with that for the aggregate Monitor Valley assemblage (fig. 167b). The null hypothesis of no difference is rejected at the 0.01 level (K-S two-sample test: \( p < 0.05; D = 0.178; D_{0.05} = 0.047; D_{0.01} = 0.057; n_1 = 2227; n_2 = 1319; \) chi-square = 39.4818, df = 4, \( p < 0.0001 \)).

This means that available samples are sufficient to establish that highly significant differences in bifacial staging behavior exist between the woodland assemblages and the rest of the aggregate Monitor Valley assemblage. Specifically, we find early-stage byproducts—cores and roughouts (\( n = 136 \); expectation = 101.92) and rough percussion blanks (\( n = 193 \); expectation = 167.76)—to be especially common on the lowland slope.

**Are lithic assemblages discarded on the valley bottom staged differently from other Monitor Valley assemblages?** The technological profile for valley bottom assemblages is statistically and graphically (fig. 167b) compared with that for the aggregate Monitor Valley assemblage. The null hypothesis of no difference is rejected (K-S two-sample test: \( p < 0.05; D = 0.084; D_{0.05} = 0.0509; D_{0.01} = 0.061; n_1 = 2554; n_2 = 992; \) chi-square = 21.9624, df = 4, \( p < 0.0001 \)).

On the valley bottom, we find fine percussion blanks (\( n = 298 \); expectation = 257.37) and pressure flaked bifaces (\( n = 280 \); expectation = 228.56) to be particularly common. The available samples establish highly significant differences in bifacial staging behavior between the valley bottom assemblages and the rest of the aggregate Monitor Valley assemblage.

We also looked at the variability in staging within the aggregate valley floor sample. At Box Spring, the lithic discards closely follow the ideal repair curve (as defined on fig. 166). Specifically, the null hypothesis of no difference is rejected (K-S two-sample test: \( p < 0.01; D = 0.306; D_{0.01} = 0.120; n_1 = 3352; n_2 = 194; \) chi-square = 85.6068, df = 4, \( p < 0.0001 \). The Box Spring assemblage is characterized by an abundance of pressure flaked bifaces (\( n = 87 \); expectation = 44.70) and finished bifacial tools (\( n = 73 \); expectation = 59.31). Earlier stage bifacial artifacts are correspondingly rare: cores and roughouts (\( n = 2 \); expectation = 14.99), rough percussion blanks (\( n = 16 \); expectation = 24.67), and fine percussion blanks (\( n = 16 \); expectation = 50.33).

The Monitor Lakebed assemblage also differs significantly from the aggregate Monitor Valley sample. The null hypothesis of no difference is rejected (K-S two-sample test: \( p < 0.01; D = 0.118; D_{0.01} = 0.078; n_1 = 3028; n_2 = 518; \) chi-square = 90.1857, df = 4, \( p <
The lakeside sample is characterized by an abundance of fine percussion blanks \((n = 210; \text{expectation } = 134.39)\) and pressure flaked bifaces \((n = 134; \text{expectation } = 119.35)\). Early and late stage bifacial artifacts are correspondingly rare: cores and roughouts \((n = 19; \text{expectation } = 40.03)\), rough percussion blanks \((n = 49; \text{expectation } = 65.88)\), and finished bifacial tools \((n = 106; \text{expectation } = 158.35)\).

The additional valley bottom assemblages do not differ from the aggregate Monitor Valley sample.

**IS PREHISTORIC CEREMONIAL EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

This category has been discussed earlier (Thomas, 1983a: 73). The Monitor Valley assemblage contains only three kinds of ceremonial items: incised stones, quartz crystals, and ocher (table 73). This distribution, shown in figure 168, is nonrandom across the various elevational zones (K-S two-sample test: \(p < 0.05\); \(D = 0.213; D_{0.05} = 0.133; D_{0.01} = 0.160; n_1 = 4153; n_2 = 107\); chi-square = 36.6746, df = 4, \(p < 0.0001\)). Specifically, ceremonial equipment is especially common in the woodland \((n = 33; \text{expectation } = 22.83)\) and the lowland slope \((n = 63; \text{expectation } = 43.25)\). It is relatively uncommon on the upland slope \((n = 5; \text{expectation } = 12.41)\) and the valley bottom \((n = 6; \text{expectation } = 28.18)\).

Ceremonial equipment in Monitor Valley is dominated, not surprisingly, by incised stones. When incised stone frequency is tallied against the rest of the Monitor Valley assemblage, the difference between cumula-
THE UPLAND SLOPE: Incised stones are the only ceremonial items recovered on the upland slope; five such artifacts were found in the regional Monitor Valley survey, and three more incised stones were recovered on the upland slope by Forest Service personnel (table 75).

THE WOODLAND: Incised stones are under-represented in the regional survey sample of the woodland zone; this is clearly a function of sampling error. Five incised stones were found in the CRM inventory, and 428 were excavated at Gatecliff Shelter.

THE LOWLAND SLOPE: Incised stones were recovered in significant numbers on the lowland slope of the regional survey, and it is surprising that none have been found in the CRM survey.

THE VALLEY BOTTOM: CRM projects recovered no ceremonial items here.

IS PREHISTORIC RECREATIONAL EQUIPMENT DIFFERENTIALLY DISTRIBUTED?

Recreational equipment is likewise a problem. This category was previously discussed (Thomas, 1983a: 73). "The very concept of a category of recreational equipment derives from a defective and particularizing view of the nature of such artifacts in primitive societies . . . . All that we can say at present is that the similarity of these items to ethno-historic examples of recreational equipment seems to provide a better basis for inclusion of these artifacts in [this] . . . category than in any other" (Winters, 1969: 83): gaming items, bullroarers, drums, flutes, rattles, toys.

No recreational equipment, so defined, was recovered in the regional Monitor Valley fieldwork, and this category will not be discussed subsequently.

SUMMARY: ELEVATIONAL STRUCTURE OF PREHISTORIC MONITOR VALLEY

This pattern recognition identified several statistically significant trends in the distribution of artifacts across Monitor Valley. Although the empirical generalizations are derived from a limited sample of Monitor Valley archaeology, we have drawn upon independent information from Gatecliff Shelter and from the available CRM data, where appropriate. Earlier, we argued that our sample adequately characterizes the entire, unknown population from which that sample
was derived. This is why we spent so much time on designing the sampling strategy (chap. 1) and then examining the probable sources of bias in that sample (chap. 7).

We briefly summarize the variability discovered across the elevational zones of Monitor Valley:

**The Summit Crest:** Inadequate sample for generalization.

**The Upland Slope:** Byproducts of fabrication and processing implements are especially common. From the lithic staging analysis, we know that early-stage reduction byproducts (especially rough percussion blanks) are particularly noteworthy here. The upland slope also contains an abundance of Gatecliff series points. This temporally distorted distribution is due to the preponderance of relatively early points found in association with the Table Mountain rock alignment, thought to date from the Devils Gate phase (see chap. 9).

The following artifact categories are under-represented on the upland slope: weapons in general (especially Rosegate series points, although this distinction is not statistically significant), domestic equipment (cereals being totally absent), and incised stones.

**The Piñon-Juniper Woodland:** The Monitor Valley woodland is characterized by an abundance of domestic equipment (primarily metates), and the CRM sample also contained a high frequency of grinding stones in this area. A large number of metates was also recovered at Gatecliff Shelter, but the relative frequency of metates is not particularly high at Gatecliff. The woodland contains an abundance of late stage lithics, especially projectile point tips and fragments. “Ceremonial” equipment—in this case, a large array of incised stones—is also underrepresented here.

Intermediate stage byproducts of lithic reduction (especially rough and fine percussion blanks) are underrepresented in the woodland.

**The Lowland Slope:** The lowland slope assemblage contained an unexpectedly high frequency of weapons of all kinds; by contrast, the CRM sample from the lowland slope contained relatively few weapons. This zone also contained abundant early-stage byproducts of lithic reduction (that is, cores, roughouts, and rough percussion blanks). Incised stones are also common in this elevational zone; surprisingly, none have been recovered from the lowland slope during CRM sampling.

The following artifact categories are under-represented on the lowland slope: Gatecliff and Humboldt series points, ceramics, and later stage byproducts of lithic reduction (especially fine percussion blanks).

**The Valley Bottom:** The valley bottom contained a high frequency of lithic byproducts in general, especially intermediate stage products (fine percussion blanks and pressure flaked bifaces). Ceramics were also over-represented in the valley bottom assemblage, a “trend” probably created by the Hickison Summit sample; the CRM sample contained no ceramics at all on the valley bottom.

The following artifact categories are under-represented on the valley bottom: weapons in general (especially point tips and fragments), metates, early stage reduction byproducts (cores and roughouts, rough percussion blanks), and incised stones.

This chapter is one of several parallel pattern recognition studies conducted in this volume. After the other studies are completed, we shall return to the deeper meaning of the patterns isolated in these chapters.

**NOTES**

1. Each of the “ideal” cases assumes equal sample sizes across the elevational zones. Because such sample sizes never occur in actual practice, it is necessary to (1) construct general curves based on relative proportions and (2) judge the relative independence/dependence of individual profiles by using a statistical method that controls for differential sample size.

2. We describe in this volume a raw total of 5710 artifacts from Monitor Valley. In the previous chapter, we found that differential fragmentation between lithic and ceramic artifacts vastly complicates such overall comparisons. When dealing with specific assemblage catchments (as in chap. 9), it was possible to control for ceramic fragmentation on a case-by-case basis. In the present chapter, we will arbitrarily correct ceramic totals by a factor of 10. This correction factor adjusts the total assemblage downward to a working total of 4260 items. At this point, we are also temporarily setting aside the 1903 artifacts from Gatecliff Shelter and the thousands of additional prehistoric items recovered in the Mt. Jefferson research (to be discussed in the next part of this series).
3. In this and subsequent ogives, we will use a standardized pooled regional Monitor Valley sample for graphic comparison; but keep in mind that the actual computations are modified to maintain independence between samples (as discussed above). Note that for present purposes, the values of $n_1 + n_2$ must always be equal to 4260, the adjusted grand total of artifacts recovered in this aspect of the Monitor Valley project (table 64).

4. One would, incidentally, reach the same conclusion had the distribution of each of these artifact categories been considered separately.

5. Keep in mind that the master Monitor Valley profile ($n = 4260$) is shown as a gray screen on all ogives (such as fig. 163). Although this master profile is useful for general comparison, the statistical comparison is between an individual category (such as weapons, $n = 1165$) and the modified master profile, in which weapons are subtracted from the master total ($n_2 = 4260 - 1165 = 3095$). The statistical comparisons are thus considerably more sensitive than their graphic counterparts.

6. For analytical purposes, we include the relatively few glass trade beads in this section.
In chapter 10, we analyzed the elevational variability in the Monitor Valley assemblages. We now turn to examine horizontal differentiation within the same data set, employing the geographic partitions introduced in chapter 7 (table 76).

To review briefly, we subdivided Monitor Valley into major montane isolates separated by well-demarcated natural corridors (fig. 143). Because of the sample coverage we will concentrate on the western rim of Monitor Valley, defined by the 125-km-long Toquima Range (table 63).

The Hickison Corridor: the northernmost access into Monitor Valley. Approach from both east and west is relatively gradual, and the elevation at Hickison Summit proper is only 2010 m. The following archaeological assemblages are included: Excavated Sites: Boring-as-Hell Shelter. Systematic Survey: Hickison Summit petroglyph site (Ny304), La627.

The Toquima Range North: the next 15 km south of Hickison Summit is an archaeologically little-known and relatively inaccessible stretch of the Toquima Range. We conducted no archaeological reconnaissance in this area, and this zone is excluded from the analysis below.

The Central Toquima Corridor: a major conduit between Big Smoky and Monitor valleys. Today naturally defined crossroads funnel people and game through two roughly parallel montane passes, Petes Summit (2408 m) and Clipper Gap (2460 m). The following archaeological assemblages are included: Excavated Sites: Toquima Cave, Grenouille Verte Cave. Systematic Survey: Toquima Cave catchment survey, two montane spring catchment surveys (Springs 2 and 5), Stoneberger streamside survey, randomized quad survey (quads A1, A2, B1, F1, F2, G1, G2, H1, and H2).

Middle Toquima Block: a relatively impenetrable montane block extending roughly 15 km, bounded on the north by the Petes Summit/Clipper Gap corridor, and on the southern margin by Northumberland Canyon. The following archaeological assemblages are included: Excavated Sites: Gatecliff Shelter (not included in the analysis below) and Jeans Spring Shelter. Systematic Survey: Jeans Spring catchment survey, 13 montane spring catchment surveys (Springs 6, 9, 15, 16, 17, 18, 20, 22, 23, 24, 25, 26, and 28), two streamside surveys (Mill Canyon and Ikes Canyon), randomized quad survey (quads B2, C1, C2, D1, D2, E1, E2, I1, I2, J1, and J2), Ny926.

The Northumberland Corridor: a significant access route 30 km south of Petes Summit. The highest point here is 2652 m above sea level. Access from Big Smoky Valley, through the relatively wide West Northumberland Canyon, is steep; but the route along East Northumberland Canyon is considerably more gradual. The following archaeological assemblages are included: Excavated Sites: Triple T Shelter, Ny1059. Systematic Survey: Northumberland rock art site (Ny304), Ny918.

Toquima Range South: Although it is cut by a few serviceable passes (particularly East Bald Mountain Wash), we discuss the remaining southern portion of the Toquima Range under one heading (results from our Alta Toquima/Mt. Jefferson research are excluded from this discussion). The following archaeological assemblages are included: Excavated Sites: Hunts Canyon Shelter. Systematic Survey: Ny925.

Middle Monitor Block: Although only limited archaeological survey and excavation occurred in the Monitor Range, several sites were investigated and all are within the relatively isolated Middle Monitor block. The following archaeological assemblages are included: Excavated Sites: Butler Ranch Cave, Little Empire Shelter. Systematic Survey: Butler Ranch catchment survey. These geographic categories will be used below, but at times, small sample sizes necessitate exclusion of specific geographic zones. Later in this chapter, we also regroup these same assem-
blages into a rather different geographic configuration, defining overall western Toquima slope and eastern Toquima slope.

ARE PREHISTORIC GENERAL UTILITY TOOLS DIFFERENTIALLY DISTRIBUTED?

We defined general utility tools in the last chapter, modifying the terminology and criteria of Winters (1969: chap. IV; see also Thomas, 1983a: 72–73). In the central Great Basin context, general utility tools include knives, scrapers, choppers, hammerstones, and cordage. A total of 116 general utility tools were recovered in this aspect of the project (table 73), and table 76 plots their distribution across the geographic subdivisions of Monitor Valley.

Previously, the cumulative curve technique was employed to define the elevational configuration of the various prehistoric assemblages in Monitor Valley. This technique allowed us to plot cumulative artifact frequencies across the five Monitor Valley elevational zones. Unfortunately, this ordinal approach cannot be employed here because these geographic groupings exist only at the nominal level. That is, whereas elevational zones occur in a fixed order (valley bottom, lowland slope, woodland, upland slope, and summit crest), the geographic assemblages cannot be so arrayed.

We are now asking questions at only the nominal level; accordingly, ordinal-level statistics (in this case, the Kolmogorov-Smirnov two-sample test) must be replaced by statistical methods relevant to nominal data (in this case, the chi-square technique). The statistical conventions introduced in the last chapter for chi-square testing apply here as well (see also Thomas, 1976: 264–284).

A 4 row by 2 column chi-square test is useful for examining this relationship because it views each geographic category as a nominal-level grouping. Accordingly, the four major geographical subdivisions for which we have sufficient samples—the Hickison, Central Toquima, and Northumberland corridors, plus the Middle Toquima block—define the four rows, and the two artifact categories (General Utility Tools vs. the remaining artifacts) comprise the two columns. The number of degrees of freedom is thus computed to be \((4 - 1)(2 - 1) = 3\), and the critical value of chi-square (at the 0.05 level) is 4.35493.

The probability associated with this observed value of chi-square for this grouping of general utility tools is only chi-square = 6.12433, with an associated exact probability of \(p = 0.1049\). The null hypothesis of no association cannot be rejected.

Similarly, we find no association when the Middle Toquima block frequencies are compared to the pooled frequencies for all three corridors (chi-square = 0.0337, df = 1, \(p = 0.8486\)).

We can also examine the geographic distribution by grouping the corridors into a single category to test against the Middle Toquima block frequency. These results show no significant clustering by geography (chi-square = 0.0337, df = 1, \(p = 0.8486\)).

Finally, we can examine the artifact distributions relative to position on the eastern and western Toquima flanks (chi-square = 0.018, df = 1, \(p = 0.8888\)). The null hypothesis of no association cannot be rejected in this case.

In other words, regardless of how we partition the various geographic subdivisions in Monitor Valley, we find that the distribution of general utility tools—finished bifacial knives, unifaces, scraper planes, hammerstones, and cordage—does not depart significantly from random expectation.

COMPARING ARTIFACT-LEVEL DISTRIBUTIONS

Looking at the specific, artifact-level distributions, we do find one statistically significant trend within the general utility tools. Unifaces are nonrandomly distributed across the major geographical zones (chi-square = 22.4071, df = 3, \(p = 0.0002\)). They are especially common in the Hickison Summit corridor (\(n = 13\); expectation = 4.41) and relatively rare in the Northumberland corridor (\(n = 8\); expectation = 15.22).

The sample sizes available for the other artifact types are too small to allow meaningful statistical comparison, but a couple of trends are suggested. Finished bifacial knives, for instance, tend to cluster within the Middle
Toquima block \( (n = 7; \text{ expectation } = 4.64) \) and the Central Toquima corridor \( (n = 5; \text{ expectation } = 1.98) \). By contrast, scraper planes and cordage are found only within the Northumberland corridor. Scraper planes are totally absent from the eastern Toquima flank.
### TABLE 76
Geographic Distribution of Artifacts Within the Toquima Range

<table>
<thead>
<tr>
<th></th>
<th>Hickson Summit Corridor</th>
<th>Central Toquima Corridor</th>
<th>Middle Toquima Range</th>
<th>Northumberland Canyon Corridor</th>
<th>Eastern Toquima Flank</th>
<th>Western Toquima Flank</th>
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<tbody>
<tr>
<td><strong>GENERAL UTILITY TOOLS</strong></td>
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<td>24</td>
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<td>1</td>
<td>2</td>
<td>—</td>
<td>3</td>
</tr>
<tr>
<td><strong>Firemaking equipment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Fire drill</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Sleeping mats</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td><strong>Ornaments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bone beads</td>
<td>—</td>
<td>24</td>
<td>—</td>
<td>—</td>
<td>24</td>
<td>—</td>
</tr>
<tr>
<td>Shell beads/ornaments</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>Glass beads</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>9</td>
<td>—</td>
<td>9</td>
</tr>
<tr>
<td>Pendants</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>—</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Worked turquoise</td>
<td>—</td>
<td>1</td>
<td>3</td>
<td>—</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Subtotals</strong></td>
<td>387</td>
<td>39</td>
<td>309</td>
<td>26</td>
<td>927</td>
<td>214</td>
</tr>
<tr>
<td><strong>Adjusted subtotals</strong></td>
<td>(41)</td>
<td>(39)</td>
<td>(64)</td>
<td>(26)</td>
<td>(158)</td>
<td>(58)</td>
</tr>
</tbody>
</table>
TABLE 76—(Continued)

<table>
<thead>
<tr>
<th></th>
<th>Hickson Summit Corridor</th>
<th>Central Toquima Corridor</th>
<th>Middle Toquima Range</th>
<th>Northumberland Canyon Corridor</th>
<th>Eastern Toquima Flank</th>
<th>Western Toquima Flank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FABRICATING AND PROCESSING TOOLS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perforating tools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drills/Gravers</td>
<td>2</td>
<td>3</td>
<td>14</td>
<td>8</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Bone awls</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Shaft smoother</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Polishing stone</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Edge ground cobbles</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>Abrader</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td><strong>Subtotals</strong></td>
<td>3</td>
<td>4</td>
<td>14</td>
<td>15</td>
<td>19</td>
<td>20</td>
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<tr>
<td><strong>FABRICATING AND PROCESSING BYPRODUCTS</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cores/Roughouts</td>
<td>20</td>
<td>14</td>
<td>86</td>
<td>76</td>
<td>89</td>
<td>107</td>
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<tr>
<td>Rough percussion blanks</td>
<td>17</td>
<td>36</td>
<td>146</td>
<td>68</td>
<td>129</td>
<td>132</td>
</tr>
<tr>
<td>Fine percussion blanks</td>
<td>38</td>
<td>65</td>
<td>269</td>
<td>171</td>
<td>314</td>
<td>244</td>
</tr>
<tr>
<td>Pressure flaked bifaces</td>
<td>30</td>
<td>28</td>
<td>242</td>
<td>104</td>
<td>267</td>
<td>181</td>
</tr>
<tr>
<td>Point preforms</td>
<td>3</td>
<td>3</td>
<td>11</td>
<td>9</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td><strong>Subtotals</strong></td>
<td>108</td>
<td>146</td>
<td>154</td>
<td>428</td>
<td>809</td>
<td>682</td>
</tr>
<tr>
<td><strong>CEREMONIAL EQUIPMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incised stones</td>
<td>—</td>
<td>7</td>
<td>73</td>
<td>4</td>
<td>14</td>
<td>53</td>
</tr>
<tr>
<td>Quartz crystals</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>Ocher</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>+</td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td><strong>Subtotals</strong></td>
<td>2</td>
<td>7</td>
<td>73</td>
<td>4</td>
<td>16</td>
<td>53</td>
</tr>
<tr>
<td><strong>Grand totals</strong></td>
<td>554</td>
<td>287</td>
<td>919</td>
<td>718</td>
<td>2167</td>
<td>1329</td>
</tr>
<tr>
<td><strong>Adjusted grand totals</strong></td>
<td>(208)</td>
<td>(287)</td>
<td>(674)</td>
<td>(718)</td>
<td>(1398)</td>
<td>(1173)</td>
</tr>
</tbody>
</table>

*Note that because the geographic categories are not mutually exclusive, row totals are not calculated.*

ARE PREHISTORIC WEAPONS DIFFERENTIALLY DISTRIBUTED?

This inclusive artifact category includes any implements designed for procuring fauna (see chap. 10). Table 76 summarizes the distribution of weapons across Monitor Valley (see also table 73).

More than one-quarter of the artifacts in the Monitor Valley sample are weapons, and a chi-square test demonstrates that weapons are differentially distributed with respect to geography (chi-square = 105.064, df = 3, p < 0.0001). Weapons are particularly abundant in the middle Toquima Range (n = 343; expectation = 245.03) and less common than expected along the various corridors: the Hickison corridor (n = 40; expectation = 75.62), the Central Toquima corridor (n = 82; expectation = 104.34), and the Northumberland corridor (n = 221; expectation = 261.02).

Not unexpectedly, this nonrandom distribution also holds up when the Middle Toquima block frequencies are compared to the pooled frequencies for the three corridors (chi-square = 95.6788, df = 1, p < 0.0001). Weapons clearly cluster in the Middle Toquima block (n = 343; expectation = 245.03).

Weapons are not significantly distributed with respect to position on the eastern and western Toquima slopes (chi-square = 1.9908, df = 1, p = 0.1547).

COMPARING ARTIFACT-LEVEL DISTRIBUTIONS

Although not significant on a corridor-by-corridor basis, *Elko series projectile points* are significantly associated with the Middle Toquima block (n = 62; expectation = 51.08; chi-square = 3.8530; df = 1, p = 0.0470) and correspondingly underrepresented in the various corridors.
Gatecliff series projectile points are non-randomly distributed across the individual geographic zones (chi-square = 13.5949, df = 3, p = 0.0040). Gatecliff points are especially common in the Middle Toquima block (n = 25; expectation = 14.64) and rare in the Northumberland corridor (n = 6; expectation = 15.60).¹

Gatecliff series points are also significantly associated with the eastern Toquima flank (chi-square = 5.10839, df = 1, p = 0.0226; n = 30; expectation = 22.82).

Humboldt series points tend to cluster in the Middle Toquima block (n = 14; expectation = 9.27); but in this case, the frequencies are too small to allow statistical comparison. Humboldt points are likewise nonrandomly associated with the eastern flank of the Toquimas (chi-square = 8.17784, df = 1, p = 0.0046; n = 24; expectation = 16.30).

Projectile point fragments are also nonrandomly distributed geographically (chi-square = 69.0054, df = 3, p < 0.0001). Point fragments are especially common in the Middle Toquima block (n = 101; expectation = 57.15) and relatively rare in both the Northumberland (n = 32; expectation = 60.88) and Hickison corridors (n = 1; expectation = 17.64).² Point fragments are also significantly associated with the eastern Toquima flank (chi-square = 3.93556, df = 1, p = 0.0447; n = 99; expectation = 86.94).

Point tips are common in the Middle Toquima block (n = 41; expectation = 31.43), but the distribution is not quite statistically significant when corridors are partitioned (chi-square = 7.0829, df = 3, p = 0.0687). But when corridor frequencies are pooled, we find a significant association between tip points and the Middle Toquima block (chi-square = 4.6370, df = 1, p = 0.0296).

Promontory pegs are also nonrandomly distributed (chi-square = 25.8678, df = 3, p < 0.0001). They are abundant in the Northumberland corridor (n = 32; expectation = 25.87) and the Middle Toquima Range (n = 36; expectation = 24.29). Promontory pegs are absent from the Hickison (expectation = 7.50) and Central Toquima (expectation = 10.34) corridors, and are restricted to the western Toquima flank (expectation = 31.05).

Arrow fragments are concentrated in the Hickison (n = 5; expectation = 1.54) and Northumberland (n = 8; expectation = 5.33) corridors, and absent from the Middle Toquima block (expectation = 5.00). These frequencies are too small to permit statistical comparison.

Finally we examined the distribution of individual point types across the various geographic partitions. The only nonrandom distribution noted is that of Humboldt Basal Notched points, which were significantly associated with the eastern Toquima flank (chi-square = 4.16181, df = 1, p = 0.0390; n = 13; expectation = 9.15).

COMPARING THE DISTRIBUTION OF TIME-MARKERS AT THE TYPE LEVEL

As before, we will explore the spatial distribution of temporally and functionally significant projectile points—a subclass of weapons—in more detail. We approach this question with an additional pattern recognition analysis, designed to determine the empirical distribution of the subseries groupings listed on table 77.

Are Desert Side-notched and Cottonwood Triangular points differentially distributed by geography? Table 77 plots the differential distribution of Cottonwood and Desert Side-notched points by geographic zone. Two-by-two contingency table analysis shows that these two contemporary types are randomly distributed with respect to both corridors and the Middle Toquima block (chi-square = 0.8356, df = 1, p = 0.8425) and the east–west Toquima flanks (chi-square = 0.0947, df = 1, p = 0.7566).

Are Elko Eared and Elko Corner-notched points differentially distributed by geography? Two-by-two contingency table analysis shows that these two contemporary types are randomly distributed with respect to both corridors and the Middle Toquima block (chi-square = 0.2125, df = 1, p = 0.6501) and the east and west Toquima flanks (chi-square = 0.8851, df = 1, p = 0.6508).

Are Gatecliff Contracting Stem and Gatecliff Split Stem points distributed differentially by geography? Contingency table analysis shows that these two contemporary
TABLE 77
Geographic Distribution of Projectile Points Within the Toquima Range

<table>
<thead>
<tr>
<th></th>
<th>Hickison Summit Corridor</th>
<th>Petes Summit Corridor</th>
<th>Middle Toquima Range</th>
<th>Northumberland Canyon Corridor</th>
<th>Eastern Toquima Flank</th>
<th>Western Toquima Flank</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESERT SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Desert Side-notched</td>
<td>4</td>
<td>3</td>
<td>15</td>
<td>14</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>Cottonwood Triangular</td>
<td>2</td>
<td>4</td>
<td>14</td>
<td>11</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Subtotals</td>
<td>6</td>
<td>7</td>
<td>29</td>
<td>25</td>
<td>34</td>
<td>38</td>
</tr>
<tr>
<td>ROSEGATE SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3</td>
<td>24</td>
<td>20</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>ELKO SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elko Corner-notched</td>
<td>3</td>
<td>9</td>
<td>40</td>
<td>35</td>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td>Elko Eared</td>
<td>3</td>
<td>9</td>
<td>22</td>
<td>18</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>Elko series, type unknown</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>Subtotals</td>
<td>8</td>
<td>20</td>
<td>62</td>
<td>53</td>
<td>78</td>
<td>67</td>
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<td>GATECLIFF SERIES</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Gatecliff Contracting Stem</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Gatecliff Split Stem</td>
<td>1</td>
<td>2</td>
<td>12</td>
<td>2</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Gatecliff series, type unknown</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Subtotals</td>
<td>4</td>
<td>6</td>
<td>25</td>
<td>6</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>HUMBOLDT SERIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Humboldt Concave Base</td>
<td>—</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Humboldt Basal-notched</td>
<td>—</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Subtotals</td>
<td>0</td>
<td>4</td>
<td>14</td>
<td>8</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>OTHER TYPES</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Residual Concave Base</td>
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<td>1</td>
<td>—</td>
<td>1</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>Large Side-notched</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>—</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>Types older than Gatecliff</td>
<td>3</td>
<td>—</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
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<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Grand totals</td>
<td>30</td>
<td>43</td>
<td>160</td>
<td>115</td>
<td>207</td>
<td>155</td>
</tr>
</tbody>
</table>

Gatecliff types are randomly distributed with respect to both corridors and the Middle Toquima block (chi-square = 1.4663, df = 1, p = 0.6945) and the east–west Toquima flanks (chi-square = 0.4967, df = 1, p = 0.5117). These results indicate that—at the type-specific level— projectile points are not differentially distributed relative to major geographic features within Monitor Valley.

**IS PREHISTORIC HARVESTING EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

As previously defined (Thomas, 1983a: 72), *harvesting equipment* includes the probable digging stick fragment (from Toquima Cave) within the Middle Toquima block, and the píñon hook (from Ny878) from the Central Toquima corridor.

**IS PREHISTORIC DOMESTIC EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

The distribution of domestic equipment is presented on table 76; the ceramic corrections are discussed in chapter 8. When compared to the remaining artifacts recovered in the Monitor Valley sample, it is clear that domestic equipment is differentially distributed with respect to elevation (chi-square = 62.0286, df = 3, p < 0.0001). Domestic equipment is especially common in the Hickson (n = 41; expectation = 18.74) and central Toquima corridors (n = 39; expectation =
25.86), and relatively rare in the Northumberland corridor \((n = 26; \text{expectation} = 64.68)\).

Somewhat surprisingly, this nonrandom distribution does not hold up when the Middle Toquima block frequencies are contrasted with pooled frequencies for the three corridors \((\text{chi-square} = 0.2882, \text{df} = 1, p - 0.5983)\).

Weapons are also nonrandomly distributed with respect to the east–west flanks of the Toquima Range \((\text{chi-square} = 33.5621, \text{df} = 1, p < 0.0001)\). Domestic equipment clusters on the east-facing Toquima slope \((n = 158; \text{expectation} = 117.45)\).

**Comparing Artifact-level Distributions**

*Metates* are nonrandomly distributed across the individual geographic zones \((\text{chi-square} = 18.943, \text{df} = 3, p = 0.0005)\). They are especially common in the Middle Toquima block \((n = 18; \text{expectation} = 10.72)\) and the Central Toquima corridor \((n = 9; \text{expectation} = 4.56)\). Metates are rare in the Northumberland \((n = 2; \text{expectation} = 11.41)\) and Hickson \((n = 1; \text{expectation} = 3.31)\) corridors. They are also significantly associated with the eastern Toquima flank \((\text{chi-square} = 5.20983, \text{df} = 1, p = 0.0213; n = 25; \text{expectation} = 18.48)\).

*Ceramics* are also nonrandomly distributed across the individual geographic zones \((\text{chi-square} = 173.491, \text{df} = 3, p < 0.0001)\). Sherds are particularly common in the Hickson corridor \((n = 39; \text{expectation} = 7.50)\); but note that—even when corrected—these high frequencies probably reflect a single pot drop. Ceramics are rare in the Northumberland corridor \((n = 1; \text{expectation} = 25.87)\) and absent from the Central Toquima corridor \((\text{expectation} = 10.34)\). Ceramics are likewise associated with the eastern Toquima flank \((\text{chi-square} = 35.9864, \text{df} = 1, p < 0.0001; n = 87; \text{expectation} = 57.06)\).

*Bone beads* occur only in the Central Toquima corridor \((n = 24)\). They are also significantly associated with the eastern Toquima flank \((\text{chi-square} = 20.557, \text{df} = 1, p < 0.0001; n = 24; \text{expectation} = 13.04)\).

*Shell beads and ornaments* are found only on the western Toquima slope \((n = 4)\); *glass beads* are also restricted to the western Toquima slope \((n = 9)\).

**ARE PREHISTORIC FABRICATING AND PROCESSING ARTIFACTS DIFFERENTIALLY DISTRIBUTED?**

Fabricating or processing *tools* are used primarily for modifying raw materials for use as other implements (Winters, 1969: 47): flakers, perforating tools, sewing implements, weaving tools, edge-abraded cobbles. *By-products* of fabrication and processing are also included here: cores, roughouts, production stage blanks, preforms, and whittling debris.

Only 51 fabricating and processing implements were recovered in this aspect of the Monitor Valley research (table 73; see also table 76). We find no significant difference in the distribution of fabricating/processing implements across the individual corridors vs. Middle Toquima block partitions \((\text{chi-square} = 0.8756, \text{df} = 3, p = 0.8331)\). Similarly, no geographic associations are found when Middle Toquima block frequencies are compared to the pooled frequencies for the three corridors \((\text{chi-square} = 0.1529, \text{df} = 1, p = 0.6983)\). We also find no association between this artifact class and east–west distribution within the Toquima Range \((\text{chi-square} = 0.5176, \text{df} = 1, p = 0.5209)\).

By contrast, table 76 shows a highly significant difference between the byproducts of fabricating/processing and the remainder of the Monitor Valley assemblage \((\text{chi-square} = 203.816, \text{df} = 3, p < 0.0001)\). Byproducts are especially common in the Northumberland corridor \((n = 428; \text{expectation} = 318.10)\) and to some degree in the central Toquima corridor \((n = 146; \text{expectation} = 127.15)\). They are rather rare in the Middle Toquima block \((n = 154; \text{expectation} = 298.60)\).

We also found that such byproducts are not differentially distributed with respect to the east/west division of the Toquima Range \((\text{chi-square} = 0.0213, \text{df} = 1, p = 0.8788)\).

**Comparing Artifact-level Distributions**

*Cores and roughouts* are nonrandomly distributed across the individual corridors vs.
the Middle Toquima block (chi-square = 13.5972, df = 3, p = 0.0040); this same trend is evident when the corridor frequencies are pooled (chi-square = 6.2586, df = 1, p = 0.0121). Cores and roughouts are likewise associated with the Middle Toquima block (n = 86; expectation = 70.01) and rare in the Central Toquima corridor (n = 14; expectation = 29.81). They are also significantly associated with the western Toquima flank (chi-square = 6.7998, df = 1, p = 0.0091; n = 107; expectation = 89.49).

Rough percussion blanks are nonrandomly distributed across the individual corridors vs. the Middle Toquima block (chi-square = 50.9766, df = 3, p < 0.0001); this trend persists when the corridor frequencies are pooled (chi-square = 41.6092, df = 1, p < 0.0001). Rough percussion blanks are heavily associated with the Middle Toquima block (n = 146; expectation = 95.37) and rare in both the Hickison (n = 17; expectation = 29.43) and Northumberland corridors (n = 68; expectation = 101.59). They tend to be associated with the western Toquima flank, but the association is not statistically significant (chi-square = 2.81749, df = 1, p = 0.0893; n = 132; expectation = 119.17).

Fine percussion blanks are nonrandomly distributed across the individual corridors vs. the Middle Toquima block (chi-square = 65.8537, df = 3, p < 0.0001); this trend persists when the corridor frequencies are pooled (chi-square = 63.3322, df = 1, p < 0.0001). Fine percussion blanks are without question associated with the Middle Toquima block (n = 269; expectation = 193.95) and rare in all corridors.

Pressure flaked bifaces are nonrandomly distributed across the individual corridors vs. the Middle Toquima block (chi-square = 133.028, df = 3, p < 0.0001); this trend persists when the corridor frequencies are pooled (chi-square = 130.07, df = 1, p < 0.0001). Pressure flaked bifaces are associated with the Middle Toquima block (n = 242; expectation = 144.53) and rare in all the corridors. These late-stage blanks are significantly associated with the eastern Toquima flank (chi-square = 6.06352, df = 1, p = 0.0134; n = 267; expectation = 1243.44).

Projectile point preforms are significantly associated with the western Toquima flank (chi-square = 3.93014, df = 1, p = 0.0448; n = 18; expectation = 12.78).

**Geographic Variability in Lithic Staging Behavior**

We have examined the pooled Monitor Valley assemblage at the levels of the artifact and the functional assemblage. We will now determine the degree of internal variability with respect to bifacial staging behavior. To do this, the pooled regional assemblage is partitioned into geographic catchments, which are then compared with the remaining assemblages.

The following comparisons analyze the various Monitor Valley assemblages described in this volume. A total of 3546 bifacially modified lithic artifacts are included in this total. This pooled assemblage provides the master profile against which the various catchment assemblages can be arrayed; computational procedures are explained in chapter 9. Note that in this case, ordinal-level statistical procedures are once again warranted.

**Are Lithic Assemblages Discarded in the Hickison Corridor Staged Differently from Other Monitor Valley Assemblages?** The technological profile for assemblages recovered in the Hickison corridor can be statistically compared with the sample from the rest of the pooled Monitor Valley assemblage. The null hypothesis of no difference cannot be rejected (p < 0.05; D = 0.063; D0.05 = 0.115; n1 = 3401; n2 = 145).

This means that the available samples are insufficiently distinct to establish significant differences in bifacial staging behavior between the Hickison corridor and the rest of the aggregate Monitor Valley assemblage.

**Are Lithic Assemblages Discarded in the Central Toquima Corridor Staged Differently from Other Monitor Valley Assemblages?** When the technological profile for assemblages recovered in the Central Toquima corridor is statistically compared with that for the aggregate Monitor Valley assemblage, we find that the null hypothesis of no difference cannot be rejected (p < 0.05; D = 0.089; D0.05 = 0.092; n1 = 3312; n2 = 234).

We thus lack evidence of any significant
difference in bifacial staging behavior between the Central Toquima corridor sample and the rest of the aggregate Monitor Valley assemblage.

*Are Lithic Assemblages Discarded in the Middle Toquima Block Staged Differently from Other Monitor Valley Assemblages?* The technological profile for assemblages recovered in the Middle Toquima block can be statistically compared with that for the aggregate Monitor Valley assemblage. As before, the null hypothesis of no difference is not rejected ($p < 0.05; D = 0.016; D_{0.05} = 0.050; n_1 = 2469; n_2 = 1077$).

We find no evidence to suggest that any significant difference in bifacial staging behavior exists between the Middle Toquima block and the rest of the aggregate Monitor Valley assemblage.

*Are Lithic Assemblages Discarded in the Northumberland Corridor Staged Differently from Other Monitor Valley Assemblages?* The technological profile for assemblages recovered in the Northumberland corridor can be statistically compared with that for the aggregate Monitor Valley assemblage. In statistical terms, the null hypothesis of no difference cannot be rejected ($D = 0.036; D_{0.05} = 0.060; D_{0.01} = 0.072; n_1 = 2930; n_2 = 616$). The samples are not sufficient to demonstrate that a highly significant difference in bifacial staging behavior exists between the Northumberland corridor sample and the rest of the aggregate Monitor Valley assemblage.

*Are Lithic Assemblages Discarded on the Eastern Flank of the Toquima Range Staged Differently from Other Monitor Valley Assemblages?* When the technological profile for assemblages recovered on the east flank of the Toquima Range is statistically compared with that for the aggregate Monitor Valley assemblage, the null hypothesis of no difference cannot be rejected ($p < 0.05; D = 0.032; D_{0.05} = 0.048; n_1 = 2359; n_2 = 1187$).

The available samples are insufficiently distinct to establish any significant difference in bifacial staging behavior between the eastern Toquima flank sample and the rest of the aggregate Monitor Valley assemblage.

*Are Lithic Assemblages Discarded on the Western Flank of the Toquima Range Staged Differently from Other Monitor Valley Assemblages?* The technological profile for assemblages recovered on the western flank can be statistically compared with that for the aggregate Monitor Valley assemblage. In statistical terms, the null hypothesis of no difference is rejected ($p < 0.05; D = 0.065; D_{0.05} = 0.052; D_{0.01} = 0.062; n_1 = 2596; n_2 = 950$; chi-square = 31.491, df = 4, $p < 0.0001$). This relationship is shown graphically on figure 170.

The available samples are sufficient to establish a highly significant difference in bifacial staging behavior between assemblages recovered on the western Toquima slope and those in the aggregate Monitor Valley sample. Relative to the overall Monitor Valley assemblage, with cores/roughouts ($n = 107$, expectation = 73.41), rough percussion blanks ($n = 132$; expectation = 120.83), and pressure flaked bifaces ($n = 181$; expectation = 218.88) somewhat less common in the western flank assemblages.
IS PREHISTORIC CEREMONIAL EQUIPMENT DIFFERENTIALLY DISTRIBUTED?

As defined earlier (Thomas, 1983a: 73), only three kinds of ceremonial equipment are found in Monitor Valley: incised stones, quartz crystals, and ocher (table 76). We find ceremonial equipment to be nonrandomly distributed across the corridors and Middle Toquima block (chi-square = 96.5409, df = 3, \( p < 0.0001 \)). These artifacts are largely confined to the Middle Toquima block (\( n = 73 \); expectation = 30.72) and rare in all the corridors: Hickson (\( n = 2 \); expectation = 9.48), Central Toquima (\( n = 7 \); expectation = 13.08), and Northumberland (\( n = 4 \); expectation = 32.72). Not unexpectedly, this nonrandom distribution holds up when Middle Toquima block frequencies are compared to the pooled frequencies for the three corridors (chi-square = 94.2952, df = 1, \( p < 0.0001 \)).

Ceremonial equipment is also nonrandom with respect to east-west distribution within the Toquima Range (chi-square = 27.7064, df = 1, \( p < 0.0001 \)); these items cluster on the western Toquima flank (\( n = 53 \); expectation = 31.48).

COMPARING ARTIFACT-LEVEL DISTRIBUTIONS

Most so-called ceremonial items are incised stones, which are nonrandomly distributed across the individual geographic zones (chi-square = 102.514, df = 3, \( p < 0.0001 \)); this trend persists when the corridor frequencies are pooled (chi-square = 99.7277, df = 1, \( p < 0.0001 \)). They are, as noted above, significantly associated with the Middle Toquima block (\( n = 73 \); expectation = 30.00) and rare in all corridors. Incised stones are also significantly associated with the western Toquima flank (chi-square = 30.8739, df = 1, \( p < 0.0001 \); \( n = 53 \); expectation = 30.61).

SUMMARY: GEOGRAPHIC STRUCTURE OF PREHISTORIC MONITOR VALLEY

This pattern recognition study has examined the horizontal differentiation evident in the archaeological assemblages of Monitor Valley. We can isolate the following artifact-level trends:

The Hickson Corridor: This northernmost access route into Monitor Valley is characterized by an overabundance of ceramics and arrow fragments. Neither occurrence should be regarded as an important trend, since both artifact categories represent isolated finds, a single pot drop at Upper Ackerman (La627) and a cache of arrows buried in Boring-as-Hell Shelter.

The following artifact categories are rare in the Hickson assemblage: weapons in general (especially projectile point fragments), metates, byproducts of lithic reduction (especially intermediate stage blanks and bifaces), and incised stones.

The Central Toquima Corridor: This is the major pathway between Big Smoky and Monitor valleys. The archaeological record of this corridor is distinguished from the rest of Monitor Valley by the high relative frequency of domestic items, particularly metates and bone beads. Byproducts of lithic fabrication are also abundant here.

The following artifact categories are rare along the Central Toquima corridor: weapons, reduction stage byproducts (especially cores and roughouts, fine percussion blanks, and pressure flaked bifaces), and incised stones. Ceramics are absent here.

The Northumberland Corridor: This is another major route of access from Monitor Valley to the west. The assemblage recovered from this corridor contains an inordinately high frequency of lithic fabrication byproducts. An unusually large number of Promontory pegs was cached at Triple T Shelter.

The following artifact categories are rare in the Northumberland assemblage: unifaces, weapons in general (especially Gatecliff series and projectile point fragments), unifaces, domestic equipment (metates and ceramics), incised stones, and intermediate-stage byproducts of lithic reduction (especially rough percussion blanks, fine percussion blanks, and pressure flaked bifaces).

Elko points are relatively rare in the corridors and abundant in the Middle Toquima block.

The Middle Toquima Block: This relatively isolated montane block contained a rich and diverse archaeological record. Weapons in general are overrepresented here, particu-
ularly Gatecliff and Humboldt series points, and untypable point tips and other fragments. Promontory pegs were cached at Jeans Spring Shelter. Domestic equipment is well-represented, with an unusually high frequency of metates being recovered. All stages of lithic reduction are quite common here, and incised stones are clustered in the Middle Toquima Block.

The Eastern Toquima Slope: Domestic equipment, especially ceramics, metates, and bone beads, is nonrandomly associated with the eastern flank. Although weapons are not overrepresented here, the eastern flank is heavily biased toward high frequencies of Humboldt and Gatecliff series points, and unidentifiable point fragments. Late-stage byproducts of lithic reduction are also found in high quantities here.

The Western Toquima Slope: The assemblage of the western flank is biased toward early-stage lithic reduction, with cores, roughouts, and rough percussion blanks particularly common. Projectile point preforms and incised stones also tend to cluster here. Promontory pegs are restricted to the Western Toquima slope, as are shell and glass beads.

NOTES

1. This same trend persists when the corridor frequencies are pooled (chi-square = 11.3646, df = 1, p = 0.0012).
2. The same trend is evident when corridor frequencies are pooled (chi-square = 56.8912, df = 1, p < 0.0001).
3. This same trend is evident when the corridor frequencies are pooled (chi-square = 7.5860, df = 1, p = 0.0062).
CHAPTER 12. PATTERN RECOGNITION: VARIABILITY BY CONTEXT

Various functional artifact categories have been discussed in the past several chapters—general utility tools, weapons, harvesting equipment, and so forth—and we now employ these groupings to explore variability at the contextual level.

We sampled Monitor Valley through a series of integrated survey strategies, each field operation generating a series of assemblages (which are discussed in detail in the first six chapters of this monograph). These data have been compiled on table 78, and, below, we briefly recap these eight contextual divisions:

The Montane Spring Catchment Survey: Figure 7 plots the location of the 15 randomly selected spring catchments surveyed throughout the Toquima Range. The sites and loci are plotted on individual spring catchment maps (figs. 8–20). Assemblage frequencies for each site and locus are listed on tables 1 and 2; primary locational attributes are also provided at the end of chapter 17.

The Valley Floor Survey: The valley floor was surveyed in two different ways.

The Valley Floor Spring Catchment Survey: Only three active freshwater sources exist within the study area on the floor of Monitor Valley: Dianas Punch Bowl (figs. 6 and 21), Potts Ranch Spring (fig. 22), and White Sage Spring (fig. 23). A 1 km catchment area was surveyed around each, following the same survey method as in the montane research.

The Lakebed Survey: An extensive survey was also conducted along the margins of Monitor Lake (fig. 24). Two randomly selected 100 m transects were run between the Toquima Range and the present Monitor Valley road (NV82); virtually nothing was found in either transect. A major prehistoric site, Ny1228, exists to the east of NV82, along the margins of Monitor Lake. To sample this extensive site, six 100-m-wide transects, spaced at 1 km intervals, were totally surveyed and collected. Dense artifact and debitage concentrations were encountered in every transect at roughly the 2073 m (6800 ft) contour interval (fig. 24). The archaeology of each site is described in chapter 2, and the individual artifact frequencies are listed on tables 1 and 2.

Cave and Shelter Excavations: This monograph describes excavations at 11 archaeological sites. The following caves and shelters produced artifacts which are grouped into this contextual assemblage.

Triple T Shelter (Ny345) is a small south-facing alcove in West Northumberland Canyon (fig. 48). The archaeology of Triple T Shelter is described in chapter 3; artifact totals are listed on tables 16 and 17.

Toquima Cave (La1) is located on the south facing slope of Petes Summit, the major pass through the northern Toquima Range (fig. 67). The artifacts from Toquima Cave are enumerated on tables 27 and 28.

Grenouille Verte Cave (La1071) is a small alcove located about 400 m east of Toquima Cave (fig. 66); the single artifact recovered is discussed in chapter 4.

Butler Ranch Cave (Ny303) is located on the east side of Monitor Valley, in a sheer tuff cliff on the northern margin of Butler Creek (fig. 78), approximately 1 km east of the Butler Ranch. The Butler Ranch artifacts are listed on tables 31 and 32.

Little Empire Shelter (Ny1160) is a rather large overhang, approximately 500 m upstream from Butler Ranch Cave (figs. 66 and 85); the few artifacts recovered from Little Empire are discussed in chapter 4.

Jeans Spring Shelter (Ny302) is located approximately 200 m southwest of Jeans Spring, a natural seep on the north fork of Wildcat Canyon (figs. 66 and 89); these artifacts are enumerated on table 35.

Ny1059 is located near the eastern end of Northumberland Canyon (fig. 66); the few artifacts excavated there are discussed in chapter 4.

Hunts Canyon Shelter (Ny1158) is located approximately 1 km northeast of Hunts Ranch (fig. 66) and consists of a low, narrow overhang in the massive tuff outcrop jutting up from the alluvial bottomland of Hunts Canyon (fig. 95). These artifacts are enumerated on table 40.
Bradshaw Shelter (Es81) is about 6 km northwest of Goldfield, Nevada (fig. 66), roughly 80 km south of Monitor Valley proper; the artifacts are discussed in chapter 4.

Boring-as-Hell Shelter (La1073) is located near modern Highway 50, about 100 m south of the access road to the BLM picnic area at Hickison Summit. The few artifacts found there are described in chapter 4.

The Rock Alignment Catchment Survey: The artifacts found in the vicinity of four rock alignments are grouped together.

The Table Mountain Rock Alignments occur in the Monitor Range, on the east side of Monitor Valley. The primary rock alignment (Ny831) is located at an elevation of 2710 m (8900 ft). The Table Mountain upland was completely surveyed for archaeological remains that might be associated with the rock walls; the survey crew walked at 10 m intervals, crisscrossing in both north–south and east–west transects; the artifacts from Table Mountain are listed on table 51. A second, much smaller, rock alignment (Ny832) occurs about 1.3 km due east of the major complex of serpentine alignments (fig. 107); the single artifact found at Ny832 is described in chapter 5.

The Box Spring Features, located at the northern end of Monitor Lake, consist of a series of soldier cairns situated along the discontinuous ridge that lies to the north of the spring proper, and forms a western margin of the marshy area (fig. 114). Artifact frequencies from the Box Spring sites are provided on table 52.

The Bob Scott Rock Walls (La601) occur southeast of Austin, about 3 km south of U.S. Highway 50, near Bob Scott Summit (figs. 117 and 118). The artifacts are described in chapter 5 (see also Thomas and McKee, 1974).

The Monitor Hills Rock Wall (Ny927) is located, appropriately enough, in the Monitor Hills area, south of Monitor Valley proper (fig. 124); the artifacts recovered here are described in chapter 5.

The Petroglyph Site Catchment Survey: Assemblages found in the immediate proximity of three petroglyph sites are included here.

The Hickson Summit Catchment is located north of U.S. Highway 50, in a narrow pass dividing the Toquima Range (on the south) from the Simpson Park Range (fig. 128). The Hickson Summit Petroglyph site (La9) is a dense artifact and debitage scatter that occurs in a small flat, on the southern margin of the petroglyph clusters (near clusters 4, 5, 6, and 7, as defined by T. Thomas, 1976: fig. 2; see also chap. 6, this volume). The artifacts from La9 are enumerated on table 57. This catchment also includes the Upper Ackerman Spring site (La627), a dense concentration of 385 Shoshone ware sherds along a ridge top about 1200 m south of Upper Ackerman Spring area (fig. 129).

The Northumberland Canyon Catchment centers on Ny304, a major petroglyph concentration on several welded tuff boulders along the northern side of East Northumberland Canyon (chap. 6, this volume; see also T. Thomas, 1976). A catchment area 500 m in diameter was surveyed using Ny304 as the excavations are included within the caves and shelters assemblage (enumerated above).

The Toquima Cave Catchment covered a 1 km circular survey area centered on Toquima Cave (fig. 131). The sites are discussed in chapter 6 and artifact frequencies are summarized on tables 55 and 56.

The Butler Ranch Cave Catchment encompassed a 1 km catchment surrounding Butler Ranch Cave; the site distribution is indicated on figure 136. Artifacts recovered from this catchment survey are described in tables 55, 56, and 60.

The Jeans Spring Shelter Catchment survey centered on Ny302, on the west side of the Toquima Range, near the north fork of Wildcat Canyon (fig. 128). Jeans Spring Shelter is roughly 1 km from Spring 22 (one of the randomly selected spring catchments), and since much of this area was surveyed previously, only a rather informal archaeological survey was conducted to the west of the shelter (fig. 141). Artifacts recovered from this catchment survey are described in tables 55, 56, and 62.
focal point (fig. 134). Artifacts recovered from this catchment survey are described in tables 55, 56, and 59.

The East Bald Mountain Wash Catchment centers on Ny1, a a large petroglyph-inscribed boulder, isolated in the middle of East Bald Mountain Wash, at the extreme southern end of Monitor Valley (fig. 128). Artifacts recovered from this catchment survey are described in tables 55, 56, and 61.

The Streamside Catchment Survey: This survey concentrated on the 1 km linear catchment defined for each of three streamside survey areas; in effect, a 2-km-wide strip following the water course (fig. 7). All artifacts recovered in the streamside survey are listed on tables 1 and 2.

The Mill Canyon Streamside Survey extends from the mouth of Mill Canyon, upstream to the spring at the head of the canyon. In addition to Gatecliff Shelter, described elsewhere, only a single archaeological site (Ny926) was recorded here.

The Ikes Canyon Streamside Survey was somewhat restricted since many of the springs in this area had already been examined in conjunction with the randomized spring survey. The Ikes Canyon 1 km catchment extended from 300 m west of the canyon mouth (i.e., from the margin of the Spring 26 catchment) to the margin of the survey of the Spring 20 catchment, near the bifurcation of Ikes Canyon (roughly 1.5 km upcanyon). Only one archaeological site was encountered in Ikes Canyon (Ny1229).

The Stoneberger Canyon Streamside Survey began at “the Monitor,” a prominent rock feature on the floor of Monitor Valley, and continued upstream to approximately 1 km past the fork separating Stoneberger Canyon proper from Corral Canyon (fig. 25). Five archaeological sites occur in the Stoneberger Creek catchment.

Random Quadrat Survey: This sampling domain in Monitor Valley was a pilot project involving 500 m quadrats. Gatecliff Shelter was taken as the southern boundary of the study area, and we arbitrarily extended the survey boundary 25 km to the north, to a point about 5 km north of Toquima Cave (fig. 5). We divided the total survey area into a series of 10 blocks, each 5 km north–south and approximately 10 km east–west. These blocks were labeled sequentially from A through J. Two quadrats were randomly selected within each block. The archaeological sites encountered are described in chapter 2; artifacts recovered are listed on tables 2 and 3.

HOW TO ANALYZE CONTEXTUAL VARIABILITY

We begin with another deceptively simple question: Are the 4260 artifacts in the regional Monitor Valley sample differentially sorted by context?¹

As in chapter 11, this is an ordinal-level question (because the various proveniences have no intrinsically rank-ordered relationship to one another). Accordingly, ordinal-level statistics must be replaced by statistical methods relevant to nominal data (the chi-square technique). The statistical conventions, introduced earlier, for chi-square testing apply to this chapter as well (see also Thomas, 1976: 264–284).

ARE PREHISTORIC GENERAL UTILITY TOOLS DIFFERENTIALLY DISTRIBUTED?

The distribution of the 116 general utility tools is listed on table 78, and the sampling strategy involved in each context is discussed in chapter 2.

To analyze assemblage distributions across these seven proveniences, we will employ a seven row by two column chi-square test: the seven major contextual groupings—montane spring, valley floor, cave and shelter, and so forth—define the rows, and the two artifact categories (General Utility Tools vs. the remaining artifacts) comprise the two columns; remember that “randomized quad” frequencies are not included here due to the small sample size. The number of degrees of freedom is thus \((7 - 1)(2 - 1) = 6\), and the critical value of chi-square (at the 0.05 level) is 12.5916.

The probability associated with this observed value of chi-square for this grouping of general utility tools is only chi-square = 10.1677, with an exact \(p = 0.1182\). The null hypothesis of no association cannot be re-
TABLE 78

Distribution of Prehistoric Monitor Valley Assemblages by Catchment

<table>
<thead>
<tr>
<th></th>
<th>Montane spring</th>
<th>Valley floor</th>
<th>Cave/shelter</th>
<th>Rock alignment</th>
<th>Pictograph</th>
<th>Petroglyph</th>
<th>Streamside</th>
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<td>14</td>
<td>17</td>
<td>2</td>
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**GENERAL UTILITY TOOLS**

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<th>Rosegate series</th>
<th>Elko series</th>
<th>Gatecliff series</th>
<th>Humboldt series</th>
<th>Other types</th>
<th>Tips</th>
<th>Fragments</th>
<th>Arrows</th>
<th>Foreshafts/mainshafts</th>
<th>Arrow nocks</th>
<th>Atlatl</th>
<th>Snare components</th>
<th>Promontory pegs</th>
<th>Misc. snare components</th>
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**DOMESTIC EQUIPMENT**

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Table 78—(Continued)

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<th>Petroglyph</th>
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<th>Total</th>
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<td>9</td>
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Fabricating and processing byproducts

| Cores/roughouts | 67 | 22 | 90 | 10 | 40 | 31 | 7 | 7 | 274 |
| Rough percussion blanks | 157 | 57 | 89 | 62 | 30 | 29 | 11 | 16 | 451 |
| Fine percussion blanks | 234 | 235 | 165 | 52 | 82 | 90 | 51 | 11 | 920 |
| Pressure flaked bifaces | 225 | 152 | 120 | 130 | 80 | 58 | 40 | 12 | 817 |
| Point preforms | 3 | 2 | 12 | 5 | 7 | 7 | 1 | 2 | 39 |
| Whitting debris from manufacture of Promontory pegs | - | - | + | - | - | - | - | - | - |
| Subtotals | 686 | 468 | 476 | 259 | 239 | 215 | 110 | 48 | 2501 |

Ceremonial equipment

| Incised stones | 67 | - | 4 | 5 | 6 | 14 | 2 | 4 | 102 |
| Quartz crystals | - | - | - | - | - | - | 3 | 2 | 5 |
| Other | - | - | + | - | - | - | - | - | + |
| Subtotals | 67 | 0 | 4 | 5 | 6 | 14 | 5 | 6 | 107 |
| Grand totals | 1177 | 965 | 1019 | 399 | 574 | 1127 | 182 | 267 | 5710 |
| Adjusted grand totals | (1066) | (660) | (996) | (399) | (420) | (446) | (182) | (91) | (4260) |

Artifact-level comparisons

Looking at the specific, artifact-level distributions, we find that unifaces are differentially distributed across the major contexts of Monitor Valley (chi-square = 32.996, df = 6, p = 0.0001). Unifaces are especially common in assemblages associated with rock alignments (n = 15; expectation = 6.7) and in areas near petroglyph sites (n = 17; expectation = 7.49). Unifaces are especially rare in caves and shelters (n = 7; expectation = 16.72).

Are prehistoric weapons differentially distributed?

This artifact category includes bows, arrows, fishing equipment, nets, snares, traps, nooses, rabbit and reptile hooks, disguises, decoys, rabbit clubs (Thomas, 1983a: 72). Table 78 summarizes the distribution of weapons across Monitor Valley.

A chi-square test demonstrates that weapons are differentially distributed with respect to context (chi-square = 142.634, df = 6, p < 0.0001). Weapons are particularly abundant in caves and shelters (n = 408; expectation = 275.22) and relatively rare near petroglyph sites (n = 89; expectation = 123.24).

Artifact-level comparisons

Rosegate series points are differentially distributed across the major contexts of Monitor.
Valley (chi-square = 16.7694, df = 6, \( p = 0.0107 \)). They are especially common in the valley floor assemblages \( (n = 29; \) expectation = 16.15), and underrepresented at montane springs \( (n = 20; \) expectation = 26.08) and near rock alignments \( (n = 5; \) expectation = 9.76).

**Elko series points** are also nonrandomly distributed (chi-square = 19.144, df = 6, \( p = 0.0045 \)). They are commonly associated with rock alignments \( (n = 38; \) expectation = 23.26). They are less common near pictographs \( (n = 20; \) expectation = 24.48) and even less so near petroglyph sites \( (n = 15; \) expectation = 26.00).

**Gatecliff series points** are differentially distributed across the major contexts (chi-square = 19.4403, df = 6, \( p = 0.0040 \)). Like Elko points, they are commonly associated with rock alignments \( (n = 15; \) expectation = 7.37); they are underrepresented in cave and shelter assemblages \( (n = 5; \) expectation = 18.40).

**Humboldt series points** are also nonrandomly distributed (chi-square = 79.0933, df = 6, \( p < 0.0001 \)). Like Elko and Gatecliff points, they are especially common near rock alignments \( (n = 28; \) expectation = 6.80). They are significantly underrepresented on the valley floor \( (n = 6; \) expectation = 11.24) and in cave and shelter deposits \( (n = 5; \) expectation = 16.96).

**Projectile point tips** are differentially distributed (chi-square = 52.7389, df = 6, \( p < 0.0001 \)). Tips are especially common in cave and shelter assemblages \( (n = 51; \) expectation = 26.76). They are underrepresented on the valley bottom \( (n = 2; \) expectation = 17.73)

### Table 79
**Distribution of Projectile Point Types by Assemblage**

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<th>Montane Valley</th>
<th>Cave shelter</th>
<th>Rock alignment</th>
<th>Pictograph</th>
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<td>—</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>Grand totals</td>
<td>138</td>
<td>101</td>
<td>141</td>
<td>107</td>
<td>65</td>
<td>59</td>
<td>26</td>
<td>6</td>
</tr>
</tbody>
</table>
and totally absent near rock alignments (expectation = 10.72).

**Projectile point fragments** are nonrandomly distributed (chi-square = 82.184, df = 6, p < 0.0001). Fragments are most common at montane springs (n = 76; expectation = 56.00) and in mainstream assemblages (n = 27; expectation = 9.56); fragments are also commonly found near pictograph sites (n = 40; expectation = 22.06). They are especially rare at rock alignments (n = 8; expectation = 20.96), in caves and shelters (n = 32; expectation = 52.32), and on the valley floor (n = 21; expectation = 34.67).

**Comparisons of Time-markers at the Type Level**

We will once again explore the spatial distribution of temporally and functionally significant projectile points in more detail (listed on table 79).

**Are Desert Side-notched and Cottonwood Triangular points differentially distributed by context?** Contingency table analysis shows that these two contemporary types are randomly distributed with respect to recovery context (chi-square = 2.1728; df = 5; p = 0.7466).²

**Are Elko Corner-notched and Elko Eared points differentially distributed by context?** Seven-by-two contingency table analysis shows that these two contemporary types are randomly distributed with respect to context (chi-square = 11.8052, df = 6, p = 0.0669). Although this relationship does not quite reach statistical significance, we do note that Elko Corner-notched points are somewhat overrepresented in the pictograph site catchments (n = 18; expectation = 13.65), and in proximity to rock alignments (n = 27; expectation = 23.20). They are slightly underrepresented near montane springs (n = 32; expectation = 37.53).

**Are Gatecliff Contracting Stem and Gatecliff Split Stem points distributed differentially by context?** Contingency table analysis shows that the two contemporary Gatecliff types are not randomly distributed by recovery context (chi-square = 1.3296, df = 5, p = 0.9308).³

**IS PREHISTORIC HARVESTING EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

The digging stick fragment was found in Toquima Cave, and the piñon hook from Ny878 was found near a montane spring.

**IS PREHISTORIC DOMESTIC EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

The distribution of milling equipment (manos, metates, mortars, pestles), cooking equipment (bowls, basketry containers, mush stirrers), woodworking tools, firemaking equipment, and so forth is presented on table 78, and the relevant ogive is plotted on figure 167a.

When compared to the remaining artifacts recovered in the Monitor Valley sample, it is clear that domestic equipment is indeed differentially distributed with respect to context (chi-square = 217.882, df = 6, p < 0.0001). Domestic equipment is especially common in association with petroglyph sites (n = 102; expectation = 31.88) and relatively underrepresented everywhere else.

**Comparing Artifact-level Distributions**

**Metates** are nonrandomly distributed across the various catchments (chi-square = 36.8644, df = 6, p < 0.0001). They are most common near pictograph (n = 15; expectation = 6.35) and petroglyph sites (n = 16; expectation = 6.74). These artifacts are rare on the valley floor (n = 5; expectation = 9.97), in caves and shelters (n = 9; expectation = 15.05); metates were absent near rock alignments (expectation = 6.03).

Although the sample of *manos* is too small for statistical analysis, it is clear that the greatest relative abundance (n = 10) occurs in catchments near petroglyph sites.

**Ceramics** are also nonrandomly distributed across the individual contexts (chi-square = 329.301, df = 6, p < 0.0001). Sherds are
particularly common near petroglyph sites \( (n = 76; \text{expectation} = 15.06) \). Ceramics are relatively underrepresented elsewhere and totally absent near rock alignments (expectation = 13.49) and at streamside sites (expectation = 6.16).

**ARE PREHISTORIC FABRICATING AND PROCESSING ARTIFACTS DIFFERENTIALLY DISTRIBUTED?**

*Fabricating or processing tools* are listed on table 78. We find no significant difference between the distribution of fabricating/processing implements within the various contexts and the overall Monitor Valley assemblage (chi-square = 7.5007, df = 6, \( p = 0.2772 \)).

By contrast, table 78 shows a highly significant difference between the *byproducts of fabricating/processing* and the remainder of the Monitor Valley assemblage (chi-square = 131.016, df = 6, \( p < 0.0001 \)). Such byproducts are especially common on the valley floor \( (n = 468; \text{expectation} = 388.34) \) and to some degree near the montane springs \( (n = 686; \text{expectation} = 627.22) \). Fabrication byproducts are relatively less common in caves and shelters \( (n = 476; \text{expectation} = 586.04) \) and especially near petroglyph sites \( (n = 215; \text{expectation} = 262.42) \).

Such highly significant results might be expected from the rather large sample sizes involved, so it is worthwhile to explore spatial distributions of specific byproduct categories.

**COMPARING ARTIFACT-LEVEL DISTRIBUTIONS**

*Cores and roughouts* are nonrandomly distributed across the Monitor Valley contexts (chi-square = 41.06, df = 6, \( p < 0.0001 \)). They are clearly associated with caves and shelters \( (n = 90; \text{expectation} = 63.79) \) and pictograph sites \( (n = 40; \text{expectation} = 26.90) \). These early-stage artifacts are underrepresented near rock alignments \( (n = 10; \text{expectation} = 25.55) \) and on the valley bottom \( (n = 22; \text{expectation} = 42.27) \).

*Rough percussion blanks* are nonrandomly distributed by context (chi-square = 56.8308, df = 6, \( p < 0.0001 \)). Such blanks are especially associated with montane springs \( (n = 157; \text{expectation} = 111.23) \) and, to a lesser extent, with rock alignments \( (n = 62; \text{expectation} = 41.64) \). Rough percussion blanks are underrepresented at petroglyph sites \( (n = 29; \text{expectation} = 46.54) \) and most other contexts.

*Fine percussion blanks* are nonrandomly distributed (chi-square = 113.885, df = 6, \( p < 0.0001 \)). They are particularly abundant on the valley floor \( (n = 235; \text{expectation} = 143.91) \) and also in the streamside assemblages \( (n = 51; \text{expectation} = 39.68) \). Fine percussion blanks are underrepresented in cave and shelter samples \( (n = 165; \text{expectation} = 217.17) \) and near rock alignments \( (n = 52; \text{expectation} = 87.00) \).

*Pressure flaked bifaces* are nonrandomly distributed by context (chi-square = 99.1182, df = 6, \( p < 0.0001 \)). They are especially common near rock alignments \( (n = 130; \text{expectation} = 77.04) \), at montane springs \( (n = 225; \text{expectation} = 205.84) \), and on the valley floor \( (n = 152; \text{expectation} = 127.44) \). These artifacts are underrepresented in cave and shelter assemblages \( (n = 120; \text{expectation} = 192.32) \) and near petroglyph sites \( (n = 58; \text{expectation} = 86.12) \).

**LITHIC STAGING VARIABILITY**

The following comparisons analyze the various Monitor Valley assemblages described in this volume. A total of 3546 bifacially modified lithic artifacts are included in this total (see fig. 171), and this pooled assemblage provides the master profile against which the various catchment assemblages can be arrayed; computational procedures are explained in chapter 10.

*Are Lithic Assemblages Discarded near Montane Springs Staged Differently from Other Monitor Valley Assemblages?* In statistical terms, the null hypothesis of no difference cannot be rejected \( (p < 0.05; D = 0.046; D_{0.05} = 0.052; n_1 = 2603; n_2 = 943) \). The available samples are insufficiently distinct to establish any significant difference in bifacial staging behavior between the montane spring sample and the rest of the aggregate Monitor Valley assemblage.

*Are Lithic Assemblages Discarded on the Valley Floor Staged Differently from Other
Monitor Valley Assemblages (fig. 171a)? The null hypothesis of no difference is rejected ($p < 0.01; D = 0.089; D_{0.01} = 0.073; n_1 = 2943; n_2 = 603; \chi^2 = 85.3846, df = 4, p < 0.0001)$.

The available samples demonstrate a significant difference in bifacial staging behavior between the valley floor sample and the rest of the aggregate Monitor Valley assemblage. Specifically, we find fine percussion blanks to be overrepresented ($n = 235; \text{expectation} = 156.45$), with roughouts and cores ($n = 22; \text{expectation} = 46.59$) and finished products ($n = 137; \text{expectation} = 184.34$) relatively underrepresented.

Are Lithic Assemblages Discarded in Caves and Shelters Staged Differently from Other Monitor Valley Assemblages (fig. 171a)? The null hypothesis of no difference is rejected ($p < 0.05; D = 0.061; D_{0.05} = 0.057; n_1 = 2833; n_2 = 713; \chi^2 = 50.8928, df = 4, p < 0.0001$).

The available samples demonstrate a significant difference in bifacial staging behavior between the cave and shelter samples and the rest of the aggregate Monitor Valley assemblage. Cores/roughouts are unexpectedly common in caves and shelters ($n = 90; \text{expectation} = 55.09$), as are finished bifaces ($n = 249; \text{expectation} = 217.96$). Correspondingly, fine percussion blanks are underrepresented ($n = 165; \text{expectation} = 184.99$), as are pressure flaked bifaces ($n = 120; \text{expectation} = 164.28$).

We also subdivided the cave and shelter assemblage into component samples. When the Butler Ranch Cave sample is compared

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**Fig. 171.** a. Bifacial staging profiles for assemblages recovered from the valley floor, caves and shelters, and b. from petroglyph sites, and near rock alignments. The shaded line represents the pooled Monitor Valley assemblage ($n = 3546$).
against the overall Monitor Valley assemblage, the null hypothesis of no difference is rejected ($p < 0.01$; $D = 0.276$; $D_{0.01} = 0.207$; $n_1 = 3483$; $n_2 = 63$; chi-square $= 55.8163$, $df = 4$, $p < 0.0001$). The lithic reduction profile at Butler Ranch Cave rather closely approximates a quarry curve. Cores and roughouts ($n = 20$; expectation $= 4.87$) and rough percussion bifaces ($n = 10$; expectation $= 8.01$) are more common than expected. All later stages are underrepresented, especially pressure flaked bifaces ($n = 6$; expectation $= 14.52$).

The lithic profile for Toquima Cave also departs from the overall Monitor Valley assemblage ($p < 0.05$; $D = 0.198$; $D_{0.05} = 0.180$; $n_1 = 3488$; $n_2 = 58$; chi-square $= 14.8061$, $df = 4$, $p = 0.0057$). In this case, intermediate-stage bifaces are conspicuously rare, especially fine percussion blanks ($n = 7$; expectation $= 15.05$) and pressure flaked bifaces ($n = 9$; expectation $= 13.36$). Cores and roughouts ($n = 7$; expectation $= 4.48$) and particularly finished bifacial products ($n = 29$; expectation $= 17.73$) are overrepresented.

Triple T Shelter also varies from the rest of Monitor Valley ($p < 0.05$; $D = 0.065$; $D_{0.05} = 0.065$; $n_1 = 3043$; $n_2 = 503$; chi-square $= 33.1575$, $df = 4$, $p < 0.0001$). Cores and roughouts are uncommonly abundant ($n = 67$; expectation $= 38.87$) and pressure flaked bifaces are rare ($n = 86$; expectation $= 115.89$). In other words, lithic staging at Triple T Shelter generally follows a quarry curve—except that the frequency of finished products is rather high.

No significant departure from the Monitor Valley staging profile was noted at Jeans Spring Shelter ($p < 0.05$; $D = 0.213$; $D_{0.05} = 0.253$; $n_1 = 3517$; $n_2 = 29$; chi-square $= 9.85301$, $df = 4$, $p = 0.0429$) or at Hunts Canyon Shelter ($p < 0.05$; $D = 0.055$; $D_{0.05} = 0.143$; $n_1 = 3453$; $n_2 = 93$; chi-square $= 7.412$, $df = 4$, $p = 0.1154$). In both cases, the statistical results are undoubtedly influenced by the small samples involved.

Are Lithic Assemblages Discarded near Rock Alignments Staged Differently from Other Monitor Valley Assemblages (fig. 173b)? The null hypothesis of no difference is rejected ($p < 0.01$; $D = 0.152$; $D_{0.01} = 0.089$; $n_1 = 3168$; $n_2 = 378$; chi-square $= 67.2322$, $df = 4$, $p < 0.0001$).

Rough percussion bifaces are more common than in the overall Monitor Valley assemblage ($n = 62$; expectation $= 48.08$), as are pressure flaked bifaces ($n = 130$; expectation $= 87.09$). Cores and roughouts are underrepresented ($n = 10$; expectation $= 29.21$), as are fine percussion bifaces ($n = 52$; expectation $= 98.07$). In other words, the available samples demonstrate significant differences in bifacial staging behavior between samples found near rock alignments and the rest of the aggregate Monitor Valley assemblage.

It is also instructive to subdivide the rock alignment assemblage into component samples. When the Table Mountain sample is compared against the overall Monitor Valley assemblage, we find that the null hypothesis of no difference is rejected ($p < 0.05$; $D = 0.112$; $D_{0.05} = 0.110$; $n_1 = 3385$; $n_2 = 161$; chi-square $= 35.5331$, $df = 4$, $p < 0.0001$): rough percussion bifaces are more common than expected at Table Mountain ($n = 44$, expectation $= 20.48$), whereas cores and roughouts are significantly underrepresented ($n = 6$; expectation $= 12.44$).

In chapter 10, we noted the Box Spring assemblage closely follows a repair curve.

Are Lithic Assemblages Discarded near Pictograph Sites Staged Differently from Other Monitor Valley Assemblages? The null hypothesis of no difference cannot be rejected ($p < 0.05$; $D = 0.067$; $D_{0.05} = 0.075$; $n_1 = 3180$; $n_2 = 366$). Available samples are insufficiently distinct to establish significant differences in bifacial staging behavior between the pictograph samples and the rest of the Monitor Valley assemblage.

Are Lithic Assemblages Discarded near Petroglyph Sites Staged Differently from Other Monitor Valley Assemblages? In substantive terms, the available samples demonstrate significant difference in bifacial staging behavior between the petroglyph-associated samples and the rest of the aggregate Monitor Valley assemblage (fig. 171b). The null hypothesis of no difference is rejected ($p < 0.01$; $D = 0.138$; $D_{0.05} = 0.097$; $n_1 = 3234$; $n_2 = 312$; chi-square $= 10.2185$, $df = 4$, $p = 0.0369$).
Relative to the overall Monitor Valley assemblage, fine percussion blanks \((n = 90; \text{ expectation } = 80.95)\) and finished products \((n = 104; \text{ expectation } = 95.38)\) are overrepresented.

**Are Lithic Assemblages Discarded as Streamside Assemblages Staged Differently from Other Monitor Valley Assemblages?** The null hypothesis of no difference cannot be rejected \((p < 0.05; D = 0.101; D_{0.05} = 0.108; n_1 = 3379; n_2 = 167)\).

The available samples are insufficiently distinct to establish any significant difference in bifacial staging behavior between the streamside assemblages and the rest of the aggregate Monitor Valley assemblage.

**IS PREHISTORIC CEREMONIAL EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

Only three kinds of *ceremonial equipment* are found in the Monitor Valley assemblage: incised stones, quartz crystals, and ocher (table 78). Ceremonial equipment is nonrandomly distributed by context in Monitor Valley (chi-square = 105.9869, \(df = 6, p < 0.0001\)). Such items are heavily overrepresented near montane springs \((n = 67; \text{ expectation } = 25.83)\) and especially rare in caves and shelters \((n = 4; \text{ expectation } = 24.13)\), near rock alignments \((n = 5; \text{ expectation } = 9.67)\), near pictograph sites \((n = 6; \text{ expectation } = 10.18)\), and absent from the valley floor \((\text{ expectation } = 15.99)\).

Most ceremonial equipment consists of incised limestone objects, which are (not unexpectedly) nonrandomly distributed by context as well (chi-square = 110.362, \(df = 6, p < 0.0001\)). Incised stones are found above all in association with the montane springs \((n = 67; \text{ expectation } = 25.06)\); they are rare elsewhere.

**IS PREHISTORIC RECREATIONAL EQUIPMENT DIFFERENTIALLY DISTRIBUTED?**

*Recreational equipment* includes gaming items, bullroarers, drums, flutes, rattles, toys (Thomas, 1983a: 73). No recreational equipment, so defined, was recovered in the regional Monitor Valley fieldwork.

**SUMMARY: CONTEXTUAL VARIABILITY**

This final pattern recognition study successfully isolated several sources of variability across the various recovery contexts:

- **Montane Springs**: The byproducts of lithic reduction were generally common here, especially unidentifiable projectile point fragments, rough percussion blanks, and pressure flaked bifaces. Incised stones also occurred in great numbers around montane springs. Only Rosegate series points were unexpectedly rare.

- **Valley Floor**: Byproducts of lithic fabrication were also relatively abundant on the valley floor, especially fine percussion blanks, and pressure flaked bifaces. Rosegate series points were overrepresented.

- **Caves and Shelters**: Weapons were overrepresented in the cave and shelter assemblages, especially broken point tips. Cores and roughouts were found in greater than expected frequencies, as were finished bifacial artifacts.

- **Rock Alignments**: Assemblages found in proximity to rock alignments contained an inordinate number of unifaces, rough percussion blanks, and pressure flaked bifaces. Elko, Gatecliff, and Humboldt series points were also found here in higher than expected frequency.

The following artifact categories were rare near rock alignments: Rosegate series and unidentifiable projectile point fragments, incised stones, and byproducts of lithic reduc-
tion (especially cores, roughouts, and fine percussion blanks). Broken projectile point tips, metates, and ceramics were totally absent.

PICTOGRAPH SITES: Projectile point fragments were found in significant numbers in catchments of the pictograph sites. Domestic equipment (especially metates) were also common, as were cores and roughouts.

Elko series points and incised stones were significantly underrepresented.

PETROGLYPH SITES: Assemblages from these sites contained an inordinate frequency of domestic equipment (most notably metates and ceramics). Fine percussion blanks and finished lithic artifacts were also common, as were unifaces.

Weapons were statistically underrepresented near petroglyph sites; so were byproducts of lithic reduction (especially rough percussion blanks and pressure flaked bifaces).

STREAMSIDE: Projectile point fragments and fine percussion blanks were particularly common. Ceramics were totally absent.

NOTES

1. For completeness, we have included the randomized quads in table 78, but the resulting small sample size \( n = 91 \) precludes use of the quad data in the following analysis. Accordingly, the adjusted grand total must be reduced from 4260 to 4169.

2. The frequency of Desert Side-notched and Cottonwood Triangular points is too small in the streamside catchments \( n = 4 \) to permit valid comparison using the chi-square statistic. Accordingly, the streamside catchment is dropped from this analysis, and the number of degrees of freedom reduced to \( df = 5 \).

3. The frequency of Gatecliff Contracting Stem and Split Stem points is too small in the streamside catchments \( n = 4 \) for valid comparison using chi-square. The streamside catchment is dropped from this analysis, and the number of degrees of freedom reduced to \( df = 5 \).
CHAPTER 13. PATTERN RECOGNITION: VARIABILITY IN HEARTH TECHNOLOGY

This chapter examines variability in size and technology of the hearths in Monitor Valley. Unfortunately, little middle range theory is available to document the ways in which hearths are structured, and this inquiry must proceed largely on a pattern recognition basis. Here, we explore some middle range considerations that relate hearth patterning per se to the broader issues of overall site structure.

This inquiry is based on the sample of 91 hearths encountered in our Monitor Valley excavations. Triple T Shelter contained 22 of these hearths (described in chapter 3). Fifty-six hearths were excavated at Gatecliff Shelter; thirty-six of these were previously described (Thomas, 1983b: chaps. 21–23), and primary description for 20 additional hearths is presented here for the first time, as an Appendix to this volume. Thirteen hearths were encountered in other excavated sites described in chapter 4. The primary data on hearth structure are summarized on table 82 (at the end of this chapter).

VARIABILITY IN HEARTH SIZE

Before looking at regional variability in hearth technology, it is necessary to operationally define the key variables involved. Even a relatively simple variable, such as size, can be defined in sometimes conflicting ways—volume, surface area, circumference, diameter, mass, depth, etc. Whereas each definition might offer certain advantages in specific circumstances, these various possibilities must be weighed prior to application.

For our purposes, the most satisfactory operational definition of hearth size depends almost entirely upon what we could observe at the time of excavation. Table 82 clearly indicates that these 91 Monitor Valley hearths vary greatly in terms of preservation, and this variability leads us to define hearth size according to the inside hearth diameter—a variable that could be accurately measured in more than 75 percent (70 of 91) of the hearths excavated. Inside hearth diameter seems to be a good operational indicator of size (see also O'Connell, 1987: 79); not only is this the most readily observable attribute for Monitor Valley hearths, but it is probably also the most replicable.

These hearths range from 15 to 150 cm in diameter; this unimodal distribution has a mean hearth size of 58.13 cm (\(S = 27.44, n = 70\)). Several trends can be noted in hearth size across Monitor Valley by partitioning the overall hearth sample into relevant analytical segments.

SIZE VARIABILITY BY SITE

Gatecliff Shelter contained the largest hearths in Monitor Valley, with a mean hearth diameter of 61.22 cm (\(S = 30.75, n = 45\)). The smallest excavated hearths were encountered at Triple T Shelter, where mean inside hearth diameter was only 50.93 cm (\(S = 18.13, n = 15\)). Hearths at other excavated sites are of intermediate size, averaging 55.0 cm in diameter (\(S = 24.04, n = 10\)). But because the degree of intrasite variability is relatively high, these site-by-site groupings are not significantly different from one another (\(F = 0.85, df = 69, p = 0.565\)).

TEMPORAL VARIABILITY

Hearth size changes significantly through time in Monitor Valley, and this variability can be approached in several ways. Given the relatively gross level of temporal resolution in these data, we feel the more diversified the approaches, the more reliable will be the results.

RADIOCARBON AGE: Most of the 91 Monitor Valley hearths can be related to radiocarbon age determinations, either by direct dating of hearth fill, or by extrapolation to correlative radiocarbon dates. The dates on hearths at Gatecliff and Triple T Shelters are obviously more reliable than are those from the less securely dated sites.

There is throughout Monitor Valley a slight tendency for hearths to become smaller through time. Overall linear correlation between inside hearth diameter and radiocarbon-
bon age B.P. is \( r_{id,bp} = 0.21 \), but this relationship lacks statistical significance (df = 67, \( p = 0.086 \)).

Partitioning the valleywide sample, we find the correlation between inside hearth diameter and radiocarbon age at Gatecliff Shelter to be \( r_{id,bp} = 0.29 \), a value significantly different from zero (df = 43, \( p = 0.047 \)). The hearths at Gatecliff clearly become smaller through time (fig. 172a).

This trend does not hold up at Triple T Shelter, where the correlation between hearth size and radiocarbon age is \( r_{id,bp} = -0.18 \) (df = 13, \( p = 0.463 \); see fig. 172b).

**Stratigraphic Position:** Relative age can also be estimated by considering **stratigraphic superposition**, in this case operationally defined as “depth below site datum.”

Stratigraphic sorting at Triple T Shelter produces results almost identical to those derived from radiocarbon analysis. The correlation between hearth size and depth below datum is \( r_{id,dd} = -0.13 \); that is, the lower hearths tend to be slightly smaller than those in stratigraphically superior position, but this tendency is not statistically significant (df = 13, \( p = 0.357 \)).

The hearths at Gatecliff Shelter tend to become smaller toward the top of the stratigraphic column. But the correlation between depth below datum and hearth size is only \( r_{id,dd} = 0.18 \), not a statistically significant relationship (df = 43, \( p = 0.228 \)).

Three relatively large Reveille phase hearths at Gatecliff Shelter—4/6-I, 7-A, and 7-E—are marked exceptions to this trend. When the three outliers are removed, the correlation jumps to a statistically significant \( r_{id,dd} = 0.37 \) (df = 40, \( p = 0.04 \)). There is surely a tendency for hearths to decrease in size toward the top of Gatecliff Shelter, but exceptions occur.

**Cultural Phasing:** Changing hearth size through time can be analyzed by looking at the cultural phasing (table 82). Although this classification is based in part upon both radiocarbon age and stratigraphic position, some rather different findings emerge.

Table 80 plots changes in hearth size across the six cultural phases at Gatecliff Shelter. Both radiocarbon and stratigraphic evidence previously suggested that hearths decrease in size through time at Gatecliff; table 80 puts this relationship into clear focus. The largest hearths at Gatecliff Shelter—averaging nearly 70 cm in diameter—were constructed during the Reveille phase. The earlier hearths are slightly smaller, although this difference is not statistically significant. Hearths constructed after Reveille times are considerably smaller.

These data strongly suggest that the sample
of hearths excavated at Gatecliff Shelter was drawn from two statistically different populations (df = 42, t = 2.026):

1. hearths constructed during Reveille times and before are relatively large, averaging 66.23 cm in diameter ($S = 31.82$, $n = 35$).
2. hearths built after Reveille times are relatively small, averaging 43.56 cm in diameter ($S = 15.71$, $n = 9$).

The cultural phasing at Triple T Shelter is not as clearly defined. The upper geological unit is a rubble matrix (Stratum IA), known to range in age from approximately 1550 B.C. to the present (chap. 3). Because 15 of the Triple T hearths occur here, it is desirable to impose finer stratigraphic control, and we have found it useful to divide Stratum IA into upper and lower subunits, employing a stratigraphic cutoff point of 20 cm below datum. We emphasize that this division is arbitrary and does not reflect a stratigraphic division that could be clearly observed in the field.

Using this criterion, we can partition the Triple T hearths into three stratigraphic groupings:

1. hearths in the upper part of Stratum IA (mean inside diameter = 47.25 cm, $S = 11.70$, $n = 4$);
2. hearths in the lower part of Stratum IA (mean inside diameter = 53.75 cm, $S = 19.04$, $n = 8$);
3. hearths below Stratum IA (mean inside diameter = 48.33 cm, $S = 27.54$, $n = 3$).

These slight differences in hearth size per stratum do not approach statistical significance ($F = 0.185$, df = 14, $p = 0.834$).

Thus, unlike the hearths at Gatecliff Shelter, those at Triple T do not systematically change size through time. Some of this apparent discontinuity may be spurious because of the relatively coarse-grained chronological controls; after all, Stratum IA at Triple T Shelter spanned the past 3500 years B.P. (with cultural materials from Yankee Blade through Devils Gate phases). Still, sufficient stratigraphic control exists to demonstrate that, in our sample, dramatic temporal changes in hearth size occur only at Gatecliff Shelter.

<table>
<thead>
<tr>
<th>TABLE 80</th>
<th>Relationship of Hearth Diameter to Cultural Phase at Gatecliff Shelter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (cm)</td>
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<tr>
<td>Yankee Blade Phase (Horizon 1)</td>
<td>43.33</td>
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<td>Underdown Phase (Horizons 2, 3)</td>
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<td>Reveille Phase (Horizons 4–7)</td>
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<td>Reveille/Devils Gate Phases (Horizon 8)</td>
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<td>Devils Gate Phase (Horizons 9–11)</td>
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<tr>
<td>Clipper Gap Phase (Horizon 12 &amp; below)</td>
<td>68.33</td>
</tr>
</tbody>
</table>

**VARIABILITY IN INTRASITE POSITIONING**

Table 82 contains ample data about the relationship between the size of each hearth and where it was constructed inside the enclosure. To assess these intrasite structural data, we must define some specific variables that reflect the internal geometry of rock-shelters and shallow caves.

We begin by imposing an arbitrary X and Y coordinate system across the surface of each site; this grid may (but does not necessarily) correspond with the excavation grid system. The X dimension runs from outside to inside, and when plotted along the midline, generally divides the site into bilaterally symmetrical portions. The Y dimension runs perpendicular to the X axis; in the ideal case, the Y axis parallels the site dripline.

This arbitrary grid allows us to describe any point within a cave or rock-shelter in terms of three (not necessarily independent) spatial coordinates, defined in figure 173:

- **distance to dripline [dl]**: measured parallel to the X dimension.
- **distance to rear wall [rw]**: measured parallel to X, to the furthest point along the rear margin.
- **distance to lateral wall [lw]**: measured relative to the nearest vertical cave surface (but not necessarily parallel to the X,Y grid system).

We emphasize that this coordinate system
Fig. 173. Analytical coordinate system imposed on the caves and rock-shelters of Monitor Valley. Triple T Shelter is shown here as example.

does not necessarily correspond with the grid system employed during excavation. Applied with care, these analytical variables can be defined with consistency from site to site and between investigators. The geometric implications of these variables are explored in more detail in the next two chapters.

**DISTANCE TO REAR WALL:** We look first at the way in which hearth size varies relative to inside-outside positioning. The correlation coefficient between hearth size and *distance to rear wall* for the entire Monitor Valley sample is $r_{id, rw} = 0.25$, a value significantly different from zero ($df = 63, p = 0.040$). This means that there is a well-defined tendency for the indoor hearths to become smaller as they approach the rear wall.

When the overall Monitor Valley hearth sample is partitioned, we find that this significant and positive relationship is due to the microtopographic positioning of hearths at Triple T Shelter, where correlation between size and distance to the rear wall is $r_{id, rw} = 0.50$. Although this value is not statistically significant ($df = 13, p = 0.057$), it is clear that the largest hearths (those larger than about 60 cm in diameter) are constructed more than 2 m from the rear wall; smaller
hearts are built anywhere within 3 m of the rear of the shelter.

Similar relationships exist in the residual sites (i.e., the shelters other than Triple T and Gatecliff). Correlation between hearth size and distance to the rear wall is \( r_{id, rw} = 0.81 \); probably due to the small sample size (df = 3), the level of probability is only \( p = 0.097 \).

Interestingly, this relationship does not occur at Gatecliff Shelter. Although larger hearths are generally constructed more than 5 m from the rear wall, the overall correlation between hearth size and rear wall distance is only \( r_{id, rw} = 0.16 \) (df = 43, \( p = 0.282 \)).

**Distance to Lateral Wall:** Table 82 provides measurements between the hearth centers and the nearest lateral wall (as defined above). But regardless of how the Monitor Valley sample is partitioned, there is no relationship between hearth size and distance to the lateral wall.

*Total Monitor Valley Sample:* \( r_{id, lw} = 0.11 \) (df = 68, \( p = 0.351 \)).

*Gatecliff Shelter Subsample:* \( r_{id, lw} = 0.10 \) (df = 43, \( p = 0.496 \)).

*Triple T Shelter Subsample:* \( r_{id, lw} = 0.13 \) (df = 13, \( p = 0.361 \)).

*Residual Site Subsample:* \( r_{id, lw} = 0.17 \) (df = 8, \( p = 0.364 \)).

**Distance to Dripline:** Table 82 likewise contains data regarding the relationship between hearth size and distance inside the shelter dripline. There is, as expected, a negative correlation between hearth size and distance to dripline in the overall sample: hearths get larger as the distance to the dripline decreases. But the correlation coefficient is low \( r_{id, dl} = -0.09 \) and lacking in statistical significance (df = 68, \( p = 0.488 \)). None of the subsample partitions produce significant correlations.

**Hearth Size and Intrasite Geometry**

We then looked to see if there is a significant degree of interaction between these positioning variables and hearth size. Multiple regression analysis was performed on the overall hearth sample, taking inside hearth diameter as the dependent variable and the three distance measures as independent variables. The coefficient of multiple correlation is only \( R = 0.269 \), not a statistically significant value \( (F = 1.582, df = 3 \& 61, p = 0.202) \). This sample was also partitioned by individual site, but the associated level of probability never exceeds \( p = 0.151 \).

In other words, there is no significant interaction between the size of a hearth and its position within a cave or rock-shelter.

**VARIABILITY IN HEARTH TECHNOLOGY**

Table 82 describes the observed variability in technology of hearth construction for the 91 excavated hearths from Monitor Valley. We begin exploring technological variability in this sample by classifying the various hearths into five observably different methods of construction. As lamented earlier, little middle range theory presently exists to relate hearth construction techniques with the thermodynamic properties of such hearths, so this categorization is necessarily preliminary.

*The Unprepared Hearth:* Fire is built on the unprepared ground surface. Unprepared hearths provide minimal heat efficiency; not only does energy radiate in all directions, but there is no protection from gusting wind that scatters hearth contents. The unprepared hearth is the cheapest, most expedient way to build a fire. Use of unprepared hearths may imply that ample fuel supply is nearby.

*The Shallow-Pit Hearth:* Fire is contained within a relatively small unlined pit (less than 15 cm deep). This technique requires a slight increase in construction cost over the simple unprepared hearth, but increased costs are offset to some degree by greater thermal efficiency.

*The Deep-Pit Hearth:* Fire is confined to a relatively large unlined pit (greater than or equal to 15 cm in depth). Sometimes such hearths are used as open-air heaters; in other cases, food items are placed inside and the hearth is then covered over, creating an "oven effect" (O'Connell, 1987: 83). Both labor costs and thermal efficiency are further increased by this technique. Deep-pit hearths seem particularly effective when excavated into the sterile, compact silts that commonly form the floor of the Early Neoglacial and Middle Holocene components in Monitor Valley caves. The surrounding silts are usually oxidized to
TABLE 81
Distribution of Hearth Technology in Monitor Valley

<table>
<thead>
<tr>
<th>Shelter</th>
<th>Shallow pit hearth</th>
<th>Deep pit hearth</th>
<th>Rock encircled hearth</th>
<th>Rock filled hearth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatecliff Shelter</td>
<td>15</td>
<td>4</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Triple T Shelter</td>
<td>5</td>
<td>8</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Toquima Cave</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grenouille Verte Cave</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Butler Ranch Cave</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Little Empire Shelter</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Jeans Spring Shelter</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ny1059</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hunts Canyon Shelter</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Boring-as-Hell Shelter</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grand total</td>
<td>23</td>
<td>16</td>
<td>33</td>
<td>6</td>
</tr>
</tbody>
</table>

a bright red color, attesting to the efficiency of this method.

The Rock-Encircled Hearth: Fire is confined within a stone circle, often (but not necessarily) aligned around a hearth pit. This method requires higher construction cost than does the pit hearth, since most hearth stones are carried in, suitable stones being rarely found on-site. But, as before, the added labor is probably offset by more efficient use of available fuel supply. The encircling hearth stones not only absorb heat themselves (to be passively radiated later), but they also reflect heat inward, keeping coals and ash from spreading across the rest of the work/sleep surface. Binford (1983: 149–154) notes that hearth stones also provide useful cutting/pounding anvils for hearth-associated work.

The Rock-Filled Hearth: Fire is confined in a distinct pit filled with fist- to grapefruit-sized stones. In some cases, fuel efficiency was maximized by carefully lining the hearth with stones of roughly the same size. Other hearths were merely filled with haphazardly placed fire-cracked rocks (probably used for stone boiling). Other rock-filled hearths were true earth ovens in which thermal efficiency was increased by covering the entire feature with stones and/or silt. The rock-filled pit is the most labor intensive, most heat efficient method of construction observed in Monitor Valley.

Each of the 91 Monitor Valley hearths on table 82 has been categorized into one of the mutually exclusive modes of construction.

As implied above, construction technology could perhaps be scaled along a continuum of increasingly efficient use of thermal energy (for both heating and cooking functions): unprepared hearths seem to be the least efficient, shallow pit hearths are somewhat more efficient, and so forth. Such a scale would also reflect increasing cost of construction: unprepared hearths are the most expedient, shallow pits cost a bit more, and so forth. Although the unprepared hearth and the rock-filled hearth probably define the extremes of such ordinal continua, adequate experimental and middle range support is presently lacking, and we will not press the issue by imposing ordinal-level statistics. Rather, the following analysis will treat hearth construction technology in simple nominal fashion.

VARIABILITY BY SITE

Table 81 summarizes hearth technology at the excavated sites in Monitor Valley. Although it would be desirable to examine this contingency table using chi-square techniques, the hearth counts from Gatecliff and Triple T Shelters swamp the data from other excavated sites. Using the size criteria expressed earlier (chap. 12), R by C chi-square analysis of this distribution would be seriously distorted, since eight cells contain expected frequencies of less than five (and five of these cells have expected frequencies less than two).

But viewed on a site-by-site basis, we find a highly significant difference in relative distribution of hearth technology between Gatecliff and Triple T shelters (chi-square = 16.15, df = 4, p = 0.003). Although unprepared and rock-encircled hearths occur within the range of expected frequencies for both sites, Gatecliff Shelter contains a disproportionate number of deep-pit hearths. At Triple T, the relative proportion of shallow-pit and rock-filled
hearth technology. The age of rock-filled hearths is far higher than one would expect by chance alone.

**Relationship Between Hearth Size and Technology**

One intuitively suspects that the size of a hearth might correlate with the technique of construction, but such is not the case in Monitor Valley.

Rock-filled hearths tend to be the largest, with an average inside diameter of 66.9 cm \((S = 26.26\text{ cm}, n = 13)\). Rock-encircled hearths are the smallest, averaging 53.3 cm \((S = 26.01\text{ cm}, n = 6)\). The remaining hearths are intermediate in size: shallow pit hearths average 54.9 cm \((S = 22.52\text{ cm}, n = 13)\), deep-pit hearths average 56.1 cm \((S = 28.73\text{ cm}, n = 31)\), and unprepared hearths average 61.0 cm \((S = 38.16\text{ cm}, n = 7)\). Thus, hearth technology has no demonstrable relationship to hearth size \((F = 0.466, \text{df} = 69, p = 0.763)\).

Similar results are obtained when the overall sample is partitioned into component sites. The hearths at Gatecliff Shelter do not significantly size-sort by technology \((F = 0.296, \text{df} = 44, p = 0.879)\). At Triple T Shelter, hearth diameters likewise do not vary significantly by method of construction \((F = 1.999, \text{df} = 14, p = 0.172)\). But as noted earlier, hearths at Triple T tend to be smaller than the rest of the Monitor Valley sample. Particularly notable are the small rock-encircled hearths, averaging only 35.0 cm in diameter \((S = 7.07\text{ cm}, n = 2)\). Unprepared hearths are also quite small, with an average diameter of only 37.0 cm \((S = 24.04\text{ cm}, n = 2)\).

Generally speaking, we find a lack of correspondence between hearth size and hearth technology.

**Temporal Variability**

If absolute size differences fail to account for the observed variability in Monitor Valley hearth technology, then perhaps technological criteria vary through time, responding to changing articulations between natural and cultural geography. To explore this possibility, we examine temporal variability following several avenues of inquiry.

**Radiocarbon Age**: Hearths from Monitor Valley were once again partitioned according to hearth construction technique, and the estimated radiocarbon ages subjected to one-way analysis of variance (ANOVA). The statistically significant results indicate that hearth technology does indeed vary through time among this sample of 91 hearths \((F = 2.594, \text{df} = 89, p = 0.041)\).

Specific results are as follows:

1. **Unprepared hearths** are the oldest, with an average age of 3453.9 radiocarbon years B.P. \((S = 1271.85\text{ radiocarbon years B.P.}, n = 23)\).
2. **Rock-encircled hearths** average 3050.0 radiocarbon years B.P. \((S = 1839.36\text{ radiocarbon years B.P.}, n = 6)\).
3. **Deep-pit hearths** average 2573.5 radiocarbon years B.P. \((S = 1437.63\text{ radiocarbon years B.P.}, n = 33)\).
4. **Shallow-pit hearths** average 2468.1 radiocarbon years B.P. \((S = 1716.70\text{ radiocarbon years B.P.}, n = 16)\).
5. **Rock-filled hearths** average 2018.5 radiocarbon years B.P. \((S = 1034.6\text{ radiocarbon years B.P.}, n = 13)\).

Keep in mind that the average radiocarbon age is heavily influenced by sampling and preservation factors; these findings mean very little in absolute terms.

But viewed in relative fashion, these results clearly demonstrate the antiquity of the unprepared hearth. Additional statistical analysis shows that unprepared hearths are significantly older than both shallow-pit hearths \((t = 2.084, p = 0.046)\) and deep-pit hearths \((t = 2.274, p = 0.022)\). The age difference between unprepared hearths and rock-filled hearths is highly significant \((t = 2.902, p < 0.001)\).

Partitioning the valley-wide sample, we find, not surprisingly, that the strength of this relationship derives, in large measure, from the Gatecliff Shelter sample. Although the overall ANOVA (analysis of variance) lacks statistical significance \((F = 1.745, \text{df} = 54, p = 0.154)\), unprepared hearths are significantly older than rock-filled hearths \((t = 2.381, p = 0.013)\). There is also a strong (but not sta-
tistically significant) trend for unprepared hearths to antedate deep-pit hearths ($t = 1.868, p = 0.087$).

Very similar trends are evident at Triple T Shelter. Although the overall relationship between hearth technology and radiocarbon age is not statistically significant ($F = 1.437, \text{df} = 21, p = 0.264$), there is a strong (but not statistically significant) tendency for unprepared hearths to antedate both rock-filled hearths ($t = 1.832, p = 0.095$) and deep-pit hearths ($t = 1.957, p = 0.068$).

These trends, evident at Gatecliff and Triple T shelters, heavily condition tendencies for Monitor Valley at large; after all, these two sites account for more than 85 percent (78 of 91) of the total excavated hearths in the area (excluding for the moment the dozens of hearths excavated at Alta Toquima).

But it is surprising that the relationship between age and hearth construction technology should be so parallel between these two sites. Not only do similar temporal trends hold for Gatecliff and Triple T shelters, but the radiocarbon evidence suggests that the succession of hearth technology is contemporaneous at both sites.

Consider the case of unprepared hearths, which are the most ancient. The 15 unprepared hearths at Gatecliff have an average age of 3827.3 radiocarbon years B.P. The five unprepared hearths at Triple T Shelter have an average age of 3466 radiocarbon years B.P. The relatively minor discrepancy in the age of unprepared hearths at these sites—361.3 radiocarbon years—is not a statistically significant difference ($t = 0.622, \text{df} = 18, p = 0.548$).

That is, within acceptable margins of sampling error, unprepared hearths were constructed during the same temporal interlude at both sites—despite the fact that Gatecliff and Triple T Shelters contain different geological strata and involve an elevational differential of almost 350 m.

Contemporaneity is not limited to unprepared hearth technology. Shallow-pit hearths at Gatecliff Shelter have an average age of 2673.8 radiocarbon years B.P.; those at Triple T average 2828.4 radiocarbon years. As before, there is no statistically significant difference in absolute average age ($t = 0.136, \text{df} = 10, p = 0.89$).

The same trend holds for rock-enhanced hearths. At Gatecliff Shelter, rock-encircled hearths average 3218.8 radiocarbon years. Rock-encircled hearths at Triple T Shelter average 2712.5. This 506.3 year difference in age does not approach statistical significance ($t = 0.287, \text{df} = 4, p = 0.782$). Similarly, the rock-filled hearths at Gatecliff Shelter average 2345.7 radiocarbon years in age. Similarly constructed hearths at Triple T Shelter average 1756.0. This 589.7 year difference in age is not statistically significant ($t = 0.969, \text{df} = 10, p = 0.643$).

Deep-pit hearth construction is the only marginal case. Deep-pit hearths at Gatecliff Shelter average 2970.2 radiocarbon years B.P.; at Triple T Shelter they average 1050.0 radiocarbon years B.P. Although this 1920.2 year difference lacks statistical significance ($t = 1.987, \text{df} = 26, p = 0.055$), larger samples could readily convert this to a significant difference.

Without belaboring the point, we find striking parallels in the timing of hearth technology between these two sites. As discussed in chapter 19, hearth technology was apparently responsive to subtle climatic changes experienced during the Neoglacial period.

Stratigraphic Position: It remains prudent, as before, to double-check the radiocarbon chronology against another measure of relative age, in this case, stratigraphic superposition, operationally defined (as before) by depth below site datum.

This stratigraphic sequence generates results almost identical to those derived from radiocarbon assay. Analysis of variance on the Gatecliff Shelter hearths demonstrates that overall hearth technology does not vary systematically with depth ($F = 1.418, \text{df} = 55, p = 0.241$).

But a look at individual construction methods shows that unprepared hearths—built an average depth of 330.5 cm below datum ($S = 130.86, n = 15$)—were significantly lower than were rock-filled hearths—built an average of 161.4 cm below site datum ($S = 117.68, n = 7$). This difference in average depth is statistically significant ($t = 2.259, p = 0.023$).

Analysis of variance for the Triple T Shelter hearths also indicates that overall depth differences between the five hearth technologies are not statistically significant ($F = 1.072, \text{df} = 21, p = 0.401$). But unprepared
hearth at this site tend to be constructed toward the bottom of the site, an average of 166.5 cm below deep-pit hearths (the stratigraphically highest hearth type at Triple T). This trend, while suggestive, is not quite statistically significant \((t = 1.953, p = 0.069)\).

**Intrasite Variability**

Finally, we can examine the intrasite distribution of hearth technology in Monitor Valley, employing the three site geometric variables defined above.

**Distance to Rear Wall:** There is no systematic relationship between hearth technology and distance from the rear wall for Monitor Valley sites in general \((F = 1.95, df = 83, p = 0.109)\). Individual hearth types do, however, vary significantly in positioning across site surfaces.

Shallow-pit hearths tend to be constructed toward the back of the Monitor Valley sites, an average of only 234.0 cm from the rear wall \((S = 126.1, n = 15)\). Deep-pit hearths, by contrast, were built further toward the site apron, an average of 363.2 cm from the rear wall \((S = 175.08, n = 30)\). This is a highly significant difference in intrasite patterning \((t = 2.565, p = 0.005)\).

Unprepared hearths also occur toward the outer lip, an average of 337.6 cm from the rear wall \((S = 174.09, n = 21)\), but the contrast with shallow-pit hearths is not statistically significant \((t = 1.925, p = 0.075)\).

We noted earlier the statistically significant tendency for these indoor hearths to become smaller as they are built closer to the rear wall. This trend is particularly evident for unprepared hearths \((r_{id, rw} = 0.58, df = 5, p = 0.173)\) and combined deep- and shallow-pit hearths \((r_{id, rw} = 0.21, df = 38, p = 0.182)\), but the tendency is not statistically significant.

**Distance to Lateral Wall:** There is no systematic relationship between the way a hearth is built and its distance from the lateral wall in the overall Monitor Valley sample \((F = 0.773, df = 55, p = 0.613)\).

But at the two major excavated sites shallow-pit hearths show a degree of parallel patterning. At Triple T Shelter, shallow-pit hearths tend to be constructed toward the lateral margins, an average of only 99.4 cm from the lateral wall \((S = 62.30, n = 8)\), and the rock-filled hearths occur further toward the center, an average of 205 cm from the sides \((S = 59.37, n = 5)\); but the relationship does not quite reach statistical significance \((t = 2.018, p = 0.057)\).

The four shallow-pit hearths are also built near the sides of Gatecliff Shelter, averaging only 135.0 cm from the lateral walls \((S = 62.45)\); the other hearth types average 179.1 cm from the lateral wall \((S = 98.31, n = 52)\). This trend is not statistically significant \((F = 0.773, df = 55, p = 0.613)\).

**Distance to Dripline:** The technology does not vary systematically according to distance inside the shelter dripline \((F = 0.365, df = 90, p = 0.834)\).

We noted earlier the expected negative correlation between hearth size and distance to dripline in the overall sample. This is particularly true for the various pit hearths \((r_{id, dl} = -0.17)\) but the correlation is not statistically significant \((p = 0.255, df = 42)\).

**Summary**

Having examined the relationship of hearth size to technology, we found several trends within the caves and shelters of Monitor Valley.

**Intersite variability:** The hearths in this sample range from 15 to 150 cm in diameter. Rock-filled hearths tend to be the largest, rock-encircled hearths have the smallest average diameter, with other hearth types of intermediate size. But despite these trends, there is no systematic correlation between the size of a hearth and the way it was constructed.

It is true that the hearths at Gatecliff Shelter are much larger than those at Triple T Shelter, with other sites having intermediate-size hearths. Technology also differs between these two sites. Although hearths are built in five different ways at both sites, Gatecliff Shelter contains a disproportionate number of deep-pit hearths, and Triple T has a large proportion of shallow-pit and rock-filled hearths.

**Temporal variability:** Hearth technology changes systematically through time in Monitor Valley. The oldest fires were generally built on unprepared surfaces; within our sample, such hearths average nearly 3500 B.P. Rock-encircled hearths are somewhat later, an average of about 3000 B.P. Pit hearths, both deep and shallow, are later still, aver-
aging about 2500 B.P. Rock-filled hearths are the latest, averaging about 2000 B.P.

Despite differences in geological substrate, topographic aspect, and elevation, the radiocarbon evidence demonstrates that the succession of hearth technology is essentially parallel and simultaneous at Gatecliff and Triple T shelters. There is a slight tendency for the Gatecliff Shelter hearths to decrease in size through time, but this trend does not hold up at Triple T.

Intrasite variability: The indoor hearths in Monitor Valley change size somewhat relative to intrasite positioning. Specifically, hearths tend to become larger toward the center of Triple T Shelter; this correlation does not hold at Gatecliff.

Shallow-pit hearths tend to be constructed well inside the dripline, toward the rear and sides of the excavated shelters. Deep-pit hearths are built farther toward the front. Un-prepared hearths are generally found toward the outer lip.

Behavioral implications of these trends are explored in more detail in subsequent chapters (esp. chaps. 15, 16, and 19).

NOTES

1. We also have detailed information on several dozen hearths from Alta Toquima and the Mt. Jefferson complex; these hearths will be described, compared, and contrasted in the next volume of this series.

2. In the case of asymmetrical hearths, the arithmetic mean of the two perpendicular diameters is employed.

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**TABLE 82**

**Excavated Hearths in Monitor Valley**

<table>
<thead>
<tr>
<th>Hearth</th>
<th>Probable age</th>
<th>Distance to lateral wall (cm)</th>
<th>Distance to rear wall (cm)</th>
<th>Distance to dripline</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GATECLIFF SHELTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-A</td>
<td>Yankee Blade phase post-A.D. 1300</td>
<td>40</td>
<td>180</td>
<td>550</td>
<td>(40 cm below datum) rock-encircled hearth; no pit; built near small overhang; contains red ocher; 35 cm in diameter.</td>
</tr>
<tr>
<td>1-B</td>
<td>Yankee Blade phase A.D. 1400 ± 90 (GAK-3614)</td>
<td>110</td>
<td>230</td>
<td>570</td>
<td>(10 cm below datum) pit 65 cm in diameter; 20 cm deep; several rocks inside, including broken metate (rock-filled hearth).</td>
</tr>
<tr>
<td>1-C</td>
<td>Yankee Blade phase A.D. 1480 ± 90 (GAK-3616)</td>
<td>210</td>
<td>340</td>
<td>440</td>
<td>(10 cm below datum) pit 30 cm in diameter; ca. 15 cm deep; fill contains fist-size rocks, charcoal, ash, and grass (rock-filled hearth).</td>
</tr>
<tr>
<td>3-A</td>
<td>Underdown phase ca. A.D. 700–1300</td>
<td>50</td>
<td>50</td>
<td>650</td>
<td>(97 cm below datum) shallow hearth dug into underlying silt, ca. 50 cm in diameter (shallow-pit hearth).</td>
</tr>
<tr>
<td>3-B</td>
<td>Underdown phase ca. A.D. 700–1300</td>
<td>40</td>
<td>50</td>
<td>710</td>
<td>(104 cm below datum) pit dug 15 cm underlying silt; ca. 35 cm in diameter; contained bone bead (deep-pit hearth).</td>
</tr>
<tr>
<td>3-C</td>
<td>Underdown phase A.D. 950 ± 50 (GAK-3608)</td>
<td>410</td>
<td>175</td>
<td>540</td>
<td>(97 cm below datum) diffuse burnt zone, ca. 75 cm across; scooped out of underlying silt (deep pit hearth).</td>
</tr>
<tr>
<td>3-D</td>
<td>Underdown phase ca. A.D. 700–1300</td>
<td>210</td>
<td>305</td>
<td>375</td>
<td>(45 cm below datum) oblong pit ca. 50 × 25 cm, 25 cm deep and reused several times; contains red ocher; Rosegate point found nearby (deep pit hearth).</td>
</tr>
<tr>
<td>Hearth</td>
<td>Probable age</td>
<td>Distance to lateral wall (cm)</td>
<td>Distance to rear wall (cm)</td>
<td>Distance to dripline</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>------------------------------</td>
<td>---------------------------</td>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>3-E</td>
<td>Underdown phase ca. A.D. 700-1300</td>
<td>200</td>
<td>525</td>
<td>100</td>
<td>(30 cm below datum) oblong pit ca. 55 × 25 cm, less than 15 cm deep (shallow-pit hearth).</td>
</tr>
<tr>
<td>3-F</td>
<td>Underdown phase ca. A.D. 700-1300</td>
<td>290</td>
<td>695</td>
<td>−10</td>
<td>(35 cm below datum) distinct, circular pit 25 cm in diameter; 25 cm deep (deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-A</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>35</td>
<td>80</td>
<td>790</td>
<td>(120 cm below datum) oblong pit 20 × 30 cm; ca. 30 cm deep; incised stone found in hearth fill (deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-B</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>20</td>
<td>80</td>
<td>800</td>
<td>(105 cm below datum) circular pit 25 cm in diameter; 25 cm deep; associated with several artifacts (deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-C</td>
<td>Reveille phase 810 B.C. ± 60 (UCLA-1895F)</td>
<td>120</td>
<td>210</td>
<td>490</td>
<td>(110 cm below datum) rock-encircled charcoal scatter 65 cm in diameter; three Elko points in hearth fill (rock encircled hearth).</td>
</tr>
<tr>
<td>4/6-D</td>
<td>Reveille phase A.D. 280 ± 80 (GAK-3609) &amp; A.D. 370 ± 90 (GAK-3610)</td>
<td>125</td>
<td>225</td>
<td>440</td>
<td>(105 cm below datum) complex feature with at least three pits; diameters range 25–40 cm; aggregate depth is 45 cm; several artifacts in hearth fill (deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-E</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>150</td>
<td>210</td>
<td>540</td>
<td>(130 cm below datum) complex feature 15 m in diameter at top; ca. 60 cm deep; probably reused (deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-F</td>
<td>Reveille phase A.D. 220 ± 90 (GAK-3611) &amp; 330 B.C. ± 90 (GAK-3617)</td>
<td>250</td>
<td>350</td>
<td>380</td>
<td>(90 cm below datum) extremely complex feature; at least 10 individual hearths; large artifact inventory in fill (see text; deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-G</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>320</td>
<td>460</td>
<td>300</td>
<td>(130 cm below datum) rock-lined, rock-encircled hearth; 40 cm in diameter; ca. 10 cm deep; fill contained an Elko Corner-notched point (rock-filled hearth).</td>
</tr>
<tr>
<td>4/6-H</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>75</td>
<td>300</td>
<td>490</td>
<td>(154 cm below datum) oblong feature 80 × 35 cm; Elko Eared point nearby (deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-I</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>200</td>
<td>600</td>
<td>210</td>
<td>(72 cm below datum) ash and charcoal concentration; ca. 125 × 150 cm (unprepared hearth).</td>
</tr>
<tr>
<td>4/6-J</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>240</td>
<td>510</td>
<td>240</td>
<td>(195 cm below datum) circular pit 62 m × 75 cm (deep-pit hearth).</td>
</tr>
<tr>
<td>4/6-K</td>
<td>Reveille phase ca. 1350 B.C.–A.D. 700</td>
<td>80</td>
<td>380</td>
<td>110</td>
<td>(110 cm below datum) paired hearths; western pit, 50 cm in diameter; eastern pit, 40 cm in diameter (both deep-pit hearths).</td>
</tr>
<tr>
<td>7-A</td>
<td>Reveille phase ca. 1300 B.C.</td>
<td>200</td>
<td>600</td>
<td>225</td>
<td>(ca. 200 cm below datum) burnt silt and charcoal, pit ca. 150 cm in diameter (deep-pit hearth).</td>
</tr>
<tr>
<td>Hearth</td>
<td>Probable age</td>
<td>Distance to lateral wall (cm)</td>
<td>Distance to rear wall (cm)</td>
<td>Distance to drip line</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7-B</td>
<td>Reveille phase</td>
<td>350</td>
<td>575</td>
<td>200</td>
<td>(ca. 200 cm below datum) localized burnt zone, slightly overlaps Hearth 7-A (unprepared hearth).</td>
</tr>
<tr>
<td>7-C</td>
<td>Reveille phase</td>
<td>225</td>
<td>400</td>
<td>375</td>
<td>(ca. 200 cm below datum) distinct pit, 40 cm in diameter (deep-pit hearth).</td>
</tr>
<tr>
<td>7-D</td>
<td>Reveille phase</td>
<td>160</td>
<td>450</td>
<td>75</td>
<td>(ca. 200 cm below datum) rock-lined pit, 1 m in diameter (rock-filled hearth).</td>
</tr>
<tr>
<td>7-E</td>
<td>Reveille phase</td>
<td>150</td>
<td>175</td>
<td>500</td>
<td>(ca. 200 cm below datum) oblong pit 150 by &lt;100 cm wide; contained angular roof fall (rock-filled hearth).</td>
</tr>
<tr>
<td>7-F</td>
<td>Reveille phase</td>
<td>275</td>
<td>300</td>
<td>400</td>
<td>(ca. 200 cm below datum) light charcoal scatter (unprepared hearth).</td>
</tr>
<tr>
<td>7-G</td>
<td>Reveille phase</td>
<td>150</td>
<td>175</td>
<td>500</td>
<td>(ca. 200 cm below datum) pit 100 by 65 cm, 10 cm deep (shallow-pit hearth).</td>
</tr>
<tr>
<td>7-H</td>
<td>Reveille phase</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>(ca. 200 cm below datum) oxidized silt (unprepared hearth).</td>
</tr>
<tr>
<td>7-I</td>
<td>Reveille phase</td>
<td>200</td>
<td>375</td>
<td>250</td>
<td>(ca. 200 cm below datum) well-defined pit 100 cm in diameter (deep-pit hearth).</td>
</tr>
<tr>
<td>8-A</td>
<td>Reveille/Devils Gate phase; 1350–1300 B.C.</td>
<td>125</td>
<td>410</td>
<td>410</td>
<td>(ca. 280 cm below datum) 30 cm deep pit, 50 cm in diameter; contained fire fractured rock, artiodactyl long bones and teeth (rock-filled hearth).</td>
</tr>
<tr>
<td>8-B</td>
<td>Reveille/Devils Gate phase; 945 B.C. ± 90 (QC-287)</td>
<td>25</td>
<td>450</td>
<td>420</td>
<td>(ca. 290 cm below datum) 40 × 60 cm pit, dug into area of desiccated cracks (deep-pit hearth).</td>
</tr>
<tr>
<td>8-C</td>
<td>Reveille/Devils Gate phase; 1190 B.C. ± 90 (QC-288)</td>
<td>250</td>
<td>650</td>
<td>200</td>
<td>(ca. 290 cm below datum) six depressions scooped out in underlying silt; contained artiodactyl long bones and teeth; diameters range from 60 to 100 cm (deep-pit hearths).</td>
</tr>
<tr>
<td>8-D</td>
<td>Reveille/Devils Gate phase; 1605 B.C. ± 85 (UCLA-1895-C)</td>
<td>175</td>
<td>225</td>
<td>450</td>
<td>(ca. 290 cm below datum) extensive burnt area at rear of shelter; no pit; perhaps due to sweeping or wind action (unprepared hearth).</td>
</tr>
<tr>
<td>8-E</td>
<td>Reveille/Devils Gate phase; 1350–1300 B.C.</td>
<td>300</td>
<td>350</td>
<td>200</td>
<td>(ca. 290 cm below datum) 20 cm deep pit with windblown scatter (deep-pit hearth).</td>
</tr>
<tr>
<td>8-F</td>
<td>Reveille/Devils Gate phase; 1350–1300 B.C.</td>
<td>450</td>
<td>850</td>
<td>-100</td>
<td>(ca. 290 cm below datum) pit filled with charcoal; 40 cm in diameter (deep-pit hearth).</td>
</tr>
<tr>
<td>8-G</td>
<td>Reveille/Devils Gate phase; 1350–1300 B.C.</td>
<td>300</td>
<td>400</td>
<td>170</td>
<td>(ca. 290 cm below datum) poorly defined concentration of burnt silt and charcoal (unprepared hearth).</td>
</tr>
<tr>
<td>9-A</td>
<td>Devils Gate phase</td>
<td>210</td>
<td>600</td>
<td>225</td>
<td>(ca. 300 cm below datum) oxidized silt and gravel zone 40 cm in diameter, 10 cm deep, but does not appear to have been scooped out (unprepared hearth).</td>
</tr>
<tr>
<td>Hearth</td>
<td>Probable age</td>
<td>Distance to lateral wall (cm)</td>
<td>Distance to rear wall (cm)</td>
<td>Distance to dripline (cm)</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
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</tr>
<tr>
<td>9-B</td>
<td>Devils Gate phase 1450–1350 B.C.</td>
<td>250</td>
<td>600</td>
<td>170</td>
<td>(ca. 300 cm below datum) well-defined pit 70 cm in diameter; 25 cm deep; filled with fire-fractured rock, charcoal and ash (rock-filled hearth).</td>
</tr>
<tr>
<td>9-C</td>
<td>Devils Gate phase 2025 B.C. ± 65 (UCLA-1895D)</td>
<td>30</td>
<td>140</td>
<td>570</td>
<td>(ca. 300 cm below datum) entire rear of shelter blanketed with charcoal, ash, and midden; pit lacking, could be secondary windblown feature (unprepared hearth).</td>
</tr>
<tr>
<td>9-D</td>
<td>Devils Gate phase 1390 B.C. ± 80 (UCLA-1895K) &amp; 1425 B.C. ± 80 (UCLA-1895H)</td>
<td>190</td>
<td>525</td>
<td>250</td>
<td>(ca. 300 cm below datum) complex tri-lobed feature; pit 1: 100 cm in diameter, 30 cm deep, little ash fill; pit 2: 60 cm in diameter, 30 cm deep; pit 3: burnt area 100 cm in diameter, with pit 50 cm in diameter scooped out in center (all deep-pit hearths).</td>
</tr>
<tr>
<td>10-A</td>
<td>Devils Gate phase 2025 B.C. ± 65 (UCLA-1895D) &amp; 2150 B.C. ± 65 (UCLA-1895I)</td>
<td>70</td>
<td>350</td>
<td>350</td>
<td>(ca. 375 cm below datum) pit 50 cm in diameter, ash extends in semicircle to the north (deep-pit hearth).</td>
</tr>
<tr>
<td>10-B</td>
<td>Devils Gate phase ca. 2100 B.C.</td>
<td>260</td>
<td>575</td>
<td>0</td>
<td>(ca. 375 cm below datum) no pit; mottled reddish brown burnt silt; 75 cm in diameter (unprepared hearth).</td>
</tr>
<tr>
<td>11-A</td>
<td>Devils Gate phase ca. 2200 B.C.</td>
<td>130</td>
<td>400</td>
<td>250</td>
<td>(ca. 390 cm below datum) zone of oxidation 40 cm in diameter (unprepared hearth).</td>
</tr>
<tr>
<td>11-B</td>
<td>Devils Gate phase 2190 B.C. ± 70 (UCLA-1895E)</td>
<td>300</td>
<td>600</td>
<td>50</td>
<td>(ca. 390 cm below datum) zone of oxidation with light scatter of charcoal and ash (unprepared hearth).</td>
</tr>
<tr>
<td>12-A</td>
<td>Phase unknown ca. 3000 B.C.</td>
<td>150</td>
<td>275</td>
<td>190</td>
<td>(ca. 440 cm below datum) two super-imposed burnt zones; lower: pit 10 cm deep, ash scatter 200 cm in diameter; upper: pit 75 cm in diameter (deep-pit hearth).</td>
</tr>
<tr>
<td>12-B</td>
<td>Phase unknown ca. 3000 B.C.</td>
<td>225</td>
<td>400</td>
<td>200</td>
<td>(ca. 440 cm below datum) burnt zone with distinct rock circle; deliberate pit 140 × 60 cm in diameter (rock-encircled hearth).</td>
</tr>
<tr>
<td>12-C</td>
<td>Phase unknown 3050 B.C. ± 80 (UCLA-1926E), 3250 B.C. ± 120 (UCLA-1926A), &amp; 3300 B.C. ± 120 (UCLA-1926C)</td>
<td>25</td>
<td>40</td>
<td>450</td>
<td>(ca. 440 cm below datum) large area of sheet burning (unprepared hearth).</td>
</tr>
<tr>
<td>12-D</td>
<td>Phase unknown ca. 3000 B.C.</td>
<td>150</td>
<td>410</td>
<td>260</td>
<td>(ca. 440 cm below datum) indistinct burnt area (unprepared hearth).</td>
</tr>
<tr>
<td>13-A</td>
<td>Clipper Gap phase 3150–3050 B.C.</td>
<td>240</td>
<td>410</td>
<td>0</td>
<td>(ca. 460 cm below datum) pit 50 cm in diameter with rock semicircle on margin (rock-encircled hearth).</td>
</tr>
<tr>
<td>13-B</td>
<td>Clipper Gap phase 3150–3050 B.C.</td>
<td>250</td>
<td>200</td>
<td>180</td>
<td>(ca. 460 cm below datum) pit with ash and charcoal; 80 cm in diameter (deep-pit hearth).</td>
</tr>
</tbody>
</table>
TABLE 82—(Continued)

<table>
<thead>
<tr>
<th>Hearth</th>
<th>Description</th>
<th>Distance to lateral wall (cm)</th>
<th>Distance to rear wall (cm)</th>
<th>Distance to dripline</th>
<th>Probable age</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-A</td>
<td>(ca. 535 cm below datum) two adjacent pits; southern: 100 cm in diameter; northern: charcoal concentration 50 cm in diameter (deep-pit hearth).</td>
<td>100</td>
<td>225</td>
<td>100</td>
<td>Clipper Gap phase 2900 b.c. ± 95 (QC-290)</td>
</tr>
<tr>
<td>14-B</td>
<td>(ca. 535 cm below datum) charcoal and oxidation stain 40 × 80 cm (unprepared hearth).</td>
<td>60</td>
<td>300</td>
<td>60</td>
<td>Clipper Gap phase 3300–3150 b.c.</td>
</tr>
<tr>
<td>14-C</td>
<td>(ca. 535 cm below datum) large zone of oxidation (unprepared hearth).</td>
<td>130</td>
<td>300</td>
<td>270</td>
<td>Clipper Gap phase 2190 b.c. ± 125 (QC-292)</td>
</tr>
<tr>
<td>15-A</td>
<td>(ca. 600 cm below datum) poorly defined depression ca. 60 cm in diameter (shallow-pit hearth).</td>
<td>140</td>
<td>275</td>
<td>300</td>
<td>Clipper Gap phase associated dates: 3340 b.c. ± 180 (QC-289) &amp; 3850 b.c. ± 170 (UCLA-1989A)</td>
</tr>
<tr>
<td>15-B</td>
<td>(ca. 600 cm below datum) distinct pit 40 cm in diameter (deep-pit hearth).</td>
<td>275</td>
<td>410</td>
<td>35</td>
<td>Clipper Gap phase 3400–3300 b.c.</td>
</tr>
<tr>
<td>15-C</td>
<td>(ca. 600 cm below datum) zone of oxidized silt and charcoal 50 cm in diameter (deep-pit hearth).</td>
<td>130</td>
<td>410</td>
<td>-50</td>
<td>Clipper Gap phase 3400–3300 b.c.</td>
</tr>
</tbody>
</table>

TRIPLE T SHELTER

| IA-A     | (33 cm above datum) trilobed hearth, mostly ash with no rocks in fill (deep-pit hearth). | 150                           | 330                       | 50                   | Yankee Blade phase? Stratum Upper IA |
| IA-B     | (3 cm above datum) shallow hearth with abundant charcoal (shallow-pit hearth).          | 60                            | 185                       | 195                  | Late Neoglacial period Stratum Upper IA |
| IA-C     | (33 cm above datum) poorly defined concentration of ash and oxidized deposit in pit 54 cm in diameter (unprepared hearth). | 125                           | 235                       | 235                  | Late Neoglacial period Stratum Upper IA |
| IA-D     | (10 cm above datum) pit 60 cm in diameter; adjacent to sagebrush mat (deep-pit hearth). | 145                           | 300                       | 40                   | Late Neoglacial period Stratum Upper IA |
| IA-E     | (25 cm below datum) rock-filled hearth on dripline, 50 cm in diameter; metate associated (rock-filled hearth). | 205                           | 240                       | 75                   | Late Neoglacial period Stratum Lower IA |
| IA-F     | (12 cm below datum) ashy concentration in a pit 35 cm in diameter; immature artiodactyl bone splinters associated (shallow-pit hearth). | 25                            | 270                       | 160                  | Late Neoglacial period Stratum Upper IA |
| IA-G     | (25 cm below datum) complex stone and charcoal feature; outer ring is semicircular (75 cm in diameter); inner ring is 40 cm in diameter with pit 20 cm deep (rock-encircled hearth). | 315                           | 315                       | -40                  | Late Neoglacial period Stratum Lower IA |
| IA-H     | (25 cm below datum) well-defined fire pit, 40 cm in diameter, 10 cm deep, Humboldt point and sagebrush mat associated (shallow-pit hearth). | 140                           | 255                       | 270                  | Late Neoglacial period Stratum Lower IA |
### TABLE 82—(Continued)

<table>
<thead>
<tr>
<th>Hearth</th>
<th>Probable age</th>
<th>Distance to lateral wall (cm)</th>
<th>Distance to rear wall (cm)</th>
<th>Distance to dripline (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA-I</td>
<td>Late Neoglacial period Stratum Upper IA</td>
<td>135</td>
<td>205</td>
<td>145</td>
<td>(7 cm below datum) dense charcoal and ash concentration (unprepared hearth).</td>
</tr>
<tr>
<td>IA-J</td>
<td>Late Neoglacial period Stratum Lower IA</td>
<td>95</td>
<td>340</td>
<td>60</td>
<td>(20 cm below datum) circular depression filled with charcoal and ash (shallow-pit hearth).</td>
</tr>
<tr>
<td>IA-K</td>
<td>Late Neoglacial period Stratum Lower IA</td>
<td>90</td>
<td>180</td>
<td>150</td>
<td>(58 cm below datum) pit 60 x 30 cm, 6 cm deep (shallow-pit hearth).</td>
</tr>
<tr>
<td>IA-L</td>
<td>Late Neoglacial period Stratum Lower IA</td>
<td>140</td>
<td>305</td>
<td>40</td>
<td>(80 cm below datum) pit 80 cm in diameter, 35 cm deep; dug into Stratum IIA silt; lined with fist-size rocks (rock-filled hearth).</td>
</tr>
<tr>
<td>IA-M</td>
<td>Late Neoglacial period Stratum Lower IA</td>
<td>290</td>
<td>350</td>
<td>-25</td>
<td>(40 cm below datum) rock and charcoal-filled pit 80 cm in diameter; contains decomposed bone (or antler) and fire-fractured hammerstone (rock-filled hearth).</td>
</tr>
<tr>
<td>IA-N</td>
<td>Reveille phase associated date: 750 B.C. ± 105/1080 B.C. ± 110 (QC-172) Stratum Lower IA</td>
<td>230</td>
<td>230</td>
<td>90</td>
<td>(95 cm below datum) well-defined pit dug into IIA silt, 65 cm in diameter, 15 cm deep; extremely regular rock lining (rock-filled hearth).</td>
</tr>
<tr>
<td>IA-O</td>
<td>Late Neoglacial period Stratum Lower IA</td>
<td>160</td>
<td>200</td>
<td>120</td>
<td>(105 cm below datum) elliptical feature 50 x 30 cm, excavated into underlying silts (rock-filled hearth).</td>
</tr>
<tr>
<td>IB-A</td>
<td>Early Neoglacial period</td>
<td>35</td>
<td>35</td>
<td>290</td>
<td>(75 cm below datum) shallow hearth 30 cm in diameter (rock-encircled hearth).</td>
</tr>
<tr>
<td>IIB-A</td>
<td>Devils Gate phase associated dates: 1690 B.C. ± 85 (UCLA-1989H) &amp; 1770 B.C. ± 95 (QC-171) Stratum Lower IA</td>
<td>210</td>
<td>210</td>
<td>40</td>
<td>(120 cm below datum) diffuse charcoal and ash scatter (unprepared hearth).</td>
</tr>
<tr>
<td>IIIA-A</td>
<td>Devils Gate phase associated dates: 2930 B.C. ± 120/2370 B.C. ± 90 (QC-168) &amp; 3050 B.C. ± 90 (UCLA-1989G)</td>
<td>110</td>
<td>110</td>
<td>140</td>
<td>(160 cm below datum) pit filled with charcoal and ash; Gatecliff Contracting Stem point associated (shallow-pit hearth).</td>
</tr>
<tr>
<td>IIIA-B</td>
<td>Devils Gate phase ca. 3000 B.C.</td>
<td>50</td>
<td>50</td>
<td>210</td>
<td>(160 cm below datum) heavily oxidized area 50 cm in diameter; Gatecliff Split Stem point associated (shallow-pit hearth).</td>
</tr>
<tr>
<td>IIIA-C</td>
<td>Devils Gate phase ca. 3000 B.C.</td>
<td>225</td>
<td>250</td>
<td>0</td>
<td>(148 cm below datum) pit 90 x 58 cm, 3-4 cm deep (shallow-pit hearth).</td>
</tr>
<tr>
<td>IIIC-A</td>
<td>Clipper Gap phase associated date: 3750 B.C. ± 100 (UCLA-1989F) but date probably 600 years too ancient</td>
<td>350</td>
<td>185</td>
<td>40</td>
<td>(201 cm below datum) ashy concentration 20 cm in diameter (unprepared hearth).</td>
</tr>
<tr>
<td>IVC-A</td>
<td>Clipper Gap phase 3480 B.C. ± 120 (UCLA-1989C) &amp; 4390 B.C. ± 160 (QC-170); most probable date is 3500 B.C.</td>
<td>10</td>
<td>140</td>
<td>105</td>
<td>(430 cm below datum) ash and charcoal concentration adjacent to cave wall (unprepared hearth).</td>
</tr>
<tr>
<td>Hearth</td>
<td>Probable age</td>
<td>Distance to lateral wall (cm)</td>
<td>Distance to rear wall (cm)</td>
<td>Distance to dripline</td>
<td>Description</td>
</tr>
<tr>
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<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>TOQUIMA CAVE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Underdown phase</td>
<td></td>
<td></td>
<td></td>
<td>(40 cm below surface) U-shaped, rock-encircled hearth, 75 cm in diameter, 10 cm deep; fill contains pebble size chunks with white ash (rock-filled hearth).</td>
</tr>
<tr>
<td></td>
<td>A.D. 910 ± 170 (GAK-3427)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Underdown/Reveille phase</td>
<td></td>
<td></td>
<td></td>
<td>(40 cm below surface) discrete scatter of charcoal and ash (unprepared hearth).</td>
</tr>
<tr>
<td></td>
<td>A.D. 450 ± 130 (GAK-3428)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>GRENOUILLE VERTE CAVE</strong></td>
<td></td>
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</tr>
<tr>
<td>A</td>
<td>Unknown</td>
<td></td>
<td></td>
<td></td>
<td>(14 cm below surface) dense charcoal concentration 20 cm in diameter (shallow-pit hearth).</td>
</tr>
<tr>
<td><strong>BUTLER RANCH CAVE</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>A</td>
<td>Probably Yankee Blade phase, but possibly historic</td>
<td></td>
<td></td>
<td></td>
<td>(10 cm below surface) pit 10 cm deep 45 × 75 cm, filled with dense charcoal concentration (deep-pit hearth).</td>
</tr>
<tr>
<td>B</td>
<td>Late Neoglacial period</td>
<td></td>
<td></td>
<td></td>
<td>(50 cm below surface) indistinct pit ca. 50 cm in diameter, 70 cm deep (deep-pit hearth).</td>
</tr>
<tr>
<td>C</td>
<td>Late Neoglacial period</td>
<td></td>
<td></td>
<td></td>
<td>(40 cm below surface) pit about 30 cm in diameter (deep-pit hearth).</td>
</tr>
<tr>
<td>D</td>
<td>Late Neoglacial period</td>
<td></td>
<td></td>
<td></td>
<td>(40 cm below surface) pit 40 cm in diameter, 10 cm deep (shallow-pit hearth).</td>
</tr>
<tr>
<td><strong>LITTLE EMPIRE SHELTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Late Neoglacial period</td>
<td></td>
<td></td>
<td></td>
<td>(30 cm below surface) pit scooped into sandy cave floor; 25 cm deep, ca. 1 m in diameter (shallow-pit hearth).</td>
</tr>
<tr>
<td>B</td>
<td>Late Neoglacial period</td>
<td></td>
<td></td>
<td></td>
<td>(15 cm below surface) pit scooped into sandy cave floor; 35 cm deep, 60 cm in diameter (deep-pit hearth).</td>
</tr>
<tr>
<td><strong>JEANS SPRING SHELTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Probably Yankee Blade phase</td>
<td></td>
<td></td>
<td></td>
<td>(10 cm below surface) pit 20 cm deep, 75 cm in diameter (shallow-pit hearth).</td>
</tr>
<tr>
<td><strong>Ny1059</strong></td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td>(11 cm below surface) no pit; merely discrete charcoal concentration (unprepared hearth).</td>
</tr>
<tr>
<td>A</td>
<td>Late Neoglacial period</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HUNTS CANYON SHELTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Late prehistoric or early historic</td>
<td></td>
<td></td>
<td></td>
<td>(10 cm below surface) bilobed hearth; each pit 40 cm in diameter, 30 cm deep; filled with sagebrush charcoal (deep-pit hearths).</td>
</tr>
<tr>
<td><strong>BORING-AS-HELL SHELTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Late Neoglacial Period</td>
<td>155</td>
<td></td>
<td>340</td>
<td>(35 cm below surface) no pit; distinct charcoal and ash concentration (unprepared hearth).</td>
</tr>
</tbody>
</table>

* Rear wall not sufficiently well defined.
CHAPTER 14. SITE STRUCTURE: METHODS OF INQUIRY

Just as the bony skeleton provides the framework for the body around which the muscles and organs operate, so the arrangement of facilities on a site provides the skeleton around which activities are organized; the flow of persons and goods is accommodated to the facilities within a site. (Binford, 1983: 145)

This is the first of three chapters to address site structure and function—the way in which artifacts, features, and facilities are distributed within sites and across space. For now, we focus strictly on the spatial patterning anticipated for shallow caves and rock-shelters; “indoor” site structure is considered in the next volume of this series.

In part of this inquiry, particularly that involving debris disposal patterning and hearth positioning strategies, we appeal to existing middle range arguments to warrant our interpretations. In such cases, we are beginning to make behavioral sense of the observed characteristics and distributions in the archaeological record.

But too often, relevant middle range bridges do not exist, and discussion cannot proceed beyond the stage of empirical generalization. These exercises are pursued in part to enhance our knowledge of the facts about the prehistoric past in Monitor Valley, and also to highlight directions for further theoretical inquiry. The two avenues are complementary.

OUTDOOR HEARTH POSITIONING STRATEGIES

Throughout this series (esp. Thomas, 1983a), we have tried to define ways of linking behavioral and archaeological records. One of the most difficult issues is figuring out where a given site fits into the overall scheme of cultural geography.

Specifically, when we were analyzing site structure at Gatecliff Shelter, we encountered considerable difficulty in deciding whether or not a given horizon had a nocturnal use: if so, then that horizon must have functioned (at least in part) as a field camp; if not, it was only a location. Yet nowhere in that analysis could we isolate firm archaeological signatures diagnostic of nocturnal utilization, and resulting interpretations were cautious and, in places, a bit equivocal (Thomas, 1983b: 526–528).

If we could derive a valid and replicable means of detecting an overnight presence in hunter-gatherer settlements, we would possess a powerful diagnostic to separate the residential from the logistic. That is, if we could develop a consistent way of distinguishing base/field camps from their logistic outliers, we would have taken an important stride toward placing individual archaeological assemblages into an overall mosaic of regional cultural geography.

DIURNAL (WORKSHOP) SITE STRUCTURE

Binford’s Mask site analysis provides initial middle range argumentation in our search for the factors conditioning the requirements of human lifespace. Nunamiut hunters congregated at the Mask site to watch for game and to plan appropriate hunting strategies once game had been sighted (Binford, 1978b: 330). Located about 3 km from the base camp at Anaktuvuk, between about May 20 and June 10 “this site is continuously occupied by men and boys... Every evening, through the night, and into the early morning hours the site is occupied” (Binford, 1978a: 179). The Mask site is a station, where “special-purpose task groups are localized when engaged in information gathering” (Binford, 1980: 12).

Although seven primary activities dominate the observed behavior at the Mask site, only six were said to contribute materially to archaeological site structure: watching game, off-site hunting, eating and talking, target shooting, playing cards, and crafts manufacture. Whereas a seventh primary activity—sleeping—also took place here, sleeping had minimal influence on resulting site structure. Stations (such as the Mask site) “are rarely occupied overnight, and when they are, there is a continuous monitoring of the area rather
than a change of tempo within the site when everyone goes to bed. Sleeping facilities on such locations are always expedient and individual" (Binford, 1978b: 330).

An important spatial consequence is at work here. The six daytime activities determine the primary structure of the Mask site. Although men sometimes slept there, these nighttime activities did not appreciably impact the archaeological record.

Part of this effect was due to the natural setting. The nuclear zone of the Mask site was defined by three glacial boulders, and five hearths nestled among the boulders. No more than two hearths were observed in use at any one time, the differential use depending on primarily wind direction. Seating plan, and hence debris disposal pattern, depended on which hearth was in use.

Binford (1983: 149) argued that as people worked at a task requiring use of an outside hearth, "they tend to carry out the task according to a spatial pattern which appears to be universal." The Mask site example suggests that although a number of factors condition hearth construction and positioning, a significantly size sorted, drop/toss zone debris disposal model can be expected to occur whenever hearth-centered behavior is carried out under such conditions for a significant length of time.

This model, elaborated elsewhere (Thomas, 1983b: 431–433), is a deliberately simplified attempt to understand spatial patterning that operates in exogene caves such as Gatecliff Shelter. Real world cases involve multiple hearth positioning, differential effects of wind direction, irregular shelter geometry, fluctuating driplines, uneven shelter flooring. Still, the diurnal, workshop model provides a useful middle range entry to understanding prehistoric patterning at exogene cave sites such as Gatecliff Shelter.

Hearth positioning at the Mask site is conditioned largely by prevailing wind direction and sight line. Drop/toss zone patterning in this case can be attributed to mostly daytime activities conducted around an outdoor hearth (Binford, 1983: 149–157). Although hearth function and configuration depend on season, latitude, and elevation, this activity structuring is expected to persist at many diurnal, logistic sites.

Nocturnal (Bedroom) Site Structure

Residential sites are structured according to rather different criteria, largely because this is where people actually live—for part of the day and most of the night. Whereas logistic patterning is conditioned almost exclusively by what goes on during the day, residences—base camps and, to some extent, field camps—also exhibit the range of structure that anticipates nighttime needs.

We begin with the simplest case, the field camp, where single-sex groups maintain themselves while away from the primary residence. Unlike stations such as the Mask site, field camps are clearly structured by both diurnal and nocturnal considerations. Nighttime activities provide an important addition to the archaeological record since deliberate planning of debris disposal and hearth positioning is generally restricted to those sites habitually occupied overnight.

But even granted that habitual nighttime use structures the archaeological record, one must still question whether even a robust set of signatures enables solid identification of residential use. Is there a reliable way to identify where people are expecting to spend the night?

Binford responds in the affirmative for the specialized case of shallow caves and rock-shelters:

... size and basic mechanics of the human body affect patterning in the archaeological record [as] seen in terms of the space required for sleeping. ... Sleeping arrangements typical of rock shelters are especially interesting, because variations in the positions of the beds are determined by the season of the year. In winter, beds are usually located parallel to the back of the shelter; for a single bed a hearth is placed about 1.20 meters from the rock, or about 2.00 meters in the case of a double bed. In summer, when ideally one would like to reduce exposure to the heat from the sun which has been absorbed by the rock, the beds are placed perpendicular to the back wall and people sleep with their heads away from the source of the heat; in this arrangement hearths are located between the beds. ... These general patterns of sleeping arrangements derived from the ethnographic record can also be applied to the interpretations of archaeological sites: the basic structure of the human body, after all, has remained the same for a very long period. (Binford, 1983: 160–163)
If this suggestion is valid, then Binford has taken an important initial step toward distinguishing daytime from nocturnal utilization of archaeological caves and shelters. Properly keyed to item distributions, such hearth positioning signatures could lead directly into reliable recognition of cultural geographic patterns at the level of the region.

Nobody has derived a foolproof means of distinguishing nocturnal from diurnal patterns of site utilization. We will not accomplish that objective in this volume either. But it is possible to make some progress in that direction.

A FIRST APPROACH TO SITE STRUCTURE: THE CONSTANTS OF NOCTURNAL LIFESPACE

Binford introduced two levels of analysis into his hearth corridor model. On the most general level it is suggested that nocturnal sites should have definable "sleeping areas" located adjacent to the rear wall; we return to this useful notion shortly.

But in the section quoted above, nocturnal lifespaces is viewed in terms of archaeologically visible spatial constants, derived from the physical constraints of body size and potential heat loss (fig. 174). Taken at face value, Binford's various hearth corridor models imply three spatial constants:

Hearth Corridor Constant I: 1.00 m. The 1 m interval subsumes the following individual models on figure 174:

[Model B]: A single hearth, spaced 1.00 m from the cave wall, defines a single bed during the winter.

[Model C]: Paired hearths spaced 1.05 m from the cave wall imply a double sleeping area used during the winter (i.e., perpendicular to the cave wall).

[Models E-K]: Multiple hearths in series spaced 1.05 m from the rear wall imply summer usage; the number of people involved can be estimated by the inter-hearth distance.

Hearth Corridor Constant II: 2.00 m. [Model A]: Hearth spaced 2.00 m from the cave wall was probably used during the winter and defines a double sleeping area parallel to the wall.

Hearth Corridor Constant III: 3.00 m. [Model D]: Single or multiple hearths spaced 3.00 m from the wall imply summer usage; the number of people involved can be judged by the number of hearths constructed.

Binford cautions that several additional factors can condition the spacing of these sleeping corridors—use of night clothing, sleep position, latitude, size of hearth, and so forth—but he clearly maintains that size and basic mechanics of the human body provide conditions sufficiently constant that "one could hope to calculate how much space would be required for a bed, in just the same way that an architect today determines how much space to allot for particular areas within a modern house" (1983: 162).

These provocative suggestions must be refined on the basis of considerably more evidence from well-documented cases. But even at this elementary, impressionistic stage, it is useful to see whether such patterning turns up in the archaeological record.

Binford employed the nocturnal lifespaces constants in his interpretation of Upper Paleolithic site structure at Abri Pataud (1983: 163). Focusing on the early Aurignacian I phase occupation, he "found that an arrangement of single beds in between the hearths fits the archaeological spatial patterns extremely well. Among modern groups . . . the alternation of hearths and single beds typifies the sleeping patterns of all-male hunting camps. The combination of this form of bed distributions with the presence of roasting pits located in front of the sleeping area suggests to me that, at this date, the site was not used for residential purposes (as Movius originally proposed), but was a temporary camp" (Binford, 1983: 163).

As with most middle range theory, the constants of nocturnal lifespaces are based on observation of behavior. But taking these constants to the archaeological record is an important transition.

The sleep space constants defined above are distinctly two-dimensional: (1) there is an optimal front-rear positioning and (2) also a degree of lateral (between hearth) spacing. This distinction is critical because only the front-rear case is archaeologically visible; the second, lateral dimension is almost always lacking in the archaeological contexts.
Fig. 174. Binford’s generalized “sleeping area” models based on observations of ethnographic and contemporary hunter-gatherer societies (after Binford, 1983: fig. 97; reproduced with permission of the author).

It is perfectly justifiable at Abri Pataud (or anywhere else) to measure hearth–rear wall distance and then compare goodness-of-fit to the nocturnal constants. This distance, roughly 1.2 m, would seem to correspond with Hearth Corridor Constant I, enumerated above (Binford’s Models B, C, and E–K on fig. 174).

But to measure hearth-to-hearth distances tacitly assumes that each hearth is behavior-
ally contemporaneous. Although I am unfamiliar with the stratigraphic specifics of Abri Pataud, I seriously question the assumption that these Early Aurignacian hearths can be judged to be contemporaneous.

It is possible, of course, that hearths L, N, O, J, and I (Binford, 1983: fig. 89) really were used on the same night 32,300 years ago, but I doubt it.

This is a problem of scale. Such hearths might be "contemporary" at the level of the decade, the generation, or the century. But Binford's hearthline model requires literal contemporaneity, measured at the level of the minute, the hour, or (at most) the day.

It is my experience that hearthlines such as this more commonly derive from a palimpsest association—reflecting repetitive and redundant (but not necessarily simultaneous) behavior.

Very similar patterning occurred on a number of horizons at Gatecliff Shelter (Thomas, 1983b: 458–459, 482–483, and esp. 448–449). But in no case did I feel justified in assuming that individual hearths were literally contemporary. It is much more likely that individual hearths were constructed, utilized, and reused over several discrete nocturnal episodes. At Gatecliff, there was no justification for assuming Pompeii-like behavioral contemporaneity: could be, but how to tell?

The assumption of simultaneous hearth utilization is unwarranted for most (if not all) archaeological sites. And without assuming contemporaneity, the lateral, hearth-to-hearth constants simply do not apply to the archaeological case.

For this reason, I argue that analysis of hearth positioning in the archaeological record should concentrate strictly on the spacing between a hearth and a fixed geomorphic or artificially constructed barrier (such as the nearest shelter boundary, site dripline, or a purposefully constructed weather wall).

ENCOUNTERING THE EMPirical WORLD

But even recognizing this restriction, it remains possible to translate hearth corridor constants into an operational way of exploring archaeological site structure.

Figure 175a converts the various corridor models into a series of archaeological expectations: If the hearths in a given shelter were constructed to define heated sleeping areas, then mean distances from the nearest wall should cluster about 1.0, 2.0, and/or 3.0 m, the three peaks of the trimodal midrange distribution.

The uncertainties, redundancy, and inevitable noise involved in most archaeological data make it unrealistic to expect hearths to occur at exactly 1.0, 2.0, and/or 3.0 m intervals—even if they were positioned precisely to follow the above behavioral models. Binford's models were expressed in terms of central tendency, and we simply have no idea how much variability can be expected in hearth-wall spacing: perhaps point estimates are realistic, but it seems more likely that some range of variability accompanies each sleeping zone interval.

Lacking accurate estimates of variability, we arbitrarily constructed the sleeping zone model in figure 175a with a ±0.25 m fudge factor (a rather broad range of acceptable variability). Thus, while Hearth Corridor Constant I has a midpoint of 1.0 m, the empirically acceptable range is estimated to fall between 0.75 and 1.25 m (i.e., within 1.0 ± 0.25 m). We have likewise defined Hearth Corridor Constants II and III with a ±0.25 m buffer. Although the model on figure 175a is thus a deliberately conservative construction, it does provide a fair way to explore sleep zone constants in the observable data of real-world archaeology.

Figure 175a attempts to anticipate the structure of nocturnal, "outdoor" spatial organization; "indoor" bedrooms are organized very differently. The model suggests that if a given site had been occupied at different times throughout the year by groups of variable size, then the hearth–lateral wall distances should follow a distinctly trimodal frequency distribution—one mode for each sleeping area constant.

But had a given site been inhabited only seasonally by groups of fixed size, then a single hearth spacing mode should predominate. If, for instance, a site was utilized only in the winter by all-male hunting parties, then hearths should consistently be spaced roughly 1.0 m from the laterally walls.

Or, if several people consistently lived there
Fig. 175. Comparing expected and observed frequencies for hearth corridor constants. a. Expectations derived from Binford's three corridor model. b. Comparison of expectations with the 56 excavated hearths from Gatecliff Shelter. c. Comparison of expectations with the 22 hearths excavated at Triple T Shelter. d. Comparison of expectations with the 13 additional hearths excavated in Monitor Valley.

during the summer months, then the 3.0 m constant should pertain. However, if empirical hearth distances fail to correspond to any of the middle range
modes of figure 175a, then one might suspect that either (1) the hearths were not structured by nocturnal activities or (2) these sleeping area constants are not a true reflection of universal, somatically conditioned factors.

We must, of course, leave room for alternative ways to organize lifespaces. Additional middle range inquiry will undoubtedly disclose more variability in sleeping behavior than is implied on figure 174a. Low-latitude summer sites sometimes lack sleeping hearths altogether, even though considerable nocturnal activity might have occurred there. Some purely diurnal activities likely involve hearths built roughly 1.0, 2.0, and/or 3.0 m from the lateral wall. We simply lack adequate information about the positioning strategies involved for daytime hearths.

But because we have constructed the archaeological anticipatory model with a deliberately conservative fudge factor of ±0.25 m, our examination should err toward acceptance of the trimodal peaks, exceptions notwithstanding.

This preliminary bedroom model provides, at a minimum, a first step toward distinguishing residential from logistic usage on the basis of hearth positioning: many (if not most) residential sites should regularly exhibit nocturnal site planning; sites utilized strictly for logistic (diurnal) activities should lack evidence of consistent sleeping corridor structure.

**DO HEARTH CORRIDOR CONSTANTS APPLY TO MONITOR VALLEY HEARTHS?**

Ninety-one hearths were excavated during the course of our Monitor Valley fieldwork, and these data were marshaled in the previous discussion of hearth technology (chap. 13). Table 82 contains sufficient data on hearth positioning so that we can explore the applicability of Binford’s sleeping zone constants to Monitor Valley site structure.

But because we cannot assume literal contemporaneity for any two hearths in this sample, we focus strictly on hearth-wall spacing. Hearth-to-hearth spacing simply requires a level of observational resolution unattainable in virtually all archaeological contexts.

Figure 175b–d illustrates three independent tests of goodness-of-fit between the hearth constant model and the empirical reality of prehistoric Monitor Valley.

*Are the n = 56 hearths from Gatecliff Shelter positioned relative to hearth corridor constants?* Figure 175b plots the distribution of hearth–lateral wall distances for all 56 excavated hearths at Gatecliff Shelter. If any (or all) of the hearth corridor constants apply to these data, then the frequency distribution should peak at 1.0, 2.0, and/or 3.0 m from the rear wall; these expectations are compared on figure 175b.

The expected inflection points on the histogram quite obviously do not predict hearth spacing at Gatecliff Shelter. In fact, there is a distinctly inverse relationship between expected and observed. Based on the sample of excavated hearths at Gatecliff, there is no evidence that hearths were positioned according to 1.0/2.0/3.0 m interval spacing. If anything, hearth spacing at these intervals was avoided.

*Are the n = 22 hearths at Triple T Shelter positioned relative to hearth corridor constants?* Figure 175c sets out the frequency distribution of hearth-rear wall distances for the 22 excavated hearths at Triple T Shelter. If Binford’s hearth corridor constants underlie these data, the frequency distribution should peak at 1.0, 2.0, and/or 3.0 m from the lateral wall.

This did not happen: The anticipated inflection points obviously fail to predict observed hearth positioning at Triple T Shelter. Based on the overall sample of 22 excavated hearths at Triple T, there is no evidence that hearths are positioned according to 1.0/2.0/3.0 m interval spacing.

*Are the n = 13 hearths at the additional excavated sites positioned relative to hearth corridor constants?* Figure 175d plots a frequency distribution for hearth–rear wall distances of the 13 additional excavated hearths in Monitor Valley. As before, expected inflection points on the histogram do not predict the observed hearth distances. Once again, we find a distinctly inverse relationship between expected and observed. As at Gatecliff, the 1.0/2.0/3.0 m distances seem to have been avoided (except, perhaps, for the 3.0 m interval).

We thus find no correlation (at all) between hearth corridor constants and observed hearth spacing in the caves and rock-shelters of
Monitor Valley. Perhaps this lack of correspondence is due to fuzzy initial modeling. Alternatively, it could be that Monitor Valley hearths are spaced according to criteria other than those enumerated above. Or perhaps the corridor constants are not really so constant after all.

Whatever the reason, this preliminary consideration of hearth positioning is sufficient to point up potential problems with a rigid application of the sleeping area model. At this point, separating individual models of sleeping space behavior requires unrealistic assumptions about the behavioral relationships between individual hearths. Individual hearth corridor models must therefore be employed with extreme caution.

This exercise is not intended to discourage building a middle range theory of site structure. Quite to the contrary, this is the only way we can reliably make sense of evidence left to us by the past. I am concerned that unimaginative, oversimplified, rote application of Binford's provocative suggestions may overshadow their ultimate potential.

A SITE-SPECIFIC APPROACH TO HEARTH CORRIDOR PATTERNING

There is no question that consideration of hearth positioning relative to potential sleeping areas is a useful adjunct to standard living surface analysis. But rather than focusing on the so-called constants of hearth spacing, we shall consider the interrelationships between hearth corridors, site geometry, and debris disposal patterning.

TESTING THE HEARTH CORRIDOR MODELS FOR GOODNESS-OF-FIT

In the next two chapters, we analyze the intrasite positioning of the various hearths enumerated on table 82. Because each cave and shelter projects unique geometry, this analysis necessarily proceeds on a site-by-site basis, in each case determining whether the observed hearth distributions correspond to systematic sleeping corridors. Degree of fit between expected and observed distributions will be assessed by using the Coefficient of Variation (CV), defined as follows (after Thomas, 1976: 83):

\[
CV = \frac{100 \times S}{X}
\]

CV is a particularly relevant statistic here because it provides a "pure measure" of variability expressed in percentages (rather than the absolute units employed in the standard deviation).

Because the magnitude of CV is independent of the size of the mean (Thomas, 1976: 82–84), CV provides a useful measure of the degree of dispersion involved in the underlying distribution. Populations with CV approaching zero are clearly unimodal and invariant; inflated values of CV commonly reflect an underlying multimodal distribution.

We can also explore hearth positioning by computing confidence intervals about a sample mean. That is, the sample mean for each hearth corridor provides the best point estimate for \( \mu \), the population mean. But this point estimation will almost certainly not be precisely equal to the unknown population value. This is why it is more useful to determine an interval estimate within which \( \mu \) is most likely to fall.

Throughout this section, we employ the 95 percent confidence interval, computed for small samples drawn from a population with an unknown standard deviation (as discussed by Thomas, 1976: 230–234). These confidence limits permit us, within a specific range of error, to standardize our definition of such hearth corridors.

Additionally, hearths closer than 1 m to the wall (such as Hearth 12-C on fig. 193) are excluded from calculations because they could not possibly have defined a sleeping corridor; some other explanation is required for such features.

These indices enable us to determine how well each potential hearth corridor model fits the empirical data at hand. When CV values are low (and confidence intervals small), the model fits rather well; inflated values belie a poor fit between ideal and actual.

"OUTDOOR" DEBRIS DISPOSAL PATTERNING

Binford (1978b, 1983: 149–151) has also argued that a basic, underlying, "universal"
patterning is imposed by human behavior around the hearth: workspace is maximized by sitting obliquely, but within arm's distance of the hearth; hearth stones are commonly used as worktables; hearths built for use by several persons have a circular rather than perpendicular debris scatter; outside hearths commonly lack stone lining, are micropositioned according to changes in wind direction, and often generate a proximate "drop zone" of small, fumbled debris surrounded by a concentric "toss zone"; inside hearths are commonly stone lined, characteristically subjected to preventative maintenance, with the "toss zone" being moved immediately outside the doorway.

Such middle range considerations provided an initial framework of inquiry in our study of hearth positioning and debris disposal at Gatecliff Shelter (Thomas, 1983b: chaps. 21–23). Cultural debris at Gatecliff was heavily size-sorted across the various occupational surfaces. On all floors with fine to medium grain size—with the important exception of Horizon 2—the artifacts,debitage, and ecofacts deposited toward the rear were significantly smaller than those deposited near the dripline.

Debris size was isolated as the single most important factor in defining the site structure of Gatecliff Shelter. That is, internal positioning of cultural debris is best predicted by a single, easily observed variable—weight—regardless of raw material, stage of manufacture, potential uselife, edge attrition, typological or functional category.

Not unexpectedly, we found that debris disposal patterning at Gatecliff Shelter was intricately linked to hearth positioning strategies. The drop/toss zone pattern of refuse disposal occurred, to one degree or another, on most Gatecliff horizons. Specifically, we found that immediately proximate to centrally positioned outdoor hearths is a drop zone containing primary refuse discarded during the course of central workshop activities: bone chips and splinters, small byproducts of fabrication or maintenance, plus the occasional fumbled item (Binford, 1978b; Yellen, 1976, 1977; Gould, 1968, 1977, 1980; Rick, 1980; DeBoer, 1983). Although several processes condition what ends up in a drop zone (see Thomas, 1983b: 431–433; see also O'Connell, 1987), most such items are small, dull, inexpensive, and unobtrusive, with very low visibility.

In concentric distribution beyond that is a "toss zone" made up of relatively large items of refuse, generally in secondary context. Such centrifugal tossing and/or sweeping of larger items of refuse is what Binford terms "preventive maintenance" (see also Silberbauer, 1981: 230). On occasion, activities producing large quantities of bulky, "uncomfortable" debris will take place within the toss zone, with byproducts left where they fall.

Figure 176 shows the drop/toss zone model as developed from observations at the Mask site. In this ethnoarchaeological example, it was possible to distinguish direction of disposal in terms of foward and/or backward toss areas. Through time, this distinction ultimately blurs in response to shifting wind patterns and variable group size.

Drop/toss area expectations must be refined to fit the topography at hand, particularly in cases where debris cannot physically be disposed of across a 360° arc. Directionality can sometimes be imposed by cultural constraints, such as construction of artificial windbreaks.

Natural barriers such as cave walls likewise constrain the way in which debris is discarded. Since debris cannot be "tossed" through the rear wall of a rock-shelter, the toss zone is expected to build up toward the opening of the shelter, commonly near the dripline. Although centrally located hearth and workshop areas continue as the behavioral focal point, the physical constraints of exogene cave geometry dictate that debris is broadcast only across a 180° frontal arc (Thomas, 1983b: 431–433).

This is how the relatively simple Mask site model expectations were previously translated to fit the site geometry of Gatecliff Shelter, a 180° model appropriate to many exogene caves and rock-shelters.

Archaeological application of this simple model requires that one consider multiple hearth positioning, differential effects of wind direction, episodes of foul weather, irregular shelter geometry, fluctuating driplines, and uneven shelter flooring. To cope with this diversity, our initial "exogene" model will now be further refined and extended to fit the
enlarged sample of sites from Monitor Valley. Although many of these sites lack the crisp spatial patterning evident at Gatecliff Shelter, this lower degree of resolution is offset by the opportunity to compare such patterning across several geographically disparate localities.

This requires new analytical methods for dealing with spatial patterning inside the relatively small enclosures utilized in prehistoric Monitor Valley.

**Geometry of Intrasite Structure**

Site structural inquiry begins, as Binford (1983: 147) has pointed out, with a descriptive and analytical definition of archaeological site framework features. We will do this by initially defining hearth positioning in the various excavated sites (chaps. 15 and 16). Once site structure is defined on the basis of locationally fixed, known-function facilities, intrasite debris disposal patterns can be projected relative to the specifics of facility distributions and site geometry.

Relative hearth positioning was previously plotted according to three operational variables (defined on fig. 173). We now utilize these same variables to characterize overall site geometry. This is done by imposing an arbitrary X and Y coordinate system across the surface of each cave or rock-shelter, a grid
that may (but does not necessarily) correspond with the excavation grid system (fig. 178). The X dimension runs from outside to inside along the central axis. The Y axis, perpendicular to X, ideally parallels the site dripline. Given this grid system, any point within a cave or rock-shelter can be described in terms of three consistent spatial coordinates (similar to those defined in Chapter 13 and fig. 173). With care, these variables can be defined consistently from site to site and between investigators. Figure 178 shows how they are measured relative to the internal geometry of Triple T Shelter.

These variables were selected because of the relatively high degree of repeatability, and because the meaning of the raw variates (and especially their derivatives) are readily interpreted with regard to bilateral symmetry and degree of enclosure.

**Bilateral Symmetry:** Figure 179 illustrates four hypothetical shelter configurations which graphically demonstrate how bilateral symmetry can be expressed in accurate and operational fashion.

In figure 179, an X-Y coordinate system was imposed on each rock-shelter, then distance to dripline (dl) and distance to rear wall (dr) were measured at the intersection of each grid point. These dimensions for each datum point can then be summarized in terms of a correlation coefficient (some form of r). Given sufficient systematic datum points, it is possible to generate a curve defining the configuration of the dripline relative to the rear wall.

Whenever this curve is linear, the simple correlation coefficient describing the relationships between dl and rw (denoted as r_{dl,rw}) defines the relative degree of bilateral symmetry:

1. **Perfect bilateral symmetry:** The distance to dripline and distance to rear wall are perfectly and inversely correlated. In such cases, r_{dl,rw} = -1.00 (figs. 179a, b).
2. **Strong bilateral symmetry:** Distance to dripline and distance to rear wall remain inversely correlated, with r_{dl,rw} less than zero but greater than -1.00 (fig. 179c).
3. **Weaker bilateral symmetry:** The distance to dripline and distance to rear wall are less perfectly correlated and r_{dl,rw} approaches zero (fig. 179d).

Judiciously employed, r_{dl,rw} provides a useful comparison of degree of bilateral symmetry across a series of irregular archaeological caves and shelters.

**Degree of Enclosure:** We previously defined an intrasite debris disposal model specific to the ideal exogene cave (fig. 177; see also Thomas, 1983b: 433–434). As we expand consideration to additional caves and rock-shelters, it is desirable to employ a more flexible measure of cave geometry.

As illustrated in figure 180, the relationship between distance to dripline and distance to lateral wall provide an accurate way of depicting site configuration:

1. **The laterally expanding enclosure:** The distance to dripline and distance to lateral wall are inversely correlated—that is, the cave wall expands from the midline as distance to the dripline decreases—with r_{dl,lw} varying between zero and -1.00. This is typical “rock-shelter” configuration (fig. 180a).
2. **The laterally contracting enclosure:** Distance to dripline and distance to lateral wall are positively correlated, with r_{dl,lw} varying between zero and +1.00. This is typical “endogene cave” configuration (fig. 180b).
3. **The parallel-sided enclosure:** The distance...
Fig. 178. Three dimensions used to define intrasite geometry in exogene caves and rock-shelters. Triple T Shelter is presented as a test case.

to dripline and distance to lateral wall are not correlated, and \( r_{dl, lw} \) does not significantly differ from zero (fig. 180c).

The relationship between dripline and lateral wall, as measured by \( r_{dl, lw} \), provides both a workable approach to characterizing cave morphology and also a starting place for meaningful spatial analysis of cave and shelter sites in the following two chapters.

**PRACTICAL APPLICATION:** Before turning to the Monitor Valley sites in question, let us explore two cases in which the geometric variables defined above can be used to characterize enclosed sites in terms of usable human lifespan.

Gatecliff Shelter was previously characterized as an exogene cave, and intrasite variability was analyzed on that basis (esp. Thomas, 1983b: 433–434). We can now apply the three spatial variables to the relatively well-known Gatecliff case, looking for both advantages and potential procedural problems.

Figure 181 shows two plan views of Gatecliff Shelter, both plotted at initial surface level. The 2 m excavation grid system has been superimposed on figure 181a, and cave
geometry is thus characterized by a nexus of 16 datum points generated at the intersection of each X and Y coordinate (as defined above). These 16 points were measured according to the three axes defined above (dl, rw, and lw), and then intercorrelated, with the following results:

1. **Gatecliff Shelter exhibits a marked degree of bilateral symmetry.** This relationship is evident from the highly significant and inverse correlation between distance to dripline and distance to rear wall, $r_{dl, rw} = -0.79$ (df = 14, $p < 0.000$).

2. **Gatecliff Shelter is a laterally expanding enclosure.** This fact is evident from the significant and inverse correlation of distance to dripline and distance to lateral wall, $r_{dl, lw} = -0.61$ (df = 14, $p = 0.011$).

So defined, these correlation coefficients permit comparison of symmetry and shape between Gatecliff Shelter and any other natural enclosure in the Monitor Valley sample. Precise values of $r_{dl, rw}$ and $r_{dl, lw}$ are of little interest since these figures will vary slightly with the size and extent of sampling grid employed. To estimate the degree of variability, we experimented somewhat with the geometric variables.

Figure 181b shows the same plan view of Gatecliff Shelter, but with a different coordinate system superimposed. Previously, in figure 181a, we used the 2 m grid system employed in the excavation of Gatecliff Shelter. But in figure 181b, we impose a grid network roughly parallel to the dripline. Although the grid interval remains at 2 m, the orientation is rotated roughly 30°.

All such grids are arbitrarily imposed, and figure 181b demonstrates how the choice of grids influences the interpretive outcome:
Gatecliff Shelter exhibits an even higher degree of bilateral symmetry, evident from the highly significant and inverse correlation of distance to dripline and distance to rear wall, \( r_{dl,rw} = -0.93 \) (df = 19, \( p < 0.000 \)).

2. *Gatecliff Shelter* exhibits roughly the same degree of lateral expansion, as is evident from the significant and inverse correlation of distance to dripline and distance to lateral wall, \( r_{dl,lw} = -0.59 \) (df = 19, \( p = 0.008 \)).

The results differ somewhat from those obtained using the excavation grid system. By the grid system in figure 181b, Gatecliff Shelter appears to be more symmetrical (maximizing symmetry was, after all, the rationale behind the new grid); the degree of lateral expansion remains essentially unchanged.

Despite slightly different values of \( r \), the overall significant/not significant decision-making remains unchanged (all outcomes remain statistically significant, as before). Ideally, all grid systems will be imposed to maximize symmetry, but when one must employ field excavation data, this stricture is sometimes not workable.

**ANOTHER VIEW OF DROP/TOSS ZONE PATTERNING**

We now employ the arbitrary X/Y grid system to pinpoint the organization of intrasite refuse disposal within the spatial confines of the hunter-gatherer camp.

We are specifically concerned with intrasite patterning within small, naturally occurring overhangs and fissure shelters. By "small," I mean enclosures with surface area of less than about 75 sq m: all the excavated sites in Monitor Valley qualify as small. The largest enclosed site discussed in this volume is Toquima Cave, with a floor area of about 70 m². Jeans Spring Shelter is one of the smaller sites, with less than 10 m² of enclosed area. Gatecliff Shelter ranges in size from 26 to 72 m², depending on the particular surface being considered (Thomas, 1983b: table 86).

Drop/toss zone patterning is always constrained by local geography, and few spatial options exist in the relatively small overhangs and caves considered here. The previously defined "exogene cave disposal model" (Thomas, 1983b: fig. 222) can be refined in terms of the following four specific debris disposal patterns (see fig. 182 and table 83).
REAR DROP ZONE PATTERN (FIG. 182A)

Whenever a primary workshop area occurs toward the rear of a small, partially enclosed space, debris is expected to be discarded "outward" to form truncated cone extending transversely across the site. Although this toss area commonly contains secondary debris, particularly "messy" primary debris-producing activities are sometimes conducted here to avoid subsequent sweeping and other maintenance. Depending on specific dripline configuration, this debris zone might also extend onto the apron of the shelter.

As before (Thomas, 1983b: 443), we select simple weight wt as the best operational measure of size sorting. Size sorting produced from rear drop zone pattern produces the following site-specific correlates:

1. Debris size (wt) is negatively correlated with distance from dripline (i.e., $r_{wt,dl} < 0$).
2. Debris size (wt) is positively correlated with distance from rear wall (i.e., $r_{wt,rw} > 0$).
3. Debris size (wt) is randomly distributed relative to distance from lateral wall (i.e., $r_{wt,lw} = 0$).

Such expectations assume, of course, that postdepositional factors remain constant. In reality, the exigencies of preservation, scavenging, caching, trampling, crushing, alluviation, etc. will easily overshadow these size-sorting trends in specific cases.

But if we are to address the question of intrasite variability, we must commence with a certain degree of ceteris paribus reasoning,

<table>
<thead>
<tr>
<th>TABLE 83</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop/Toss Zone Modeling for Natural Enclosures Smaller than 75 m²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation between debris size (i.e., item weight [wt]) and:</th>
<th>Distance to dripline (dl)</th>
<th>Distance to rear wall (rw)</th>
<th>Distance to lateral wall (lw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear drop zone</td>
<td>negative</td>
<td>Positive</td>
<td>Random</td>
</tr>
<tr>
<td>$r_{wt,dl} &lt; 0$</td>
<td>$r_{wt,rw} &gt; 0$</td>
<td>$r_{wt,lw} = 0$</td>
<td></td>
</tr>
<tr>
<td>Lateral drop zone</td>
<td>Random</td>
<td>Random</td>
<td>Positive</td>
</tr>
<tr>
<td>Central drop zone</td>
<td>$r_{wt,dl} = 0$</td>
<td>$r_{wt,rw} = 0$</td>
<td>$r_{wt,lw} &gt; 0$</td>
</tr>
<tr>
<td>Rear/lateral drop zone</td>
<td>Positive to random</td>
<td>Negative to random</td>
<td>Negative</td>
</tr>
<tr>
<td>$r_{wt,dl} = 0$</td>
<td>$r_{wt,rw} = 0$</td>
<td>$r_{wt,lw} &lt; 0$</td>
<td></td>
</tr>
<tr>
<td>Rear/lateral drop zone</td>
<td>Positive to random</td>
<td>Positive to random</td>
<td>Positive</td>
</tr>
<tr>
<td>$r_{wt,dl} = 0$</td>
<td>$r_{wt,rw} = 0$</td>
<td>$r_{wt,lw} &gt; 0$</td>
<td></td>
</tr>
</tbody>
</table>
then attempt to identify the independent, postdepositional, and recycling processes that tend to obscure or obliterate the initial spatial patterning.
LATERAL DROP ZONE PATTERN
(fig. 182b)

When the primary workshop area occurs toward the sides of a small, partially enclosed space, debris discarded “outward” forms a band of tossed items running along the central axis and front of the site. Depending on the specific configuration of the dripline, this debris zone might also extend onto the apron of the shelter. The size sorting produced by such behavior has the following site-specific correlates:

1. Debris size (wt) is randomly correlated with distance from dripline (i.e., \( r_{wt,dl} = 0 \)).
2. Debris size (wt) is randomly correlated with distance from rear wall (i.e., \( r_{wt,rw} = 0 \)).
3. Debris size (wt) is positively correlated with distance from lateral wall (i.e., \( r_{wt, lw} > 0 \)).

CENTRAL DROP ZONE PATTERN
(fig. 182c)

When the primary workshop area occurs toward the center of a small, partially enclosed space, debris discarded “outward” forms a ringlike toss zone around the perimeter and dripline of the site. Depending on the specific configuration of the dripline, this ring of tossed debris might also extend toward the apron or the rear of the shelter. The size sorting produced by such behavior has the following site-specific correlates:

1. Debris size (wt) is positively to randomly correlated with distance from dripline (i.e., \( r_{wt,dl} \geq 0 \)).
2. Debris size (wt) is negatively to randomly correlated with distance from rear wall (i.e., \( r_{wt,rw} \leq 0 \)).
3. Debris size (wt) is negatively correlated with distance from lateral wall (i.e., \( r_{wt, lw} < 0 \)).

REAR/LATERAL DROP ZONE PATTERN
(fig. 182d)

When the primary workshop area occurs toward the rear and along the lateral margins of a small, partially enclosed space, debris discarded “outward” forms a central toss zone in the middle and toward the dripline of the site. Depending on the specific configuration of the dripline, this central zone of tossed debris might also extend onto the apron of the shelter. Rear/lateral drop zone patterning has the following site-specific correlates:

1. Debris size (wt) is negatively to randomly correlated with distance from dripline (i.e., \( r_{wt,dl} < 0 \)).
2. Debris size (wt) is positively to randomly correlated with distance from rear wall (i.e., \( r_{wt,rw} > 0 \)).
3. Debris size (wt) is positively correlated with distance from lateral wall (i.e., \( r_{wt, lw} > 0 \)).

Other expectations could readily be generated—depending on the specifics of site geometry—and it remains possible that similar patterning could be generated by very different behavioral and postdepositional processes. But the models on figure 182 provide polar extremes for assessing potential drop/toss zone configurations within confined, naturally enclosed space.

This outline provides a necessary first step to the pursuit of a substantive, site-by-site consideration of spatial variability in the next two chapters.5

NOTES

1. Keep in mind that we focus the archaeological application strictly on hearth-wall distance; as discussed earlier, analysis of hearth-to-hearth distances is an unreliable approach.
2. In biological studies, observed values of CV greater than about 10 percent are commonly taken to reflect an “impure”—often multimodal—distribution. Cultural distributions are probably less well-defined, so a somewhat greater dispersion of CV is probably permissible in the present study.
3. Following standardized speleological practice, an “exogene” cave was defined as one in which the rear portions are exposed daily to sunlight (after Payen, 1968). Gatecliff Shelter is an exogene cave, and so is Triple T Shelter. Conversely, “endogene” caves have a zone of perennial darkness; Hidden Cave (Thomas, 1985) is an endogene cave, and so are Lovelock, Danger, and Hogup caves. Cave geometry heavily conditions the available light, which in turn heavily conditions the human
use of space. For this reason, the exogene/endogene distinction was a useful point of departure in discussing intrasite variability in caves and shelters.

4. On figure 180, one can readily distinguish between rear and lateral walls in the ideal case. But in archaeological applications discussed in the next two chapters, where we cannot impose such strict boundaries, it is necessary to employ a distance to nearest wall approximation in computing the value of $r_{dl,wr}$.

5. Because the artifact, debitage, and bone fragments recovered vary widely in size, the skewing effects of differential size are minimized by employing log mean item weight throughout this analysis as the primary vehicle of sorting according to size.
CHAPTER 15. SITE STRUCTURE: LOWLAND SLOPE AND VALLEY BOTTOM

The previous chapter provides sufficient middle range and procedural support to facilitate examination of site structure on a case-by-case basis. We begin by looking at the relationship between the various debris disposal and hearth positioning models in the naturally enclosed facilities of lower portions of Monitor Valley.

Archaeological fieldwork on the valley bottom and lowland slope documented five naturally enclosed facilities with evidence of human utilization: Triple T Shelter, Jeans Spring Shelter, Hunts Canyon Shelter, Bradshaw Shelter, and Boring-as-Hell Shelter. Each site was tested, and in some cases these preliminary results warranted further excavation (as described in chaps. 3 and 4).

We know of only one additional prehistorically utilized shelter in this part of Monitor Valley, a small overhang (Ny3707) in Hoodoo Canyon (see chap. 7). U.S. Forest Service records indicate that cores and associateddebitage were found on the surface, but we have no evidence on buried deposits (if any).

TRIPLE T SHELTER

Triple T Shelter, a hemispherical cavern in West Northumberland Canyon, encloses approximately 35 m² within the dripline (chap. 3). Figure 183 shows this site in plan view, with the surface plotted as it was initially discovered.

GEOMETRIC SITE CONFIGURATION

The 1 m grid system from the 1975 excavation has been superimposed to characterize shelter geometry in terms of the data points generated by the X and Y axes. These coordinates were measured following the three variables defined in chapter 13—dl, rw, and lw—and the results intercorrelated.

We find a highly significant and inverse correlation between distance to dripline and distance to rear wall: \( r_{dl, lw} = -0.97 \) (df = 20, \( p < 0.001 \)). Triple T is also characterized by markedly expanding lateral sides, as defined by the significant and inverse correlation between distance to dripline and distance to lateral wall: \( r_{dl, lw} = -0.67 \) (df = 20, \( p = 0.001 \)).

In other words, Triple T Shelter exhibits a typical rock-shelter configuration, with near perfect bilateral symmetry.

ARTIFACT DISTRIBUTIONS

Intrasite distribution of artifacts can be plotted only for Stratum I. Although lower stratigraphic units contained considerable cultural debris, individual and aggregate sample sizes are insufficient for meaningful spatial analysis. Artifacts from Strata IA and IB have been pooled into a single sample.

Stratum I artifacts must also be grouped according to horizontal provenience unit. The 1975 sample is clustered by 1 m square units (those with alphanumeric labels on fig. 52); the 1976 sample is categorized by the 2 m square excavation units (designated by alphabetic labels). To minimize possible skewing effects from extremely small samples, we include only excavation proveniences with sample sizes of 10 or more.

All three spatial variables are significantly correlated with artifact size (as measured by average item weight). The correlation between log mean artifact size and distance to dripline is \( r_{wt, dl} = 0.75 \) (df = 7, \( p = 0.019 \)); between log mean artifact weight and distance to lateral wall it is \( r_{wt, lw} = -0.75 \) (df = 7, \( p = 0.019 \)); and between log mean artifact weight and distance to rear wall, \( r_{wt, rw} = -0.69 \), it is significant (df = 7, \( p = 0.037 \)). These results show the artifacts of Triple T Shelter to be heavily size sorted, in a manner generally consistent with the central drop pattern defined in chapter 14.

To see whether the interactions between these three variables is related to artifact size, a multiple regression analysis was performed using log artifact size as the dependent variable, and plotting the three distance measures as independent variables. In this case, the coefficient of multiple correlation is \( R = 0.843 \), a strong but not statistically significant value (\( F = 4.097 \), df = 3 & 5, \( p = 0.082 \)).
Provided into rear variables: distance not significant (F = 0.517, df = 5, p = 0.364). Multiple regression analysis of all three independent variables is likewise not significant (F = 0.542, df = 3 & 3, p = 0.478). Debitage from Stratum II at Triple T Shelter is not significantly size sorted.

**Stratum III:** Log debitage size is not significantly correlated with the spatial variables: distance from dripline (r_{wt,dl} = -0.26, df = 5, p = 0.420), distance from rear wall (r_{wt, rw} = -0.38, df = 5, p = 0.409), or distance from lateral wall (r_{wt, lw} = 0.38, df = 5, p = 0.406).

Despite these unimpressive bivariate pairings, multiple regression analysis reveals a statistically significant interaction, with a coefficient of multiple regression equal to R = 0.98 (F = 24.049, df = 3 & 3, p = 0.013). Taken simultaneously, the three spatial variables account for 96 percent of the variability noted in log flake size across Stratum III at Triple T Shelter.

This anomalous pattern is not anticipated by any of the drop/toss zone models discussed in chapter 14. Although the debitage in Stratum III is clearly size sorted, the geometric interactions are complex and not readily modeled in two dimensions. It is particularly curious in a bilaterally symmetrical site such as Triple T Shelter to find both distance from dripline and distance from rear wall negatively correlated with log debitage size.

**Stratum IV:** Log debitage size is not significantly correlated with any of the spatial variables: distance from dripline (r_{wt,dl} = -0.56, df = 2, p = 0.443), distance from rear wall (r_{wt, rw} = 0.42, df = 2, p = 0.419), or distance from lateral wall (r_{wt, lw} = -0.12, df = 2, p = 0.128). Multiple regression analysis is not feasible with such a small sample size. Debitage from Stratum IV at Triple T Shelter is apparently not size sorted.

**Bone Distribution**

Bone was not particularly abundant at Triple T Shelter and only the sample from Stratum IA could be analyzed for intrasite patterning. These faunal remains are significantly correlated with distance from rear wall (r_{wt, rw

There is no apparent interaction of spatial variables.

**Debitage Distribution**

Debitage is relatively abundant at Triple T Shelter, and the overall sample was subdivided into five stratigraphic categories.

**Stratum IA:** Log debitage weight is not significantly correlated with any of the spatial variables: distance from dripline (r_{wt, dl} = -0.19, df = 19, p = 0.424), distance from rear wall (r_{wt, rw} = 0.03, df = 17, p = 0.107), or distance from lateral wall (r_{wt, lw} = 0.15, df = 17, p = 0.466). Multiple regression analysis of the three independent variables is likewise not significant (F = 0.517, df = 3 & 17, p = 0.680). We conclude that debitage from Stratum IA at Triple T Shelter is not significantly size sorted.

**Stratum IB:** Log debitage size is not significantly correlated with any of the spatial variables: distance from dripline (r_{wt, dl} = -0.44, df = 8, p = 0.198), distance from rear wall (r_{wt, rw} = 0.44, df = 8, p = 0.202), or distance from lateral wall (r_{wt, lw} = 0.31, df = 8, p = 0.379). Multiple regression analysis of all three independent variables is likewise not significant (F = 0.843, df = 3 & 6, p = 0.520). The debitage in Stratum IB at Triple T Shelter is apparently not size sorted.

**Stratum II:** Log debitage size is not significantly correlated with any of the spatial variables: distance from dripline (r_{wt, dl} = 0.14, df = 5, p = 0.244), distance from rear wall (r_{wt, rw} = -0.25, df = 5, p = 0.410), or distance from lateral wall (r_{wt, lw} = -0.22, df = 5, p = 0.364). Multiple regression analysis of all three independent variables is likewise not significant (F = 0.542, df = 3 & 3, p = 0.478). Debitage from Stratum II at Triple T Shelter is not significantly size sorted.

**Stratum III:** Log debitage size is not significantly correlated with the spatial variables: distance from dripline (r_{wt, dl} = -0.26, df = 5, p = 0.420), distance from rear wall (r_{wt, rw} = -0.38, df = 5, p = 0.409), or distance from lateral wall (r_{wt, lw} = 0.38, df = 5, p = 0.406).

Despite these unimpressive bivariate pairings, multiple regression analysis reveals a statistically significant interaction, with a coefficient of multiple regression equal to R = 0.98 (F = 24.049, df = 3 & 3, p = 0.013). Taken simultaneously, the three spatial variables account for 96 percent of the variability noted in log flake size across Stratum III at Triple T Shelter.

This anomalous pattern is not anticipated by any of the drop/toss zone models discussed in chapter 14. Although the debitage in Stratum III is clearly size sorted, the geometric interactions are complex and not readily modeled in two dimensions. It is particularly curious in a bilaterally symmetrical site such as Triple T Shelter to find both distance from dripline and distance from rear wall negatively correlated with log debitage size.

**Stratum IV:** Log debitage size is not significantly correlated with any of the spatial variables: distance from dripline (r_{wt, dl} = -0.56, df = 2, p = 0.443), distance from rear wall (r_{wt, rw} = 0.42, df = 2, p = 0.419), or distance from lateral wall (r_{wt, lw} = -0.12, df = 2, p = 0.128). Multiple regression analysis is not feasible with such a small sample size. Debitage from Stratum IV at Triple T Shelter is apparently not size sorted.

**Bone Distribution**

Bone was not particularly abundant at Triple T Shelter and only the sample from Stratum IA could be analyzed for intrasite patterning. These faunal remains are significantly correlated with distance from rear wall (r_{wt, rw

Fig. 183. Analytical 1 m grid system superimposed on Triple T Shelter.
THOMAS: MONITOR VALLEY: 3

Fig. 184. Debris size sorting at Triple T Shelter. a. Artifact distribution in Stratum I is consistent with the central drop zone model (fig. 182c and table 90); b. faunal distribution in Stratum IA is consistent with a rear drop zone model (Fig. 182a), but the observed patterning probably results from breakage due to trampling toward the rear of Triple T Shelter.

= 0.68, df = 7, p = 0.044), but not with distance from dripline \( r_{wt,d} = -0.60, df = 7, p = 0.087 \) or with distance from lateral wall \( r_{wt,lw} = 0.37, df = 7, p = 0.331 \). Multiple regression analysis of all three independent variables is likewise not significant \( F = 1.768, df = 3 & 5, p = 0.269 \).

HEARTH POSITIONING

Triple T Shelter contained 22 distinct hearths, described in chapter 3; the salient attributes of these features have been summarized on table 82. As noted earlier, the Stratum IA hearths from Triple T can be analytically subdivided into upper and lower subunits (based on a stratigraphic cutoff point of 20 cm below datum). Keep in mind that this division is arbitrary and does not reflect a clear-cut observable stratigraphic division.

**TABLE 84**

<table>
<thead>
<tr>
<th>Stratum IA</th>
<th>Rear wall hearth distance (cm)</th>
<th>North wall hearth distance (cm)</th>
<th>West wall hearth distance (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{x} )</td>
<td>( S )</td>
<td>( n )</td>
</tr>
<tr>
<td>Upper</td>
<td>254</td>
<td>56.0</td>
<td>6</td>
</tr>
<tr>
<td>Lower</td>
<td>268</td>
<td>61.5</td>
<td>9</td>
</tr>
<tr>
<td>Below</td>
<td>179</td>
<td>55.5</td>
<td>5</td>
</tr>
</tbody>
</table>

UPPER STRATUM IA: Figure 185 shows the spatial distribution of the six hearths in upper Stratum IA at Triple T Shelter. Hearths IA-C and IA-I are unprepared concentrations of ash and oxidized silt. Hearths IA-B and IA-F are shallow-pit features. Hearth IA-D is a deep-pit hearth immediately adjacent to fragments of a large, open twined *Artemisia* mat. Hearth IA-A is a trilobed feature probably resulting from multiple construction episodes. These hearths occurred in a vertical distance of roughly 50 cm and the chances of behavioral contemporaneity are slim.

It is now possible to examine the goodness of fit between this set of empirically observed features and the behavioral models of intrasite hearth distributions developed in the last chapter. The coefficient of variation will be used to assess degree of conformation with each model.
Fig. 185. Intrasite distribution of hearths in upper Stratum IA at Triple T Shelter.

Rear wall corridor model: All six upper Stratum IA hearths fit a potential rear wall model, as indicated by the relatively low coefficient of variation value of 22.0 percent (table 84). The 95 percent confidence interval for mean distance from rear wall ranges from 195 to 313 cm.

North wall corridor model: Four of these upper Stratum IA hearths also fit a north wall model: hearths A, B, C, and I. There is considerable overlap with the rear wall corridor, but the wall-hearth intervals differ considerably. The coefficient of variation for this northern zone is 33.8 percent, and the 95 percent confidence interval for mean distance from the north lateral wall is 54 to 181 cm.

West wall corridor model: There is, strictly speaking, no western wall sleep zone since only Hearths IA-D and IA-F occur on this half of the site. No attempt is made to compute statistical goodness-of-fit for this area.

Lower Stratum IA: Figure 186 plots the distribution of the nine hearths in the lower portion of Stratum IA. Four of these features (Hearths IA-E, IA-M, IA-N, and IA-O) are rock-filled hearths. Hearth IA-G is a complex stone and charcoal feature; the outer ring is semicircular and the inner ring lines a pit 20 cm deep. The other features are merely shallow hearth depressions.

These hearths occur throughout a vertical distance of 80 cm and there is no suggestion of contemporaneity between these features.

Rear wall corridor model: All nine of these substantially constructed hearths are consistent with a rear wall model; the coefficient of variation is a relatively low 22.9 percent. The 95 percent confidence interval for mean distance from the rear wall is 221 to 316 cm. This interval cannot be statistically distinguished from patterning evident in rear zone hearth spacing in the upper part of Stratum IA ($t = 0.433$, $df = 13$, $p = 0.337$).

North wall corridor model: Eight of the nine hearths in lower Stratum IA were tested for goodness-of-fit against a potential north wall model; only Hearth IA-L is positioned too far from the north wall for inclusion. But the coefficient of variation (39.0%) is rather high and the 95 percent confidence intervals (172 to 333 cm) are rather broad, suggesting the absence of a north wall corridor. Moreover,
the differential hearth distributions along the northern wall in upper and lower Stratum IA are statistically significantly distinct (df = 10, \( t = 2.584, p = 0.026 \)).

In other words, whereas hearths in upper IA can be said to define a circumscribed northern hearth corridor, those in lower Stratum IA do not.

**West wall corridor model:** Eight of these hearths were tested against a west wall model, judging only Hearth IA-J too far east for inclusion. But the coefficient of variation is a very large 49.0 percent, and the 95 percent confidence interval for mean distance to the west wall is 165 to 362 cm, denoting a relatively poor fit to the model.

**Below Stratum IA:** Figure 187 plots the distribution of the seven excavated hearths below Stratum IA at Triple T Shelter. These hearths span more than 350 cm in the vertical stratigraphic column, and none are contemporaneous.

**Rear wall corridor model:** Five of these hearths fit into the rear wall model: Hearths IIB-A, IIIA-A, IIIA-C, IIIC-A, and IV-C-A (Hearths IB-A and IIIA-B are too close to the shelter walls for inclusion). All five features are either unprepared or shallow-pit hearths. The coefficient of variation for this zone is 31.0 percent; the 95 percent confidence interval for mean distance from the rear wall is 115 to 243 cm.

**North wall corridor model:** Four of these hearths were tested against the north wall model: Hearths IIB-A, IIIA-A, IIIA-C, and IIIC-A. These hearths are of relatively simple construction, being merely diffuse ash and charcoal scatters (IIB-A and IIIC-A) or shallow scooped-out pit hearths (IIIA-A and IIIA-C). The coefficient of variation for the northern zone is 44.0 percent, and the 95 percent confidence interval for mean distance to the north lateral wall is an unconvincing 67 to 380 cm.

There is no potential west wall corridor.

**SUMMARY**

A rather consistent picture emerges when hearth and debris distributions are synthesized. The distribution of the Stratum IA hearths at Triple T Shelter suggests that fires

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**Fig. 186.** Intrasite distribution of hearths in lower Stratum IA at Triple T Shelter.
were commonly positioned to create a corridor of heat retention between the hearth area and the rear wall (which probably functioned as a heat sink). Both upper and lower Stratum IA contain a well-defined hearthline roughly 260 cm from the rear wall. Particularly striking is the fact that no Stratum IA hearth was built closer than 185 cm to this rear wall. The 95 percent confidence intervals about this mean distance indicates that both the 2.0 and 3.0 m hearth spacing models are consistent with the observed distributions.

The south-facing, bilaterally symmetrical, laterally expanding configuration of Triple T Shelter is well suited to a rear wall heat corridor; the cave geometry also lends itself to drop/toss zone patterning. Our analysis of individual bivariate relations indicates that the artifacts from Triple T Shelter are indeed size sorted: item size is positively correlated with distance from dripline and negatively correlated with both rear wall and lateral wall distances (fig. 184a). That is, the smallest artifacts occur some distance from both rear and lateral walls in a distribution most consistent with a central drop zone pattern.

While these artifact distributions might seem in conflict with a rear wall corridor defined by hearths, a detailed look at artifact provenience shows that the largest artifacts occurred in two specific areas. Using a mean artifact weight of 40.0 g as a cutoff point, the bulkiest artifacts in Stratum IA were found concentrated along the western wall (excavation units D, H, and B-3) and on the northern edge of the living surface (unit E). Specifically, in addition to dozens of broken biface fragments, these units contained three of the four manos recovered at Triple T Shelter, four large hammerstones, and a talc shaft smoother (the only such artifact recovered at this site).

It seems likely that these bulky manos and artifact fabricators were deliberately left at the shelter periphery as passive site furniture, to be utilized on subsequent visits to Triple T. This pattern of item discard is entirely consistent with the rear hearth corridor model in this stratum.

Curiously, debitage is not systematically size sorted but faunal remains are. The distribution of bones from Stratum IA is gen-
eraly consistent with the rear drop zone model (fig. 182a): bone size is negatively correlated with distance from the dripline, positively correlated with distance from the rear wall, and randomly associated with lateral wall distances (fig. 184b). That is, the larger bones are all found near the center and toward the front of the site, with smaller bones occurring mostly in the rear of the shelter.

The mechanism behind such size sorting is not clear. It is possible that food bones were indeed discarded in a rear drop zone manner of utilization. But given the uncertainty between natural and cultural deposition, and the small size and friable nature of the faunal materials involved, it seems more likely that size sorting results from a postdepositional process such as underfoot trampling (as in Gifford, 1981).

Combining the evidence for debris size sorting and the distinct rear hearthlines, it seems clear that the rear/central portion of Stratum IA at Triple T Shelter was demarcated from the rest of the site. These hearths were generally small and stone enhanced, perhaps to conserve the scarce fuel available in West Northumberland Canyon. Behind this hearthline was a well-heated zone of deliberate preventative maintenance. A less well-defined toss zone occurred outside of the hearthline (but still within part of the sheltered area).

But did the enclosed rear zone function strictly as a sheltered workshop area, or did it also serve as a nocturnal sleep zone? Relevant here is the open twined _Artemisia_ mat found near Hearth IA-D and slightly to the west of Hearth IA-I. Considering the extent and nature of construction, this sagebrush mat almost certainly served as bedding or flooring (Adovasio and Andrews, 1983: 283–284). The two best preserved fragments were found roughly 150 and 250 cm from the rear wall, placing them well within the rear hearth corridor (which averaged about 260 cm from the rear wall). This bit of evidence points toward at least occasional usage of this rear corridor as a sleeping area during Stratum IA times at Triple T Shelter.

We find a more confusing picture below Stratum IA. Hearth distributions still tend to correspond to a rear corridor model, positioned roughly 180 cm from the rear wall. But these hearths clearly cluster toward the northeastern part of the site. With a single exception, the hearthline below IA is defined by features in Stratum III, a complex geological unit dating between roughly 4000 and 5400 radiocarbon years B.P.

Debitage size sorting is also apparent in Stratum III. The smallest flakes in this stratum occur toward the middle and western corner of the site surface. Debitage size also increases with distance from the lateral wall (much of this relationship is due to the extremely small flakes found in unit K, in the far western corner).

Although the correlation is a bit vague, the northeastern hearth arc in Stratum III suggests a drop zone of smaller debris along the northwestern wall. Unfortunately, insufficient faunal and artifact materials exist to convincingly demonstrate size sorting for these basal units.

**JEANS SPRING SHELTER**

Jeans Spring Shelter is located in a small outcrop of Hoodoo Canyon tuff, approximately 200 m southwest of Jeans Spring, a natural seep on the north fork of Wildcat Canyon (figs. 89 and 90).

Sample sizes from Jeans Spring are small, creating problems for intrasite analysis (chap. 4). But considerably more severe difficulty results from the sampling strategy we employed. While excavating this site (in September 1973), we followed what was then common practice: start with a telephone booth excavation toward site center, and dig down to bedrock. Then use the visible stratigraphy in this unit to define adequate vertical units for digging the rest of the grid squares inside the overhang. According to the contemporary wisdom, we proceeded to "completely excavate the site."

The present analysis demonstrates the shortcomings of that procedure. Although we thought that we had "dug the whole thing," the entire excavation occurred inside the overhang. There is, in hindsight, every reason to expect that similar depositional conditions prevailed on the apron of Jeans Spring Shelter; had we excavated there, we would probably have recovered a good sample of items discarded immediately outside the site as well. Digging as we did, we remain ignorant about
what was deposited immediately outside the dripline.

Culture historical objectives dominated archaeology’s early research strategies, and so long as this was true, it was defensible to keep digging “inside” our sites. In this sense, our excavation of Jeans Springs was warranted as a series of unrelated (if shallow) telephone booths. Analysis of time-sensitive artifacts across time is surely facilitated by such excavations.

But now that interest has shifted toward site structural objectives, field strategies must change as well. I think it quite likely that drop/toss zone patterning was operative in Jeans Spring Shelter; the hearth analysis suggests just that. And I further suspect that an important portion of the Jeans Springs deposits lies on the 2 m apron outside the dripline. If so, these artifacts, flakes, and bones should be significantly larger than those found inside the shelter proper (assuming that comparable postdepositional factors operate in both areas).

We lack these data because of the way we dug. By restricting excavations to the intra-dripline part of Jeans Spring Shelter, we effectively hobbled our analytical steps a decade ago. This is not to wring hands needlessly about sins of excavations a decade old; our excavations were played out according to field strategies acceptable at the time. But as analytical horizons expand, we must simultaneously modify even our most cherished and traditional field techniques to provide the data necessary for today’s models.

**GEOMETRIC SITE CONFIGURATION**

The shelter at Jeans Spring is roughly V-shaped, with the dripline running somewhat diagonally across the front; approximately 15 m² are inside. Figure 188 shows the outline of Jeans Spring Shelter with an analytical 0.5 m grid which defines a nexus of 38 data points.

These geometric criteria show a highly significant and inverse correlation between distance to dripline and distance to rear wall: $r_{dl, rw} = -0.97, df = 36, p < 0.001$. There is also a significant and inverse correlation between distance to dripline and distance to lateral wall: $r_{dl, lw} = -0.41, df = 36, p = 0.011$.

In other words, the Jeans Spring enclosure is a moderately expanding shelter with strong bilateral symmetry.

**DEBITAGE DISTRIBUTION**

The artifact sample from Jeans Spring Shelter is too small to allow meaningful intrasite spatial analysis. But debitage and bone distribution analyses could be conducted.

The smallest flakes occur toward the small rear alcove, and debitage tends to become much larger toward the outer units (fig. 189). Reflecting this relationship is the significant correlation between log flake size and distance to the rear wall ($r_{wt, rw} = 0.88, df = 4, p = 0.023$). There is no significant correlation between flake size and distance to the dripline ($r_{wt, dl} = -0.59, df = 4, p = 0.212$). Distance to lateral wall is similarly uncorrelated to log flake size ($r_{wt, lw} = -0.05, df = 4, p = 0.075$).

A multiple regression analysis was performed. The coefficient of multiple correlation is $R = 0.898$, not a statistically significant value ($F = 2.791, df = 3 & 2, p = 0.274$).

**BONE DISTRIBUTION**

The correlation between log bone size and distance to the dripline is $r_{wt, dl} = -0.44$ (df = 4, $p = 0.381$), the correlation between log bone size and distance to the rear wall is $r_{wt, rw} = -0.24$ (df = 4, $p = 0.351$), and the correlation between log bone size and distance to the lateral wall is $r_{wt, lw} = -0.05$ (df = 4, $p = 0.075$).

A multiple regression analysis was performed as before. The coefficient of multiple correlation is $R = 0.926$, not a statistically significant value ($F = 4.012, df = 3 & 2, p = 0.206$). In other words, bones are randomly distributed inside Jeans Spring Shelter.

**HEARTH POSITIONING**

Jeans Spring Shelter contained a single shallow-pit hearth, located immediately adjacent to the site dripline and 170 cm from the rear wall. Additional hearths may remain undetected near the dripline and beyond.

**SUMMARY**

Little can be said about the intrasite distribution of materials inside Jeans Spring Shelter. Not only is the artifact sample too
meager for meaningful spatial analysis but (as mentioned above), we failed to excavate outside the dripline. There is a slight tendency for bones to increase in size toward the mouth of the small shelter, but the sample is insufficient to establish that relationship satisfactorily.

Flake size, however, does demonstrate a significant degree of size sorting inside Jeans Spring Shelter, a patterning fully consistent with the rear/lateral drop zone model of table 83: positive correlation with distance to rear wall, random distribution relative to lateral wall, and a negative to random distribution relative to the dripline (fig. 189). That is, the smallest debitage in Jeans Spring Shelter occurs near the small rear alcove, with flakes becoming much larger toward the outer units.

Hearth positioning at Jeans Spring Shelter is consistent with the rear/lateral drop zone model. The only hearth discovered defines a heated U-shaped sleep/work area, varying between 1 and 2 m from the rear wall of the overhang. Smoke from this hearth would simply waft up the outer face of the shelter without intruding inside.

Ceiling height is extremely low at the rear of Jeans Spring Shelter; in fact, nowhere inside the enclosed area does the ceiling exceed 1.5 m or so. It seems most likely that the rear of Jeans Spring Shelter was used as a temporary bedding area; workshop/consumption activities were probably conducted in this area, not inconsistent with Binford's "breakfast in bed" description (1983: 163–165).

HUNTS CANYON SHELTER

Hunts Canyon Shelter is a low, narrow overhang in the massive tuff outcrop jutting up from the alluvial bottomland of Hunts Canyon (fig. 95). We tested this site in 1978 hoping to find an undisturbed deposit with potential for producing a stratified sequence of plant macrofossils. Therefore, our testing attempted to obtain a broad-scale coverage of subsurface conditions beneath the overhang. The sampling strategy was successful in this sense; yet, although preservation was adequate (at least in the upper levels), the

Fig. 188. Analytical 0.5 m grid system superimposed on Jeans Spring Shelter.

Fig. 189. Debitage size sorting at Jeans Spring Shelter, consistent with the rear/lateral drop zone model of figure 182.

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little to explore the longitudinal and lateral variability in debris disposal. Because our units were located a roughly constant distance from the rear wall, the dripline and cave apron were left untouched. That is, the volume of sediments explored would seem to be at least minimally adequate for intrasite studies, but the placement of these units vitiated meaningful spatial analysis. As in the Jeans Spring exercise, we hope that future sampling ventures will profit from our experience.

**GEOMETRIC SITE CONFIGURATION**

Figure 190 shows the plan view of Hunts Canyon Shelter, plotted at initial surface level; approximately 40 m² are enclosed inside. Although the excavation was conducted on a 1 m grid, the cave geometric variables are computed at 2 m intervals.

The interior configuration can be characterized by 20 data points, measured as before. Hunt Canyon Shelter has a highly significant and inverse correlation between distance to dripline and distance to rear wall: $r_{dl, rw} = -0.76, df = 19, p = 0.001)$. This site is also characterized by the highly significant and inverse correlation between distance to dripline and distance to lateral wall: $r_{dl, lw} = -0.72, df = 17, p = 0.001)$. These metric results reflect the extremely broad rock-shelter configuration, with a high degree of bilateral symmetry.

**DEBITAGE DISTRIBUTION**

Neither artifact nor bone samples from Hunts Canyon Shelter were sufficiently large to permit examination of intrasite variability. But enoughdebitage was recovered to permit such analysis (within the sampling constraints mentioned above).

Flake distribution in Hunts Canyon Shelter does not correspond to any anticipated drop/toss zone pattern. There is, to be sure, a systematic and highly significant relationship between log flake size and the distance to the dripline ($r_{wt, dl} = 0.93, df = 4, p = 0.008$): flakes become larger as one moves farther inside the dripline. But flakes appear to be distributed randomly with respect to the other two dimensions. There is no relationship between log flake size and the distance to the rear wall.
(r_{wt, rw} = 0.30, df = 4, p = 0.439). There is also no relationship between log flake size and the distance to the lateral wall (r_{wt, lw} = 0.25, df = 4, p = 0.359).

Multiple regression analysis was performed as before. The coefficient of multiple correlation is $R = 0.954$, a high but not statistically significant value ($F = 6.787, df = 3 \& 2, p = 0.132$). These data reflect no size sorting of debitage at Hunts Canyon Shelter.

**HEARTH POSITIONING**

Test excavations at Hunts Canyon Shelter encountered a bilobed hearth located near the center of the shelter, 80 cm from the lateral wall and about 130 cm from the rear wall. Insufficient fill was examined to determine whether this hearth was isolated or associated with a corridor-defining series.

**BRADSHAW SHELTER**

Bradshaw Shelter occurs in a massive rhyolite and chalcedony formation near the northern end of the Montezuma Range, in an area littered with tons of quarry debitage and broken bifaces.

**GEOMETRIC SITE CONFIGURATION**

Excavations at Bradshaw Shelter were conducted on a 1 m grid system, but site geometry will be analyzed on the basis of a 2 m interval (fig. 191); the cave configuration is thus characterized by 17 data points, measured as before. Bradshaw Shelter exhibits a high degree of bilateral symmetry (characterized by the highly significant and inverse correlation between distance to dripline and distance to rear wall: $r_{dl, rw} = -0.99, df = 15, p = 0.001$). Bradshaw Shelter is also parallel sided, as reflected in the high but not statistically significant inverse correlation between distance to dripline and distance to lateral wall ($r_{dl, lw} = 0.43, df = 15, p = 0.080$).

**DEBITAGE DISTRIBUTION**

The sample of artifacts and faunal remains recovered at Bradshaw Shelter is too small for intrasite analysis. While it would be desirable to have more excavation units for comparison—particularly a few pits from outside the dripline—placement of the five test units is minimally sufficient for examining debitage disposal.

Flakes are distributed in purely random fashion inside this small endogene cave. There is no systematic relationship between log flake size and the distance to the dripline ($r_{wt, dl} = -0.36, df = 3, p = 0.447$), nor between log flake size and the distance to the rear wall ($r_{wt, rw} = 0.45, df = 3, p = 0.448$), nor between log flake size and the distance to the lateral wall ($r_{wt, lw} = 0.14, df = 3, p = 0.181$).

Multiple regression analysis was performed as before. The coefficient of multiple correlation is $R = 0.985$, not a statistically significant value ($F = 10.832, df = 3 \& 1, p = 0.225$). These data reflect no size sorting of debitage at Bradshaw Shelter.

**SUMMARY**

Relatively little prehistoric debris appears to have been deposited at Bradshaw Shelter, and our strategy of limited testing is insufficient to provide even the most elementary picture of intrasite patterning at this small site.
CHAPTER 16. SITE STRUCTURE: THE UPLAND SLOPE AND WOODLAND

The previous chapter fits the various debris disposal and hearth positioning models to observable intrasite structuring in lower Monitor Valley. This chapter continues that comparison, examining the structure and function of naturally enclosed and open-air facilities in the woodland and on the upland slope.

Archaeological excavations in this part of Monitor Valley centered on six naturally enclosed facilities with evidence of human utilization: Gatecliff Shelter,¹ Toquima Cave, Grenouille Verte Cave, Butler Ranch Cave, Little Empire Shelter, and Ny1059. The results of each excavation have been reported in previous chapters (see also Thomas, 1983b).

Two additional naturally sheltered facilities, designated jointly as Ny3712, were found on Northumberland Pass (table 65). U.S. Forest Service records indicate that a mano and flake occurred on the surface, but we have no evidence regarding the nature of the subsurface deposit (if any). We know of no additional caves utilized prehistorically on the Monitor Valley upland slope.

GATECLIFF SHELTER

Gatecliff Shelter is located on the north side of Mill Canyon, about 1.5 km upstream from the canyon mouth (Thomas, 1983b). The shelter contained more than 10 m of sediments, deposited in a remarkably well-defined stratigraphic sequence of 56 geological units and 16 cultural horizons. Human usage of Gatecliff Shelter commenced about 5500 B.C. and ended within the past few centuries.

PREVIOUS INVESTIGATIONS

Examination of site structuring in Monitor Valley began with hearth analysis at Gatecliff Shelter (Thomas, 1983b). Among other avenues, we explored the way in which 36 of the prehistoric hearths were distributed across the cave interior. Surprisingly, hearth positioning at Gatecliff was virtually identical across the nine independent cultural horizons spanning four millennia.

This analysis proceeded on the basis of two key variables, hearth distance from the rear wall and hearth distance from the dripline. Although we introduced no exact experimental controls, it was possible to use the changing configuration of Gatecliff Shelter to determine how these two variables conditioned hearth positioning within the site.

Between about 5000 and 2500 B.C., Gatecliff Shelter enclosed an area of 30 to 35 m². But after this time, between 2500 and 1250 B.C., the available intrasite area at Gatecliff Shelter nearly doubled, reaching a maximum area of 72 m² about 1300 B.C. (Thomas, 1983b: table 86). Because the dripline position remained constant throughout both intervals, the increased floor area was due entirely to the configuration of the rear wall as Gatecliff filled with 8 m of sediments. The changing floor area of Gatecliff Shelter provided quasi-experimental conditions to examine hearth positioning strategies.

We found earlier that hearth distance to dripline varied considerably through time. On Horizon 15, for instance, hearths were built an average of 92 cm inside the dripline (Thomas, 1983b: table 88). But on Horizon 7, hearths averaged 346 cm from the dripline. Because the dripline is constant through time, variability in distance to dripline suggested that Gatecliff hearths were positioned relative to other factors.

By contrast, distance to rear wall remained virtually constant across these 36 hearths—randomly vacillating about a grand mean of 395.8 cm (Thomas, 1983b: table 88). In other words, despite rather major changes in the size and shape of Gatecliff Shelter during Middle Holocene and Early Neoglacial times, hearths were always positioned roughly 4 m from the rear wall.

This constant positioning seems to reflect the specific geomorphology of Mill Canyon and Gatecliff Shelter. Each of these nine cultural horizons is capped by a level of compact calcareous silt. Varying in thickness from 15
to 50 cm, these sterile silt lenses effectively sandwiched the occupational surfaces between nearly impenetrable noncultural strata. In effect, each cultural horizon in this part of the Gatecliff stratigraphic section was sealed from all earlier horizons.

The resulting internal structure of each living surface is thus independent from patterning on earlier horizons. We concluded that observed redundancy in spatial patterning between floors must reflect spatial processes, rather than simple, rote, Markovian imitation of previous patterns.

Hearth positioning at Gatecliff Shelter appeared to be relatively constant because similar strategies occurred again and again through time. This redundant patterning was played out independently at least nine times during the Middle Holocene/Early Neoglacial periods at Gatecliff.

Not only was the hearth positioning strategy relatively invariant for over four millennia, but it conditioned refuse disposal patterns as well. In the previous analysis, we partitioned living surfaces at Gatecliff into three discrete areas: The interior zone (between the rear/lateral walls and the mean hearthline) encloses between about 12 and 20 m², depending on the cave configuration at the time; the hearth zone contained between the hearthline and the dripline; and an outside zone which was taken as the excavated area outside the dripline.

With the exception of Horizon 2, we found most of the archaeological debris at Gatecliff Shelter to be heavily size-sorted, and directly related to hearth positions. Almost without exception, artifacts and debitage in the site interior were significantly smaller than those found in the hearth zone. Materials discarded outside the dripline were found to be still larger.

Previous analysis of the Gatecliff hearth data (Thomas, 1983b) did not deal with intrasite variability above Horizon 7. But for present purposes, the hearths in Horizons 1–6 contain much potentially useful information. Primary descriptive data on these features are presented in an Appendix to this volume. Using these expanded data, it is now possible to refine earlier analyses of hearth positioning and debris disposal by using the intrasite models defined in previous chapters of this volume.

We can also draw upon the recent analysis of Novick (1987), who has conducted a detailed analysis of both the technological and spatial patterning in selected horizons of Gatecliff Shelter.

**Geometric Site Configuration**

Figure 192 shows the plan view of Gatecliff Shelter (after Thomas, 1983b: fig. 8); the enclosed area, through time, varied between 26 and 72 m². The configuration of Gatecliff Shelter can be characterized by 21 data points, generated along a 2 m grid system and measured according to the three axes defined above (dl, rw, and lw).

At Gatecliff Shelter, there exists a highly significant and inverse correlation between distance to dripline and distance to rear wall ($r_{dl, rw} = -0.93, df = 19, p < 0.001$). The site also has a typical “rock-shelter” configuration, as indicated by the significant and in-
verse correlation of distance to dripline and distance to lateral wall \((r_{dl, lw} = -0.56, df = 19, p = 0.008)\).

In other words, Gatecliff Shelter has markedly expanding lateral margins and nearly complete bilateral symmetry. This geometric framework will be employed to examine intra-site structuring; the analysis proceeds stratigraphically.

In the following sections, we must depart somewhat from the graphic conventions employed earlier. Figures 193–198 compare hearth distributions to two potential corridor models, flanking the western and northern walls of Gatecliff Shelter; this procedure parallels that employed in the previous chapter. We also explore a “rear corridor” model of hearth distribution, but we have not added this third potential corridor to the living surface maps for Gatecliff Shelter. Rather, we have retained the mean hearthline measure, as computed in Thomas (1983b). In this way, we are free to discuss both the “corridor” and “hearthline” approaches employed in the analysis of spatial patterning.

**MIDDLE HOLOCENE SITE STRUCTURE**

The general term “Middle Holocene” denotes the time period between 5000 and 2500 B.C., and Horizons 12–16 at Gatecliff Shelter span this interval. Figure 193 plots the Middle Holocene hearth positions. The north and west wall corridors are shaded, but to avoid graphic confusion, the position of the rear wall hearthline is denoted for each horizon by a labeled horizontal hatch mark.

In general, the Middle Holocene horizons at Gatecliff Shelter demonstrate remarkably consistent drop/toss zone patterning. Previously, we found the mean artifact size to be relatively small toward the rear of the site, becoming larger toward the center of the site, and increasing significantly in size outside the dripline (Thomas, 1983b: fig. 223). Debitage, however, remained roughly the same size inside the shelter, then became radically larger toward the apron of the cave (Thomas, 1983b: fig. 224). Artiodactyl bones occurred almost exclusively outside the dripline, whereas small bone fragments tended to occur throughout the site (Thomas, 1983b: chap. 21).

We can now examine the fit between the various hearth corridor models and the hearths from Horizons 12–15 at Gatecliff Shelter. One hearth must be excluded from the outset; figure 193 shows that Hearth 12-C was not built to define a lateral sleeping zone. This rock-encircled hearth, built approximately 3000 B.C., is positioned within 25 cm of the northwest wall and could not have defined a hearth-wall corridor.

Six of the Middle Holocene hearths correspond to a potential *north wall corridor model*: Hearths 15-A, 14-C, 12-A, 12-B, and 12-D. With a single exception, these features are relatively shallow, poorly defined ash scatters, consistent with Binford’s (1983: 157–158) “outdoor” hearth pattern. Only 12-B is a well-defined rock-encircled firepit which, in Binford’s scheme, would be more characteristic of “indoor” use. The Coefficient of Variation is a relatively low 26.4 percent. The 95 percent confidence interval for mean distance of hearths to the north lateral wall is 126 to 222 cm.

The previous analysis indicated that although an occasional artifact occurs along the northern wall (Thomas, 1983b: figs. 225–228), this buffer area is remarkably debris-free (especially when compared with the western portion of the site). Novick (1987) likewise found little debitage along this interior portion of the site.

Six of the Horizons 12–15 hearths likewise fit a *rear wall corridor model*: Hearths 12-A, 12-B, 14-A, 14-B, 14-C, and 15-A; this model is omitted from figure 193 (although the
Fig. 193. Intrasite distribution of hearths in Horizons 12–15 at Gatecliff Shelter. For clarity, the potential “rear wall corridor” model has been omitted; but the mean hearthline (as defined in Thomas, 1983b) is indicated by a horizontal dash for each individual horizon. Changing cave wall configuration is denoted for each horizon, and the hachured line indicates extent of excavation.

Horizon-specific hearthlines are plotted). The Coefficient of Variation is a very low 15.9, and the 95 percent confidence interval for this corridor ranges between 219 and 306 cm from the rear wall (table 86).

The relatively narrow rear corridor also coincides with this distinctive drop/toss zone patterning. Very few artifacts and little debitage were recovered in the enclosed zone to the rear. The only obvious exception is the keeled metate found toward the rear wall on Horizon 14. This complete grinding stone might represent site furniture left on the site surface.

Six Middle Holocene hearths also fit a rather ill-defined “west wall corridor model”: Hearths 15-B, 15-C, 14-A, 14-B, 13-A, and 12-A. All of these fires were built in well-defined pits; Hearth 13-A is enhanced with a rock semicircle. Two of these hearths con-

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<td>9-11</td>
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<td>306</td>
<td>28.7</td>
<td>5</td>
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<tr>
<td>12-15</td>
<td>263</td>
<td>41.9</td>
<td>6</td>
<td>±43.5</td>
<td>174</td>
<td>45.9</td>
<td>6</td>
<td>±26.4</td>
<td>166</td>
<td>74.3</td>
<td>6</td>
<td>±78.1</td>
</tr>
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</table>
tain paired pits, and the microstratigraphy clearly shows sequential usage. The 95 percent confidence interval for this corridor ranges from 88 to 244 cm from the western wall.

The west wall sleep zone area is statistically consistent with both the 1.0 and 2.0 m models. The artifact discard pattern is also ambiguous. Few artifacts were deposited near the west wall of Horizons 14 and 15, but the dripline passes rather close to the wall in this area, and a large bone concentration impinges on the Horizon 14 corridor. Similarly, a dense flake concentration with apparently associated artifacts was found between Hearth 13-A and the west wall.

Refuse disposal on Horizon 12 shows that weapon fabrication occurred mostly around Hearth 12-A; byproducts and fabricators were discarded where they fell, and artiodactyl bones were discarded in a toss zone outside the dripline. If hearth and artifacts are behaviorally associated, then the Hearth 13-A and 12-A areas were probably used as hearths that heated fabrication areas rather than sleep zones. The combination of relatively wide confidence intervals for hearth spacing and the relatively cluttered western wall area suggests that this corridor zone is probably spurious.

To summarize the Middle Holocene horizons at Gatecliff Shelter, a 2.0 m hearth corridor occurred along the rear and northern walls; hearth positioning and debris disposal patterns are consistent with such usage. Hearth positioning along the western corridor is poorly defined, with debris patterning that suggests that the western part of Gatecliff Shelter was used primarily as a workshop area.

**EARLY NEOGLACIAL SITE STRUCTURE: HORIZONS 9–11**

The Early Neoglacial hearths at Gatecliff will be grouped into two subsegments for descriptive purposes. We begin with hearth distributions for Horizons 9–11, presented on figure 194 (individual hearth characteristics were presented on table 82).

A potential *west wall corridor model* is defined by five hearths: 9-C, 9-D, 10-A, 10-B, and 11-B (fig. 194). Although their position-
ing is consistent, individual hearth configuration and technology appear to be rather dissimilar. Hearth 9-C, which lacks a distinct pit, consists of piñon and sagebrush charcoal; there is a slight possibility that this "hearth" is a secondary windblown feature (see Thomas, 1983b: 474), but we will treat 9-C as a cultural hearth. Hearth 10-A is a deep-pit hearth with a burnt silt and ash zone extending in a semicircle 20 cm to the north. Hearths 10-B and 11-B are unprepared surface hearths. Hearth 9-D is a complex feature consisting of three individual deep-pit hearths which were probably excavated at different times. There is no reason to suspect that any of the hearths are contemporaneous.

Nevertheless, hearth distribution is narrowly confined to the western site margin, evident from the extremely low magnitude of the CV = 9.4 percent. The 95 percent confidence interval for mean distance of hearths to the west wall ranges from 270.4 to 341 cm.

Five Horizons 9–11 hearths can be fit to a *north wall corridor model*: Hearths 9-A, 9-B, 9-D, 10-A, and 11-A (fig. 194). These hearths also vary considerably from one another. Hearths 9-A and 11-A are rather small, unprepared surface features. Hearth 9-B is a relatively large, deep pit filled with fire-fractured rock, piñon and juniper charcoal, and ash; there is a dark brown burnt stain describing an oval 50 cm to the north. Hearth 9-D is the complex feature discussed above. Hearth 10-A is also a deep pit, with a burnt semicircle of ash and charcoal extending to the north. As before, there is little reason to suspect that these hearths are contemporaneous. The 95 percent confidence interval for mean distance of hearths to the north lateral wall is 91–249 cm.

There is no evidence for a *rear wall corridor* on Horizons 9–11.

Unfortunately, too few artifacts were recovered to plot size sorting on Horizons 10 and 11. But it is clear that the artifacts of Horizon 9 are heavily size-sorted (Thomas, 1983b: table 87): the smallest items occur within the rear of the site and become progressively larger toward the apron. The refuse disposal patterning for Horizon 9 is somewhat unusual. Although the exogene size sorting model still applies, the toss zone is less clearly defined. Most intentional discard occurred in a narrow arc across the front of the site.

Debitage sorts in reverse fashion. On all three horizons, the largest debitage occurred toward the rear of the site; flakes then became smaller toward the middle of the site, and larger again outside the dripline. In this case, the debitage drop zone occurs in the middle of Gatecliff Shelter, with larger flakes discarded toward the front and especially the rear.

Debris disposal patterns are consistent with hearth positioning on Horizons 9–11, since there is no well-defined rear wall corridor.

Hearth spacing along the northern wall is likewise dispersed, statistically consistent with both the 1.0 and the 2.0 m corridor models. Although few artifacts occurred along the northern margin of Horizons 10 and 11, the north wall area was littered with items on Horizon 9. Specifically, a dense chippage scatter occurred between Hearths 9-A and 9-B; in addition to the literally hundreds of flakes in this area, we found several broken projectile point fragments and broken production stage bifaces (Thomas, 1983b: 474–475). Toward the north wall there were dozens of large limestone and sandstone percussion flakes, several large hammerstones, a large number of edge-battered cobbles, and a limestone block metate. We noted earlier that "this zone contains primary refuse and fabricator discard from ground stone tool manufacture . . . [and] the extremely large size of the flakes and fabricators contradicts the size sorting aspect of the exogene cave model" (Thomas, 1983b: 475).

By contrast, the western wall is characterized by a tightly defined hearth corridor, statistically consistent with a 3.0 m model. This area is relatively free of debris in Horizons 10 and 11. But a number of artifacts occur along the western side of Horizon 9: several grinding stone fragments, projectile points, and a few production stage bifaces. A second concentration of about 100 limestone and sandstone fabrication flakes was found throughout this area, but these flakes were much smaller than those in the northern corridor.

It is thus unclear whether the hearths defined a distinct western wall corridor for Horizons 9–11 times. Although hearth position-
Fig. 195. Intrasite distribution of hearths in Horizons 7 and 8 at Gatecliff Shelter; "rear wall corridor" omitted.

ing seems to suggest a broad zone of preventative maintenance, the relatively bulky artifacts and debitage in this area indicate otherwise. We lack, of course, any way to establish contemporaneity between feature patterning and item patterning.

EARLY NEOGLACIAL SITE STRUCTURE: HORIZONS 7–8

Horizon 8 (1350–1300 B.C.) contains debris from very late Devils Gate and very early Reveille times. The overlying Horizon 7 (ca. 1300–1250 B.C.) is an extremely complex surface, utilized during very early Reveille phase.

A north wall corridor model is consistent with the positioning of 11 hearths: 8-A through 8-E and 7-A, 7-B, 7-C, 7-E, 7-G, and 7-H (fig. 195). These diverse features range from simple, unprepared surface hearths (7-B and 7-H) through several deep-pit features (7-A, 7-C, 8-B, 8-C, 8-E) to rock-filled hearths (7-E and 8-A). Hearth 8-D is another extensive burnt zone at the rear of the shelter (probably a fire hearth, but possibly a secondary windblown or sweeping feature; see Thomas, 1983b: 480). The 95 percent confidence interval for the northern corridor ranges from 145 to 272 cm from the lateral wall. The northern wall zone is statistically consistent only with the 2.0 m winter double bed model.

The hearth data also fit a rear wall corridor model (but, for visual clarity, this model is omitted from fig. 195). Hearth 8-F lies outside the dripline and is clearly not associated with any potential hearth-defined corridor. In this case, nine of the 16 Horizons 7–8 hearths were located too far toward the front to be considered for a rear zone model. The remaining seven hearths fall into the sample: Hearths 8-D, 8-E, 7-E, 7-F, 7-G, 7-H, and 7-I. This diverse sample includes at least one example of each hearth technological mode, as defined in chapter 13. The Coefficient of Variation is a rather high 30.8 percent, and the 95 percent confidence interval for this corridor ranges from 199 to 358 cm from the rear wall. This ill-defined potential rear corridor thus corresponds to both Binford's 2.0 m winter double bed model and also the 3.0 m summer model.
Eight hearths seem superficially to fit a potential west wall corridor model: Hearths 7-D, 7-E, 7-G, 7-H, 7-I, 8-D, 8-E, and 8-G. Hearths 7-H and 8-G are merely unprepared surface hearths. Hearth 7-H is a shallow-pit feature; 7-I and 8-E are deep-pit hearths. The remaining three hearths are rock filled. The Coefficient of Variation for the western corridor is an extremely high 59.0 percent, and the 95 percent confidence interval for the northern corridor ranges from 105 to 311 cm from the lateral wall.

This ill-defined western corridor is statistically consistent with both the 2.0 and the 3.0 m models; these hearths are so widely dispersed that the 1.0 m model remains a viable possibility as well. Horizon 7 contained relatively few items within the western sleep zone.

The artifacts on Horizon 8 are dramatically size-sorted: items found within 475 cm of the rear wall weigh an average of 18.3 g; artifacts between this area and the dripline average 609.6 g; items outside the dripline weigh an average of 707.5 g (Thomas, 1983b: table 87).

Between Hearth 8-E and the western wall there was a significant scatter of large hammerstones and broken grinding stones; a dense concentration of debitage also occurred nearby (Thomas, 1983b: fig. 237). The outer portion of the western corridor is relatively debris-free.

Debitage on both horizons is size-sorted in accordance with exogene drop/toss zone expectations: the smallest flakes occur toward the rear, with flakes becoming larger toward the dripline.

By contrast, artifacts on Horizon 7 are reverse sorted, with the largest items occurring toward the rear and the smaller fragments occurring toward the front. This unusual distribution is clarified, to some extent, by the recent reanalysis by Novick (1987). Of the 331 tools and fragments from Horizon 7, 56 pieces refit to reconstruct all or parts of 27 tools (Novick, 1987). Nearly half of the refit tools were early-stage percussion flaked bifaces; lateral displacement ranged from 1.1 m across hearths 7-G and 7-E to nearly 4 m elsewhere on this surface.

Whole and fragmentary projectile points, pressure flaked bifaces, and late-stage percussion flaked bifaces tended to occur in the central interior of the shelter. But fragmented early-stage percussion bifaces clustered along the site periphery. This differential distribution supports the argument, stated earlier (Thomas, 1983b), that "messy" activities were sometimes conducted outside the core activity area; but during Horizon 7 times, it is clear that additional tool fabrication and repair occurred inside Gatecliff Shelter. Still, the virtual absence of tools immediately adjacent to the shelter walls suggests that relatively debris-free corridors were kept along the shelter margins.

**Late Neoglacial Site Structure: Horizons 4–6**

The upper six horizons (1–6) at Gatecliff Shelter span the Late Neoglacial period, roughly the last 3300 years. The matrix of these horizons is a coarse rubble, and the intrasite patterning preserved on earlier horizons is largely absent from Late Neoglacial contexts. Figure 196 plots the distribution of the 11 hearths that can be isolated within Horizons 4–6. Individual hearth attributes are presented in the Appendix.

Hearth 4/6-F consists of several burnt zones, but repeated churning within the rubble matrix does not permit isolation of individual episodes of hearth construction (see Appendix). The following analysis excludes Hearth 4/6-F.

Seven of the hearths enumerated on table 82 for Horizons 4–6 correspond to a north wall corridor model: Hearths 4/6-A, 4/6-B, 4/6-E, 4/6-G, 4/6-H, 4/6-I, and 4/6-J (fig. 196). This potential sleep zone is characterized by an unusually homogeneous hearth technology. Hearth 4/6-I is a simple unprepared hearth, and 4/6-G is a rock-encircled, rock-lined feature. The remaining five hearths are relatively narrow, deep-pit features, averaging about 38 cm in diameter. The 95 percent confidence interval for the northern corridor ranges from 130 to 302 cm from the lateral wall.

A potential west wall corridor model for Horizons 4–6 can be defined for five features: Hearths 4/6-A, 4/6-C, 4/6-D, 4/6-E, and 4/6-K (fig. 196). As with the northern corridor, most hearths in the western zone are deep charcoal-filled pits, the only exception
being Hearth 4/6-C, a rock-encircled charcoal scatter. The Coefficient of Variation for the western corridor is a relatively low 23.9 percent. The 95 percent confidence interval for the western corridor ranges from 83 to 145 cm from the lateral wall. This zone is thus statistically consistent only with the 1.0 m corridor model.

These data have also been tested against a rear wall corridor model, with eight of 11 Horizons 4–6 hearths fulfilling the criteria for a sleeping corridor: Hearths 4/6-A, 4/6-B, 4/6-C, 4/6-D, 4/6-E, 4/6-F, 4/6-H, and 4/6-K. With a single exception (4/6-C), all the features in this rear zone sample are deep-pit hearths. The Coefficient of Variation is a relatively high 48.9 percent, and the 95 percent confidence interval for this corridor ranges from 136 to 323 cm from the rear wall.

**Late Neoglacial Site Structure: Horizon 3**

Horizon 3, dating sometime between A.D. 700 and 1300, is a coarse-grained assemblage dating from early and middle Underdown phase. Discrete features were rare due to the rubble matrix (fig. 197). Although such rubble units serve as effective artifact traps, they preserve little in the way of spatial artifact patterning. Nevertheless, it was possible to isolate six distinct hearths within Horizon 3 (see Appendix).

But all six hearths fit a west wall corridor model. Each of the six features is a relatively small pit hearth, averaging about 44 cm in diameter. Multiple reuse is clearly evident in at least one of these (Hearth 3-D). No rock enhancement is evident on Horizon 3. The Coefficient of Variation is a relatively low 29.1 percent. The 95 percent confidence interval for the western corridor ranges from 164 to 308 cm from the lateral wall.

Horizon 3 does not fit either rear or northern corridor models.

**Late Neoglacial Site Structure: Horizon 1**

The basal part of Horizon 1 is defined by an extensive sagebrush mat, laid down as bedding or flooring to cover the extensively
burnt Horizon 2 bone bed. Within a few decades after this mat was positioned, a major portion of the ceiling of Gatecliff Shelter caved in, covering the eastern half of the site with tons of chert rubble (Thomas, 1983b: figs. 4 and 14). Two radiocarbon dates from immediately below the roof fall suggest that the cave-in occurred shortly after about A.D. 1450.

We recognized only three hearths on Horizon 1 (fig. 198), but lacking specific radiocarbon evidence, we cannot tell whether Hearths A, B, and C predate or postdate the roof fall. It is also possible that additional undetected hearths could have been constructed on the eastern part of the site prior to A.D. 1450 and then obliterated by the roof fall.

It is not possible to fit the north wall corridor model to the three hearths of Horizon 1, and the rear wall corridor model also shows a rather poor correlation: The Coefficient of Variation is 33.6 percent, and the 95 percent confidence interval for the northern corridor ranges from 32 to 349 cm from the lateral wall.

A potential western wall corridor is very poorly defined. The Coefficient of Variation for the western corridor is an extremely high 57.6 percent, and the 95 percent confidence interval for the western corridor ranges from 0 to 517 cm from the lateral wall. This zone obviously has no spatial integrity and is consistent with all corridor models developed in chapter 14.

**SUMMARY**

The size and configuration of Gatecliff Shelter changed significantly during the five millennia of human utilization. In an earlier analysis (Thomas, 1983b), we emphasized the relatively redundant usage of space at Gatecliff. While we still think that positioning strategies remained rather constant, it is now possible to look more closely at the subtle variability in hearth positioning and debris disposal.

Gatecliff Shelter was relatively small during Middle Holocene times, enclosing between 30 and 44 m² (Thomas, 1983b: table 86). The western wall of the site was positioned rather near the dripline, providing lit-
tle natural shelter. Hearth distribution and debris disposal patterns were inconsistent and ambiguous in this area. But the northern and rear walls were significantly recessed relative to the dripline, and both areas were warmed by a distinctive hearth corridor. Available paleoenvironmental data suggest that the climate was warmer than at present, dominated by summer-wet conditions with intense storms (Thomas, 1983b: table 90). The piñon-juniper woodland began to invade the Monitor Valley area about this time.

During the Horizons 9–11 interval, summer precipitation declined, and overall effective precipitation was less than at present. Temperature was becoming cooler, and the piñon-juniper woodland was well established locally. Gatecliff remained roughly the same size (enclosing between 36 and 48 m²); but as the shelter progressively filled up, the western wall began to recede relative to the dripline. This newly protected western portion was apparently heated by a rather broad, yet well-defined hearth corridor. But the western corridor also contained several large artifacts, suggesting multiple episodes of differential usage. Hearth corridors along the rear and northern walls were no longer utilized.

During the later part of Early Neoglacial times, precipitation was evenly distributed throughout the year in amounts similar to the present. But temperatures were rather cooler than today. Sediments continued to accumulate inside, and the western wall once again advanced toward the dripline (particularly during Horizon 8 times), thereby diminishing the natural protection for this part of the site. Hearths were no longer positioned to define a heated corridor along the western wall, and artifact distributions suggest that this area was used mostly for activities resulting in relatively bulky discards. Simultaneously, the northern wall retreated dramatically from the dripline (fig. 195), creating a sheltered zone warmed by a well-defined 2 m corridor. During this period of decreasing temperatures, intrasite patterning shifted toward the well-protected northern wall, which was further warmed by the incoming sunlight entering this south-facing shelter.

Precipitation shifted during Horizons 4–6 to a winter-dominant pattern and although

Fig. 198. Intrasite distribution of hearths in Horizon 1 at Gatecliff Shelter.
Gatecliff Shelter continued to fill up, the interior site area stabilized between 60 and 65 m². Despite the relatively cool climate during this period, the protected hearth corridor shifted back from the northern to the western wall. Although this new position failed to take full advantage of incoming solar heat, the western wall may have become more attractive as the size of the shelter generally increased and as it became more protected.

Available paleoenvironmental data suggest that during the rest of the Late Neoglacial, climate fluctuated within modern limits. But by Horizon 3 times, the shelter had diminished to only 56 m². The small hearths along the western wall continued to define a heated corridor. Such patterning was lacking along the rear and northern areas.

Gatecliff stayed about the same size during Horizon 2, but attendant site structure changed dramatically. This floor was dominated by a kill-butcherling episode in which more than two dozen bighorn sheep were processed on site (Thomas 1983b: chap. 23; Thomas and Mayer, 1983). Field butchered, yet partially articulated bighorn carcasses were stacked up inside the dripline near the center of the site; bighorn were further disarticulated in place, and a work-walk zone was created around the margins.

Horizon 2 contained the most heavily burnt zone in Gatecliff Shelter, and we could not identify specific hearths. Given the intensive charring of much of the surface, we think that Horizon 2 was probably intentionally fired. If hearths had been present, the extensive sheet burning obliterated the evidence.

Finally, during Horizon 1 times, the roof of Gatecliff Shelter literally caved in, decreasing the available enclosed area to only 26 m². This roof fall protruded from the cave floor, creating a semicircular sheltered area at the rear of the site. Apparently this intrusion shifted the site geometry so that hearth corridors were no longer utilized. Overall site utilization dropped off markedly, and what activities did occur were restricted to this crescentic zone around the rear periphery of the site.

Hearth size and technology are clearly related to these shifting local and regional conditions. Hearths in Gatecliff Shelter tend to decrease in size through time, particularly above Horizons 4–6 (chap. 13); this diminution in size closely corresponds with a general rise in local temperature (Thomas, 1983b: table 90). There is also a strong tendency for rock-filled hearths to correspond stratigraphically with the relatively colder climate during Reveille times (chap. 13).

Hearth technology also varies significantly between sites: relative to the rest of the Monitor Valley, Gatecliff Shelter contains a disproportionate number of deep-pit hearths. It is the largest of the excavated Monitor Valley sites, and its hearths are significantly larger as well (chap. 14). This increase in hearth size is presumably a response to the greater area to be heated, and perhaps also to greater local availability of firewood, especially when compared with Triple T Shelter (chap. 15).

SITE STRUCTURE OF TOQUIMA CAVE

Toquima Cave is located on Petes Summit, the major pass through the northern Toquima Range (fig. 67). The cave was formed in a major fissure of the local rhyolite ash-flow tuff. Toquima Cave is more than 25 m long and 10 m wide; the entrance faces almost due south.

GEOMETRIC SITE CONFIGURATION

Figure 199 shows the plan view of Toquima Cave, plotted at initial surface level; approximately 70 m² are enclosed inside the dripline (excluding the long, narrow, tortuous chute that extends to the rear). Although the original excavation was conducted according to a 1 m grid system, we have chosen to analyze cave geometry in terms of a 2 m interval (see fig. 199).

The configuration of Toquima Cave can be characterized by 32 data points, measured according to the three axes defined above (dl, rw, and lw). The cave exhibits a highly significant and perfect inverse correlation of distance to dripline and distance to rear wall \( r_{dl, rw} = -1.00, df = 31, p < 0.001 \). This site is also characterized by a significant but relatively low inverse correlation of distance to dripline and distance to lateral wall \( r_{dl, lw} = \)
rear wall is $r_{wt, rw} = -0.13$ (df = 5, $p = 0.218$). The raw correlation with lateral wall distance is $r_{wt, lw} = -0.47$ (df = 5, $p = 0.284$).

Unit G7 is a major outlier in all three plots, and this anomalous datum point can be removed from the statistical analysis. With outlier G7 removed, distance from dripline remained uncorrelated with log artifact size ($r_{wt, dl} = -0.24$, df = 4, $p = 0.348$). There remains a strong, but not statistically significant, correlation with distance from the rear wall ($r_{wt, rw} = -0.80$, df = 4, $p = 0.057$). There is likewise no significant correlation between log artifact weight and distance to the lateral wall ($r_{wt, lw} = 0.50$, df = 5, $p = 0.312$).

A multiple regression analysis was performed using log artifact size as the dependent variable and plotting distance to dripline, lateral wall, and rear wall as independent variables (unit G7 was excluded from this analysis). The coefficient of multiple correlation is $R = 0.981$, a high but not quite significant value ($F = 17.416$, df = 3 & 2, $p = 0.054$).

**Debitage Distribution**

Sufficient debitage was recovered at Toquima Cave to permit analysis by "upper" and "lower" stratigraphic units. The breakpoint was determined on a unit-by-unit basis; most units were deeper than 1 m, and the midpoint in the stratigraphic column was generally about 60 cm below surface.

**Upper Stratum:** Units M11 and L11 have extremely small average flake sizes, and these outliers are removed from the statistical analysis. The remaining eight excavation units show a marked negative correlation of $r_{wt, rw} = -0.68$ between log flake size and rear wall distance (df = 6, $p = 0.063$). Regression with dripline distance is not significant ($r_{wt, dl} = -0.30$, df = 6, $p = 0.478$) and neither is the relationship between log flake weight and distance to the lateral wall ($r_{wt, lw} = 0.10$, df = 7, $p = 0.212$).

Multiple regression analysis was performed as before. The coefficient of multiple correlation is $R = 0.453$, not a statistically significant value ($F = 0.429$, df = 3 & 5, $p = 0.743$). Considered simultaneously, spatial variables account for roughly 20 percent of the observed variability in debitage size in the upper stratum of Toquima Cave.
LOWER STRATUM: Debitage size is not significantly correlated with distance from the dripline \( (r_{wt.dl} = -0.22, \text{df} = 8, p = 0.462) \) or with distance from the lateral wall \( (r_{wt lw} = -0.08, \text{df} = 8, p = 0.179) \). Flake size is, however, significantly correlated with distance from rear wall \( (r_{wt rw} = -0.66, \text{df} = 8, p = 0.035) \).

Multiple regression analysis was performed as before, with similar results. The coefficient of multiple correlation is \( R = 0.766 \), a high but not statistically significant value \( (F = 2.838, \text{df} = 3 & 6, p = 0.128) \).

**BONE DISTRIBUTION**

Sufficient bone was recovered at Toquima Cave to allow analysis of the "upper" and "lower" stratigraphic units, using the same criteria as discussed for debitage.

**UPPER STRATUM:** Bone size is significantly and inversely correlated with distance from rear wall \( (r_{wt rw} = -0.92, \text{df} = 8, p < 0.001) \), but not with distance from the dripline \( (r_{wt dl} = -0.30, \text{df} = 8, p = 0.404) \) nor with distance from lateral wall \( (r_{wt lw} = 0.43, \text{df} = 8, p = 0.219) \).

Multiple regression analysis was performed as before. The coefficient of multiple correlation is \( R = 0.942 \), a highly significant value \( (F = 15.858, \text{df} = 3 & 6, p = 0.004) \). Considered simultaneously, the spatial variables of dripline, lateral wall, and rear wall distances account for 88.8 percent of the observed variability in bone size in the upper stratum of Toquima Cave.

**LOWER STRATUM:** Bone size is not correlated with distance from the dripline \( (r_{wt dl} = -0.04, \text{df} = 8, p = 0.101) \), distance from the rear wall \( (r_{wt rw} = -0.09, \text{df} = 8, p = 0.210) \), nor with distance from the lateral wall \( (r_{wt lw} = 0.09, \text{df} = 8, p = 0.203) \).

Multiple regression analysis, performed as before, defined a coefficient of multiple correlation of only \( R = 0.117 \), not a significant value \( (F = 0.049, \text{df} = 2 & 7, p = 0.953) \). There is no apparent interaction between the independent variables in this case.

**HEARTH POSITIONING**

Only two hearths were encountered in the testing of Toquima Cave (see chap. 4 and table 82), both features near the center of the site. Hearth A is a rock-encircled, U-shaped feature built about 350 cm from the west wall, associated with a radiocarbon date of A.D. 910 ± 170 (GAK-3427).

Hearth B is a second discrete charcoal concentration that occurred not far from the first feature. But the two hearths are definitely not contemporary: (a) Hearth B is associated with a radiocarbon date of A.D. 450 ± 130 (GAK-3428), and (b) the two are separated by 30 cm of well-stratified deposits. Hearth B is located 275 cm from the western wall.

**SUMMARY**

Toquima Cave contained a workshop and hearth area situated near the site midpoint. Despite our testing across the site, the only two hearths found were in this central zone, and both are consistent with the 3.0 m sleep zone model.

Although size sorting at Toquima Cave is not crisp, a distinctive pattern cross-cuts both materials and stratigraphic position: despite the lack of statistically significant relationships, an obvious size sorting is apparent. When outlier unit G7 is considered, the artifact distributions in Toquima Cave generally correspond with a central drop zone model: weakly positive to negative correlation with dripline distance, negative to random correlation with rear wall distance, and negative correlation with lateral wall distance.

But in outlier G7, several large production stage bifaces, averaging 26.63 g in weight, were recovered. When this single unit is removed, the apparent size sorting is dampened, and were it not for correspondences in debitage and bone distributions, we probably would not recognize the distinctive drop/toss zone pattern for artifacts.

Flakes in the upper stratum of Toquima Cave are obviously much smaller toward the central portion of the site; this trend is particularly evident in the outliers M11 and L11. Debitage in the lower stratum follows a similar pattern: the largest flakes occur toward the rear, and smaller flakes in the middle area. This intermediate area seems to represent a central drop zone, but the patterning does not extend to the lateral walls of the site in either upper or lower strata.

Faunal remains in the upper stratum are
heavily size sorted: bone size is negatively correlated with distance from the rear wall, and randomly distributed with respect to lateral walls and dripline. That is, the central portion of the site contains the smallest bone fragments, but this zone does not extend laterally or toward the front. Bone size is randomly distributed in the lower stratum.

These combined data suggest that hearths, artifacts, debitage, and bones in Toquima Cave are patterned along the longitudinal, central axis: larger items occur in a well-defined toss zone toward the rear; a peripheral, rather ill-defined secondary toss zone may also exist toward the dripline.

Lateral size sorting of debris is notably absent, meaning that the toss zone does not extend toward the sides of the site; unfortunately, too few excavation units were opened in this area to adequately define the lateral patterning. Hearths are similarly lacking along the lateral margins, suggesting that perhaps bedding areas existed on one or both sides of the central workshop/hearth area.

In contrast to the more common exogene cave configuration, Toquima Cave is a deep, endogene cave, patterned on a longitudinal rather than lateral basis, with the rear of the site providing the primary zone of discard. It thus displays a site structure unique in the Monitor Valley sample.

GRENouille VERTE CAVE

This small alcove encloses fewer than 9 m², and the ceiling height is almost everywhere less than 1 m (fig. 77). Our limited testing produced few artifacts, little debitage, and no evidence of intrasite debris patterning. A single small charcoal concentration (Hearth A) was found near the center of the cave, located 160 cm from both lateral and rear walls. This is consistent with the 1.0 m model of hearth spacing, and if Binford’s (1983) interpretations hold, this feature may have been employed to heat a single bed sleeping area during the winter.

BUTLER RANCH CAVE

Butler Ranch Cave is a small enclosure located in a sheer protruding tuff cliff on the eastern side of Monitor Valley (figs. 78 and 79). The entire site was excavated, the units reaching a depth of 60 cm in places.

GEOMETRIC SITE CONFIGURATION

Butler Ranch Cave is configured as a V, with the dripline slanting diagonally across the southern margin; approximately 15 m² are enclosed inside. Figure 201 shows the plan view of this site, plotted at initial surface level. The original 1 m excavation grid system has been superimposed, and geometry is char-
characterized by 23 data points, measured as before.

Butler Ranch Cave exhibits a high degree of bilateral symmetry (defined by the highly significant and near perfect inverse correlation of distance to dripline and distance to rear wall: \( r_{dl, rw} = -0.87, df = 21, p < 0.001 \)). This site also exemplifies a relatively typical rock-shelter configuration, with laterally expanding margins (defined by the highly significant and inverse correlation of distance to dripline and distance to lateral wall: \( r_{dl, lw} = -0.52, df = 21, p = 0.010 \)).

**SITE STRUCTURE: LOWER STRATUM**

The lower part of the site contains about 40 cm of the visually homogeneous midden common in excavated sites of this area. But the upper stratum is distinctive because it was bounded by a rock wall and probably a brush windbreak (fig. 84). The base of the wall occurs 20 cm below the surface, effectively defining the extent of the boundary between upper and lower strata. It was thus possible to separate stratigraphically that portion of the site so enclosed from the earlier deposits that accumulated inside the site. We consider first these earlier deposits, which we designate as the lower stratum. We then consider the artificially enhanced upper stratum.

**ARTIFACT DISTRIBUTION:** Artifacts are heavily size-sorted in the lower stratum. The largest occur near the dripline, and they become systematically smaller inside the dripline. The correlation between log artifact size and distance to the dripline is significant \( r_{wt, dl} = -0.81, df = 4, p = 0.05 \). There is also a significant tendency for artifacts to become smaller toward the rear of the cave \( r_{wt, rw} = 0.87, df = 4, p = 0.025 \). Artifacts likewise decrease in size toward the lateral wall \( r_{wt, lw} = 0.82, df = 4, p = 0.046 \).

Multiple regression analysis was performed as before. The coefficient of multiple correlation is \( R = 0.987 \), a statistically significant value \( (F = 24.415, df = 3 & 2, p = 0.038) \). In other words, the geometric variables considered simultaneously account for more than 97 percent of the observed size variability in artifacts of the lower stratum at Butler Ranch Cave.

**DEBITAGE DISTRIBUTION:** The largest flakes at Butler Ranch Cave also occur near the dripline, generally becoming smaller inside the cave. There is a highly significant correlation between log flake size and distance to the dripline \( r_{wt, dl} = -0.71, df = 12, p = 0.004 \). There is also a nonsignificant tendency for flakes to become smaller toward the rear of the cave \( r_{wt, rw} = 0.47, df = 12, p = 0.089 \), as well as a nonsignificant trend for flakes to decrease in size toward the lateral walls \( r_{wt, lw} = 0.49, df = 12, p = 0.073 \).

Multiple regression analysis was performed as before, and the coefficient of multiple correlation is \( R = 0.712 \), not a statistically significant value \( (F = 3.42, df = 3 & 10, p = 0.06) \).

**BONE DISTRIBUTION:** Bones are randomly distributed in the lower stratum, with a slight trend to become smaller as distance to the dripline increases \( r_{wt, dl} = 0.50, df = 4, p = 0.312 \). The correlation between log bone size and distance to the rear wall is \( r_{wt, rw} = -0.07 \) \( (df = 4, p = 0.109) \), and the correlation to lateral wall distance is \( r_{wt, lw} = -0.54 \) \( (df = 4, p = 0.274) \).

Multiple regression analysis was performed as before. The coefficient of multiple correlation is \( R = 0.818 \), not a statistically significant value \( (F = 1.352, df = 3 & 2, p = 0.451) \). Taken together, the spatial variables do not demonstrate an overall degree of significant size sorting of debitage in the lower stratum.

**HEARTH POSITIONING:** Virtually all of Butler Ranch Cave was excavated, and three of the four hearths encountered were in the low-
er stratum (chap. 4). Hearth B occurred near the center of the cave, about 50 cm below the surface. The bottom of this deep-pit hearth extends nearly to bedrock. Hearth C is a small, deep-pit hearth built about 20 cm from the western wall. Hearth D is a shallow-pit feature built in the middle of the site, roughly 90 cm from both lateral walls.

**SUMMARY: LOWER STRATUM:** Debris size sorting is pronounced in the lower stratum. The artifact distribution corresponds to a rear/central drop zone model, exhibiting a strongly negative correlation between log size and dripline distance, and strongly positive correlations with both rear wall and lateral wall distance.

Debitage from the lower stratum is also consistent with the rear/central drop model, but the patterning is less distinct: negative correlation between log item size and dripline distance, positive to random correlation with rear wall distance, positive to random correlation with lateral wall distance.

Bone size was randomly distributed.

Three hearths occurred in the lower stratum. Hearth D, roughly 90 cm from both lateral walls, would have heated both sides of the interior equally.

Hearth B and C are built next to the southern cave wall, considerably too close to have demarcated a sleeping zone on that side. But in both cases, the distance to the opposite (eastern) wall varies between 200 and 260 cm and a central/eastern sleeping zone could have been utilized.

In the lower stratum, when Butler Ranch Cave functioned as a simple exogene shelter, hearths were constructed in the middle of the central/rear drop zone (fig. 202). But building the wall on the southern margin effectively turned this cave into an artificial house, and hearth positioning changed.

**SITE STRUCTURE: UPPER STRATUM**

The upper stratum of Butler Ranch Cave is unusual because it was bounded by a rock wall and, presumably, a brush windbreak (fig. 201). The weather wall, probably constructed in Yankee Blade times, is the only such artificial enhancement noted in Monitor Valley although similar structures have been noted elsewhere in the Great Basin. A crescent-shaped boulder alignment was found at Wagon Jack Shelter, approximately 130 km to the west (Heizer and Baumhoff, 1961: p. 137, fig. 8). The excavators surmised that it was free-standing, probably constructed during the Reveille phase, with the open side or doorway facing the cliff. Another similar structure was discovered behind the primary occupational fill at Danger Cave (Jennings, 1957: fig. 58).

A series of loose, semicircular rock walls followed the rear contours of Catlow Cave No. 1, and Cressman (1942: p. 19, fig. 3) somewhat reluctantly interpreted these walls as anchors for small windbreaks or shelters. At Dirty Shame Shelter, a complex series of pole-and-thatch huts and windbreaks was excavated, with rock slabs anchoring the base of a thatched wall (Aikens et al., 1977: pp. 10–11, fig. 10). Radiocarbon dates on this structure range from about 1500 B.C. to A.D. 900.

Such facilities imply foul weather habitation, during which artificial walls defined a discrete "interior" space within a naturally occurring enclosure. In the cases of Danger and Catlow caves and Dirty Shame Shelter, a relatively small group of people seemed willing to invest necessary construction costs in order to minimize costs of heating the larger area.

A different strategy is implied at Butler Ranch Cave and Wagon Jack Shelter. Here the protection afforded by relatively small, naturally occurring shelters was merely en-
hanced by addition of a weather wall. These small facilities completed, in a sense, the modest housing configuration already suggested by the natural alcove. These shelters are situated near the entrance to long, narrow canyons and, as such, both are exposed to sometimes severe gusts of downslope cold air drainage. The artificial walls prevented entry of cold exterior air, reduced the loss of radiant heat, and particularly enhanced the efficiency of fires built within by reducing the internal volume to be heated. As Legge (1972: 101) points out, such intracave structures are analogous to the Eskimo snow house and the double-walled Chukchi skin house (see also Hunter-Anderson, 1977: 308–309). Thus, with a relatively modest labor investment, the rock walls at Butler Ranch and Wagon Jack would have significantly enhanced interior conditions.3

**Artifact Distribution:** The largest artifacts in the upper stratum at Butler Ranch Cave occurred toward the dripline, becoming smaller inside. This relationship is demonstrated by the highly significant correlation between log artifact size and distance to the dripline ($r_{wt,dl} = -0.78$, df = 8, $p = 0.008$). There is a correlative tendency for artifacts to become smaller toward the rear of the cave, but this relationship has too many exceptions to be statistically significant ($r_{wt,rt} = 0.45$, df = 8, $p = 0.189$). There is also a slight trend for artifacts to decrease in size toward the lateral wall, but this relationship is not significant ($r_{wt,lw} = 0.37$, df = 8, $p = 0.289$).

A multiple regression analysis was performed with log artifact size as the dependent variable, and distance to dripline, rear wall, and lateral wall considered as independent variables. The coefficient of multiple correlation is $R = 0.90$, a statistically significant value ($F = 8.503$, df = 3 & 6, $p = 0.015$). In other words, the geometric variables considered simultaneously account for more than 80 percent of the observed size variability in artifacts of the upper stratum.

**Debitage Distribution:** The largest flakes in the upper stratum of Butler Ranch Cave also occurred near the dripline, and debitage generally became smaller inside the cave. There is a highly significant correlation between log flake size and distance to the dripline ($r_{wt,dl} = -0.79$, df = 13, $p = 0.001$), and a significant tendency for flakes to become smaller both toward the rear of the cave ($r_{wt,rt} = 0.59$, df = 13, $p = 0.019$) and toward the lateral walls ($r_{wt,lw} = 0.61$, df = 13, $p = 0.016$).

Multiple regression analysis was performed with log flake size as the dependent variable, and distance to dripline, rear wall, and lateral wall were considered as independent variables. The coefficient of multiple correlation is $R = 0.79$, a statistically significant value ($F = 6.107$, df = 3 & 11, $p = 0.011$). In other words, the geometric variables considered simultaneously account for 62.5 percent of the observed size variability in the debitage of the upper stratum.

**Bone Distribution:** Bones are randomly distributed in the upper stratum of Butler Ranch Cave. There is a slight but not significant trend for bones to decrease in size as distance to the lateral wall increases ($r_{wt,lw} = -0.05$, df = 5, $p = 0.092$). The correlation between log bone size and distance to the dripline is $r_{wt,dl} = 0.14$ (df = 5, $p = 0.232$); the correlation between log bone size and distance to the rear wall is $r_{wt,rt} = 0.51$ (df = 5, $p = 0.238$).

A multiple regression analysis was performed as before. Although the coefficient of multiple correlation is $R = 0.889$, this value is not statistically significant ($F = 3.772$, df = 3 & 3, $p = 0.152$).

**Hearth Positioning:** The upper stratum contained only a single fire pit. Hearth A is a charcoal-filled shallow pit constructed in an alcove toward the extreme rear of the site (see fig. 77). This hearth occurs on a living surface coeval with the stone weather wall erected across the southeast wall of the site; there is a slight chance that this hearth was constructed (or utilized) during the historic period.

**Summary:** Upper Stratum: Debris size sorting is pronounced in the upper stratum, where debitage distributions exhibit a strongly negative correlation between log size and dripline distance, and strongly positive correlations with both rear wall and lateral wall distance. This intrasite pattern corresponds to a rear/central drop zone model (similar to that in fig. 202).

Artifact distribution also corresponds to a rear/central drop zone configuration, but the patterning is not quite as distinct: negative
correlation between log item size and dripline distance, positive to random correlation with rear wall distance, positive to random correlation with lateral wall distance.

Bone size was randomly distributed in the upper stratum, and there is no reason to suspect any degree of size sorting. We must caution that bone preservation is not exceptional at Butler Ranch, and larger samples might have produced different results.

Thus, as in the lower stratum, artifacts and debitage in the upper part of this site are heavily size-sorted according to a rear/central drop zone pattern: there appears to be a band of workshop activities around the rear and lateral peripheries of this site, with a distinct toss zone formed toward the entrance. The rock wall did not have a significant influence on debris disposal.

But the weather wall did influence hearth positioning. When Butler Ranch Cave functioned as a simple exogene shelter, hearths were constructed in the middle of the central/rear drop zone. It is clear that the single hearth in the upper stratum, positioned only 30 cm from the lateral wall, could not possibly have defined a sleeping corridor at the rear. But building the wall on the southern margin effectively turned Butler Ranch Cave into a house. Hearth A was built in the alcove at the northern end, as far as possible from the artificially defined entrance and away from the central activity area (see also Binford, 1983: 185–186). So positioned, Hearth A would have provided ample light at the rear of the enclosure, while the entrance would have lighted the southern portion.

LITTLE EMPIRE SHELTER

This rather large overhang is located approximately 500 m upstream from Butler Ranch Cave. The shelter is approximately 7 m wide, and the area enclosed between the cliff wall and the dripline is less than 20 m² (figs. 86 and 87). Although five units were excavated here, materials recovered were insufficient to permit analysis of intrasite debris sorting.

Two hearths were encountered. Hearth A is a charcoal-filled pit scooped out of the sandy cave floor deposit. Hearth B is another circular depression scooped out of the sand floor of the shelter. The distance to the lateral wall is 260 cm.

Little can be said about the intrasite structure of Little Empire Shelter.

Ny1059

Ny1059 is a small overhang in a massive chert outcrop, enclosing an area approximately 2.3 m wide and 2.5 m deep. A single hearth was encountered in our brief testing of this shelter. The hearth, positioned 80 cm from the lateral wall and 90 cm from the rear wall, is consistent with both sleeping and workshop utilization of this small site. Little can be said about the intrasite structure of Ny1059.

ARTIFICIALLY CONSTRUCTED ENCLOSURES

Archaeological fieldwork by the American Museum of Natural History in the woodland and on the upper slope of Monitor Valley identified nearly two dozen additional artificially constructed housing facilities.4

THE PETES SUMMIT CLUSTER

Several prehistoric house foundations were located in the Petes Summit/Toquima Cave area. One house cluster occurred at La675, an arbitrary "site" grouping of four facilities. These four stone circles occur within a radius of 75 m, but there is no necessary behavioral relationship among them.

All four houses at La675 were deliberately positioned on the lee side of nearby natural outcrops. Feature 1 is a complex structure with two concentric and superimposed stone circles; a small circular cache or exterior windbreak feature is appended to the southwestern side of the outer ring. Feature 2 is an isolated house foundation, protected by a massive rock outcrop 20 m due west. Feature 4 is a small stone circle located about 3 m south of a large outcrop. Feature 3 is a two-tiered house ring situated near a large rock outcrop roughly 25 m to the north.

La676 is also located in the Toquima Cave
rock art catchment area (table 58 and fig. 131). This site contains three discrete stone circles. Feature 1 is an isolated stone circle on the eastern margin of a slight plateau. A distinctive doorway occurs on the southeastern margin. Feature 2, located 100 m to the west on the northern margin of the plateau, is protected by a natural rock outcrop 5 m to the north. A doorway is evident on the southeastern margin. The third house foundation is 50 m to the south.

The third distinctive house cluster at Petes Summit occurs at La677, where three stone circles were found within a radius of about 90 m. Feature 1 is a semicircular structure with a stone-rimmed "foyer" (probably an external windbreak) on the southeastern corner. Feature 2 is a collapsed stone circle, situated 150 m due west of Feature 1. The doorway faces east and the northwest margin is buttressed directly against a large protective rock outcrop. The third house feature is located on the southwestern margin of the plateau that contains both La677 and La676. A poorly defined doorway opens to the southeast.

An isolated house foundation also occurred at nearby Petes Spring; because the elevation of the site is 2121 m, this feature was discussed in the previous chapter.

THE JOHNNY POTTS SPRING HOUSES

Two house foundations were mapped at Johnny Potts Spring (Spring 16) on the eastern scarp of the Toquima Range at an elevation of approximately 2225 m. The first house occurred on the southwestern margin of Ny876, in apparent association with a relatively large chipping and artifact scatter. The house is situated in a saddlelike area extending across three adjacent knolls. Access to the local spring is relatively easy.

The second house occurred at Ny878, along the margins of a sagebrush-grass meadow where standing water periodically exists. Rimrock borders the meadow to the east. The well-defined and obviously rather recent house ring occurs along the eastern margin of Ny878. The entrance to this house is toward the northwest, and a wooden piñon hook was found hanging in a tree immediately to the north.

THE BUTLER RANCH CLUSTER

Three house foundations were found within the 1 km catchment surrounding Butler Ranch Cave. Ny921 is a medium-size site on the toe of a ridge south of Butler Creek. Two distinct rock rings (Features 1 and 2) occur in the middle of the artifact scatter. Ny922 occurs along the crest of a ridge north of Butler Creek. It contained a single rock ring (Feature 1), probably a house foundation.

ADDITIONAL HOUSES

Six additional stone rings were located in the survey of the Monitor Valley floor and lowland slope (chap. 2). Four of these foundations occurred in the vicinity of Jeans Spring, on the western slope of the Toquima Range (technically within Big Smoky Valley). One isolated house ring was found on a ridge top approximately 500 m northwest of Petes Spring, and one was found in southern Monitor Valley on a piñon-juniper covered ridge near the East Bald Mountain Wash petroglyph boulder. These six structures are within the lower portion of the woodland/upland slope complex, but we integrate them into the summary discussion below.

SUMMARY

House foundations in Monitor Valley were found over an elevational range of more than 350 m. The lowest houses occur near Jeans Spring, at an elevation of 2140 m. Excluding the Alta Toquima complex (discussed in a subsequent volume), the highest house foundations occur at La677, at an elevation of 2512 m. The mean elevation of house remains throughout Monitor Valley is 2352.9 m (\( n = 27, S = 117.49 \) m).

But this elevational distribution is distinctly bimodal. Houses located on the western slope of the Toquima and Monitor ranges are consistently positioned relatively low, at an average elevation of 2266.8 m above sea level (\( n = 11, S = 82.43 \)). By contrast, houses on the eastern slope of the Toquima Range are
This highly significant difference in mean housing elevation (t = 6.029, df = 21, p < 0.001) is due to the ecological structure of the Toquima and Monitor ranges. Most central Great Basin ranges are economically "west facing" because of a pervasive rainshadow effect. These generally north–south mountain ranges create an uneven distribution of precipitation and temperature. These effects are discussed in considerable detail in the next two chapters.

Inside house diameter measurements are available on three-quarters of the stone rings in Monitor Valley. Mean house size is 273.3 cm (n = 20, S = 104.12 cm). As with the elevational data, house size is bimodally distributed across the valley. Houses on the west side of the Toquima Range average only 215 cm in diameter (n = 8, S = 97.85 cm) whereas those on the eastern side of the Toquimas are an average of 312.1 cm in diameter (n = 12, S = 88.96 cm). This is a highly significant difference (t = 2.179, df = 18, p = 0.041).

Given these two statistical findings, one might be inclined to look for a general correlation between elevation and house size, but that relationship is not significant for the Monitor Valley sample as a whole (r = 0.16, df = 18, p = 0.489). Statistically significant correlation is also lacking in the partitioned samples.

NOTES

1. Although the archaeology of Gatecliff Shelter has been discussed in some detail elsewhere (Thomas, 1983b), it is imperative to include these data in the present consideration of site structure. In addition to previously discussed materials, we have employed new methods outlined in chapter 14 to further our understanding of spatial use at this site.

2. For graphic purposes (figs. 193–198), we plot only western and northern sleeping corridors, for continuity retaining the hearthline distances of the previous analysis (Thomas, 1983b: chaps. 21–23).

3. The wall at Wagon Jack would have been doubly important because the shallow shelter faces north northwest, at an angle of 330°.

4. Cultural resource management surveys located two other artificial facilities in the Monitor Valley study area (see chap. 7). At Ny3732, at Northumberland Pass, a lithic scatter is associated with a stone circle, 2.15 m in diameter. Another stone circle was found at Ny3747, an open site in Water Canyon, associated with an incised stone, a metate, a mano, and a flake scatter. These two features seem to follow the patterns discussed in this chapter, but CRM features are not included in the statistical analysis.
CHAPTER 17. REGIONAL SETTLEMENT STRUCTURE

Monitor Valley fieldwork began more than 15 years ago with two basic objectives. To warrant the just completed surface archaeology at Reese River, we found it necessary to locate and excavate a series of deeply stratified sites. Since no such sites had turned up in our surveys at Reese River, we began to look elsewhere, and this search ultimately led us to Monitor Valley. We also thought it worthwhile to conduct a second regional random survey to expand our understanding of the settlement structuring observed at Reese River.

Data generated in conjunction with the first objective are discussed throughout this monograph and elsewhere (esp. chaps. 3 and 4; Thomas, 1983b). In this chapter, we compare the regional settlement structure between these two valley systems.

We intend specifically to clarify the relationship between observable topographic factors and the prehistoric archaeological record. But this emphasis in no way assumes that past site positioning was conditioned solely or absolutely by topography: it is abundantly clear from ethnographic and contemporary observations that cultural geography at times involves critical social, political, economic, and/or personal factors (e.g., O'Connell, 1987: 88). The present research direction will array site distributions against three probabilistic models, which can be used descriptively, to simulate on-the-ground site distributions or to project site distributions in archaeologically unknown areas (figs. 203–205).

The following discussion fails to account for relevant sociopolitical and economic factors, a shortcoming which continues to bedevil all such predictive modeling efforts in archaeology (e.g., Kohler and Parker, 1986: 401).

PREHISTORIC SETTLEMENT STRUCTURE ALONG THE REESE RIVER VALLEY ECOTONE

During initial fieldwork at Reese River (in 1969 and 1970), we adopted a regional random design based on a uniform 10 percent sampling fraction. Once in place, this procedure dictated that we concentrate survey efforts equally throughout the valley. Although this approach enabled us to generate a large set of relatively unbiased regional data, our even-handed approach meant that the available sample from the heavily occupied piñon-juniper woodland was relatively small.

In part to compensate for this, we turned in 1971 to an intensive examination of the lower Reese River woodland and, in so doing, encountered a situation familiar to most field archaeologists: After spending considerable time working in an area, we knew instinctively where most of the sites "ought to be," even in areas totally unsurveyed. A primary objective in the 1971 follow-up was to explore this intuitive notion of site positioning, to pin down just why we knew what we knew (Williams et al., 1973).

Our first step was to review preliminary ideas about the structure of the piñon-juniper woodland settlements with the late Julian Steward. His extensive ethnographic experience here and elsewhere coincided closely with our own primary archaeological observation:

In my own fieldwork I made it a point to go over the root areas and the camping areas with my informant. It was commonly possible to verify the location of campsites and winter settlements by the presence of artifacts, particularly pottery which I believe implies some stability . . . . May I venture a couple of suggestions about the prehistoric settlement patterns [in areas like Reese River] . . . . it would be most profitable to ascertain the specific factors determining winter settlement locations and then explore such places to see whether they were indeed utilized. I have always regretted that I did not have the time to do this to a much greater extent but what little I was able to do, I invariably found signs of occupation where the critical factors came together. These are reasonable access to pine nuts, a piñon-juniper belt which supplied firewood and preferably a stream for water or else higher altitudes where snow could be obtained. (Julian Steward, personal commun., 1971; cited in Thomas and Bettinger, 1976: 270–271)

We decided to put Steward's "critical factors" to the test by determining how well they
predicted site locations in the archaeologically unknown situation.

We isolated specific environmental criteria relating to potential site location—basically a series of calculated guesses as to where residential sites "ought to be." Previous experience (ours and Steward's) pointed up several common denominators among most known woodland village encampments. Ethnohistoric Western Shoshone people positioned most winter base camps in the low foothills, along the lower margin of the piñon-juniper woodland, with easy access to springs or flowing streams. But rarely were such camps placed directly adjacent to the water source; like many hunter-gatherers, the Western Shoshone preferred to live a few hundred meters away from the actual water source.

Previous experience also disclosed that substantial encampments usually occurred on long ridges that snake toward the valley bottom; similar sites were also found on the gently sloping saddles that commonly straddle the piñon-covered knolls. Although access to these camps was sometimes difficult, the sites themselves were almost always perched on relatively flat ground.

These informal criteria seemed to us sufficient (if not necessary) to account for placement of most known prehistoric sites in the Reese River woodland. But to inject a greater degree of rigor, we tightened up the variables into a single, overall, polythetic definition of potential habitation areas (as elaborated in Williams et al., 1973). An area of potential habitation—we called it a "locus"—was defined as a place that satisfied at least five of the following seven criteria (after Thomas and Bettinger, 1976: 272):

- The locus should be on a ridge or saddle.
- The ground should be relatively flat: "relatively flat" ≤5 percent.
- The locus should be in the low foothills; "low foothills" ≤250 m above the valley floor.
- The locus should be within the modern piñon-juniper biotic community.
- The locus should be near the extant piñon-juniper ecotone: "near" ≤800 m.
- The locus should be near a semipermanent water source: "near" ≤1000 m.
- The locus should be some minimal distance from this source: "some minimal distance" ≤100 m.

These threshold criteria were then applied to a previously unsurveyed parcel of piñon-juniper woodland at Reese River. With a combination of aerial photography and field examination, we isolated 74 areas of potential habitation (loci)—places where residential sites "ought to be."

During the summer of 1971, the 4080 ha target area was exhaustively surveyed, and we turned up 65 previously unrecorded archaeological "sites" (as defined in the first chapter of this volume). There was little doubt that, as a pattern recognition device, the polythetic definition worked extraordinarily well: more than 95 percent of the sample sites were situated on loci, and 85 percent of the loci actually contained archaeological sites.

These data further enabled us to generate several empirical generalizations regarding the environmental predictors themselves. In the long run, the topographic site predictors turned out to be of more interest than specific site locations.

We discovered a surprisingly high degree of redundant patterning with respect to the topography of the eastern Reese River Valley. The behavior of these environmental characteristics was summarized in two elementary probabilistic models, one for linear asymmetrical resources and the other for linear symmetrical resources (Thomas and Bettinger, 1976: 359–363; see also figs. 203 and 204 in the next chap.). In subsequent fieldwork, we became quite interested in the degree to which the archaeological record of places like Monitor Valley conformed or contrasted with the stochastic models developed for the Reese River Valley.

ECOLOGICAL VARIABILITY BETWEEN THE REESE RIVER AND MONITOR VALLEYS

At this point, we moved our fieldwork to Monitor Valley, located less than 50 km east of the Reese River. These areas share many obvious environmental conditions: both valleys are relatively well watered; both have for millennia supported ample stands of piñon-juniper woodland; both once hosted vast areas of additional native plant foods; both con-
tained abundant large and small mammal populations. The Central Numic-speaking Western Shoshone who occupied both areas during protohistoric times were extremely similar (if not physically the same people). I suspect that even in prehistoric times, one would have been hard pressed to distinguish between the aboriginal people of the Reese River Valley and those of the Monitor Valley on the basis of language or culture.

And yet, the ecological structure of these two valley systems was different, conditioned in large measure by sometimes subtle, qualitative variability in microtopography, hydrology, and biogeography. These differences are explored in some depth elsewhere (Thomas, 1983a: 161–163), but some key points deserve emphasis.

First of all, Pacific storm systems (which track from west-northwest to east-southeast) are strongly influenced by the unique Reese River topography (see Thompson, 1983 and esp. Tausch in Thomas, 1983a: 161–162). As a result, the Reese River Valley hosts a more mesic environment than Monitor Valley.

While higher elevations generally receive more precipitation than lower areas, the configuration and exposure of these high places is critical because storm systems can simply bypass a single, high-reaching peak. The Reese River Valley captures much precipitation not just because it drains high mountains, but also because the Toiyabe ridgeline creates a major unbroken orographic barrier, dozens of kilometers long. Precipitation is even further enhanced in the Reese River headlands, where the Toiyabe and Shoshone ranges join to create an uplifted basin. Moreover, these ranges have extraordinary exposure to frontal storm systems because mountains to the west are relatively short and/or low.

The same orographic forces that attract moisture into the Reese River basin tend to deprive the nearby Monitor Valley of it. The Toiyabes effectively rainshadow most of the Toquima and Monitor ranges from the Pacific frontal systems: at equivalent elevation, the latter ranges receive considerably less precipitation than do mountains surrounding the Reese River Valley.

The immediate upshot of these combined effects is simple: "Increased moisture results in more productive and more diverse (more species) plant communities in Reese River Valley... It also means a greater productivity of important root crops and small game: more sage grouse, more rabbits, and more ground squirrels" (Robin Tausch, quoted in Thomas, 1983a: 162).

The two valleys also have rather different hydrological structure. The Reese River Valley is characterized by dozens of relatively permanent streams. Although springs occur throughout the high country, surface flow is generally sufficient to foster a stream or creek that flows for some distance. Most surface water in Reese River Valley is structured as a relatively reliable, linear resource.

Over millennia, this linear-directed surface water has carved dozens of relatively flat-top ridges within the upland drainages of the Reese River. Eroded ridge topography, largely lacking in Monitor Valley, provides excellent lifespace conditions for winter settlement—flat areas on relatively snow-free ridges, warmer winter temperatures, access to ecotone and woodland resources.

This effect is enhanced because the Toiyabe woodland is largely dependent on inversion layers for protection from late winter and early spring freezes. The heavy impact of Pacific frontal systems on the Toiyabe Range reduces such inversion layers—particularly on the northern flanks and exposed mountain peaks—thereby precluding establishment of piñon-juniper woodland in these areas. Increased available moisture in Reese River has created a restricted distribution of the piñon-juniper woodland (Thomas, 1983a: 162). Although the contemporary woodland is limited to a rather low-lying belt, there is a suggestion that these trees may produce more pine nuts than in other central Great Basin groves (Tausch, in Thomas, 1983a: 162).

By contrast, surface water in the Monitor Valley woodland is generally restricted to a series of localized springs. With few exceptions, this point-specific distribution creates a limiting factor on aboriginal settlement throughout the Monitor Valley woodland.

Because the Monitor Valley piñon zone is not as commonly subjected to the severe buffeting of Pacific frontal systems, the resulting temperature inversions tend to create broader, less circumscribed stands of woodland vegetation. The lower, "ecotone" part of the piñon-juniper margin is thus poorly defined
in Monitor Valley, and trees often blanket the entire mountain slopes (particularly in places where the ranges do not exceed 2500 m or so in elevation; Thomas, 1983a: fig. 35). Consequently, especially along the west-facing flank, the Monitor Valley woodland lacks the sharply defined upper and particularly lower margins characteristic of the Reese River area.

The interacting effects of topography, biogeography, and hydrology combine to create greater residential potential for aboriginal groups living in the Reese River Valley. Although Monitor Valley does not lack such potential, the overall resource distribution and biogeographic proximity means that—at least when compared to nearby Reese River—the choices are rather limited.

**SETTLEMENT STRUCTURE OF THE MONITOR VALLEY ECOTONE**

These differing ecological structures heavily influenced archaeological expectations for Monitor Valley, particularly the distinction between residential and logistic exploitative strategies (as spelled out in Thomas, 1983a). But in the early 1970s, when we began the Monitor Valley survey, we were more concerned with exploring the empirical generalizations derived at Reese River.

How far beyond Reese River, for instance, do such positioning criteria apply? Do Reese River site predictors operate similarly in nearby Monitor Valley? Does Monitor Valley contain equivalent piñon ecotone sites? If so, do such sites tend to average 450 m from water? Are site and assemblage distributions both symmetrical and parallel to the water sources? Do Monitor Valley sites occupy, on the average, an 8 percent slope? Are sites normally distributed with respect to major topographic features? The 1973–75 Monitor Valley survey was largely conducted with such empirical objectives in mind.

**SUBSAMPLING THE MONITOR VALLEY SURVEY DATA**

We designed our Monitor Valley fieldwork to be strictly comparable with that already conducted at Reese River. But the 1970s were a time of rapid archaeological change, and the Monitor Valley research spanned 13 years. This bind is familiar to all archaeologists with experience in long-term field research: keeping initial field objectives in mind while simultaneously adjusting field strategies to recent developments. Quite naturally, our methods and objectives evolved as the Monitor Valley fieldwork progressed, and previous chapters address some of these excursions.

Still, our initial desire to compare regional archaeological patterning between Monitor and Reese River valleys persisted throughout. To facilitate these diachronic purposes, it became necessary to define objective-specific subsets of the Monitor Valley data. Three such subsamples are relevant to the present discussion.

**THE OVERALL MONITOR VALLEY MONTANE SURVEY:** The first subsample includes all of the relevant data from the mountains of Monitor Valley (note, once again, that we exclude data from high-altitude research in the Alta Toquima/Mt. Jefferson area, to be introduced in the next volume of this series). This area was surveyed in several ways, with the woodland zone receiving particularly close scrutiny (see chap. 1). Roughly 625 m$^3$ of deposit was excavated in five sheltered sites in the Toquima Range woodland (Gatecliff Shelter, Toquima Cave, Grenouille Verte Cave, Northumberland Cave, and Ny1059). Two additional sites (Butler Ranch Cave and Little Empire Shelter) were excavated in the woodland portion of the Monitor Range.

The surface archaeology of this area was explored in several randomized and systematic surveys: three 1 km spring survey catchments, eight randomized 500 m square quadrats, and three streamside surveys in Stoneberger, Ikes, and Mill canyons. The Toquima Cave catchment survey also falls into this zone. In all, about 4775 ha (11,800 acres) were examined in close-order systematic survey in the Monitor Valley woodland, and several thousand hectares were examined in more cursory fashion in the search for rare element sites.

The adjacent lowland flank was examined in three randomized 1 km spring catchment surveys, four fully recorded rock art localities (two of which were examined in a 1 km catchment survey), a hunting barrier, eight 100 m
wide transects across the lowland flank south of Mill Canyon, and five randomized 500 m quadrats (table 87). About 62 m$^3$ of stratified deposits were excavated from sites on the lowland flank, and approximately 1780 ha (4400 acres) were examined in systematic archaeological survey. A much larger area was extensively surveyed for rare elements.

This first, fairly inclusive subsample will be hereafter termed the overall Monitor Valley montane survey.

The Monitor Valley Ecotone Subsample: A second, filtered subsample is required because the broad-based methods employed at Monitor Valley contrast severely with the piñon ecotone survey at Reese River, which was restricted to intensive coverage of 4080 ha (10,082 acres) along the western flank of the Toiyabe Range. This Reese River survey concentrated on the area within 350 m of the valley floor—a zone approximately 17 km long and 2.4 km wide, and roughly 2000 to 2400 m above sea level (Thomas and Bettinger, 1976: figs. 2 and 3, table 6).

Because many Monitor Valley survey catchments were located high in the Toquima Range—well outside the contemporary piñon-juniper woodland—only the following subset of survey data is directly comparable to the 1971 Reese River survey:

1. All sites and loci found within 350 m of the valley floor. Most of these sites come from the following six spring catchment surveys: Petes Spring, Disaster Spring, Willow Canyon Spring, Deer Spring, Johnny Potts Spring, and Spring 26. Each 1 km survey catchment encompassed an area of about 314 ha, so the total relevant spring catchment survey area in Monitor Valley is about 1884 ha.

2. Sites found in the three systematic streamside survey catchments (Stoneberger, Ikes, and Mill canyons). All these sites were within 350 m of the valley floor (and hence comparable to the Reese River sample). The total relevant streamside catchment survey area is 3400 ha.

3. Sites found within the 20 randomized 500 m survey quads (which likewise contained only sites within 350 m of the valley floor). The total randomized quad survey area is 500 ha.

In all, roughly 5784 ha (14,292 acres) of the Monitor Valley piñon-juniper ecotone was surveyed for archaeological sites in a manner directly comparable to the 1971 Reese River survey. In other words, the Reese River ecotone survey covered only about 70 percent of the equivalent area surveyed in Monitor Valley.

Data on table 87 have been screened to create a comparable data set, which we term the Monitor Valley ecotone subsample.

The Partitioned Monitor Valley Subsample: As discussed in chapter 7, the Monitor Valley landscape is analytically partitioned into absolute elevational zones rather than reconstructed biotic communities (see also Thomas, 1983a: 141–145). For present purposes, three of these elevational zones will be utilized to examine settlement structure in the Toquima portion of the Monitor Valley survey.

The woodland zone contains sites and loci between 2250 and 2500 m elevation. This arbitrarily designated zone includes the major mountainside communities including piñon-juniper overstory, riparian associations, and a diverse understory defined largely by local, edaphic factors. The Toquima woodland sample is further subdivided into east-facing and west-facing flanks.

The following subset of these data are isolated into the eastern woodland subsample:

1. All sites and loci found within the following three spring catchment surveys: Deer Spring, Johnny Potts Spring, and Spring 26. Each 1 km survey catchment encompassed an area of about 314 ha, so the total relevant spring catchment survey area in Monitor Valley is about 942 ha.

2. All sites found within the 1 km catchment of the Northumberland rock art site (314 ha).

3. Sites and loci found in the three systematic streamside survey catchments (Stoneberger, Ikes, and Mill canyons). The total relevant streamside catchment survey area is 3400 ha.

4. Sites found within 10 of the 20 randomized 500 m survey quads. The total relevant quad survey area is 250 ha.

In all, roughly 4906 ha (12,123 acres) of the data on table 87 can be included in the eastern Toquima flank subsample.

The following data are partitioned into the western woodland subsample:
1. All sites and loci found within the following four spring catchment surveys: Pete's Spring, Disaster Spring, Willow Canyon Spring, and Spring 22. Each 1 km survey catchment encompassed an area of about 314 ha, so the total relevant spring catchment survey area in Monitor Valley is about 1256 ha.

2. Sites found within the Toquima Cave and Jeans Spring rock art catchment surveys (a total of 628 ha).

3. Sites found within 10 of the 20 randomized 500 m survey quads. The total relevant quadrat survey area is 250 ha.

In all, roughly 2134 ha (5273 acres) of the data on table 87 can be included in the western Toquima flank subsample.

The uplands encompasses sites and loci between 2500 and 2750 m. The Toquima uplands are dominated by a sagebrush-grass community, and the lower margin often includes mountain mahogany as overstory.

Although site definitions remain the same as for the woodland area, criteria for isolating potential loci in the uplands requires modification of the former criteria (Thomas and Bettinger, 1976: 272). Specifically, because the upland is (by definition) not situated in the low foothills, potential upland loci could not possibly occur in the “low foothills” (defined as within 250 m above the valley floor). Similarly, the upland is not “near” the extant pinyon-juniper ecotone, so any polythetic criterion requiring a potential residential locus to be within 800 m of that ecotone is inoperative.

Despite these difficulties, the concept of the residential locus remains valuable for comparing potential with realized exploitative strategies, and the uplands are a critical control case for patterns observed in the woodland zone. To retain the locus concept, we recast the polythetic definition for upland loci to discount the two irrelevant variables.

A locus in the uplands must satisfy three of five of the following threshold conditions:

\[ f_1 \] The locus should be on a ridge or saddle.

\[ f_2 \] The ground should be relatively flat: “relatively flat” \( \leq 5 \) percent.

\[ f_3 \] The locus should be within the modern pinyon-juniper biotic community.

\[ f_4 \] The locus should be near a semipermanent water source: “near” \( \leq 1000 \) m.

The locus-controlled Monitor Valley subsample is thus restricted to: 1830 ha on the upland; 1256 ha in the western Toquima woodland; 4342 ha in the eastern Toquima woodland.

A total of 7428 ha were thus surveyed in locus-controlled fashion. The Reese River-compatible subset of the locus-controlled survey excludes 9 of 15 spring catchments, decreasing the total area to 5284 ha (13,057 acres).

Selective employment of these subsamples allows us to examine how topographic criteria influenced human settlement patterns in the prehistoric Reese River and Monitor valleys. In the discussions to follow, please keep in mind exactly which subsample being considered.

**COMPARATIVE DISTRIBUTION OF ARCHAEOLOGICAL SITES AND NONCULTURAL LOCI**

Locational analysis begins by examining how various topographic criteria, taken together, relate to specific, on-the-ground prehistoric site positioning. We first compare the
The Reese River and Monitor Valley settlements, then turn to a more detailed consideration of vertical variability within Monitor Valley settlements. Individual positioning criteria and their impact on cultural geography can then be evaluated on a one-by-one basis (chap. 18).

**The Reese River–Monitor Valley Comparison**

The Reese River piñon ecotone survey plotted 74 loci and 65 archaeological sites in an area of about 4080 ha, with specific survey results as follows (from data presented by Thomas and Bettinger, 1976): 63 projected loci contained a prehistoric archaeological site; 11 projected loci did not contain a prehistoric archaeological site; 2 additional sites (La614 and La615) were not located on a projected residential loci.

The fit between site and locus was extremely close along the Reese River ecotone.

To generate comparable data on site/locus distributions in Monitor Valley, we must employ the locus-controlled subsample of the Reese River-compatible data, slightly more than 5200 ha (defined as above). Within the relevant survey areas of Monitor Valley, we recorded 135 loci and 50 archaeological sites, distributed as follows (table 87): 46 projected loci contained a prehistoric archaeological site; 89 projected loci did not contain a prehistoric archaeological site; 4 additional sites (La658, Ny867, Ny891, and Ny892) were not located on a projected residential locus. In other words, more than 90 percent of the Monitor Valley sites occurred on loci, but only 34 percent of the loci were found to contain archaeological sites.

Prehistoric settlements in Reese River and Monitor valleys are hence similar in some respects, yet contrasting in others. Because "site" and "locus" were defined identically in both surveys, we can make some detailed observations regarding relative and absolute prehistoric utilization of the two regions.

Comparative site and locus distribution leaves no doubt that the Reese River piñon ecotone was more intensively utilized prehistorically than equivalent zones in Monitor Valley. Four independent lines of evidence point up the same conclusion.

**Absolute Site Density:** The Reese River ecotone averages one archaeological site per 62.8 ha surveyed (65 sites in 4080 ha). The equivalent zone in Monitor Valley contains a notably lower density of cultural materials, only one site per 105.7 ha (50 sites in 5284 ha). In terms of absolute site density, this part of the Reese River Valley was utilized roughly 1.7 times more intensively than the equivalent zone in Monitor Valley.

**Regional Intensity of Utilization:** The ratio of utilized sites to potential loci available in the Reese River Valley is extremely high (0.878: 65 sites per 74 loci)—nearly every locus suitable for residential use in the Reese River piñon ecotone contained evidence of prehistoric utilization. But in Monitor Valley, the site: nonutilized locus ratio drops to 0.370 (50 sites per 135 loci); fewer than 4 of 10 Monitor Valley loci showed evidence of utilization.

**Site-Specific Intensity of Utilization:** Comparison at the Feature Level: "Intensity of utilization" is an amorphous, ill-defined concept that we can approach from two independent directions. One measure of occupational intensity is the frequency of aboriginal stone house foundations, but there are several intervening factors: winter houses tend to be more visible than those constructed for summer occupation; sporadic residential visits will result in more houses, but those foundations should be less substantial than for houses at annually occupied sites; house foundations survive better on geomorphologically stable surfaces; large hunting blinds are sometimes virtually identical to house foundations, and so forth.

Nevertheless, all else being equal, we expect that the number of prehistoric house foundations will ultimately be proportionate to the overall degree of prehistoric residential activity.

The Reese River survey recorded a total of 31 probable house foundations (Thomas and Bettinger, 1976: 328–345). On the average, one house was found in every 131.6 ha searched. Or, viewed another way, sites encountered in the 1971 Reese River survey contained an average of 0.48 houses.

House density is considerably lower in Monitor Valley, where only seven house foundations were discovered in the 5284 ha
locus-controlled, Reese River-compatible survey (one house each at La636, Ny850, Ny868, Ny876, and Ny878; two foundations at Ny892). This portion of Monitor Valley thus contained one house in every 754.9 ha surveyed; we recorded an average of only 0.14 houses per site.

If all else is truly equal, aboriginal houses are three times more common along the Reese River ecotone than in equivalent areas of Monitor Valley.6

**SITE-SPECIFIC INTENSITY OF UTILIZATION: ASSEMBLAGE LEVEL COMPARISONS:** Although artifact collection strategies differed between the two regional surveys, there can be no doubt that ecotone sites at Reese River Valley contained a significantly higher density of cultural items than equivalent sites in Monitor Valley. Except for our work at Mateo’s Ridge (Hatoff and Thomas, 1976), only time-sensitive artifacts were collected in the Reese River ecotone survey (Thomas and Bettinger, 1976: 274). We changed this procedure in Monitor Valley where, as discussed earlier, we collected all artifacts and debitage encountered.

These restrictions aside, the differences in absolute artifact density are striking. Sixty-five sites at Reese River contained 441 time-markers, averaging 6.78 time-sensitive artifacts per site. The comparable 50 Monitor Valley sites contained only 108 time-markers, an average of 2.16 items per site.

The Reese River ratio is inflated by the unusually large assemblage at Mateo’s Ridge (which alone accounted for 230 time-sensitive artifacts). Even when the Mateo’s Ridge sample is removed, sites in Reese River average 3.3 time markers per site (211 artifacts/64 sites = 3.30 items per site).

Regardless of how the numbers are manipulated, the density of time-sensitive artifacts along the Reese River ecotone was somewhere between 1.5 to more than three times that of equivalent Monitor Valley sites.7

These data can also be recast in areal terms. Discounting nonsite isolated finds, the Reese River survey averaged one time-marker for every 9.9 ha surveyed (this figure decreases to one time-marker per 19.3 ha when the Mateo’s Ridge artifacts are set aside). In this part of the Monitor Valley survey, one time-marker was recovered for every 49 ha searched.

Thus, in terms of regional density, the Reese River ecotone contained from 2.5 to nearly 5 times the number of time-sensitive artifacts as equivalent areas of Monitor Valley.

**THE PARTITIONED MONITOR VALLEY SUBSAMPLE**

Locus-controlled Monitor Valley survey recorded 244 loci and 80 archaeological sites, distributed as follows: 75 projected loci contained a prehistoric archaeological site; 169 projected loci did not contain a prehistoric archaeological site; 5 additional sites were not located on a projected locus. More than 94 percent of sites in this survey were situated on loci, but only 31 percent of the Monitor Valley loci contained sites. These overall results can be partitioned into the elevational zones defined above.8

**THE WESTERN TOQUIMA FLANK:** The west-facing flank of the Toquima Range contained 80 loci and 32 sites, distributed as follows: 28 projected loci contained a prehistoric archaeological site; 52 projected loci did not contain a prehistoric archaeological site; 4 additional sites were not located on a projected locus. Whereas most western flank sites occurred on projected loci, the four exceptions are themselves of some interest.

La658 is immediately adjacent to Petes Spring and contains a great profusion of both historic and aboriginal debris. This location was a priori considered to be “atypical” because the local topography conflicts with three of the seven polythetic locus-defining criteria. Specifically, this site was not recorded as a residential locus because: (1) it was on a bench; (2) it was 1 km from the foothill margin; (3) it was only 50 m from nearest water. It is particularly unusual to find a site so close to the water supply.

A second exception is Ny892, a large site in the Spring 22 catchment. Two relatively well-defined house circles were associated, and historic debris occurred nearby. The position of this site is unusual because: (1) it was near a wash; (2) it was 295 m above the valley floor; (3) it did not occur in a modern stand of piñon-juniper woodland. The topography of Ny892 conflicts with three of the seven polythetic criteria that define a locus.9

Another exception on the western flank is
Ny891, also near Spring 22. The setting of this site is unusual because: (1) it was located on a bench; (2) it was 290 m above the valley floor; (3) it did not occur in a modern stand of piñon-juniper woodland. As at Ny892, the topography of Ny891 conflicts with three of the seven locus-defining polythetic criteria.

The final exception is Ny867, near Spring 15 which flows sporadically to the southwest into Big Smoky Valley. The location of this site is aberrant because: (1) it was in a wash; (2) it was on a 6 percent slope; (3) it was situated 50 m from nearest water. The topography of Ny867 conflicts with three of the seven polythetic criteria that define a locus. It is particularly unusual to find a site so near an active wash.

Except for these anomalous sites, more than 85 percent of the archaeological sites on the western Toquima flank occurred on potential loci; only 35 percent of the loci actually contained sites.

**The Eastern Toquima Flank:** Survey throughout the east-facing flank of the Toquima Range recorded 63 loci and 26 sites, distributed as follows: 26 projected loci contained a prehistoric archaeological site; 37 projected loci did not contain a prehistoric archaeological site; no sites were found away from projected loci. All sites on the eastern Toquima flank were situated on loci, and 41 percent of the loci contained sites.

**The Toquima Uplands:** Survey in the Toquima uplands recorded 101 loci and 22 archaeological sites, distributed as follows: 21 projected loci contained a prehistoric archaeological site; 80 projected loci did not contain a prehistoric archaeological site; one archaeological site was not located on a projected locus.

The only site not on a locus is Ny910, a stone hunting blind constructed overlooking the draw leading to Spring 25. Although no artifacts were associated, this blind was almost certainly aboriginal in origin. The location of this site is unusual because: (1) it was on a steep hillside; (2) the slope is 30 percent; (3) it did not occur in a modern stand of piñon-juniper woodland. Strictly because the topography of Ny910 conflicts with three of the five polythetic indices, one might guess that this site was logistic rather than residential, and the associated hunting facility supports this interpretation.

We thus find that 95 percent of the archaeological sites on the upland did occur on loci; but only 21 percent of the loci contained sites.

**Implications of the Site and Locus Distributions**

These systematic data permit some controlled comparisons regarding variability in prehistoric utilization of Monitor Valley.

**Absolute Site Density:** Monitor Valley fieldwork included about 7428 ha of locus-controlled survey, and from these data we can approximate site densities for each elevational zone.

Roughly 4342 ha were surveyed on the eastern Toquima flank, and 26 archaeological sites were found. The eastern flank thus contains an average of one archaeological site per 167 ha systematically examined. A total of 1256 ha was surveyed on the western Toquima flank, and 32 archaeological sites were found; thus the western flank contains an average of one archaeological site per 39.3 ha surveyed. Approximately 1830 ha were surveyed in the uplands, and only 22 archaeological sites were found; the upland contains one archaeological site per 83.2 ha surveyed.

It is clear that the western flank of the Toquima Range contains a much higher site density than either the uplands or the eastern woodland; sites along the eastern flank are particularly rare. But nowhere in Monitor Valley does site density approach that of the Reese River piñon ecotone.

**Regional Intensity of Utilization:** The overall ratio of utilized sites to loci in the locus-controlled survey of Monitor Valley is 0.328 (80 sites per 244 loci), and this grand total can be partitioned by elevational zone.

Twenty-six sites and 63 loci were recorded on the eastern Toquima flank, defining a utilization ratio of 0.413. Very similar densities are evident on the western flank, where the site : locus ratio is 0.400 (32 sites per 80 loci). But in the uplands, the utilization ratio is an extremely low 0.218 (only 22 sites per 101 loci).

It comes as small surprise that relatively more woodland loci were used as sites than upland loci. But site packing in Monitor Valley does not approach that of the Reese River.
ecotone, where nearly every locus had been converted into a site (65 sites per 74 loci).

**SITE-SPECIFIC INTENSITY OF UTILIZATION:** Too few houses were located in the locus-controlled survey to allow comparison across elevational zones. But it is possible to compare absolute artifact densities across the Monitor Valley landscape using this same subsample.

Employing a site-specific framework, we found that the 32 surface sites encountered in the western woodland survey contained an average of only 12.31 artifacts per site ($S = 12.67$). The eastern woodland averaged 16.7 artifacts per site ($S = 22.50$), and the 22 sites in the uplands contained an average of 15.8 artifacts ($S = 24.22$). Artifact densities are variable across these subsamples, and none of these differences are statistically significant from one another.

Viewed in nonsite fashion, 376 artifacts were recovered in systematic survey of the western Toquima woodland, which covered 1256 ha (one artifact for each 3.3 ha surveyed). Five hundred artifacts were recovered in systematic survey of the eastern Toquima woodland, which covered 4342 ha (one artifact per 8.7 ha surveyed). Systematic survey of 1830 ha in the uplands recorded 347 artifacts (one artifact for every 5.7 ha surveyed). The combined data show that the western Toquima flank contains a significantly higher density of artifacts than either the upland or eastern flank; artifacts on the eastern slope are particularly scarce.

Most of the artifacts recovered in Monitor Valley were found on well-defined archaeological sites. Only 5.0 percent of the artifacts on the eastern and western flanks occurred as isolates. But in the uplands, 9.2 percent of the artifacts were not in sites.

**SITE DISTRIBUTIONS: EXCAVATED CAVES AND ROCK-SHELTERS**

A counterpoint to the above approach is to look at site positioning criteria with respect to excavated caves and rock-shelters of Monitor Valley. Archaeologists have realized for years that caves and rock-shelters cannot be taken as regionally "typical" of site positioning, site function, spatial variability, or much of anything else. But by the same token, serious investigators can ill afford simply to ignore the cave or rock-shelter setting.

Positioning of the 11 excavated caves or shelters in the Monitor Valley sample can be evaluated using the same positioning criteria applied to surface sites: percent slope, distance to nearest water, elevation above the valley floor, and so forth (table 87). Potential loci are defined, as before, using the best-five-of-seven definition.

It comes as no surprise that only 3 of 11 excavated caves and shelters—Gatecliff Shelter, Butler Ranch Cave, and Little Empire Shelter—are considered to be loci. The remaining eight sites fall outside the positioning guidelines developed for the surface archaeological assemblages encountered in the central Great Basin. By these criteria, caves and rock-shelters do not occur in optimal locations.

As always, the exceptions prove informative. Triple T Shelter in considered to be "atypical" because local topography conflicts with three of seven polythetic locus-defining criteria. Specifically, Triple T is not a locus (1) because it was on a steep talus, and (2) it was situated outside the contemporary piñon-juniper community (3) hence distance to foothill margin assumes a negative and unacceptable value. Ny1059 and Boring-as-Hell Shelters are not loci for the same reasons.

Toquima and nearby Grenouille Verte caves are not loci because (1) they are too high (situated 285 m above the valley floor), (2) they are too far (2700 m) from the foothill margin, (3) they are too far (2000 m) from water, and (4) they are located on a steep hillside. The topography of Toquima and Grenouille Verte caves conflict with four of seven polythetic criteria that define a potential locus of residence.

Jeans Spring Shelter is not a locus because (1) it is too high (269 m above the valley floor), (2) it is situated outside the contemporary piñon-juniper woodland, and (3) it is located in a flat swale area near a spring.

Hunts Canyon Shelter is not a locus because it occurs outside the contemporary piñon-juniper woodland, and it is located in a butte that juts up in the alluvial bottomland of Hunts Canyon.

Bradshaw Shelter is not a locus because (1) the site interior is very steep (averages a 45° slope inside the dripline), (2) the site is lo-
cated on a hillside, and (3) the shelter is situated outside today's piñon-juniper woodland (and well south of the Monitor Valley study area).

These results are not particularly surprising, given that locus-defining criteria were specifically selected to assist in analysis of central Great Basin woodland-associated assemblages. This approach would be greatly enhanced by a noncultural cave survey of the Monitor Valley area; in that way, we could perhaps frame more specific criteria defining just which cave and rock-shelters are utilized and which are ignored.

But even lacking a comprehensive cave survey, the exercise underscores the general point that naturally enclosed sites were selected on the basis of criteria very different from those used for open sites. For this reason alone, one must be extremely cautious in using cave- or shelter-generated data when generalizing about regional cultural geographic patterning.

SUMMARY: SITE AND LOCUS DISTRIBUTIONS

Archaeologists wishing to explore patterns of prehistoric cultural geography must do more than merely document where the sites are. To fully understand the positioning criteria, it is necessary to consider where the sites are not, and the locus concept is one effective way to do this.

Comparative study of the site/locus interrelationship can provide a powerful tool for exploring the overall settlement fabric because we achieve an assessment of where residential sites could and should be. Nearly all sites at Reese River were situated on potential loci, and fully 93 percent of the relevant Monitor Valley sites occurred on potential loci. Even the exceptions are informative about the role of positioning criteria.

The best-five-of-seven threshold definition of locus is, of course, hardly a universal of hunter-gatherer residential behavior; this woodland-specific definition does not even hold for the Monitor Valley uplands. Topographic site positioning factors vary with level of technology and population density, and these criteria fluctuate through space and across time. But finding site predictors that work is a first step toward understanding the processes that conditioned where those residential settlements were established.

Systematic evaluation of site positioning criteria also defines the degree of variability within regional settlement patterns. We found that virtually all sites in the ecotone portions of Monitor and Reese River valleys occurred on loci. But there are major differences between the way loci were utilized (or not utilized) in the two areas.

Considering the site/locus comparisons enumerated above, there is no escaping the fact that prehistoric residential exploitation of the Reese River ecotone was considerably "more intensive" than in equivalent areas of Monitor Valley:

1. Nearly all available loci in Reese River had been utilized as sites. But in Monitor Valley, only a small proportion of loci had been so used.
2. Absolute site density is significantly higher at Reese River than in Monitor Valley.
3. Absolute density of aboriginal houses is more than four times higher in Reese River than in Monitor Valley.
4. Reese River sites contain somewhere between 1.5 and 3 times the number of time-sensitive artifacts than do equivalent sites in Monitor Valley.

Through systematic comparison of the cultural ("sites") vis-à-vis the noncultural ("loci"), it is possible to assess the absolute intensity of residential utilization between and within regions. All diversity indices argue that the Reese River ecotone was much more densely populated than its Monitor Valley counterpart.

This approach also highlights the variability in prehistoric settlement of Monitor Valley. Our surveys produced comparative distributional data on 244 loci and 80 archaeological sites, leading to the following conclusions:

1. Site density is considerably higher on the western flank of the Toquima Range than on either the eastern flank or upland zone. Sites are particularly rare on the eastern flank, due primarily to the relative paucity of sites found in the streamside surveys.
2. Proportionate utilization of loci is considerably less intense in the uplands.
3. Archaeological sites on the eastern flank
and in the uplands tend to have slightly more artifacts than those of the western Toquima Range.

4. Overall artifact density is considerably higher on the western flank of the Toquima Range, and the vast majority of the assemblages are site associated. Although artifacts are much rarer on the eastern flank of the Toquimas, they still tend to be site-associated. Artifact density in the uplands is also low, and a significantly higher proportion of the upland assemblage occurs as isolated finds.

There is no question that the eastern and western sides of the Toquima woodland were utilized differently; and the upland zone was exploited rather differently from both woodland flanks. The behavioral strategies behind these empirical trends are explored in the next chapters.

NOTES

1. We employ the term ecotone without apology. But in light of the unfortunate confusion that seems to exist regarding the meaning of this useful concept (esp. Rhoades, 1978; see also Madsen, 1981: 637), it may be useful to clarify specifically how I use the term.

The genesis and intellectual history of the ecotone concept is well documented and need not be reiterated here (e.g., Rhoades, 1978; King and Graham, 1981; Epp, 1984). We employ Odum's (1971: 157) now classic definition of an ecotone, as a transition between two or more diverse communities as, for example, between forest and grassland or between a soft bottom and hard bottom marine community. It is a junction zone or tension belt which may have considerable linear extent but is narrower than the adjoining community areas themselves. The ecotonal community commonly contains many of the organisms of each of the overlapping communities and, in addition, organisms which are characteristic of and often restricted to the ecotone. Often, both the number of species and the population density of some of the species are greater in the ecotone than in the communities flanking it. The tendency for increased variety and density at community junctions is known as the edge effect.

There has also been considerable discussion regarding the appropriate spatial extent of an ecotone. In this regard, we subscribe to Kendeigh's (1961: 30) general definition of ecotone as a transition between any plant aggregations—irrespec-

tive of size or scale (see also King and Graham, 1981: 130).

Thus defined, an ecotone occurs between the North American eastern deciduous forest and the prairie. An ecotone likewise occurs between the upper portion of the sagebrush-grass zone and the lower piñon-juniper woodland (as defined by Billings, 1951, and Cronquist et al., 1972: 134–140). It is in the latter sense that we employ the ecotone concept here, referring specifically to the increased resource availability and diversity along the piñon ecotone of the central Great Basin.

Rhoades (1978: 610) mistakenly asserted that I employ the edge effect to mean merely "exploitation of dual life zones." Had Rhoades bothered to familiarize himself with the full content and context of the research in question, he would have realized that the ecotone and edge effect concepts were utilized in the fashion stipulated above.

2. The polythetic concept was hardly new to archaeology (esp. Clarke, 1968; see also Thomas, 1972c). Subsequent applications have demonstrated the utility of polythetic thinking in other areas of anthropological inquiry (e.g., Needham, 1975; Solheim, 1976).

3. The Monitor Range woodland was systematically surveyed only in the Butler Ranch Cave catchment survey. We do not analyze settlement patterns in the woodland of the Monitor Range.

4. This total is in addition to the 960 ha (2370 acres) that were surveyed in the piñon woodland as part of the 1969–70 randomized quadrat fieldwork in the Reese River Valley.

5. A few sites and loci considered in this chapter sprawl out onto the lowland flank (the landscape below 2250 m). For present purposes, these relatively rare low-lying sites can be lumped into the woodland zones. Woodland loci are defined as before, based on their satisfying five of seven polythetic criteria (see above).

6. We can extend this consideration of absolute house density to the overall surveys of Monitor and Reese River valleys. Truly regional, systematically controlled data are hard to come by, but it is possible to control the variable sufficiently for adequate comparison.

Absolute feature density data for the Reese River randomized quadrat survey (1969–70) were not published previously because the BASIN I projections dealt strictly with assemblage density and distribution. But we have subsequently returned to the original fieldnotes to retrieve relevant feature data; keep in mind that these data derive from the 1969–70 field seasons and do not include the 1971 features discussed above.

Twenty-one probable house foundations were recorded in the 1969–70 regional random survey, which covered a total of 3500 ha (8645 acres). That
is, for the Reese River Valley in general, one house was recorded for every 166.7 ha. These figures indicate that houses are somewhat more common in the piñon ecotone area of Reese River (which averaged one house per 131.6 ha searched). It is perhaps more relevant that both Reese River survey figures are considerably higher than the house density derived above for the Monitor Valley piñon ecotone (one house for every 754.9 ha surveyed).

7. Unfortunately, the time-markers involved here are projectile points, prime targets of Great Basin pothunters. Disturbance by relic collectors without question introduces serious bias into inter-regional comparisons such as these.

But in this case, bias (if any) would tend to minimize differences between the two valleys. This is so because the major sites at Reese River Valley have been far more significantly impacted by pothunters than equivalent areas in Monitor Valley. We know firsthand, as one instance, of nearly 100 specific projectile points looted by pothunters. At Mateo’s Ridge, we had flagged these specimens for systematic collection one day, and they were stolen before we came to work the next day. If pothunting is a factor, then such collector bias operates to diminish the relative importance of time-markers in Reese River.

8. Keep in mind that the totals employed here derive from the locus-controlled subsample of the Monitor Valley data (as defined above). In the subsequent chapter, comparisons will be made using an expanded subsample (which adds several sites without the strict controls on loci distributions).

9. Historic period debris occurred on only 5 of the 69 spring catchment sites, and it is perhaps relevant that two of these five sites (La658 and Ny892) did not occur on potential loci. It may be that the “exceptions” were positioned in response to changing locational criteria during the historic period.

10. A slight definitional modification was required when these topographic criteria were applied to caves and shelters. When we measured the relative slope of a surface site, we defined the minimum area of a locus as about 50 m², then proceeded to measure slope across the entire locus. When measuring the slope of a shelter, we took measurements only inside the dripline, using a hand-held Brunton compass; several readings were taken in both longitudinal and lateral directions, and the results averaged.

For surface survey sites, aspect was simply estimated, based on the general configuration of the locus. But for caves and shelters, aspect could be measured precisely using Brunton compass sightings perpendicular to the dripline (see chap. 18).

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**UPLAND SPRING CATCHMENT SURVEY**

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**Table 87: Locational Characteristics of Sites and Loci in Monitor Valley**

**Notes:**
- Elev. above valley: elevation above the valley floor.
- Dist. to ecotone: distance from the edge of the ecotone.
- Dist. to water: distance from the water source.
- Aspect: orientation of the slope.
- Landform: type of landform.
- Area: extent of the area material.

**Columns:**
- Site: name of the site.
- Locus: specific location within the site.
- Elev. above valley: elevation.
- Slope: percentage.
- Dist. to ecotone: distance.
- Dist. to water: distance.
- Aspect: orientation.
- Landform: type.
- Area: extent.
TABLE 87—(Continued)

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**ROCK ART CATCHMENT SURVEY**

TOQUIMA CAVE SURVEY

La675  LRW 1-4  2512  8  376  2600  1500  West  Ridge  Small  Sparse
### TABLE 87—(Continued)

<table>
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<th>Site</th>
<th>Locus</th>
<th>Elev. above valley (m)</th>
<th>Slope (%)</th>
<th>Elev. to ecotone (m)</th>
<th>Dist. to water (m)</th>
<th>Aspect</th>
<th>Landform</th>
<th>Area</th>
<th>Density of cultural material</th>
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**EAST NORTHUMBERLAND SURVEY**

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<td>Saddle</td>
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**EAST BALD MOUNTAIN WASH SURVEY**

| Ny925    | E-1009| 2170 | 5  | 35  | 3500 | 2000 | South | Ridge | Large | Dense |

**JEANS SPRING SURVEY**

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<td>Ridge</td>
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### STREAMSIDE CATCHMENT SURVEY

**STONEBERGER CANYON SURVEY**

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<td>Ridge</td>
<td>Large</td>
<td>Sparse</td>
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</tbody>
</table>

**IKES CANYON SURVEY**

| Ny1229   | E-1002|       | 9  | —   | —   | —     | —     | Ridge | Small  | sparse |

**MILL CANYON SURVEY**

| Ny926    |       | 2300 | 165| 100 | 300 | East  | Ridge | Large  | Moderate |        |

**RANDOM QUADRAT SURVEY**

| Ny1231   | D1-1  | 2195 | 245 | 100 | 400 | —     | Ridge | —     | —     |        |
| Ny1232   | D1-2  | 2195 | 245 | 100 | 400 | —     | Ridge | —     | —     |        |
| La699    | G1-1  | 2225 | 90  | 600 | 1200| —     | Ridge | —     | —     |        |
| La700    | G1-2  | 2225 | 90  | 600 | 1200| —     | Ridge | —     | —     |        |
| La701    | G1-3  | 2255 | 120 | 600 | 1200| —     | Ridge | —     | —     |        |
| Ny1233   | I2-1  | 2286 | 150 | 50  | 1000| —     | Ridge | —     | —     |        |
| Ny1234   | I1-2  | 2286 | 150 | 50  | 1000| —     | Ridge | —     | —     |        |

**EXCAVATED CAVES AND SHELTERS**

| Gatecliff Shelter | 2319 | <5 | 184 | 2300 | 250 | 180° | Other | 26–72 m² | Large |
| Triple T Shelter  | 2024 | <5 | 74  | -500 | 150 | 180° | Other | 35 m²   | Large |
| Toquima Cave      | 2420 | <5 | 285 | 2700 | 2000| 180° | Other | 70 m²   | Moderate |
| Grenouille Verte  | 2420 | 0  | 285 | 2700 | 2000| 180° | Other | 9 m²    | Sparse |
| Butler Ranch Cave | 2259 | 5  | 124 | 600  | 150 | 160° | Other | 15 m²   | Moderate |
| Little Empire Shelter | 2260 | 2  | 125 | 400  | 250 | 160° | Other | <20 m²  | Sparse |
| Jeas Spring Shelter | 2219 | 0  | 269 | -50  | 200 | 270° | Other | 15 m²   | Moderate |
| Ny1059  |       | 2260 | 5  | 125 | -500 | 500  | 350° | Other | 6 m²   | Sparse |
| Hunts Canyon Shelter | 2100 | 2  | 50  | -1000| 1000| 235° | Other | 40 m²   | Moderate |
| Bradshaw Shelter  | 1890 | 45 | 200 | —    | 1000| 135° | Other | <15 m²  | Sparse |
| Boring-as-Hell Shelter | 2010 | 0  | 60  | -50  | 1000| 340° | Other | <10 m²  | Sparse |

* Site not on potential locus.
* Orientations for caves and rock-shelters expressed relative to true north.
CHAPTER 18. SETTLEMENT STRUCTURE WITHIN MONITOR VALLEY

Having examined the relationship between archaeological sites and loci, we now take a close look at the behavior of various topographic criteria—slope, distance to water, landform, aspect, and so forth. While we certainly agree with Rapoport (1969: 84–85) regarding the dangers of isolating single variables when considering conditions of human residence, we think a variable-by-variable approach is enlightening. But first it is necessary to examine the way in which these spatial data are structured.

BUILDING AND EVALUATING PREDICTIVE MODELS OF SITE STRUCTURE

We utilize several resource-specific probability models, each grounded in the familiar bell-shaped curve as a device for assessing on-the-ground site and assemblage distributions. The generalized probability models were introduced elsewhere (Thomas and Bettinger, 1976: 359; Thomas, 1983a: 69–71) and only a few points need to be reiterated here.

LINEAR PROBABILITY MODELS

People choose where to live and work carefully, and these decisions are made in response to a wide variety of environmental, social, and economic criteria. When exploited in a consistent manner over a lengthy period of time, resources and topography eventually foster specific and predictable distributions of sites and artifacts. We are concerned here with defining how such criteria condition frequency distributions and on-the-ground positioning of archaeological assemblages.

Cultural geographic decisions commonly involve an optimal positioning strategy relative to critical resources (Bettinger, 1980: 222–224). Both logistic and residential settlements will, in the long run, impose distinctive central tendencies on assemblage discard patterns. But such behavior likewise involves an expected and predictable degree of variability about that central tendency, and the normal distribution is often appropriate for modeling such dispersal patterns.

In the first such model (fig. 203), the upper ridge represents the maximum probability of resource-associated archaeological materials (as estimated by a sample mean). Lateral dimensions are defined by relative degree of variability about that mean (estimated by the sample standard deviation). This stochastic model has been utilized to project specific site positioning relative to measures such as ground slope, absolute distance to valley floor, travel distance to quarry, and so forth.

Some probability statements can be directly translated into on-the-ground distributions of assemblages and sites: archaeological debris is literally distributed in linear, asymmetrical fashion. For other variables (such as percent ground slope), variate distributions remain mathematical abstractions. In either case, the probability distribution in figure 203 remains useful for descriptive, projective, and heuristic purposes.

Consider the way in which archaeological debris is deposited relative to nearest water source. In a lacustrine setting, access to water is structured in linear fashion; that is, associated archaeological debris commonly accumulates along a correlative arc on the shoreline, usually defining a mean distance to water distributed in unidirectional, normally distributed fashion. This model provides an accurate description of Early Holocene debris disposal in the Great Basin; all experienced pothunters know to search for fluted and stemmed points by walking the long, curving shorelines that once paralleled now-extinct pluvial lakes.

Assemblage spacing relative to such lakeside resources can be modeled as (1) normally distributed (about a parametric mean value), (2) linear (i.e., parallel to ancient beach ridges), and (3) asymmetrical (because artifacts are usually deposited on land—rarely underwater). This generalized frequency distribution appears in figure 203.

Archaeological debris generated from
similar behavioral activities will accumulate rather differently when the resource in question occurs in a different spatial configuration. Suppose, for instance, that the nearest water source is a stream rather than a lake. Although water remains structured in linear fashion, access to that resource becomes symmetrical (since water-related activities can occur on either side of a stream).

Accordingly, streamside sites and assemblages can be modeled using a linear, symmetrical probabilistic approximation, in which an infinite number of bell-shaped probability curves extend on both sides of the linear resource. In figure 204, sites and assemblages are expected to accumulate most frequently at the parametric mean (as estimated by the sample mean). The likelihood of site or artifact occurrence diminishes gradually on either side of that probability peak, ultimately approaching zero. The symmetrical, linear model was shown to be appropriate for describing known distributions and for projecting unknown archaeological frequencies in the Reese River Valley (Williams et al., 1973; Thomas and Bettinger, 1976).

A Concentric Probability Model

The hydrology of Monitor Valley differs from that of Reese River. Except for the oc-
casional stream, water sources throughout the Monitor Valley woodlands are restricted to mountain springs: water in this context becomes a point rather than a line. Consequently, linear probability models become poor descriptors of Monitor Valley cultural geography (at least for sites and assemblages directly conditioned by the presence of potable water).

Local hydrologic conditions suggest that a concentric probability model will be more appropriate for anticipating assemblage distributions relative to such point resources. In figure 205, an infinite number of normal curves are projected about a central point.

Concentric models may apply whenever point resources are exploited by a normally distributed positioning strategy. But keep in mind that the resource-specific behavior behind this model does not necessarily differ from behaviors associated with the linear distributions in figure 203 and 205. For asymmetrical linear resources, assemblage distributions often occur in a parallel band along a resource margin (such as a beach). When linear resources are symmetrical, two such parallel bands commonly occur along both margins of a stream or creek. In the case of mountain springs, assemblage distributions are anticipated as a concentric probabilistic doughnut ringing the point resource.

The expected probability distributions, in all cases, display characteristic central tendencies and dispersions, commonly distributed in normal fashion. Whereas positioning strategies and discard parameters might be similar, the on-the-ground consequences could be quite different, depending upon local resource structure.

These (and other) probabilistic models can be used to simulate on-the-ground site distributions. Such models also function to project site distributions in archaeologically unknown areas. But probabilistic models are perhaps most revealing when empirically observed site and assemblage distributions do not correspond with expectations. Coping with divergence can at times be more enlightening than confirming expectations.

**Assessing Goodness-of-Fit**

Before comparing these a priori probabilistic models with observed site and assemblage distributions, it is necessary to derive specific criteria for assessing degree of fit between the theoretical and the empirical. We begin with normality and the implications of normal distributions for sampling strategies. We then focus on deviations from normality. These techniques in hand, we move on to the empirical archaeological distributions.

**The Central Limit Theorem:** The normal distribution reflects central tendency and dispersion for a wide variety of biological and cultural variables (e.g., Thomas, 1976: chap. 7). In the following discussions, we compare a series of observed site and assemblage distributions with the theoretical expectations outlined above. Each continuous variable will be arrayed in standard frequency distribution fashion, using stepwise histograms to characterize the observed field data.

A priori models provide, in effect, cultural geographic "expectations" by projecting observed data against the relevant theoretical distribution, portrayed as a standard probability density function. By *density*, we mean the relative concentration of variates along the Y-axis; the height of the curve at that point is determined by the density of variates (top of fig. 206).

The perfectly normal curve on figure 206 demonstrates the following characteristics (after Thomas, 1976: 172–173):

1. Normal curves are symmetrical.
2. Normal curves are asymptotic at both ends.
3. The maximum height of the normal curve occurs at the mean.
4. Areas under the normal curve represent probabilities of events.

A second probability function, the chi-square distribution, can be used to assess goodness-of-fit between an idealized normal distribution and an observed frequency distribution (Thomas, 1976: 285–287). This method will be applied throughout this chapter, with a cut-off point of $p = 0.05$.

Sampling exigencies make it unrealistic to expect that an observed curve will correspond exactly to normal expectation, even if means and standard deviations are identical. Although there are acceptable graphic techniques for assessing normality (e.g., Sokal and Rohlf, 1969: 119–125), we prefer to resolve the question of what is the same? and what is different? by recourse to more exact methods which allow, in turn, more precise estimates of variability (as explained in Thomas, 1976: 285–287).

Beyond the characteristics listed above, the normal distribution has certain additional intrinsic properties that must be considered. Particularly critical in this context is the well-known Central Limit Theorem:

For every statistical population of finite variance, the distribution of means from samples of $n$ independent observations approaches a normal distribution. When $n$ is very large, the distribution of sample means invariably approximates the normal. (see esp. Hays, 1973: 316–318)

Simply stated, the Central Limit Theorem holds that regardless of how a population may be distributed, if sufficiently large samples are drawn from this population at random, the means of those samples tend toward normality. We find in this (deliberately simplified) statement the cornerstone of modern parametric statistical methods.

Note that absolutely nothing is said regarding the form of the population: Sufficiently large samples tend to have normally distributed means, no matter what. In fact, the Central Limit Theorem is sufficiently robust that (1) even for populations distributed in decidedly not normal form and (2) even for samples with a very small $n$, the resulting sample means tends toward normality.

Consider a uniformly distributed population, in which all variates (the $X_i$) occur in equal proportions (e.g., 25 variates of value "1", 25 variates of value "2", 25 variates of value "3", and so on). We could draw randomized samples from this population, calculating the sample mean as we go. Common sense seems to dictate that the sample means should follow the distribution of the population from which they were calculated, reflecting the uniform proportions of the $X_i$.

The Central Limit Theorem tells us that common sense is wrong. The distribution of sample means does not reflect that initial uniform distribution; instead, even for relatively small values of $n$, the sample means will closely follow the familiar unimodal, symmetric form known as the normal distribution (for more mathematical examples, see Hays, 1973: 238–242; Snedecor and Cochran, 1967: 51–56).

In the present context, the Central Limit Theorem warns against taking an observed, empirically normal distribution at face value; caution is required when assessing the degree of fit between middle range expectations and empirical observations. There will be times (especially when dealing with sample means) when a normal distribution means nothing except that the sample size is sufficiently large to generate a normal distribution regardless of the underlying population distribution. In other cases—particularly those involving the distribution of variates rather than sample means—an observed normal distribution may accurately reflect the shape of the underlying population.

While the Central Limit Theorem does not preclude an examination of cultural geographic distributions, one must tread carefully when interpreting the meaning of these observed distributions in terms of underlying behavior and decision-making.

Comparing the Expected and the Observed

We have stressed that the study of variability can be as enlightening as the pursuit of regularities. Fitting the normal curve is one such instance. When empirical observations correspond to normal expectations, one can explore the causes behind the finding: What is the effect of the Central Limit Theorem? What is the influence of sampling fraction?
Was sampling truly randomized? What are the biasing depositional factors? What behavioral factors would lead to such a result?

But what happens when observations fail to distribute normally? Rather than simple rejection as "not corresponding to expectation," it is more appropriate to explore the nature of that deviation. Specifically with respect to normality, it is useful to evaluate commonly observed causes of nonnormality as a necessary first step toward understanding why things did not behave as "expected."

Figure 206 demonstrates some common distributional deviations that can be expected to occur in this context. One common departure from normality is termed skewness (basically another name for asymmetry). A curve is skewed to the right if an inordinate number of items are found toward the higher end of the Y-axis. Curves are skewed to the left when too many variates cluster at the lower end of the Y scale.

We measure the relative degree of skewness in a distribution by employing the sample statistic $g_1$, an estimator of the population parameter $\gamma_1$ (as defined by Sokal and Rohlf, 1969: 113–118). In a normally distributed population, $\gamma_1$ is zero, reflecting a symmetrical distribution of variates about the mean. A negative value of $g_1$ shows that a sample of variates is skewed to the left (fig. 206c); a positive $g_1$ is characteristic of a sample distribution skewed to the right (fig. 206d).

Another departure from normality is termed kurtosis, the relative "peakedness" or "flatness" of a frequency distribution. A curve is leptokurtic when an inordinate number of items cluster around the mean (relative to a normal distribution of identical mean and standard deviation; see fig. 206b). The reverse situation, a platykurtic distribution, displays a more uniform distribution of variates, with relatively too few items near the mean (fig. 206a).

Kurtosis can be measured by $g_2$, an estimator of the population parameter $\gamma_2$ (as defined by Sokal and Rohlf, 1969: 113–118). In a normal population, $\gamma_2$ will be zero, reflecting the absence of kurtosis.
Negative $g_2$ indicates platykurtosis in the observed sample (fig. 206a); a positive $g_2$ denotes a leptokurtic distribution.

Deviations from normality (as reflected in the relative degree of skewness and kurtosis) are of interest here because they provide a way of monitoring the underlying behaviors responsible for the distribution of archaeological debris across the Reese River and Monitor valleys.

We can now assess the cultural geographic significance of specific topographic factors: ground slope, elevation above valley floor, distance into foothills, distance to nearest water, landform, and solar aspect. As in chapter 17, we first compare and contrast positioning criteria in the Reese River and Monitor valleys, then focus directly on variability by partitioning the expanded Monitor Valley sample into component elevational segments.

**RELATIVE SLOPE**

When framing the operational definitions employed in the 1971 ecotone survey, we reviewed the available archaeological data on such settlements and found (not surprisingly) that sites usually occur on relatively flat areas. After years of trying to find a flat place to camp in the steep Toquima foothills, we intuitively considered relative slope to be a critical condition of human lifespace.

Relative slope was measured in the field with a handheld Brunton compass; several readings were taken in both longitudinal and lateral directions, and the results averaged.

**RELATIVE SLOPE: THE REESE RIVER–MONITOR VALLEY COMPARISON**

The previous analysis of Reese River data concluded that the apparent optimal slope for this area is about 8 percent (Thomas and Bettiger, 1976: 357). We can now refine this assessment.

Seventy-four loci were recorded in the 1971 Reese River ecotone survey. These discrete areas range in slope from 0 to 20 percent slope, defining a mean ground slope of 8.39 percent ($S = 4.18\%$). By projecting an ideal normal curve with this mean and standard deviation (as described in Thomas, 1976: 285–287), it is possible to compare these observed frequencies with those expected under a strictly normal distribution (fig. 207). Chi-square is 3.080 (df = 3), demonstrating that
Sixty-three of these loci contained archaeological sites. As with the population of available loci, the ground surface of sites ranges between 0 and 20 percent slope, averaging 8.31 percent ($S = 4.24\%$). The frequency distribution of site slope cannot be distinguished from a normal distribution (chi-square = 2.073, df = 4). The remaining 11 noncultural loci had an overall mean slope of 8.82 percent ($S = 3.74\%, n = 11$). The negligible difference in slope between sites and noncultural loci is not statistically significant ($t = 0.36, df = 72$, $p = 0.719$). Although extremely steep areas were avoided at Reese River, there was no deliberate selectivity for flat ground within the range of acceptable slope.

The Reese-River-compatible portion of the Monitor Valley survey recorded 135 loci, with a mean slope of only 4.07 percent ($S = 2.71\%, n = 132$). This sharply peaked, leptokurtic distribution ($g_2 = 1.28$) is skewed to the right ($g_1 = 1.13$). The difference between observed loci slopes and those expected under the normal model are statistically significant (chi-square = 23.27, df = 4; see fig. 208).

Forty-six loci in the Monitor Valley survey contained archaeological sites, with a mean slope of 4.65 percent ($S = 2.84\%, n = 43$). Although mean site slope does not differ significantly from the slope of noncultural loci ($t = 1.723, df = 130$, $p = 0.083$), sites are distributed very differently from loci. Kurtosis almost vanishes in the site curve ($g_2 = 0.089$), and the variates are not severely skewed to the right ($g_1 = 0.694$). In fact, the distribution of observed site slopes cannot be distinguished from a normal distribution of identical mean and variance (chi-square = 1.624, df = 2).

Figure 208 provides strong evidence that the distribution of archaeological sites in Monitor Valley reflects distinctive, culturally conditioned decision-making with regard to ground slope.

process of site selection, kurtosis almost vanishes and the variates are hardly skewed to the right. There is no significant difference between expectations and observations.
**Relative Slope: The Partitioned Monitor Valley Subsample**

In the expanded Monitor Valley sample, ground slope varies between 0 and 15 percent on the archaeological sites recorded in the Toquima Range (table 87), and mean site slope is 4.16 percent ($S = 2.78\%$, $n = 67$). Slopes of noncultural loci range between 0 and 30 percent, and the mean locus slope is 4.50 percent ($S = 3.67\%$, $n = 181$). The minimal difference in slope between sites and nonutilized loci does not approach statistical significance ($t = 0.671$, $df = 246$, $p = 0.51$).

That is, whereas steeper loci were deliberately avoided in the Monitor Valley settlements, there is no difference in mean slope between cultural and noncultural loci. But the underlying strategy for site selectivity becomes apparent when the overall Monitor Valley sample is partitioned into western Toquima, eastern Toquima, and upland samples.

**The Eastern Toquima Flank:** The 63 loci available on the eastern Toquima flank have a mean slope of 4.40 percent ($S = 2.63\%$, $n = 58$), and the overall distribution does not depart from normality (chi-square = 6.6748, $df = 4$).

The 23 archaeological sites on these loci have a mean slope of 4.67 percent ($S = 2.81\%$, $n = 18$). Sites have a somewhat platykurtic, multimodal distribution ($g_2 = -0.958$), but the overall configuration does not differ significantly from a normal distribution (chi-square = 0.4527, $df = 4$). The remaining nonutilized loci have a mean slope of 4.28 percent ($S = 2.53\%$), and the difference in slope between cultural and noncultural loci is not statistically significant on the eastern Toquima flank ($t = 0.518$, $df = 56$, $p = 0.613$).

**The Western Toquima Flank:** Mean slope of 97 available loci on the western Toquima flank ranges between 0 and 13 percent, with a mean ground slope of 3.59 percent ($S = 2.48\%$, $n = 92$). This leptokurtic distribution ($g_2 = 3.18$) is skewed to the right ($g_1 = 1.62$). That is, western loci show relatively less variability and somewhat higher slopes than one expects under the normal distribution. The observed curve deviates significantly from a normal curve with identical mean and variance (chi-square = 42.3846, $df = 4$).

Thirty-four of these loci were also prehistoric sites, with a mean slope of 3.86 percent ($S = 2.64\%$, $n = 29$); these frequencies closely follow the expected normal distribution (chi-square = 5.500, $df = 3$). The remaining loci not utilized as sites have a mean slope of 3.46 percent ($S = 2.40\%$). The difference in slope between cultural and nonutilized loci is not statistically significant ($t = 0.716$, $df = 90$, $p = 0.517$).

**The Toquima Uplands:** Available loci in the Toquima uplands have a mean slope of 5.18 percent ($S = 4.38\%$, $n = 98$). This severely leptokurtic distribution ($g_2 = 13.41$) is also skewed to the right ($g_1 = 3.04$); although upland loci show surprisingly little variability about the mean, several potential loci are extremely steep. The observed curve deviates significantly from a normal curve with identical mean and variance (chi-square = 17.0766, $df = 5$).

Upland archaeological sites have a mean slope of 4.15 percent ($S = 2.89\%$, $n = 19$). Although this distribution retains a slight degree of kurtosis ($g_2 = 1.027$) and skewness ($g_1 = 1.273$), deviations do not depart significantly from normality (chi-square = 7.164, $df = 3$). Remaining nonutilized loci have a mean slope of 5.45 percent ($S = 4.65\%$, $n = 79$), but the overall difference in slope between cultural and nonutilized loci is not statistically significant ($t = 1.18$, $df = 96$, $p = 0.239$).

**Topographic Intercorrelations:** There is a slight tendency for sites and particularly loci to become steeper toward the heights of the Toquima Range. Percent slope is positively correlated with elevation above sea level ($r = 0.18$, $df = 259$, $p = 0.004$), elevation above valley floor ($r = 0.15$, $df = 259$, $p = 0.016$), and distance from the ecotone ($r = 0.13$, $df = 259$, $p = 0.032$). Additional key indices—artifact density, site area, and distance to water—are unrelated to degree of slope.

**Relative Slope: Summary and Implications**

Analysis of relative slope shows that sites at Reese River were built on ground nearly twice as steep as corresponding sites in Monitor Valley. But, as it turns out, once the slope
of available loci is considered, we find that Monitor Valley simply provided more naturally flat loci from which to choose: People in both areas selected from within the middle range of available loci for habitation. The absolute difference in site slope between the two valleys is hence a function of topography, not selectivity. But even given these physical differences, we do find major differences in the selection process between the two valleys.

There is no hint in the Reese River data of deliberate choice of flat ground within the range of acceptable slope. Prehistoric Reese River Valley was a densely packed landscape, with most (85%) available loci hosting archaeological sites. Ground slope of potential loci occurred in unimodal, symmetrical fashion, indistinguishable from both the ideal normal distribution, and also the cultural sample of archaeological sites (fig. 207). Selectivity for site slope at Reese River is thus fully consistent with the general decision-making probabilistic model in figure 203.

But this characteristic normal distribution does not result from cultural decision-making; the available loci at Reese River were already so distributed.

A very different situation obtains in comparable parts of Monitor Valley (fig. 208). We lack firm evidence for (or against) cultural selectivity on the eastern flank: The population of available loci was normally distributed, as was the sample of site locations selected from the loci. Random selection could easily account for the observed site distributions. Eastern Toquima sites were positioned similarly to the ecotone sites of Reese River Valley.

But on the western Toquima flank and in the Monitor Valley uplands, loci occur in skewed, leptokurtic distribution. Prehistoric site locations were selected from this nonnormal pool of available loci, and this selectivity was not random. In effect, the site selection process in these parts of Monitor Valley smoothed and dampened the leptokurtic, skewed distribution of ground slope, without changing the mean and range of acceptable site slope. This smoothing strategy was implemented by truncating skewness and dampening kurtosis—creating, in effect, a normally distributed sample of variates from a nonnormal parent population.

Almost never do we find an archaeological site on extremely steep ground—these loci were usually ignored, even when other locus-defining criteria were satisfactory. There was a distinct cut-off point beyond which loci were rarely utilized; avoiding steep ground in effect truncated the extreme right-hand tail of the overall locus distribution (without significantly modifying the central tendency). Impression of this culturally conditioned cut-off point is the process by which skewed loci distributions were normalized on sites of the western flank and uplands.

The natural distribution of Monitor Valley loci was also strongly leptokurtic: Naturally occurring ground slopes were tightly clustered about a mean, reflecting a low degree of variability in the population. Sites were demonstrably chosen across a relatively wide range of slope variability. Although extremely steep areas were generally avoided, and flatter loci slightly favored, the site selection process was in full accord with the principles behind the probabilistic model on figure 203.

The central tendency depends almost exclusively on what was available. When loci were relatively flat (as in Monitor Valley), sites were built on relatively flat ground; when only rather steep loci were available (as at Reese River), then sites were constructed on relatively steeper ground. The result of this site selection strategy is to dampen the "peakedness" of available loci curve.

To summarize, while a flat place to live was surely a factor in prehistoric site positioning, these data make it clear that other, more immediately compelling factors conditioned exactly which loci were selected.

Slope functioned in two very different ways in the prehistoric central Great Basin. In general, percent slope operated as a threshold, not a gradient. Archaeological sites in the woodlands and in the uplands almost never occurred on land steeper than about 10 percent.3 But excluding these extremes, the precise degree of slope had a negligible effect on microtopographic positioning of specific sites: “Twice as flat” was clearly not “twice as good.”

ELEVATION ABOVE VALLEY FLOOR

Unlike slope, relative elevation did indeed operate as a significant site positioning factor,
functioning as a topographic gradient buffering microenvironmental temperature. This effect showed up in two independent variables measured in the Reese River and Monitor Valley surveys. The first relevant variable is elevation above the valley floor—operationally defined as vertical differential between locus elevation and the elevation of the nearest valley bottom.

**Elevation Above Valley Floor: The Reese River-Monitor Valley Comparison**

In the earlier 1969–70 Reese River survey, we found that most sites were clustered in a band running parallel to the valley floor. Not only did this pattern coincide with known distributions of western Shoshone winter villages, but the strategy behind such placement seem to make sense in simple cost/benefit terms. In the follow-up Reese River survey, this vertical positioning strategy could be delineated with considerably more precision.

The 74 loci mapped in the 1971 ecotone survey ranged from 0 to 322 m above the valley floor, with the average relative elevation at 97.6 m from the valley bottom (\(S = 65.36 \text{ m}\)). The leptokurtic distribution of relative loci elevations (\(g_2 = 3.10\)) is somewhat skewed to the right (\(g_1 = 1.67\)): A large proportion of Reese River loci cluster about the mean elevation of 97 m, and several occur at rather extreme elevations. Although this distribution is rather distorted, it does not differ significantly from that anticipated by the normal curve (chi-square = 6.237, df = 3).

The 63 sites on these Reese River loci occur an average of 95.2 m above the adjacent valley floor (\(S = 63.84 \text{ m}\)). The absolute difference in elevation between sites and noncultural loci is not statistically significant (\(t = 0.773, \text{df} = 72, p = 0.552\)). The leptokurtic distribution of site elevations (\(g_2 = 2.87\)) is skewed to the right (\(g_1 = 1.60\)). But site elevations in the Reese River sample do not significantly deviate from the normal approximation (chi-square = 4.680, df = 3).

The 135 loci mapped in the equivalent Monitor Valley survey ranged from 0 to 350 m above the valley floor, defining a mean relative elevation of 184.3 m from the valley bottom (\(S = 87.20 \text{ m}, n = 133\)). This platykurtic distribution (\(g_2 = -0.719\)) is highly symmetrical (\(g_1 = 0.048\))—loci elevations tend to be uniformly and symmetrically distributed across the range. This deviation from normal expectation is not statistically significant (chi-square = 10.635, \(\text{df} = 5\)).

The 46 sites on these loci average 178.6 m above the adjacent valley floor (\(S = 70.43 \text{ m}, n = 45\)). The absolute difference in elevation between sites and noncultural loci is not statistically significant (\(t = 0.54, \text{df} = 131, p = 0.298\)). The rather platykurtic distribution of relative site elevation (\(g_2 = -0.884\)) is fairly symmetrical and does not differ significantly from the normal approximation (chi-square = 6.773, df = 3).

In other words, the Monitor Valley sites are positioned an average of nearly 90 m higher than equivalent sites in Reese River. But this discrepancy in mean relative elevation is due to the differential elevations of loci available, not selectivity: Monitor Valley loci simply occur higher above sea level. When absolute elevation is factored out, the deviations in relative site elevation between valleys disappear.

**Elevation Above Valley Floor: The Partitioned Monitor Valley Subsample**

Archaeological sites mapped in the overall Toquima Range survey average 282.5 m above the valley floor (\(S = 184.98 \text{ m}, n = 91\)), and the mean elevation of noncultural loci is 403.2 m (\(S = 244.45, n = 182\)). This difference is highly significant (\(t = 4.138, p < 0.001\)), suggesting that site selection decisions favored loci at lower elevations in the Toquima Range. This complex relationship is more sharply defined by partitioning elevational and directional subsamples.

**The Eastern Toquima Flank: Sixty-three loci** were mapped on the eastern Toquima flank (fig. 209), with a mean elevation of 154.7 m (\(S = 73.58 \text{ m}\)). Although these loci are distributed in multimodal fashion (ranging from 55 to 340 m), the overall pattern is not significantly different from normality (chi-square = 3.630, \(\text{df} = 4\)).

Twenty-six eastern Toquima loci were also archaeological sites. This restricted cultural subset, ranging between 60 and 235 m ele-
vation, is also normally distributed (chi-square = 0.658, df = 2) with a mean elevation above valley floor of 133.5 m ($S = 45.81$ m, $n = 23$). The remaining noncultural loci are located a mean elevation of 180.3 m above the valley floor ($S = 109.66$ m, $n = 40$). The elevational differential between sites and noncultural loci is nearly 50 m, a statistically significant value ($t = 1.922$, df = 61, $p = 0.028$ for a directional test). We conclude that lower loci were deliberately selected for utilization on the eastern Toquima flank.

The Toquima Uplands: A similar distribution occurs in the uplands, where the available loci average 630.9 m above the valley floor ($S = 131.58$ m, $n = 98$). These loci range between 400 and 960 m elevation and are normally distributed in terms of relative elevation (chi-square = 14.839, df = 8). Twenty-one loci contained prehistoric archaeological sites at a mean relative elevation of 562.8 m ($S = 148.94$ m, $n = 19$), and site elevations are also normally distributed (chi-square = 5.4311, df = 4). For the remaining noncultural loci in the uplands, mean site elevation is 648.3 m above the valley floor ($S = 120.70$ m, $n = 79$).

This statistically significant difference in relative elevation ($t = 2.662$, df = 96, $p = 0.003$) demonstrates that sites in the uplands were deliberately constructed on loci that average 85 m lower than nonutilized loci.

The Western Toquima Flank: A different site selection strategy operated on the western Toquima flank (fig. 210), where loci average 249.0 m above the valley floor ($S = 105.18$ m, $n = 97$) and range between 0 and 465 m. This irregular distribution is significantly different from the normal approximation (chi-square = 15.742, df = 8), although neither skewness ($g_1 = -0.148$) nor kurtosis ($g_2 = -0.224$) are particularly aberrant.

Archaeological sites were recorded on 34 of these loci, at a mean elevation of 255.74 m above the valley floor ($S = 72.64$ m). Site elevations range between 160 and 455 m. The site distribution is somewhat skewed to the right ($g_1 = 1.154$) and leptokurtic ($g_2 = 0.892$). But these deviations do not significantly depart from normality (chi-square = 6.884, df = 3), indicating that a normally distributed

![Graph](https://via.placeholder.com/150)

**Fig. 209.** Elevation above valley floor for sites and loci on the eastern slope of the Toquima Range. The upper curve a plots the distribution of potential loci against the appropriate normal curve. There is no significant difference between expectations and observations. The lower curve b plots the distribution of archaeological sites against a normal curve. There is no significant difference between the two curves.
sample has been selected from the nonnormal distribution of available loci.

The remaining noncultural loci have a mean elevation of only 245.4 m above the valley floor ($S = 118.94$ m). This minor difference in elevation between sites and noncultural loci is not statistically significant ($t = 0.46$, $df = 95$, $p = 0.652$). There was no obvious preference for lower loci on the west-facing flank of the Toquima Range.

**Comparisons of Absolute Elevation:**
Mean elevation of west-facing Toquima sites is 2205 m above sea level ($S = 73.04$ m). East-facing sites are located at a mean elevation of 2284.6 m ($S = 82.27$ m). This absolute elevational difference is statistically significant ($t = 4.178$, $df = 68$, $p < 0.001$): Sites on the eastern flank are significantly higher than those on the western Toquima flank.

This relationship is due to the absolute elevation of available Toquima loci. The average west-facing noncultural locus is 2197.6 m above sea level ($S = 119.73$ m); mean site elevation for this area is 2205.6 m ($S = 73.04$ m). Because this difference is not statistically significant ($t = 0.35$, $df = 95$, $p = 0.727$), there appears to have been no deliberate intention to select absolutely lower loci along the western Toquima flank.

The mean elevation of east-facing loci is 2300.0 m above sea level ($S = 82.09$ m); mean site elevation for this area is 2267.0 m ($S = 46.43$ m). This difference is statistically significant ($t = 0.041$, $df = 61$, $p = 0.041$ for a directional test). This relationship strongly suggests that lower loci were deliberately chosen in the eastern Toquima woodlands.

Similarly, the average upland locus is 2777.8 m above sea level ($S = 125.19$ m); mean site elevation for this area is 2697.8 m ($S = 149.12$ m). This difference is statistically significant ($t = 2.423$, $df = 96$, $p = 0.008$ for a directional test). There was a deliberate selection of lower loci in the uplands as well.

**Comparison of Assemblage Densities:**
When artifact distribution is analyzed in nonsite fashion—that is, when site-specific assemblages are pooled with isolated finds—we find an overall and statistically significant decline in log artifact frequency with increasing elevation in Monitor Valley ($r = -0.25$, $df = 122$, $p = 0.006$). This relationship is clarified when partitioned into component segments.

There is no interaction between artifact frequency and elevation in the Toquima woodlands. Correlation between log artifact frequency and elevation above valley floor for the west-facing Toquima woodland is only $r = 0.04$ ($df = 41$, $p = 0.189$); a similar nonsignificant correlation holds for the east-facing flank ($r = 0.16$, $df = 41$, $p = 0.291$).

But in the uplands, the correlation between log artifact frequency and elevation above valley floor is $r = -0.42$ ($df = 36$, $p = 0.008$). Artifact density drops off radically in sites and nonsites located above 2500 m above sea level.

**Elevation Above Valley Floor: Summary and Implications**

Even minor changes in verticality can influence site positioning because of the intimate relationship between elevation and temperature (Thomas, 1972a). Relative elevation was defined to monitor the vertical separation between a site (or locus) and the nearest bottomland.

In fact, slight differences in on-site temperature seem to be the single most important factor conditioning the precise placement of ecotone sites in the central Great Basin. To the west, winter temperatures are generally moderated by warm downslope winds off the Sierra Nevada (Houghton et al., 1975), but the Reese River and Monitor valleys lie too far east to benefit from such moderation. The bitterly cold winter temperatures in these central valleys commonly result from nighttime radiative cooling under the stagnant air of the Great Basin Highs (Thompson, 1983). Below zero temperatures (colder than $-20^\circ$C) are not uncommon for long periods during the winter.

Extreme winter temperature was a critical lifespace consideration throughout the central Great Basin, and sites occupied during severe winter months were positioned to maximize sources of naturally available heat. For one thing, the margins of today’s pîñon-juniper woodland generally correlate with thermal belts of relatively moderate winter
temperatures; this means that loci in the woodland zone offer correspondingly warmer average winter temperatures than similar loci at either higher or lower elevations. This may be why no apparent temperature-buffering was noted in the ecotone sample from either valley.

Winter temperatures are further moderated by storm systems moving from the west, which tend to disperse the winter inversion layers, especially in the Reese River Valley. Throughout much of central Nevada, west-facing flanks are somewhat warmer than east-facing counterparts.8

We also suspect that verticality is a more critical positioning factor in a relatively high valley like Monitor than at lower elevations, as in the Reese River Valley. At the latitude of Gatecliff Shelter, the floor of Monitor Valley is at least 95 m higher than the Reese River valley bottom; further north, at the latitude of Toquima Cave, Monitor Valley is 110 m higher than Reese River Valley (Thomas, 1983a: figs. 33 and 34). Higher overall elevations of Monitor Valley mean that this area is subjected to more severe winter temperatures, suggesting that prehistoric sites in Monitor Valley should exhibit more winter temperature-dependent positioning than equivalent Reese River sites.

Since western flanks tend to be somewhat warmer, vertical positioning should be a more critical factor on east-facing flanks. This effect is particularly exaggerated in the Toquima Range, where the eastern flank is considerably higher than the west-facing flank (Thomas, 1983a: figs. 33 and 34). All else being equal, eastern Toquima sites should manifest considerably more planning for severe winter temperatures than sites on the west-facing flank.

Our survey data confirm this suspicion. Eastern flank sites average about 50 m lower than available loci in the same area, showing that site selection deliberately favored lower loci. A similar relationship exists in the uplands, where archaeological sites are significantly lower than the average noncultural locus: Lower loci were selected in the uplands. Corresponding artifact densities in the uplands dropped off significantly with increases in elevation above the valley floor.

This positioning strategy was apparently not employed along the western flank of the

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**Fig. 210.** Elevation above valley floor for sites and loci on the western slope of the Toquima Range. The upper curve a plots the distribution of potential loci against the appropriate normal curve. The observed distribution differs significantly from normal expectation. The lower curve b plots the distribution of archaeological sites against normal expectations. There is no significant difference between observed and expected distributions.
Toquimas, where there is no elevational difference between sites and noncultural loci. Instead, western sites avoided both extremely low and high loci, concentrating toward the middle of the distribution. Although there is no difference in mean elevation between sites and loci, the site selection process created a normality from the nonnormal population of available loci, deliberately selecting for loci of intermediate elevations (rather than for the lower ones, as noted on eastern and upland flanks). The lack of selectivity for western sites is in accord with climatic and topographic parameters for Monitor Valley.

We determined earlier that lower loci in the eastern Toquima woodlands were favored for use as sites; there was no such selectivity for lower loci along the Toquima western flank. Where potential loci occur across the landscape is a given condition of nature. But positioning strategies favored those loci best suited to the needs at hand.

**DISTANCE FROM FOOTHILL MARGIN**

We have just considered **elevation above valley floor**, defined as the vertical relationship between a foothill site (or locus) and the closest valley bottomland. We now look at a second, related variable that monitors a similar relationship. **Distance from foothill margin** measures the surface distance between a site or locus and the lower margin of the foothills.9 Whereas **elevation above valley floor** focuses on vertical separation between site/locus and bottomland, distance from foothill margin reflects the degree to which a site or locus is nestled into the foothills. Whereas relative elevation is responsive to changes in temperature and precipitation, distance from foothill margin measures travel distance and general accessibility to lowland resources.

As an operational control, we employ the green woodland symbol on available USGS quad sheets to define the foothill-valley bottom margin in both Reese River and Monitor valleys.

**DISTANCE FROM FOOTHILL MARGIN: THE REESE RIVER–MONITOR VALLEY COMPARISON**

The 74 loci mapped in the 1971 ecotone survey ranged from 0 to 1400 m from the foothill margin, and were an average distance of 528.1 m from the valley floor (S = 358.64 m). This slightly platykurtic distribution (g2 = -0.703) is somewhat skewed to the right (g1 = 0.446), but the overall loci distances at Reese River do not differ significantly from those that are anticipated by the normal curve (chi-square = 5.545, df = 4).

The 63 sites on these loci average 508.0 m from the foothill margin (S = 354.39 m). Absolute difference in distance between sites and noncultural loci is not statistically significant (t = 1.148, df = 72, p = 0.254). The somewhat platykurtic distribution of relative site distances (g2 = -0.346) is slightly skewed to the right (g1 = 0.600). But site distances in the Reese River sample do not significantly deviate from the normal approximation (chi-square = 1.048, df = 4).

The 135 loci mapped in the equivalent Monitor Valley survey range from 0 to 4000 m from the foothill margin, defining a mean distance of 396.4 m from the valley bottom (S = 87.20 m, n = 133). This extremely leptokurtic distribution of relative loci distances (g2 = 15.847) is likewise skewed to the right (g1 = 3.218). The distances of loci from the foothill margin are tightly bunched about the mean, with relatively little variability; several loci occur at extreme distances from the margin. This deviation from normal expectation is highly significant (chi-square = 32.984, df = 5).

The 45 sites on these loci average 481.1 m from the foothill margin (S = 518.40 m). The noncultural loci average 353.1 m from the valley floor (S = 522.80 m, n = 88). The difference between cultural and noncultural loci is not statistically significant (t = 1.33, df = 131, p = 0.182).

Site distribution is skewed notably to the right (g1 = 1.056), with minimal kurtosis (g2 = -0.02). The frequency distribution of sites differs significantly from expectation under normality (chi-square = 12.461, df = 5).

In looking at the skewed distributions on figure 211, we thought that perhaps the data existed in lognormal form, so a logarithmic transformation was attempted to see if such regularity existed (see chaps. 16 and 17 for previous examples of logarithmic transformations of the Monitor Valley data).

When suitably transformed, the 135 loci mapped in the Reese-River-equivalent por-
Figure 211. Distance from foothill margin of sites and loci in the Reese-River-compatible portion of Monitor Valley. The upper curve a plots the distribution of potential loci against the appropriate normal curve. This extremely leptokurtic distribution is skewed to the right and differs significantly from normal expectation. The lower curve b plots the distribution of archaeological sites against a normal curve. The site frequency distribution is bimodal, platykurtic, skewed to the right, and significantly different from normal expectation.

### Distance from Foothill Margin: The Partitioned Monitor Valley Subsample

The archaeological sites recorded in this portion of the Toquima survey average 1333.2 m from the lower foothill margin ($S = 2104.22$ m, $n = 77$). Non-cultural loci occur much farther from the valley floor, an average of 2375.6 m from that margin ($S = 2790.11$ m, $n = 45$). The distance from the foothill margin is skewed to the right, but there is no evidence of deliberate selectivity: Within the study area, potential loci simply distribute this way in nature. A comparable site sample from Monitor Valley does not approach normal distribution and hence fails to fit the asymmetrical, normal probability resource model in figure 202. Although distance from foothill margin may have been a positioning consideration for Monitor Valley ecotone sites, the effect was neither regular nor marked in comparison with Reese River.
n = 181). The difference is highly significant (t = 2.93, df = 256, p = 0.002). Sites tend to be considerably closer to the foothill margin, suggesting a degree of site selectivity. But this overall relationship masks some subtle, intraregional variability, and the Toquima samples can profitably be partitioned into elevational zones.

The Eastern Toquima Flank: The east-facing Toquima woodland contains 63 loci, averaging 445.6 m from the foothill margin (S = 946.54 m). Distribution ranges between 0 and 5800 m. The distinct modes evident at zero and 100 m reflect rounding by field investigators.

This extremely leptokurtic distribution (g2 = 18.48) is also markedly skewed to the right (g2 = 4.227), reflecting a minimal variability about the mean coupled with a few extremely inflated variates. This distribution differs significantly from that expected under the normal curve model (chi-square = 35.273, df = 5).

Twenty-three east-facing loci are also prehistoric archaeological sites, averaging only 285.9 m from the foothill margin (S = 301.34 m). The remaining 40 noncultural loci average 537.5 m from the foothill margin (S = 1155.76 m). Despite a distance differential of more than 250 m, the variability is so extreme that site and noncultural locus samples do not differ statistically (t = 1.008, df = 61, p = 0.319).

But sites on the eastern flank differ greatly from available loci in their frequency distribution. As noted above, potential loci occur haphazardly and irregularly throughout the eastern Toquima Range. But culturally selected site locations define a restricted subset of available loci. Site distances from the foothill margin range only between 0 and 1000 m, and both kurtosis and skewness are heavily dampened. The site distances follow a normal distribution (chi-square = 6.125, df = 3).

In other words, prehistoric positioning created a systematic subsample of eastern Toquima loci, with a distinctive central tendency and characteristic degree of symmetrical variability about that mean.

The Toquima Uplands: The Toquima uplands contain loci varying between 0 and 8000 m from the foothill margin. Mean distance to foothill margin for these loci is 4757.2 m (S = 2453.11 m, n = 98; see fig. 212). The bimodal frequency distribution contains a number of variates clustered between 0 and 650 m, with a larger cluster centering about the mean. The rather platykurtic curve (g2 = -0.309) is badly skewed to the left (g1 = -0.696) and differs significantly from that generated from normal expectations (chi-square = 58.72, df = 6).

Sites established on selected loci average 3958.0 m from the foothill margin (S = 2689.15 m, n = 20). As with the parent distribution of loci, the site frequency distribution is bimodal, platykurtic (g2 = -1.108), skewed to the left (g1 = -0.146), and significantly different from normal expectations (chi-square = 5.77, df = 1). The remaining 79 noncultural loci in the uplands average 4962.3 m from the foothill margin (S = 2345.29 m).

Although sites and noncultural loci differ by more than 1 km in distance from the foothill margin, the difference between means is not statistically significant (t = 1.64, df = 96, p = 0.10). There is no particular selectivity with regard to distance to the foothills in the uplands (which warrants our previous decision to eliminate this variable from the definition of upland loci).

The Western Toquima Flank: The west-facing flank of the Toquimas is patterned differently. Loci are spaced an average of 395.3 m into the foothills (S = 413.04 m, n = 97), in a leptokurtic (g2 = 1.908) distribution that is skewed to the right (g1 = 1.498). Deviations from normality are statistically significant (chi-square = 34.235). Part of the irregularity results from the obvious modes at 100 and 200 m, clearly introduced by rounding errors during fieldwork. But overall deviation from normal expectations cannot be attributed strictly to field technique.

Prehistoric sites average 497.8 m (S = 470.31 m, n = 30) into the foothills. The remaining 67 loci occur much closer to the foothill margin, a mean distance of only 340.0 m from the lower foothill margin (S = 366.85 m). The difference in means is not statistically significant (t = 1.807, df = 95, p = 0.07); nevertheless, the relationship is reversed, since we expect sites to be closer to the foothill margin than noncultural loci. This culturally defined subsample is slightly platy-
kurtic \((g_1 = -0.732)\) and skewed to the right \((g_1 = 0.658)\), but deviations are not significant; the site distribution is consistent with a normal distribution \((\text{chi-square} = 8.6896, \ df = 5)\).

**Comparison of Assemblage Densities:**
Nonsite artifact distributions vary considerably relative to positioning within the foothills. For the overall Toquima Range sample, we find a significant relationship between log artifacts recovered and distance to foothill margin \((r = -0.23, \ df = 122, p = 0.01)\). That is, artifact frequencies drop off as distance to foothills increases. This tendency is particularly marked in the uplands, where the negative correlation is \(-0.32 (\df = 36, p = 0.048)\).

This trend does not hold for either woodland flank. On the eastern Toquima side, the reverse relationship occurs, with artifact frequencies increasing with distance to the foothill margin \((r = 0.42, \ df = 41, p = 0.005)\). On the western flank, the relationship between distance to foothills and artifact frequency disappears altogether \((r = -0.17, \ df = 41, p = 0.287)\).

**Topographic Intercorrelations:**
Similar relationships are apparent between distance to foothill margin and elevation above valley floor (considered earlier). One generally expects distance to the foothills to increase in proportion to increasing elevation above the valley bottom, and this is true for the overall sample of sites and loci in the Toquima Range \((r = 0.80, \ df = 271, p < 0.001)\). Similarly, with respect to site-specific distributions within the Toquimas, there is a strong relationship between elevation and distance to foothill margin \((r = 0.77, \ df = 89, p < 0.001)\). When site distributions are partitioned, this same relationship persists for both the east-facing woodland area \((r = 0.54, \ df = 34, p = 0.001)\) and for sites of the upland Toquima flank \((r = 0.69, \ df = 19, p = 0.001)\).

Something different happens on the west-facing Toquima flank, where elevation above the valley floor and distance to the foothill margin are statistically unrelated \((r = 0.09, \ df = 32, p = 0.395)\).

**Distance from Foothill Margin:**
**Summary and Implications**

Julian Steward (1938: 232) recognized the importance of the lower foothill positioning
strategy for multiseason Great Basin village encampments:

accessibility to stored seeds, especially pine nuts, water, sufficient wood for house building and fuel, and absence of extremely low winter temperatures. These conditions were most often fulfilled in the mouths of canyons or within the pine nut-juniper belt in the mountains... Encampments tended to cluster with respect to mountain masses rather than valleys. But whether they were scattered at intervals of several hundred yards to a mile along streams, situated at springs on mountainsides, or were clustered in dense colonies depended upon the quantity of foods which could be gathered and stored within convenient distance of each camp.

Specifically with respect to the Reese River ecotone, Steward (1938: 101) observed that “camp sites... were conveniently located, for the mountains behind them afforded pine nuts, roots, and seeds, while the low and partly marshy valley floor provided seeds and roots, most of which grew within 4 or 5 miles of each camp.”

Although five decades have passed since Steward’s discussion, his data and exposition clearly presage the modern edge effect concept. The lower foothill margin is a functional ecotone between diverse communities, a “junction zone or tension belt which may have considerable linear extent but is narrower than the adjoining community areas themselves” (Odum, 1971: 157). Resource diversity and density are greater here than in immediately flanking communities—not just with respect to foodstuffs, but also firewood, moderate climate, water, and sheltered flat ground.

The lower foothill margin also offers a degree of microtopographic protection from severe winter storms. As noted earlier, Pacific frontal systems in the Toiyabes tend to reduce inversion and concentrate piñon-juniper woodland into a restricted, beltlike distribution. Archaeological data from Reese River strongly support a lower foothill positioning strategy; the 65 recorded sites clustered an average of about 500 m from the lower foothill margin, just as Steward’s ethnographic model suggested they would.

Comparable sites in Monitor Valley do not follow this model. Although mean distance to foothills is similar to that in the Reese River Valley, the Monitor sites are distributed very differently. Rather than following the expected normal distribution, ecotone sites in Monitor Valley tend to cluster within about 400 m of the margin and then scatter upward in no particular pattern.

But the Reese-River-compatible portion of the Monitor Valley survey sample obscures the differential positioning strategies operating within the Toquima Range. In the eastern Toquima woodlands, sites are closer to the foothill margin than noncultural loci. And whereas locus distribution is irregular, the site selection process creates a unimodal, symmetrical normal distribution. East-facing Toquima sites provide clearcut evidence of deliberate selectivity favoring loci closer to the foothill margin, fully in accord with the asymmetrical, linear model in figure 204.

Western flank sites also show selectivity, but in the opposite direction. The distribution of western loci is decidedly skewed to the right, but the subsample of site-selected loci approaches symmetry. The site selection process has created, in effect, a normally distributed site sample from the originally skewed population of available loci. Unlike that on the eastern flank—where loci closer to the foothill margin were favored—the site selection strategy on the western Toquima flank favored loci more distant from the ecotone (sites in the western Toquimas averaged 150 m farther away from the lower foothill margin than noncultural loci). Dozens of otherwise satisfactory loci were available much closer.

This relationship may result from the patchy distribution of woodland vegetation across the west-facing flank. The Monitor Valley woodland zone is not directly subjected to moisture-laden Pacific frontal systems as is the Reese River, and, as a result, temperature inversions have created broader, less circumscribed stands of woodland vegetation, especially along the west-facing flank. The Monitor Valley woodland thus lacks a sharply defined lower margin, and there is no evidence of an “edge effect.”

Because the upland sites occur several kilometers from the ill-defined lower foothill margin, no “edge effect” is expected to operate here. Nonsite artifact distributions in the Monitor Valley uplands drop off significantly with increased distance from the foothills.
The Monitor Valley elevational samples thus reflect different positioning strategies relative to the foothill margin. Eastern Toquima sites were deliberately selected to minimize distance to the ecotone; as at Reese River, an edge effect is evident. But sites in the western Toquimas were positioned to maximize distance from the lower foothill margin, negating any potential edge effect. No demonstrable selectivity operates for upland sites.

**DISTANCE TO NEAREST WATER**

Access to potable water is a universal of human residential settlement, but the surface distribution of water varies widely: perennial streams, springs, lakes, ephemeral seeps, rainwater catchment cisterns, subsurface aquifers, freshwater lenses, seasonal snowpacks, and so forth. Because many such sources, particularly in desert areas, lack archaeological visibility, we commence research with the most accessible, visible, low-cost water sources. Should these resources fail to account for observed site distributions, one would be forced to look into the more expensive sources of water.

**DISTANCE TO NEAREST WATER: THE REESE RIVER–MONITOR VALLEY COMPARISON**

The 74 loci from the 1971 Reese River survey range from 20 to 1500 m from the nearest water source, defining an average distance of 470.0 m ($S = 369.27$ m). This slightly leptokurtic distribution ($g_2 = 0.836$) is also skewed to the right ($g_1 = 1.208$), but the overall distances to water do not differ significantly from those anticipated by the normal curve (chi-square = 8.830, df = 4).

The 63 sites on these loci average 427.4 m from nearest water ($S = 340.31$ m). The difference in distance from water between sites and noncultural loci is statistically significant ($t = 2.434$, df = 72, $p = 0.017$). Locii closer to water were clearly selected for utilization. The site distributions remain leptokurtic ($g_2 = 1.656$) and slightly skewed to the right ($g_1 = 1.386$), but site distances in the Reese River sample do not significantly deviate from the normal approximation (chi-square = 6.598, df = 4).

These site distributions from water correspond to the symmetrical, linear probabilistic model set out in figure 204. We will compare the Reese River situation with that in Monitor Valley, but before so doing, it is necessary to modify the a priori model somewhat.

Although linear water sources can be found in Monitor Valley, they are rare, and relatively few sites occur in association with streams or creeks. Most low-elevation sites in Monitor Valley are near small springs that flow for a couple of hundred meters, then dry up. Such point water sources have different spatial implications, and we earlier considered a concentric probabilistic model for them (fig. 205). But despite differences in physical configuration between linear and concentric models, the resource-specific positioning behavior behind each model is identical.

The 135 loci mapped in the equivalent Monitor Valley survey range from 50 to 1100 m from the nearest water source, defining a mean distance of 575.6 m ($S = 298.37$ m, $n = 134$). This platykurtic distribution of relative loci distances ($g_2 = -1.096$) is slightly skewed to the right ($g_1 = -0.28$): That is, an unexpectedly large proportion of loci occur immediately proximate to water, and relatively few loci correspond to the mean distance. The deviation from normality is highly significant (chi-square = 12.802, df = 4).

The 46 sites on these loci average 447.8 m from nearest water ($S = 289.77$ m, $n = 45$). The site distribution remains platykurtic ($g_2 = -1.133$) and skewed to the right ($g_1 = 0.251$). The difference between this empirically observed frequency distribution and normal expectation is statistically significant (chi-square = 9.4312, df = 3). The Monitor Valley site distributions thus do not correspond to an a priori probabilistic model, even with necessary changes to take into account the local configuration of water sources.

**DISTANCE TO NEAREST WATER: THE PARTITIONED MONITOR VALLEY SUBSAMPLE**

A more complete picture of the water-tethering process emerges when the entire Monitor Valley area is considered. Archaeological sites in the Toquima sample are spaced an average of 559.6 m from water ($S = 323.56$ m, $n = 77$). Nonutilized loci are slightly fur-
ther away, an average distance of 616.16 m from water ($S = 278.83$ m, $n = 181$), but this difference is not statistically significant ($t = 1.414$, df = 256, $p = 0.077$ for a directional test). These overall trends can be dissected in several complementary ways.

The Eastern Toquima Flank: The 63 available loci on the eastern Toquima flank average 610.3 m from nearest water source ($S = 328.53$ m). This frequency distribution is decidedly skewed, not consistent with a normal distribution (chi-square = 20.838, df = 10). The archaeological sites average 519.6 m from nearest water ($S = 394.18$ m, $n = 23$). Although this bimodal distribution tends to cluster toward 500 and 1000 m, the deviations are not large, and overall site positioning is consistent with a symmetrical normal distribution (chi-square = 13.003, df = 10). Those loci not converted to sites occur an average of 662.5 m from water ($S = 270.53$ m, $n = 40$). This difference is statistically significant ($t = 1.673$, df = 61, $p = 0.048$ for a one-tailed test).

The Upland Toquima Flank: The 98 loci on the upland Toquima flank occur a mean distance of 576.3 m from nearest water ($S = 294.49$ m). The distribution is somewhat platykurtic ($g_2 = -0.308$) and skewed to the left ($g_1 = -0.696$), not following a normal distribution (chi-square = 26.5708, df = 8). Archaeological sites average 570.0 m from the nearest water ($S = 295.87$ m, $n = 20$). Although the subset of loci utilized as sites retains a similar mean distance from water, the site distributions closely follow a symmetrical normal curve (chi-square = 9.730, df = 8), although the platykurtic form persists ($g_2 = -1.108$; $g_1 = -0.146$). Those loci not used as sites average 577.9 m from water ($S = 294.11$ m, $n = 78$); this is not a statistically significant difference ($t = 0.106$, df = 96, $p = 0.456$ for a one-tailed test).

The Western Toquima Flank: Finally, loci on the western flank average 615.4 m from water ($S = 267.14$ m, $n = 97$). As in the woodland, loci are scattered across the landscape and do not conform to a normal distribution (chi-square = 28.1374, df = 9). Roughly one-third of the potential loci were transformed into archaeological sites, which average 580.6 m from the nearest water ($S = 280.89$ m, $n = 34$). But in this case, the site distributions range between 0 and 1000 m from water, and do not follow a normal distribution either (chi-square = 20.1131, df = 9). The remaining noncultural loci average 634.1 m from water ($S = 257.48$ m, $n = 63$). This difference is not statistically significant ($t = 0.936$, df = 95, $p = 0.323$ for a one-tailed test).

Comparison of Assemblage Densities: There is no correlation between artifact density and distance to water throughout the Toquima Range ($r = 0.07$, df = 122, $p = 0.439$). Significant correlations also fail to emerge when the Toquima-wide sample is partitioned.

Distance to Nearest Water: Summary and Implications

The contemporary Reese River Valley is relatively well watered, and there is every reason to suspect this area was more mesic than most mid-Basin valley systems during the Holocene. Most water is concentrated in flowing channels, largely montane feeder streams that ultimately drain into the north-flowing Reese River itself. This hydrological regimen is clearly related to the distribution of ecotone sites in the Reese River Valley.

The mean distance from water is comparable between the two neighboring valleys, but we find differences in the way sites are positioned across the landscape. Plenty of water-tethered loci were available for habitation in both Reese River and Monitor valleys. At Reese River, most such loci contained evidence of prehistoric utilization, and the 63 Reese River ecotone sites generally were found near semipermanent sources such as San Juan, Cottonwood, and Washington creeks. Site distances to water closely fit a linear, symmetrical probabilistic model (fig. 204), describing parallel, bell-shaped site frequencies extending along both sides of these creeks. The most probable location for an archaeological site occurs at the parametric mean; as distance from mean increases, probability of site occurrence drops. Because most loci at Reese River had sites on them, the degree of locus-selectivity is quite low. We are unable to monitor specific decision-making in such cases: Both site and loci distributions correspond to normal approximations.

By contrast, archaeological sites are found
on fewer than half the available Monitor Valley loci. Since one of every two apparently suitable loci was rejected, Monitor Valley provides a test case for exploring the dynamics and ranking of locus-defining criteria.

Water-tethered behavior in Monitor Valley varied significantly by elevational zone, and three different positioning strategies can be identified. On the Toquima upland flank, where water is exclusively a point resource, there is no difference between the site spacing and the occurrence of noncultural loci. But there are important differences between the frequency distributions of sites and loci. Upland loci are irregularly distributed relative to nearest water source, and less than ¼ of these contained archaeological sites. This subset of deliberately selected loci conforms closely to an expected normal distribution.

In other words, although the overall distribution of loci is skewed, the frequency of upland sites relative to water corresponds to a concentric resource model (fig. 205). We find no behavioral difference between the Reese River and upland Monitor Valley sites because observed spatial differences can be attributed to differing resource configuration. Decision-making in the Monitor Valley case is particularly evident because of the low site/locus ratio.

Selecting a nonrandom, normally distributed sample from a skewed population illustrates how upland Monitor Valley sites were deliberately positioned relative to nearest water source: There is clearly a site positioning strategy involving optimal spacing relative to water. The process of locus-selection obviously involved a biased choice of what was available. Decision-making did not significantly modify the mean distance to water between upland sites and loci, but the frequency distribution was significantly truncated: Loci too close and those too distant were deliberately avoided.

A different strategy operated along the eastern Toquima flank, where both distance and distribution relative to water differed between sites and loci. Loci averaged about 600 m from nearest water source and these were not normally distributed. Less than 40 percent of these loci were utilized as prehistoric archaeological sites, and as in the uplands, microtopographic site selection generated a normally distributed sample from a distinctly skewed population.

Several eastern flank loci were apparently judged to be an unacceptably long distance from water; sites were closer to water. This filtering process is nonrandom, and the mean distance to nearest water was reduced from about 610 m (for all loci) to 520 m (for the subset of archaeological sites). Both absolute distance and frequency distribution differed between site and loci.

On the eastern Toquima flank, expected and observed site distributions also conform to a concentric resource model (fig. 205). But these sites are distributed in a high-probability doughnut with the central tendency about 50 m tighter than for upland sites: Sites were selected relatively closer to water, with an unexpected degree of symmetrical variability about that central tendency.11

Sites on the western Toquima flank involved a third positioning strategy relative to water. As in the rest of Monitor Valley, the available habitation loci are irregularly distributed, with a mean distance from the nearest water of 615 m. About 35 percent of the loci were converted to archaeological sites.

Unlike the normal site distributions observed elsewhere in the Toquimas, actual site locations on the western flank were selected randomly relative to water. That is, loci on the western flank occur in haphazard distribution relative to water, and this lack of patterning is retained in sites actually utilized. The skewed distribution of site positioning makes it clear that a single strategy of site location relative to water was lacking on the western Toquima flank. Archaeological sites on the western Toquima flank do not fit any anticipated probability model for water resources.

This analysis defines three rather different approaches to water-tethering, all played out in the Toquima Range of central Nevada. On the western flank, neither central tendency nor overall distribution differ between sites and loci. Site positioning is not anticipated by any a priori probabilistic model; site locations on the western flank were conditioned by factors other than distance to nearest water.

On the eastern Toquima flank, several available loci were apparently too far from water; these distant loci were deliberately
avoided. Archaeological sites occur significantly closer to water than noncultural loci; this site selection process created a normally distributed cultural sample from a skewed population of naturally occurring loci. Thus site and loci distributions differed both in central tendency and frequency distribution. Here, site locations were chosen according to the expected concentric probability distribution on figure 205.

Upland loci occur somewhat closer to water, on the average, than loci on the eastern flank. Accordingly, the general locus spacing was retained by eliminating a roughly equal number of loci considered to be too close or too distant from water. As on the western flank, a normally distributed sample was culturally generated from a skewed population of naturally occurring loci, following the expected concentric probability distribution on figure 205. Humans, not topography, determined which loci became sites.

**LANDFORM**

Landform was selected primarily in response to foul weather considerations: Camps in the piñon-juniper woodland enjoy warmer winter temperatures than sites at either higher or lower elevations; west-facing flanks tend to be somewhat warmer than their east-facing counterparts; canyon bottomlands are rarely utilized because the nearby elevated ridges avoid the frigid downslope cold air drainage.

The initial polythetic criteria employed at Reese River stressed the importance of landform, and during our fieldwork at Reese River and in Monitor Valley, we recorded landform for all sites and loci. Below, various comparisons will be made using three relatively simple nominal categories: ridge, saddle, and “other” (primarily benches, knolls, washes, meadows, draws, sidehills, and outcrops).

**LANDFORM: THE REESE RIVER–MONITOR VALLEY COMPARISON**

In the Reese River survey, loci occurred on 60 ridges, 7 saddles, and 7 additional landforms (particularly steep hillsides and washes). Corresponding loci in Monitor Valley were found on 101 ridges, 21 saddles, and 13 other landforms (especially benches, knolls, and washes). Although the Monitor Valley survey area contained proportionately fewer ridges and relatively more saddles than Reese River, there is no statistically significant difference between the survey areas in terms of landform distribution (chi-square = 1.99, df = 2, p = 0.370). Accordingly, differential site positioning relative to landform must result from differences in decision-making rather than regional geomorphic variability.

The 63 Reese River sites were distributed as follows: 82.5 percent (52 of 63) on low ridges, 11.1 percent (7 of 63) on saddles, and the remaining four sites on various other landforms. Comparable Monitor Valley sites were distributed in a rather similar fashion: 82.6 percent (38 of 46) also on ridges, 8.7 percent (4 of 46) on saddles, and the remaining four sites scattered across other landforms. Overall landform proportions between valleys are not statistically different (chi-square = 5.62, df = 2, p = 0.060). We conclude that the Monitor and Reese River Valleys are similar both with regard to natural distribution of landforms and the proportionate utilization of each landform for archaeological sites.

The major difference between the two valleys is relative intensity with which available landforms were used. At Reese River, most potential loci had archaeological sites on them: 86.7 percent (52 of 60) of the suitable ridges contained archaeological sites; all (7 of 7) the suitable saddles contained sites; 57.1 percent (4 of 7) of “other” loci-based landforms were associated with archaeological sites.

Comparable Monitor Valley loci were utilized far less intensively: 37.6 percent (38 of 101) of the suitable ridges contained archaeological sites; 19.0 percent of the loci-positioned saddles (4 of 21) contained sites; 30.8 percent (4 of 13) of the “other” available landforms had sites on them.

**LANDFORM: THE PARTITIONED MONITOR VALLEY SUBSAMPLE**

The relationship between site positioning and landform can be further explored using the locus-controlled sample from Monitor Valley (as defined above; see also table 87).
Nearly three-quarters (173 of 244) of all potential loci are on ridges. Almost 20 percent (46 of 244) of the loci occur on saddles. Archaeological sites were found on slightly more than one-quarter of the available loci, in the following distribution: 64.2 percent (43 of 67) were ridgetop sites, 17.9 percent (12 of 67) of the sites were constructed on saddles, and the remaining 12 sites occurred on other landforms such as benches, washes, and sidehills.

This means that landform utilization is nonrandomly distributed (chi-square = 9.79, df = 2, p = 0.007); throughout Monitor Valley, there is a slight (but significant) bias favoring ridges and “other” landforms. Saddles in this area were disproportionately underutilized.

The Monitor Valley sample is partitioned as before. Site positioning on the western Toquima flank follows the general trend: whereas most sites (23 of 29) occur on ridges and saddles, a disproportionate number of the “other landforms” (6 of 6)—particularly benches and dry washes—contain archaeological sites. This tendency is statistically significant (chi-square = 13.29, df = 2, p = 0.001).

This trend is not evident elsewhere in the Toquima survey area. Nearly 85 percent of the sites (15 of 18) in the eastern Toquima woodlands are found on saddles and ridges, but only three sites exist on the seven “other” landforms recorded. Similarly in the uplands, 85 percent (17 of 20) of the sites occur on ridges or saddles, with the remaining three sites on “other” landforms. Neither association between archaeological sites and landforms is statistically significant (eastern woodland: chi-square = 2.78, df = 2, p = 0.249; uplands: chi-square = 1.62, df = 2, p = 0.443).

**Comparison of Assemblage Densities:**

There is no assemblage correlate to landform configuration. The flatter saddles of the western flank may actually have been avoided, since only 23.5 percent (4 of 17) have archaeological sites present. In the eastern area, half (5 of 10) of the saddles contained archaeological sites. This finding corresponds with the earlier conclusion that percent slope operates only as a positioning threshold, not a metric gradient for decision-making.

**Topographic Intercorrelations:**

Landform is, as might be expected, closely correlated with percent slope. Saddles provide the flattest surface area in the Toquima-wide sample, averaging only a 3.33 percent gradient (S = 2.73%). Ridges have a mean slope of 4.54 percent (S = 2.68%). Other recorded landforms—benches, knolls, washes, draws, sidehills, and so forth—tend to be steeper, with a mean slope of 5.48 percent (S = 7.50%).

The variability in average slope is statistically significant (F = 3.683, df = 253, p = 0.026). This trend is particularly evident in the west-facing Toquimas, where the 17 observed saddles are nearly flat, with an average slope of only 1.76 percent (S = 0.97%). Saddles in the eastern woodland area are considerably steeper, sloping an average of 5.50 percent (S = 3.80%).

Geomorphic landforms are randomly distributed relative to elevation above valley floor (F = 1.542, df = 254, p = 0.214), and when this overall sample is partitioned, there is no significant elevational sorting of landforms in the Toquima woodlands (F_east-facing flanks = 0.293, df = 69, p = 0.751; F_west-facing flanks = 1.161, df = 87, p = 0.381). But upland saddles have a mean elevation of 699.2 m above valley floor (S = 117.88 m, n = 19), whereas ridges average 612.0 m above the valley floor (S = 132.92, n = 69). The other nine recorded geomorphic landforms are lower still, an average of 591.1 m above the valley floor (S = 137.36 m). The elevational difference between ridges and saddles is statistically significant (t = 2.579, p = 0.036), as is that for all three landforms considered simultaneously (F = 3.703, df = 96, p = 0.027).

There is thus a high-altitude differentiation in landform distribution throughout the Toquima uplands, with saddles being located an extreme distance above the valley floor. But as with slope, there is no cultural response to this elevational difference: saddles are utilized precisely in proportion to their availability in the uplands.

Distribution of geomorphic landforms in the Toquimas is also closely correlated with distance to available water. For the Toquima-wide sample, saddles are an average of 701.7 m away from the nearest semipermanent water source (S = 241.65 m, n = 48).
Ridges are significantly closer, averaging only 598.9 m from water ($S = 317.07$, $n = 184$). Additional landforms tend to be even closer to water, with an average distance of only 456 m ($S = 338.61$, $n = 23$). The mean of each of the three groups is significantly different from that of the others ($F = 5.109$, df $= 254$, $p = 0.007$).

This apparent relationship derives strictly from the positioning of sites and loci within the uplands. Upland saddles occur an average of 833.2 m away from the nearest water source ($S = 165.87$, $n = 19$). Ridges are significantly closer, averaging 538.0 m from water ($S = 311.44$, $n = 69$). Other landforms are even closer to water, with an average distance of only 402.2 m ($S = 274.22$, $n = 9$). The mean of each of the three groups is significantly different from the others ($F = 9.912$, df $= 96$, $p < 0.001$). There is no demonstrable cultural response to the elevational differentiation in upland landforms.

**LANDFORM: SUMMARY AND IMPLICATIONS**

Although minor differences in prehistoric utilization of landform exist between the Reese River and Monitor valleys, more than 90 percent of the sites in both areas occur on ridges or saddles.

We find little variation in landform use throughout the Toquima Range. Site positioning on the western flank favors utilization of “other” landforms (particularly benches and dry washes); but even in this extreme case, ridgetop and saddle positioning accounts for more than three-quarters of the recorded sites.

The intensity of utilization differs greatly between the two target valleys. Most acceptable microtopographic environments were utilized as sites at Reese River; but in Monitor Valley, only a small proportion of similar landforms had been so used. Coupled with independent evidence enumerated below, this strongly suggests that the Reese River ecotone was much more intensively utilized than the Monitor Valley counterpart.

The advantages of ridgetop and saddle settlement are not difficult to understand: relatively warmer winter temperatures than surrounding areas, immediate availability of flat ground, upland and lowland food resources, proximity to flowing water, and ready access to ample supplies of wood for shelter and warmth.

Because ridges and saddles are common in the central Great Basin, landform rarely constitutes major primary limiting factor in site positioning. Topography functioned as a relatively passive constant in such decision-making. This is an important consideration because site positioning strategies can thus be readily adjusted to accommodate to seasonal (or annual) availability of critically variable resources (such as food, water, and fuel).

Like percent slope, differential landform utilization operated as a threshold, defining a cut-off point which site positioning rarely exceeded. Living on a ridgetop or saddle approached a necessary, but hardly sufficient condition for site positioning strategies in both target valleys.

**ASPECT**

Aspect clearly conditioned the positioning of prehistoric settlements in the central Great Basin. Solar orientation influenced which caves and rock-shelters were utilized, the doorway direction of aboriginal houses in the Toquima Range, and which ridgetops and saddles were selected for utilization in both Reese River and Monitor valleys.

**ASPECT: THE CAVES AND ROCK-SHELTERS OF MONITOR VALLEY**

Solar aspect has probably influenced site utilization patterns since at least the Upper Paleolithic. De Sonneville-Bordes (1960) noted that Magdalenian occupations in the Perigord are often found along south-facing slopes and cliff faces; similar positioning is evident in the Upper Paleolithic sites of Epirus, north-western Greece (Higgs and Web- ley, 1971; Legge, 1972).

White (1983) has explored the dynamics of cave orientations by assembling a comprehensive sample of nearly 200 Upper Paleolithic cave sites from the Perigord region, southwestern France. A decidedly southern exposure is characteristic of the majority of these sites, and may also hold for artificially constructed houses of the same period.

We began looking at aspect by observing
the orientations of 11 excavated sites described in this volume (see also Thomas, 1983b). Specifically, we were curious to see whether the inhabited caves and rock-shelters of Monitor Valley were selected to face south.

Figure 213 provides striking confirmation of a south-facing locational strategy: More than half of the inhabited caves and shelters are situated with a distinctive southern exposure. Six sites face toward the south: Gatecliff Shelter (180°), Triple T Shelter (180°), Toquima Cave (180°), Grenouille Verte Cave (180°), Butler Ranch Cave (160°), and Little Empire Shelter (160°). Bradshaw Shelter (135°) is oriented to the southeast, and Hunts Canyon Shelter (235°) faces southwest. Jeans Spring Shelter faces west, along an azimuth of 270°, and its utilization as a temporary hunting station and ambush locale reflects its anomalous orientation. At this site, "aspect" was critical only in the sense that...
ambush cover is provided relative to the nearby spring (it is). In such cases, only microtopographic orientation is involved, and solar aspect becomes irrelevant.

Two additional Monitor Valley sites are oriented facing north. The deposits of Boringas-Hell Shelter—a tiny endogene cave suitable only for extremely short-term protection from adverse elements—were found to be virtually sterile; because this site had no occupational potential, aspect seems not to have mattered.

But north-facing Ny1059 (350°), with sufficient interior space and a source of water nearby, could easily have been utilized at least as intensively as, say, Butler Ranch Cave. But the archaeological record of Ny1059 makes it clear that such utilization did not occur. That this north-facing site was virtually ignored prehistorically is consistent with a south-facing solar maximization strategy.

There is a problem here, however. For studies such as this to be fully convincing, it is necessary to inventory orientations of strictly noncultural caves and shelters as well. Such a survey would, in effect, correspond to the locus-controlled survey we conducted of the open sites and nonsites in Monitor Valley. While our conventional cave and shelter survey sufficiently documents some of the caves people chose to use, we lack reliable data regarding caves and shelters that prehistoric people chose to ignore.

But even lacking a comprehensive noncultural cave survey, it remains my distinct impression that most north-facing caves in the central Great Basin lack evidence of significant prehistoric utilization. Most utilized caves and shelters in this area face southward.

**Aspect: Aboriginal Houses in Monitor Valley**

As documented elsewhere in this monograph, 20 aboriginal house foundations were recorded in various phases of the Monitor Valley survey. We could identify doorway orientations in only six of these houses. Figure 214 shows that five of these doorways open to the east or southeast and one entryway faces toward the northwest. Although an expanded sample of properly recorded house foundations from this area will surely provide more reliable insights into house positioning, these data suggest that artificially constructed houses may have been oriented in systematic fashion.14

**ASPECT: THE REESE RIVER-MONITOR VALLEY COMPARISON**

Roughly 90 percent of the ecotone sites in the Reese River Valley and another 80 percent of equivalent Monitor Valley sites occur on ridges and saddles. But geomorphic landform aside, most of these loci also have an intrinsic directionality: the west-facing ridge, the north-facing bench, the south-trending wash. It was possible to assess such directionality for most sites and loci discussed here, and these data demonstrate a nonrandom selection for aspect.

For the 74 loci mapped in the 1971 piñon ecotone survey at Reese River, we assessed aspect in 63 cases: 6 loci are north-facing, 5 loci are east-facing, 4 are south-facing, and 48 face to the west. Associated archaeological sites had the following aspect: 5 sites are north-facing, 5 are east-facing, 4 face south, and 39 are west-facing. Although sample sizes are too small to permit valid statistical comparisons between sites and noncultural loci, there is no apparent selectivity with regard to aspect along the western Toiyabe flank.

The following orientations were recorded on 104 of the 135 equivalent Monitor Valley loci: 23 loci occurred on north-facing slopes, 40 loci on east-facing slopes, 12 loci on south-facing slopes, and 29 loci on west-facing slopes. Correlative Monitor Valley sites were oriented as follows: 13 sites occurred north-facing slopes, 20 on east-facing slopes, 2 on south-facing slopes, and 4 on west-facing slopes. This is a highly significant difference in aspect between archaeological sites and noncultural loci (chi-square = 15.39, df = 3, p = 0.002). For Monitor Valley in general, both south- and west-facing slopes seem to have been avoided.

This overall relationship comes into clearer focus when the Monitor Valley sample is subdivided into eastern and western components, as before. The following orientations were recorded on the eastern Toquima
Fig. 214. Orientations of prehistoric house doorways in Monitor Valley.

Slope: 9 loci occurred on north-facing slopes, 22 on east-facing slopes, 10 on south-facing slopes, and 7 on west-facing slopes. Archaeological sites associated with these loci were oriented as follows: 7 sites occurred on north-facing slopes, 8 on east-facing slopes, 2 on south-facing slopes, and 4 on west-facing slopes. There is no statistically significant relationship between aspect and site selectivity on the eastern Toquima slope (chi-square = 7.52, df = 3, p = 0.057).

A very different pattern pertains on the western Toquima slope, where loci were oriented as follows: 14 loci occurred on north-facing slopes, 18 on east-facing slopes, 2 on south-facing slopes, and 23 on west-facing slopes. Archaeological sites recorded on these loci were oriented as follows: 6 sites occurred on north-facing slopes and 12 on east-facing slopes; sites were absent on both south- or west-facing slopes. There is a highly significant difference in aspect between archaeological sites and noncultural loci (chi-square = 22.61, df = 3, p > 0.001).

The two valleys obviously differ greatly with respect to landform orientation. At Reese River, we see a very high proportion of west-facing loci, reflecting the regularized arrangement of ridges along the west-facing Toiyabe Range. No such regularity exists on Toquima Range, where loci occur in all directions (with only a slightly higher proportion of east-facing slopes, and a lower percentage of south-facing slopes).

It is true, of course, that whereas the Reese River ecotone sites existed on the west-facing Toiyabe Range, the Monitor Valley sample spans both western and eastern Toquima slopes. But the difference between the two valleys persists even when we restrict the
Monitor Valley sample to the western Toquima slope.

**ASPECT: THE PARTITIONED MONITOR VALLEY SUBSAMPLE**

Aspect of loci throughout the Toquima Range is distributed as follows: 55 loci occurred on north-facing slopes, 58 on east-facing slopes, 43 on south-facing slopes, and 54 on west-facing slopes. Archaeological sites on these loci had the following aspect: 15 sites occurred on north-facing slopes, 21 on east-facing slopes, 14 on south-facing slopes, and 14 on west-facing slopes. Aspect does not differ significantly between archaeological sites and noncultural loci (chi-square = 1.78, df = 3, \( p = 0.619 \)).

When the overall Monitor Valley sample is partitioned, we find surprising variability in aspect. In the eastern Toquimas, we measured aspect on 45 of 63 recorded loci: 8 loci occurred on north-facing slopes, 23 on east-facing slopes, 8 on south-facing slopes, and 6 on west-facing slopes. The 16 archaeological sites on these loci were oriented as follows: 5 sites occurred on north-facing slopes, 7 on east-facing slopes, 1 on a south-facing slope, and 3 on west-facing slopes. There is apparently no deliberate selectivity for orientation in the eastern Toquimas (chi-square = 5.2, df = 3, \( p = 0.158 \)).

On the west-facing Toquima slope, we determined aspect for 79 of the 97 loci: 13 loci occurred on north-facing slopes, 19 on east-facing slopes, 9 on south-facing slopes, and 38 on west-facing slopes. Archaeological sites on these loci were oriented as follows: 6 sites occurred on north-facing slopes, 13 on east-facing slopes, 3 on south-facing slopes, and only 8 on west-facing slopes. As in the Reese-River-compatible subsample of the western Toquima sample, sites were disproportionately positioned on east-facing loci; west-facing loci seem to have been deliberately avoided (chi-square = 12.54, df = 3, \( p = 0.006 \)).

On the upland slope, aspect was measured on 86 of 98 potential loci: 34 occurred on north-facing slopes, 16 on east-facing slopes, 26 on south-facing slopes, and 10 on west-facing slopes. Archaeological sites on these loci were oriented as follows: 4 occurred on north-facing slopes, one on an east-facing slope, 10 on south-facing slopes, and 3 on west-facing slopes. This is a statistically significant association (chi-square = 9.13, df = 3, \( p = 0.028 \)). South-facing loci were differentially selected, with avoidance of east- and north-facing aspect.

South-facing archaeological sites likewise tend to have higher artifact densities than sites oriented in other directions. Although artifact density and aspect are unrelated in the overall Monitor Valley sample (\( F = 1.567, \text{df} = 70, \ p = 0.204 \)), when taken two at a time, we find an average of 1.18 artifacts per south-facing site (\( S = 0.49, \ n = 16 \)), but only 0.84 artifacts per north-facing site (\( S = 0.40, \ n = 19 \)); this trend is not statistically significant (\( t = 2.14, \ p = 0.057 \)) for the overall sample. But in the partitioned sample, artifact density and aspect significantly covary across the upland slope (\( F = 3.427, \text{df} = 31, \ p = 0.030 \)). Specifically, artifact density is relatively low on both the north-facing (0.33 items per site, \( S = 0.32, \ n = 12 \)) and east-facing uplands (0.36 items/site, \( S = 0.36, \ n = 4 \)). Artifact densities are significantly higher on the west- (1.07 items/site, \( S = 0.84, \ n = 3 \)) and south-facing slopes (0.84 items/site, \( S = 0.54, \ n = 13 \)).

**ASPECT: SUMMARY AND IMPLICATIONS**

The caves and shelters in Monitor Valley were selected for their southern exposure. Houses were constructed with doorways positioned to the east. The orientations of utilized geomorphic landforms were at times selected in nonrandom fashion. A number of available explanations could account for this behavior.

Some might favor a calendric explanation, perhaps employing solar time-factoring to account for the observed orientations. Others might find a ritual explanation more satisfying, in which site aspect is accounted for by the specifics of past magicoreligious behavior. Still others might choose to invoke more strictly environmental causality: Most caves face south simply because of geological structures; most houses face east because of local wind conditions; landforms were differentially selected only because of canyon-to-canyon geomorphic variability, not any underlying positioning strategy.
While these (and other) ad hoc explanations may have merit, I explore the relevance of passive solar radiation not only because of its testability, but also because of its applicability well beyond the specifics of central Great Basin prehistory. If, as I believe, human shelter is commonly oriented with energy concerns in mind, then we should find such repetitive positioning behavior in the archaeological record throughout the world. Not that all caves should face south; but we do think that the processes of energy capture are sufficiently pervasive for people to have exploited the solar advantage time and time again, creating a behaviorally consistent (and archaeologically) visible record.

Consider first the orientations of Monitor Valley caves and shelters, since site positioning relative to aspect is most pronounced for these naturally occurring enclosures. Such selectivity is somewhat surprising because in many (if not most) cases, we think that site locations are conditioned by variability in local distribution of critical resources. Caves exist in fixed geographical space, usually offering little more than minimal lifespace conditions (see chap. 17). Even moderate residential mobility assumes flexibility in choosing where to build one’s house, and rarely do caves occur in precisely the right place. This is why most of the archaeological record in this area occurs on ridgetops and saddles rather than inside rock-shelters.

Further, it is well established that resource diversity, seasonality, and patchiness generally increase with latitude (Kelly, 1983): Whereas equatorial foragers move to position labor forces and consumers relative to comparatively low-level resource variability, high-latitude hunter-gatherers position people with respect to particular food species that are highly variable in both time and space (Binford, 1980: 16–17). If relative mobility is a function of latitude, then one expects systematic utilization of caves and shelters to be considerably more common in the low-latitude, low-variability setting (e.g., Seligmann and Seligmann, 1911; Peralta, 1981), and less advantageous for mid- and high-latitude hunter-gatherers.

However, occasionally environmental concerns override local resource variability, even in high latitudes. At times, the distinctive cave microclimate becomes itself a relevant positioning factor. Particularly in areas subject to extreme heat and cold, cave environments can provide what Legge (1972) termed the “highly preferred site.” In specialized and restricted seasonal contexts, suitably oriented caves offer shelter superior to that available in artificially constructed dwellings.

There are two reasons for this: Absolute insulation and relative solar gain. According to standards assembled by the American Institute of Architects (1981: 77–86), three primary factors—wind, solar radiation, and air temperature—determine optimal orientation for contemporary residences. Of these, incoming solar radiation is considered to be most critical.15

Direct thermal impact has been of concern to builders for millennia, and solar radiative processes have conditioned where people lived for even longer. It is well known that in the Northern Hemisphere, a south-facing aspect provides certain solar advantages (see table 88).

But aspect can assume a distinctly seasonal role. At the latitude of Monitor Valley (roughly 40°), the south side of a structure receives nearly twice as much radiation in the winter as during the summer. Moreover, in places like Monitor Valley, southern aspects receive nearly three times the winter-time solar radiation as east- or west-facing slopes (and more than 12 times that of a northern exposure). But during the summer months, southern exposures receive only about 65 percent that of eastern or western aspects (though still twice that of north-facing slopes).

The summer sun usually does not fully penetrate the interior of a south-facing rock-shelter (fig. 215). Sunshine will strike a sheer south cliff face during midmorning and disappear from this vertical surface by midafternoon. During this brief period, the angle of incidence is very small and the degree of insulation is minimized. By contrast, the winter sun usually shines continuously on such cliffs. The rear of the cave admits warming rays of the low winter sun, but shields the shelter interior from the rays of the more northern summer sun. The south-facing shelter offers a high degree of protection from the summer sun (Knowles, 1981: 12). Similar
shelters facing east tend to be much colder in the winter; west-facing enclosures are considerably hotter in the summer.

Viewed in solar terms, the south-facing shelter functions as an energy system to mitigate both daily and seasonal variation in insolation. Southern exposures receive considerably more radiation when air temperature is cold, and less radiation when ambient temperature is high. At latitudes high enough to have cool winter temperatures, one expects aboriginal residences to favor a southerly exposure, especially those utilized during winter months (unless local, independent factors become sufficiently critical and override the absolute degree of solar insolation).

The south-facing rock-shelter has the second, distinctive advantage of solar gain: energy absorbed from the sun and subsequently emitted as heat. Favorably oriented cave walls function as a latent heat sink, absorbing solar energy during hot summer months, then releasing this stored heat over a period of time—up to three months after the onset of cold weather (Legge, 1972; Farwell, 1981: 46).

Both passive solar radiation and their intrinsic heat-retentive properties should make caves and rock-shelters more desirable to live in wherever diurnal/nocturnal temperatures are extreme. The Great Basin—generally characterized by high elevations and a continental temperature regime—is one such place: cold winters, hot summers, and marked diurnal temperature spread. In Monitor Valley, daytime summer temperatures often exceed 32°C (90°F), and nighttime temperatures approach freezing. Winter temperatures frequently drop below -20°C (-4°F) and may remain there for long periods whenever stagnant air pressure cells linger over this area (Houghton et al., 1975; see also Thompson, 1983).

Although we lack a control survey of non-cultural caves, it seems clear that the most heavily utilized caves and shelters of Monitor Valley were selected in line with a south-facing strategy. Particularly striking are the precise orientations of the major sites.

But a number of cultural geographic factors conditioned how such solar constants were exploited during the prehistoric past. Whereas a north-facing cave is unsuitable for win-

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**TABLE 88**

<table>
<thead>
<tr>
<th>Solar orientation</th>
<th>East</th>
<th>South</th>
<th>West</th>
<th>North</th>
<th>Horizontal</th>
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</thead>
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<tr>
<td>Winter</td>
<td>416</td>
<td>1374</td>
<td>416</td>
<td>83</td>
<td>654</td>
</tr>
<tr>
<td>Summer</td>
<td>1314</td>
<td>978</td>
<td>1314</td>
<td>432</td>
<td>2536</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>517</td>
<td>1489</td>
<td>517</td>
<td>119</td>
<td>787</td>
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<tr>
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<td>839</td>
<td>1277</td>
<td>430</td>
<td>2619</td>
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<td>Winter</td>
<td>620</td>
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<td>620</td>
<td>140</td>
<td>954</td>
</tr>
<tr>
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<td>1207</td>
<td>452</td>
<td>2596</td>
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<tr>
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<tr>
<td>Summer</td>
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<td>344</td>
<td>1193</td>
<td>616</td>
<td>2568</td>
</tr>
</tbody>
</table>

* Values provided by American Institute of Architects, 1981: 86.
* Solar radiation expressed in Btu/ft²/day.
Architectural building orientations, of course, have an experimental aspect. The heat west of the house is greatest during the daytime and released at night—heat-retain
tive effects in artificially constructed houses are minimal, and there is only limited evidence that aboriginal houses were oriented to maximize overall solar input.

Doorway orientation seems to have been a response to diurnal changes in solar radiation. Figure 216 shows the approximate hour
to-hour variability in contemporary room orientation, with an eastward to south-facing orientation superior for several reasons. First of all, east-facing surfaces receive significantly more intense morning sunshine, and a better balance of heat distribution through
tout the day. Further, in the upper latitudes, the east side receives two to three times as much solar radiation as a corresponding southern exposure. Overall insolation is also enhanced during summer months, but “the west exposure is more disadvantageous than the east exposure, as the afternoon high temperatures combine with the radiation effects” (American Institute of Architects, 1981: 86), thereby creating unbalanced (and at times, extreme) heat impacts.

East-facing doorways maximize incoming morning sunlight (particularly in the summer). Such passive solar planning would lower fuel costs and provide for drier intrasite space due to increased evapotranspiration.

Finally, we examine possible effects of incoming solar radiation on landform selectivity. At Reese River, there was no such effect—most available loci faced to the west, and this is where the sites occurred. Site orientation here was simply a function of locus availability, not deliberate cultural choice.

Similar positioning characterized the eastern Toquima woodland. Although Monitor Valley was less intensively exploited—only 35 percent of the available loci were utilized as sites—loci were not deliberately selected for specific landform orientation.

But selection for aspect certainly did occur in the western Toquimas, where east-facing loci were disproportionately selected. Particularly vivid is the contrast between the western Toquima woodland and the Reese River sample. At Reese River, most loci faced west, and so did the sites. On the western Toquima

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**Fig. 216.** Interior temperatures for varying building orientations, based on summertime experimental observations at Princeton University's Architectural Laboratory (after American Institute of Architects, 1981: 78). Note particularly the unequal heat distribution and high heat impact of the west exposure compared with an eastern aspect. The southern exposure provides a low heat volume, only slightly higher than a northern exposure.
slope, fully 40 percent (23 of 57) of available loci faced west, and yet not a single west-facing Toquima locus contained an archaeological site.

The east-facing strategy played out here parallels the eastern orientation of doorways in Monitor Valley. Perhaps landforms in the western Toquimas were selected to maximize favorable summertimme insolation; but it may well be that wind or other topographically-dependent factors were involved as well. The role of solar insolation is not clearcut in this case: We see a marked degree of strategic variability not only between Reese River and Monitor valleys, but also within Monitor Valley.

Site positioning followed yet another strategy in the Monitor Valley uplands. Archaeological sites on the upland slope were most commonly situated on south-facing loci, and north-facing slopes were particularly avoided. We also found south-facing upland sites to have significantly higher artifact densities than sites oriented elsewhere.

The reasoning behind this upland strategy is undoubtedly complex, reflecting as yet unknown internal differentiation in temporal, functional, and preservational factors. But we do know that the south-facing slope becomes more desirable with increasing elevation, a process in accord with the earlier discussion of solar radiation. Increases in absolute elevation mean colder air temperatures, thereby creating even greater need for a solar boost.

To summarize, there is strong evidence that prehistoric people in Monitor Valley took advantage of differential solar gain. Most of the archaeologically significant caves and shelters here are south-facing. The naturally insulated cave walls functioned as heat sinks to store solar radiation during the daytime and release it at night. Such shallow shelters would have functioned best in the winter, when southern exposures receive two to three times the radiation absorbed in the summer. Strictly on the basis of solar potential, it is clear that south-facing exogene caves and shelters are most admirably suited for fall and winter utilization.

There is also a suggestion that doorways of aboriginal houses were deliberately positioned eastward, to capture the more equalized distribution of solar heat from that direction. This aspect is particularly advantageous during summer months, when east-facing openings receive up to three times the incoming solar radiation striking southern exposures.

NOTES

1. Ny910, the only nonlocus upland site, has been excluded from these tabulations.

2. The four western slope nonlocus sites (La658, Ny891, Ny892, and Ny867) are excluded from these tabulations. Keep in mind also that this chapter discusses the overall Monitor Valley sample of sites and loci; the current sample sizes are generally larger than those of the strictly locus-controlled samples considered in chapter 17. Moreover, the reported sample sizes (the various values of n) refer to observations on a given variable, which is not necessarily equal to the number of sites recorded. On the western Toquima slope, for instance, we recorded 97 individual loci; but for a variety of reasons, measurements of percent slope were available for only 92 of these loci. The value of n for this specific variable thus becomes 92 (the number of observed variates), not 97 (the number of observed loci).

3. Extremely high-altitude sites do not follow this pattern because other critical environmental factors override the importance of flat ground as a site selection factor. Alta Toquima, at an elevation of about 3350 m, has a mean slope in excess of 30 percent (as discussed in the fourth volume of this series).

4. Previously we employed a square root transformation to convert the Reese River variable to normal form comparable to the other distributions under consideration (Thomas and Bettinger, 1976: 356–357); such conversions are not appropriate to the present discussion.

5. Because of differential rounding in the computer programs employed, these numbers differ slightly from those previously published (Thomas and Bettinger, 1976).

6. Because the Reese River ecotone survey was restricted to the west-facing Toiyabe slope, it is possible that differences in relative elevation could arise due to gross aspect rather than a true difference between valleys. To test this possibility, we did an additional comparison with the west-facing ecotone sites in the Monitor Valley sample. These western sites are placed relatively high, averaging 230 m above the nearby valley floor ($S = 40.02$ m, $n = 29$). Even though all of the Reese River sites are likewise on the west-facing side, the av-
average elevation difference (nearly 140 m) remains highly significant \((t = 11.545, df = 92, p < 0.001)\). This difference obviously cannot be attributed to gross aspect (but see discussion of microtopographic aspect later in this chapter).

7. One-tailed tests of significance are used here whenever the direction of difference is implicit in the research question under consideration; but unless otherwise specified, a nondirectional (two-tailed) test is employed.

8. The Reese River Valley may be subjected to more frequent late winter and early spring freezes since the Pacific frontal systems reduce inversion layers along the Toiyabe Range, particularly on the north slopes and exposed mountain peaks.

9. This same variable was previously termed *distance to ecotone* (Williams et al., 1973; Thomas and Bettinger, 1976); but confusion regarding the nature of this biogeographic margin and its implications for archaeology prompts us to use the present name. Nomenclature aside, *distance from foothill margin* is fully comparable with the variable defined and measured in the previous Reese River survey (Thomas and Bettinger, 1976).

10. We noted previously that the definition of locus required modification of the criteria employed in the woodlands. Specifically, since sites and loci on the upland slope are not (by definition) situated “near” the lower foothill margin, the polythetic criterion requiring a locus to be within 800 m of that margin became unworkable. But despite the fact that this variable was dropped from the polythetic definition of upland loci, the distance was measured for each locus, and these data provide some useful insights as to site positioning on the upland Toquima slope.

11. This generalization may be oversimplified because seven sites and eight loci tallied as part of the eastern Toquima survey were recorded on the streamside survey of Stoneberger, Ikes, and Mill canyons. Technically, 30 percent (7 of 23) of the sites and 13 percent (8 of 63) of the loci correspond to the symmetrical, linear resource model on figure 204. We simplify here because the underlying positioning behavior does not differ between resource models, but we should point out that on-the-ground site distributions are indeed different because of the differing configuration of the resource.

12. This count excludes Northumberland Cave, a culturally sterile complex of caverns and tubes that extend for some distance beneath Mount Gooding (see chap. 4). The entrances to Northumberland Cave are so small and diverse that “aspect” cannot be realistically measured.

13. For present purposes, *solar aspect* is operationally defined as the azimuth of the X axis previously imposed on each site plan (chap. 14). Note further that all orientations discussed in this chapter have been converted from magnetic to true north to conform with the relevant solar models.

14. In the early years of the Monitor Valley survey, we failed to record the orientations of doorways visible in the various stone house rings encountered, and the data on figure 215 represent only results from the last field season. Ample comparable data is, incidentally, available from Alta Toquima and the other high-altitude sites on Mt. Jefferson (discussed in the next volume of this series).

15. This is particularly true for structures built relatively low to the ground. As buildings increase in height, they dampen the effects of surrounding terrain, and wind orientation can have serious structural consequences.

16. Natural heat sinks are particularly effective when coupled with deliberate hearth spacing, creating a naturally and artificially heated rear room (chaps. 16 and 17; see also Thomas, 1983b: 525).
CHAPTER 19. INTEGRATIVE SYNTHESIS

The objective of this volume is to employ primary archaeological data to recognize and define strategies of prehistoric cultural geography, the way in which individuals and groups positioned themselves across the landscape. In this chapter we summarize and synthesize the diverse analyses conducted throughout this study.

We express our conclusions in terms of most probable interpretations (see Thomas, 1983b: 440). We have been candid throughout this volume about the difficulties in interpreting the archaeology of Monitor Valley; but it is insufficient to let this study stand as simply one further cautionary tale. Here, we advance a series of most probable interpretations, attempting to bridge the gap between methodological purity and substantive relevance. These integrative syntheses are set out as simply the best bet, when all presently available evidence is taken into account. In most cases, we think the probability of being correct is quite high; in other instances, the associated probability is much lower. Please keep these varying degrees of confidence in mind.

The epistemological and operational baseline for this inquiry has been detailed elsewhere (Thomas, 1983a), and only the most relevant aspects will be recapped here. The regional positioning model employed here follows a pattern of concentric cultural zone (after Binford, 1982):

campground radius: a generally overexploited nuclear zone containing the immediate workings of a base camp; it rarely extends more than a kilometer or so in all directions.

foraging radius: the zone beyond the campground radius which is systematically searched and exploited by task-specific work parties who leave camp to forage but return home each night; it rarely extends more than 10 km from the residential base.

logistic radius: the zone exploited by specialized task groups who stay away from the residential base overnight or longer; the size of this radius increases in proportion to the degree of logistic organization within the system.

extended range: the area commonly monitored relative to changing resource abundance and distribution; size varies according to the resources involved and the nature of intergroup communication.

Although we model these economic zones as a series of concentric catchments about a central base (Thomas, 1983a: fig. 11), the actual configuration in any given case will be heavily conditioned by labor and transport costs, local topography, effective resource distribution, tethering effects of water availability, and funneling effects of access routes.

STRATEGIC MODELS FOR EXPLOITING MONITOR VALLEY

We anticipated the archaeological record in Monitor Valley by isolating five regional mobility strategies that might have operated there. These strategies were defined by extreme cases, and other mixes are quite possible (Thomas, 1983a: 139–141).

I. A STRATEGY OF HIGH RESIDENTIAL MOBILITY. Pure foragers could have exploited Monitor Valley as part of their extended range. This strategy would produce a series of low-density residential bases and locations, with perhaps a few caches of high-bulk resources.

II. A STRATEGY OF SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE CAMP/FORAGING RADII. Mixed-mode forager-collectors could have exploited the Monitor Valley environment by establishing optimally positioned residential bases, then foraging within the campground radius and establishing field camps throughout other parts of the valley. This strategy involves a series of relatively visible base camps and a network of supportive procurement locations, field camps, and extensive season-specific caching systems in areas of high-bulk resources.

III. A STRATEGY OF SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE LOGISTICAL RADIUS. The same strategy of mixed-mode foraging and collecting could have been used by groups, working out of base camps established elsewhere, visiting Monitor Valley only as logis-
tic, special-purpose task groups. This strategy would involve intercept hunting locations, field camps, evidence of caching, and transport of high-utility, low-bulk resources to base camps located outside Monitor Valley.

IV. A STRATEGY OF MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE CAMP/FORAGING RADII. True collectors could have exploited Monitor Valley by establishing nearly year-round optimally positioned base camps there, and then pursuing foraging and logistic procurement throughout the rest of the valley. This strategy would involve very high-visibility residential bases and a network of procurement locations, field camps, and extensive caching facilities, especially in areas of high-bulk resources.

V. A STRATEGY OF MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE LOGISTIC RADIUS. A similar collector strategy could be employed by establishing nearly permanent residential bases elsewhere and visiting Monitor Valley only in logistic, special-purpose task groups. This strategy would require a series of intercept hunting locations, field camps, caching spots, with evidence of transport of high-utility, low-bulk resources, and the conspicuous absence of residential bases.

These general expectations have been applied on a specific, habitat-by-habitat basis to the landscape of protohistoric Monitor Valley (Thomas, 1983a: chaps. 9-11).

The archaeological expectations for the mountains and lowlands of Monitor Valley form the basis of inquiry in this monograph; expectations for the high country are considered in the next volume in this series.

DISTINGUISHING RESIDENTIAL FROM LOGISTIC PATTERNING

Given such a regional framework, the next step is to define what a residential base should look like, and how that pattern is manifested archaeologically.

Under the ideal conditions of archaeological preservation, we might expect residential utilization to exhibit some of the following structural consequences:

Domestic dwellings: Evidence of housing should be present, but there is no direct, infallible correlation between subsistence strategy and any specific house type or house size (C. Fowler, 1982; Thomas, 1983a: 76).

Site furniture (ad hoc caches): e.g., storage of ceramics, stone vessels, milling equipment, hammerstones.

Specialized utilitarian structures: e.g., snow dams, above-ground caches, windbreaks and foul weather walls, specialized grinding structures.

Service centers (sensu Wagner, 1960: 170): e.g., sweat houses, game fields, menstrual huts, cemeteries.

Relatively high degree of internal site structuring: e.g., differentiated outdoor work areas, designated debris dumps, bedrock milling facilities (base camps of collectors are expected to have a higher degree of internal differentiation than forager base camps).

We might also expect residential utilization to generate the following assemblage-level consequences:

Diversified tool fabrication and repair: evidence of artifact fabrication and repair; relatively high proportion of fabrication tools; relatively high proportion of byproducts of fabrication and repair; relatively high diversity of raw materials; relatively high proportions of spent materials; relatively high proportion of in situ manufacture of planned tools (and relatively lower proportions of expedient tools); additional evidence of fabrication and repair (e.g., house construction, clothing manufacture, manufacture of basketry, hide, and woven items).

Diversified food consumption and storage: relatively high quantity and diversity of food consumption and preparation items (e.g., cooking equipment, milling equipment, butchering equipment, firemaking equipment; sometimes these items are deliberately cached for future use), facilities for preparation and consumption (e.g., hearths and firecracked rocks); relatively high diversity of edible plant resources; relatively high diversity of edible faunal resources (with differential butchering and relatively large proportion of high-utility elements).
Facilities for food storage
Facilities for storing high-bulk domestic raw materials and tools
Relatively higher proportion of luxury items
Relatively higher proportion of recreational devices and ceremonial paraphernalia
Evidence of child rearing

These expectations are polythetic in nature, viz., we expect all well-preserved residential settlements to have some of these characteristics, but no residence will exhibit all of them.

Viewed at a different level, residential utilization takes place at two kinds of sites: base camps and field camps. The base camp is the settlement “headquarters” (Steward, 1933: 238), the so-called “hub” of all subsistence activities (Binford, 1980: 9), where most processing, manufacturing, and maintenance activities occur. “Collector residential base camps should have randomly distributed structures built with higher labor costs, associated cache features, and showing signs of frequent reuse. Logistic strategy base camps also have communal structures such as well-established sweat houses, cemeteries, well-defined public places, traditional loci of debris disposal, high cost procurement facilities” (Thomas, 1983a: 76). Base camps are generally positioned optimally, with explicit concern for adequate shelter, firewood, temporary food supplies, and water.

Field camps are temporary living quarters where a single-sex task group sleeps, eats, and otherwise maintains itself while absent from the residential base (Binford, 1980: 10). We assume that field camps are usually established whenever task groups are required to travel more than about 10 km from the base camp.

Intrasite structure of field camps can be quite variable, reflecting differentiation in both target resources and overall positioning strategies. Field camps are commonly established relatively close to procurement locations, and usually show heavy bias toward consumption of either plants or animals (rarely both). Positioning is not as critical as that for base camps since task groups can temporarily disregard the concern for shelter, fuel, food, and even water.

We projected the following specific expectations for field camp structure: specialized subsistence, limited artifact inventory, low diversity of byproducts, restricted faunal and floral inventory, little investment in construction of dwellings or features, absence of child-rearing, more concern with logistic than domestic positioning. But we also find that “these characteristics do not provide us with the clear-cut archaeological signature we desire. In truth, it is extremely difficult to distinguish field camps from base camps in the archaeological record” (Thomas, 1983a: 80).

Areas previously used as residential base camps are often reoccupied by task groups, and these short-term visits lose archaeological visibility when superimposed on one another. Former residential sites can readily become temporary field camps just a few weeks or months later.

There is nothing particularly distinctive about the composition of field camp assemblages, facilities, or positioning. The field camp is merely a restricted subset of aggregate base camp behavior, and without spatial separation, it is extremely difficult to differentiate between the two (Thomas, 1983a: 80–81).

Residential activities must, in turn, be distinguished from diurnal, extractive pursuits. Procurement locations occur within the foraging radius, assumed to be less than about 10 km from the residential base. Archaeological visibility of procurement locations is largely a function of the resource being exploited, and the way in which that extraction is woven into the overall settlement strategy.

Foragers (sensu Binford, 1980) typically exploit low-density resources, commonly solving problems of spatial incongruity by residential rather than logistic mobility. The cost of constructing permanent procurement facilities is usually outweighed by the advantages of simply moving on; because of this, forager locations are generally lightly used and lacking in high-cost facilities. The primary entry into the archaeological record are tools and debris scattered haphazardly and reflecting the encounter strategy which characterizes so much of the foraging economy. Some foragers are more tethered than others, and the increased density of archaeological debris resulting from this spatial redundancy markedly enhances the archaeological visibility of their foraging localities.

Animal procurement is generally more visible than plant procurement; intercept strat-
tery hunting tends to be more visible than hunting by an encounter strategy. Artifact losses are generally restricted to extractive tools and debitage, particularly items involved in kill and primary butchering.

Although plant harvesting has a generally low visibility, resources involving high-bulk and high transportation costs generate more evidence in the form of temporary storage and processing facilities at the locus of harvesting. Plants procured on a low-density, encounter basis foster thin, difficult to find, nonsites. In general, such procurement activities involve a modest artifact inventory, primarily highly curated personal "gear," specialized implements for extraction, and debris from limited artifact repair. Residentially mobile groups, at times, produce invisible locations, and archaeologists can hope to recognize base camps rather than locations.

Procurement by logistically organized groups generates many low-density nonsites, but much more as well. A collector strategy is best suited for zones of relatively high resource density and predictability. In such areas, it makes good cost/benefit sense to construct relatively permanent facilities: dams, canals, blinds, hunting walls, corrals, and soldier cairns. Although the mode of hunting might be identical, all else being equal, facilities constructed by collectors will be more visible archaeologically than those built by foragers.

Nevertheless, distinguishing extractive from residential activities in such circumstances is difficult at best, and even more severe problems arise when wholly different site types are superimposed.

A CAUTION REGARDING TEMPORAL CONTROLS

Before turning directly to the archaeological record, we must consider how that record is structured temporally. In Monitor Valley, we found a few stratified sites, several stratigraphically mixed sites, and hundreds of unstratified surface scatters. We began resolving the temporal issue by conducting a series of correlative stratigraphic excavations, deriving a suite of more than 100 radiocarbon determinations: 47 radiocarbon dates from Gatecliff Shelter (Thomas, 1983b: table 2; see fig. 217), 13 from Triple T Shelter (table 14, this volume), 4 dates from Toquima Cave (table 26, this volume), and over three dozen determinations from Alta Toquima (volume 4, this series). These data define chronostatigraphic relationships within specific sites, and serve to anchor a master chronological sequence designed for application to the surface archaeological record of this area.

Beyond such relatively conventional excavations, we also attempted to expand our research to a regional level by collecting relatively unbiased samples from a broad range of surface sites (and nonsites). Although the unglamorous surface assemblage has much to tell regarding patterns of prehistoric cultural geography, such scatters characteristically retain only an extremely coarse-grained temporal structure. The surface scatter thus forms the weak link in any attempt to deal with archaeology at a regional level.

This generally low level of temporal resolution requires that new methods be devised to provide the necessary minimal temporal control. As detailed in chapter 9, considerable caution is required when extending a chronology derived from excavated sites to temporally uncontrolled surface scatters.

Chronologies of this sort operate at two distinct levels. When dealing with individual artifacts, defining so-called time-markers requires one to estimate the approximate date of manufacture. Most archaeologists finding a Desert Side-notched point on a central Great Basin surface site would estimate that this artifact was manufactured after A.D. 1300 but prior to about A.D. 1860. Similarly, an isolated Elko Corner-notched point commonly evokes an estimated date of manufacture sometime between 1000 B.C. and A.D. 700 (in this geographical area).

Both estimates are subject to error, because the life history of any given artifact is almost always unknown: individual points can be curated, recycled, scavenged, imitated, reworked, redeposited, or counterfeited. But lacking independent chronometric, technological, chemical, or stratigraphic input, such projected dates of manufacture remain the most probable temporal interpretations. These chronological estimates are at present the best way available to project absolute dates from surface finds.
The origins of the chronological devices used in Monitor Valley are long-standing and diverse (as discussed in Thomas, 1981a: 9). The so-called Berkeley chronology (e.g., Heizer and Hester, 1978) was refined, based on our excavations at Gatecliff Shelter. The Gatecliff chronology was then examined against a wide variety of sites in Monitor Valley and elsewhere in the Great Basin (this volume; see also Thomas, 1981a, 1983b). Although much chronological tinkering remains to be done, there is no question that the Monitor Valley projectile point classification holds throughout much of the central and western Great Basin.

But to apply this classification effectively to surface materials requires more than merely matching up time-markers. A rather different inferential structure is involved when moving from the level of the artifact to that of the assemblage. Whereas artifact chronologies provide estimated dates of manufacture for specified time-markers, such estimates cannot simply be transferred to associated assemblages. Finding three Desert Side-notched points in a surface scatter does not mean that the assemblage should be assigned perforce to the Yankee Blade phase (chap. 9).

Regional archaeology too often proceeds as if two or three time-markers were sufficient to date surface sites. This is often untrue, and such impressionistic procedures muddle a most complex situation. Transcending the case of \( n = 1 \) requires that one consider some necessary (if nettlesome) sampling issues.

The relative frequencies of time-markers can profitably be used to monitor temporal variability between assemblages, but only when appropriate attention is paid to sampling considerations. In chapter 9, we explored ways of moving from the chronology of artifacts to assemblage chronology. We began by defining a series of cumulative curves to describe temporal structure of the well-defined stratigraphic sequence at Gatecliff Shelter. In effect, these curves characterized the 6000 year occupational history of Gatecliff as discrete, ordinal steps, telescoping B.C./A.D. interval-level estimates into five, phase-level temporal categories, based on the conventional central Great Basin cultural phases (after Thomas, 1981a; 1983a): Clipper Gap phase (ca. 4500 to 3000 B.C.), Devils Gate phase (ca. 3000 to 1300 B.C.), Reveille phase (1300 B.C. to A.D. 700), Underdown phase (A.D. 700 to 1300), and the Yankee Blade phase (A.D. 1300 to 1850).

So translated, the Gatecliff-calibrated chronology was extended from an artifact level to an assemblage level, and could be used to estimate temporal relationships of surface assemblages—*at this level of resolution*. Within a specified range of error, one could determine whether or not estimated median dates of occupation for two assemblages were "operationally contemporary." If so, it became appropriate to combine (or "pool") these contemporary horizons into a single temporal estimate. If not, then the two assemblages were assigned to different temporal periods.

Sample size is an extremely important consideration in all such temporal analysis, and temporal discrimination is appropriate only when sample sizes can be statistically demonstrated to be sufficient. This procedure is critical because even apparently radical difference in median age can be misleading when viewed from the perspective of very small samples.

Monitor Valley contains only one surface assemblage even approximating a single temporal component, that from Table Mountain. If this assemblage is indeed behaviorally associated with the serpentine rock alignment, then this labor-intensive facility probably was constructed during the Devils Gate phase (ca. 3000 to 1300 B.C.). But at this gross level of resolution, it is very difficult to distinguish significant change through time in most assemblages.

**THE MONITOR VALLEY LOWLANDS**

The floor of Monitor Valley is considerably higher than that of surrounding valleys (see Thomas, 1983a: figs. 33 and 34), and this elevational differential creates generally more favorable summer conditions and rather less favorable winter conditions. This fosters distinctive migratory patterns of grazing herbivores between Monitor Valley and neighboring valleys, with obvious implications for prehistoric hunters.

The surface water distribution of the Mon-
Geomorphological processes occasionally intervene to separate artifact aggregates into relatively short-term subsets, as in the basal portions of Gatecliff Shelter. The deposits of Gatecliff Shelter are atypical of Monitor Valley, where the vast majority of prehistoric archaeological debris occurs in coarse-grained, multicomponent, palimpsest aggregations.
itor Valley lowlands is likewise distinctive in that the dry alkali sink characteristic of many neighboring, internally drained basins is lacking here. Instead, Monitor Valley retains a relatively permanent shallow playa lake (fig. 218). This sulphurous, alkaline body of water is unusual because it survives in approximately the same form and dimensions as its ancestor, pluvial Lake Diana (see Melhorn and Trexler, 1983a: fig. 13).

Monitor Valley also lacks the central bisecting stream characteristic of some central Great Basin valleys. In fact, all linear water sources are rare in Monitor Valley. Instead, the subsurface artesian ground water pressure creates a sequence of lowland point water sources (as at Box Spring, Potts Ranch Spring, and White Sage Spring).

**ARCHAEOLOGICAL EXPECTATIONS**

Based on middle range considerations discussed elsewhere (Thomas, 1983a), we previously concluded that the residential potential for the prehistoric Monitor Valley lowlands was severely limited: potable water was nowhere abundant; the valley floor lacked adequate food and fuel, both essential for establishing long-term base camps; extreme cold due to air inversion probably precluded residential usage of the lowlands during most of the winter months; although the valley floor was generally habitable from spring through fall, the niche was considerably more constricted than that of residential settlements in the neighboring woodland slopes only a few kilometers to the east and west.

Archaeological expectations for the valley lowlands are not complex. Base camps are not anticipated; should they occur, such residential sites should be tightly tethered to the few available water sources, and should contain a diverse set of materials imported from the upland microenvironments. Monitor Lake is a significant residential factor only during years of consistently high water table.

These lowlands fall within the foraging radius of any base camps established in the woodland zone, and several procurement opportunities for game, plants, and minerals are available on the valley bottom. None of these procurement activities would be expected to produce a very substantial archaeological record.

It seemed to us likely that field camps were established from time to time on the valley floor, especially when used as satellites for base camps outside Monitor Valley proper. Such field camps were projected as water-tethered, low-density affairs.
In terms of the five middle range overall procurement strategies defined earlier (Thomas, 1983a: chaps. 8 and 11), we assigned the following probabilities to the Monitor Valley lowlands.

**STRATEGY I. HIGH RESIDUAL MOBILITY.** Possible: base camps were probably established in the woodland, with foraging groups ranging in established strategies. Procurement ability. Lake Valley a short-term base camps several years, allowing for the development of a lacustrine plant association.

**STRATEGY II. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE CAMP/FORAGING RADII.** Fusion camps in the lowlands are extremely improbable, but summer dispersal camps are a remote possibility. The niche breadth of the nearby woodland probably eliminated the lowlands from base camp consideration, but foraging activities from these woodland camps could easily have occurred in the lowlands.

**STRATEGY III. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE LOGISTICAL RADIUS.** This, together with strategy V, is the most likely possibility. Evidence of logistic usage of the lowlands should appear largely as low-density nonsites, although field camps were probably established occasionally on the flats.

**STRATEGY IV. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE CAMP/FORAGING RADII.** This is the most unlikely possibility of all; Monitor Valley lacks the high-bulk, seasonally stable resources necessary to support nearly sedentary base camps, and, had such camps been established, the valley floor would have been a poor choice indeed. If nearly sedentary base camps were established in the woodlands, foraging, and perhaps even logistic activities could be conducted on the flats, but this is also a low probability event.

**STRATEGY V. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE LOGISTIC RADIUS.** This is most likely; game and plant procurement, together with occasional field camps, would be identical with those of strategy III. The only factor limiting this possibility is whether any set of microenvironments was sufficiently productive and diverse to permit a nearly sedentary base camp to be established, such that Monitor Valley would fall within the logistical radius of that camp.

**DEGREE OF COVERAGE AND BIAS**

We were somewhat concerned about our sampling procedures in the Monitor Valley bottomland (see chap. 7). When we initially designed our survey strategy for Monitor Valley, we concentrated efforts on the lower slope, woodland, and upper slope. For a variety of reasons (detailed previously), we chose a considerably smaller sampling fraction for the valley bottom. We believed that whatever prehistoric material culture was present in the lowlands would be concentrated near relatively permanent, readily identifiable sources of water.

In all, we systematically surveyed about 1750 ha of the Monitor Valley lowlands, distributed as follows: one randomized 1 km spring survey (Disaster Spring), seven randomly selected 500 m² quadrats, and three arbitrarily selected 1 km spring catchment surveys (Dianas Punch Bowl, Potts Ranch Spring, and White Sage Spring). Rock features were mapped at Box Spring and the Monitor Hills feature. Surface remains were also mapped and collected at the Monitor Lakebed site and at Hickson Summit. This field strategy was obviously skewed toward large, water-tethered assemblages.

To estimate the degree of bias introduced by this lowland survey procedure, we examined the results of all subsequent CRM-related fieldwork conducted in the target area. Independent CRM surveys covered an additional 517 ha, and although a bit of this work duplicated our previous surveys, these results demonstrate conclusively that the major lowland assemblages of Monitor Valley were distinctly water-tethered (table 65). Although the valley bottom does contain a few sites positioned away from an extant water supply, these assemblages are extremely rare and tend to be very small.

In other words, our operating assumption turned out to be correct: The archaeological record of the Monitor Valley bottomland consists of predominantly large assemblages,
tethered either to water (as at the Monitor Lakebed or the springs of the valley floor) or to prominent topographic characteristics (as at Hickison Summit). Given this tendency, we find that no significant bias was introduced by the bottomland survey procedures employed in our Monitor Valley study.

ARCHAEOLOGY OF THE MONITOR VALLEY BOTTOMLAND

THE HICKISON SUMMIT CORRIDOR: Hickison Summit provides the northernmost access route from Monitor Valley to the west, skirting the northern margin of the Toquima Range. Capt. James H. Simpson utilized Hickison Summit on his May, 1859 east-west traverse of the Great Basin (Simpson, 1876). In the next year, Pony Express riders followed the same Hickison Summit route (Thomas, 1983a: 126–129). Present-day U.S. Highway 50 passes through Hickison Summit as it skirts the northern end of Monitor Valley.

Elevation at Hickison Summit is 2010 m. The western approach, from Big Smoky Valley, is quite gradual, following a gradient of only 2.2 percent (60 m elevational gain in 2.7 km). Access from Monitor Valley is likewise easy, rising approximately 2.6 percent (242 m elevational gain in 9.5 km). This pass is a well-known migration route for contemporary deer herds (see Heizer and Baumhoff, 1962: 40).

The impressive Hickison Summit rock art site is located just north of the modern highway, in the narrow pass dividing the Toquima Range proper from the Simpson Park Range (figs. 128 and 219). Approximately 350 petroglyph elements are carved and pecked, in 14 distinct clusters, along a series of vertical, welded tuff outcrops. Hickison Summit has been taken as archetypical of the association between rock art and potential game ambush, a hypothesis detailed by Heizer and Baumhoff (1962); in fact, it was the topography of Hickison Summit that initially suggested this hypothesis (M. A. Baumhoff, personal commun.).

More recently, T. Thomas has fully recorded and reanalyzed the rock art complex at Hickison Summit (T. Thomas, 1976). She suggests that artiodactyl ambush at Hickison was conducted in a series of consecutive at-
tacks, by hunters stationed at preordained hiding places. The petroglyph clusters occur at these hypothesized attack stations; “out-of-line” boulders were simply ignored. She argues that “only those faces which meet the oncoming or passing animal were carved; those faces represent the directions from which the hunter attacked.” The attack at each station had to be launched from the proper angle to ensure that escaping quarry would run in the direction of the next attack station. Faces were not chosen for their carvable surface qualities (i.e., smoothness and patination). One face, unpatinated and irregular, might be heavily carved while a smooth, patinated face immediately adjacent but facing a different direction, is left untouched” (T. Thomas, 1976: 70).

The positioning of the Hickson Summit petroglyphs strongly suggests the prehistoric utilization of natural welded tuff barriers for intercept strategy hunting (Binfeld, 1978a; Thomas, 1983b). Successful intercept strategy hunting begins by monitoring game movements, then channeling the agglomerated game toward prearranged areas of intercept, where ambush actually occurs. Such intercept hunting facilities share certain positioning characteristics: access to a game lookout, a funneling factor, and a change of pace factor (Thomas, 1983a: 41; see also Binfeld, 1978a). At Hickson Summit, the natural landscape is fortuitously structured, and artificial modifications are unnecessary; this is also the case at Northumberland Canyon, East Bald Mountain Wash, Barley Creek, White Rock Canyon, and the Monitor Hills. In other instances, enabling facilities had to be artificially constructed (see also T. Thomas, 1976: 70).

Given the relative abundance of water, the channeling effect of local topography, the availability of ridgetop sites and relatively flat ground, and the contemporary piñon-Juniper ground cover, one might expect that the Hickson area may have hosted field camps, and even the occasional base camps. But at this point, the direct evidence is not compelling. The bifacial reduction sequence at Hickson is not particularly distinctive, although middle-stage artifacts are relatively more common than the earlier and later production stages. Unifaces are inordinately common here; incised stones and metates are rare.

The assemblage-level comparisons suggest something of a residential component at Hickison, but this is probably due to the skewing effect of the several hundred sherds found at La627. In effect, this single shattered pot tends to overemphasize the importance of domestic equipment, at the expense of other categories (especially weapons).

In addition to recording the rock art and conducting an archaeological survey of the area, we conducted test excavations at Boring-as-Hell Shelter, a small alcove overlooking the main confines of Hickson Summit. Today, Highway 50 channels thousands of people through this area each month, and we think this topography served as a similar biogeographic corridor in the past. Travelers often stop their cars to view the well-preserved rock art so clearly displayed there. But the casual visitor immediately notes the lack of naturally available shade or shelter. The Bureau of Land Management has solved this problem by erecting a dozen metal sunshades, so that travelers are protected from the summer sun.

Boring-as-Hell Shelter functioned similarly in the prehistoric past, as a diurnal way station, part of an overall desert adaptive strategy. In a sense, this small alcove is similar to Hidden Cave, allowing passersby to avoid the “heat of the day” by finding natural (or constructing artificial) shady areas to sit it out (see references cited in Thomas, 1985: chap. 27).

Boring-as-Hell Shelter is also similar to Hidden Cave because both sites were used as tool caches. As elaborated below, the bundle of arrow shafts cached at Boring-as-Hell Shelter illustrates the important distinction between active and passive gear. The pattern represented by this cache is repeated throughout selected parts of Monitor Valley. In fact, such utilization of trailside shelters for deliberate or ad hoc caching is one important thread drawing together the archaeological record of this area.

Combining the evidence from archaeological survey and excavation, we think it clear that Hickson Summit once provided the major pathway around the northern perimeter of the Toquima Range. The archaeological
record reflects the movement of seasonally migrating antelope and bighorn and of the hunters who waited here to ambush them, moving as they did in a seasonally predictable pattern—leaving the relatively high ground of Monitor Valley in the fall for the lower reaches of Big Smoky Valley to the west; returning to higher Monitor Valley once again as the weather ameliorated the next spring.

The importance of such natural corridors in structuring both human and nonhuman biogeography is a theme encountered repeatedly in the archaeological record of Monitor Valley. Hickison Summit provides the northernmost expression of this pattern.

**The Box Spring Hunting Facility:** A second series of distinctive features occurs at Box Spring, near the northern end of Monitor Lake, where we mapped a series of soldier cairns along the discontinuous ridge west of the Box Spring marsh. The general location and specific distribution of these features suggest that the Box Spring feature functioned as a prehistoric antelope trap. This *most probable interpretation* is consistent with several ethnographic and ethnohistoric accounts describing similar features (e.g., Thomas, 1983a: 49).

The artifact assemblage also supports this interpretation. The Box Spring assemblage is skewed toward the “late” stage of bifacial reduction, closely approximating the repair model of biface production. General utility tools are rare, and domestic equipment is totally absent. Fabrication and processing by-products are relatively overrepresented (table 52).

The Box Spring facility exhibits the primary elements required for classic intercept hunting. This lowland, marshy area is a constant attraction for game animals, and the low surrounding ridges provide both elevation and cover for monitoring their movements. It would have been easy to drive game between the sheer cliffs and the low ridges on the east, but the western ridges provide no such barrier, and this is where artificial cairns were erected. These “stone men” would have complemented the low ridges to the east, together providing the funneling factors necessary for successful intercept strategy hunting.

We think that the facility at Box Spring (and perhaps also the rock walls mapped in

![Fig. 220. View across the Monitor Lakebed site (Ny1228), the most significant lowland assemblage in Monitor Valley. This lacustrine resource was probably used irregularly for short-term, non-winter base camps and field camps (after Thomas, 1983a: fig. 19).](image-url)

the Monitor Hills; see chap. 5) was built in conjunction with prehistoric intercept strategy procurement. But the absence of evidence for encounter strategy hunting or low-bulk plant procurement cannot be taken as conclusive. Encounter strategy hunting could have occurred on the valley floor; plant procurement quite likely occurred on the lowlands. But the archaeological debris generated from such activities is not sufficiently distinctive to allow us to detect those activities.

Our interpretation cannot eliminate the possibility that Box Spring per se functioned at other times as a field camp or even a residential base. But if such residential utilization occurred, it left no visible record. It is important to distinguish (1) what, according to the evidence, we think actually happened, from (2) what might have happened, but left no evidence.

**Monitor Lakebed:** The most significant lowland site in Monitor Valley occurs along the margins of Monitor Lake. Ny1228, the Monitor Lakebed site, contains a rich array of aboriginal remains, and this site certainly has potential for subsurface deposits. Future excavations could be quite enlightening, particularly if enhanced with the remote sensing
technology now available, such as the proton precession magnetometer and ground penetrating radar prospection (fig. 220).

The massive Ny1228 assemblage leaves little doubt that here was a primary focus of lowland utilization. This lacustrine assemblage contains an inordinate quantity of lithic discards. The bifacial assemblage differs significantly from the aggregate Monitor Valley assemblage. Specifically, the Ny1228 assemblage is skewed toward the middle of the biface staging profile, with an abundance of fine percussion blanks and pressure flaked bifaces. Earlier and later stage bifacial artifacts (especially projectile point fragments) are correspondingly rare. Incised stones and grinding stones are also uncommon.

No structural remains of any kind were recorded in the surface reconnaissance of the Monitor Lakebed site.

RESIDUAL LOWLAND ASSEMBLAGES: Relatively little can be said about the specific activities that took place at the other lowland valley springs; unfortunately, no features survived here, and the only archaeological evidence is surface lithic assemblages.

White Sage Spring, near the northern end of the study area, consisted of an extensive artifact scatter across a series of small rolling bluffs overlooking the spring area. Archaeological materials were also encountered at Dianas Punch Bowl, where they were concentrated around a small sink which previously had extended for several hectares to the northeast. A series of hot and cold springs occurs in the center of Monitor Valley (fig. 22), in the vicinity of Potts Ranch. Nineteenth and twentieth century ranching activities have disturbed the prehistoric archaeological record at Potts Ranch, and we recorded only a single archaeological site, Ny1240, atop the large knoll not far from the ranch complex. Chippage and artifacts are scattered over an area approximately 150 m in diameter, extending downhill into the meadow adjacent to the ranch buildings.

These three lowland spring assemblages are very small and statistical analysis does not disclose any significant temporal differences between them. When artifacts from the three spring catchments were combined, the pooled profile suggested a particularly high degree of utilization during the Devils Gate and Rev-elle phases. But there is no significant temporal difference when the pooled time-marked frequencies for the three lowland springs are compared with the master Monitor Valley temporal profile.

However, in terms of relative diversity, the pooled assemblages from these three lowland springs differ markedly from the rest of the Monitor Valley sample (fig. 153). In this case, the sample size effect is reversed, with assemblage diversity decreasing as sample size increases. This surprising result is attributed to differential fragmentation. Whereas the Dianas Punch Bowl and Potts Ranch Spring assemblages comprise strictly stone tools, nearly 90 percent of the White Sage Spring materials were Shoshone ceramics.

Disaster Spring (no. 6), located in the Big Smoky Valley drainage at an elevation of 1978 m (6490 ft), fell into the randomized spring catchment survey. Although scattered prehistoric debris was recorded at several localities (with a mean density of only 0.02 artifacts per ha searched), no “sites” as such were found.

THE BOTTOMLAND OF MONITOR VALLEY: A SETTLEMENT SUMMARY

The archaeology of the Monitor Valley bottomland creates three distinct impressions. First, it is clear that prehistoric exploitation of the lowland environment was overwhelmingly water-tethered. Six major lowland water sources are available within the study area, and each has produced archaeological evidence of prehistoric exploitation. Virtually no archaeological remains exist away from the small oases.

Second, we found two prehistoric hunting facilities. The Box Spring rock cairns were probably for summertime intercept strategy procurement of antelope. Hickison Summit is considerably more generalized and flexible; situated at a naturally defined migration trail, this facility could have been employed year round, probably for both antelope and big-horn.

We were also struck by the paucity of evidence for residential utilization of the lowlands during prehistoric times. Few distinctive signatures are presently recognized to define a residential pattern in concrete terms.
But earlier in this chapter, we isolated several structural and assemblage-level expectations for areas of predominantly residential utilization. These expectations are basically polythetic in nature: some characteristics should show up in most well-preserved residences, although no residential base is expected to exhibit all the characteristics. Yet evidence of domestic dwellings (site furniture, specialized utilitarian structures, service centers, differentiated outdoor work areas, and designated debris dumps) is totally lacking on the valley bottom.

Taken by itself, this strictly negative evidence is admittedly equivocal. It is possible, for instance, that summer occupations involved only perishable houses, ramadas, and windbreaks (with minimal archaeological visibility). It is likewise possible that subsurface structures are present at sites like the Monitor Lakebed, or that structure evidence will be found outside the area sampled (although subsequent CRM surveys have failed to locate any such evidence).

The complete absence of structures in the Monitor Valley lowlands takes on added significance when compared with the considerable structural evidence documented in the nearby woodland zone. Of the two dozen house foundations recorded in Monitor Valley, not one was found on the valley floor.

Areas of extensive residential usage are expected to have a number of assemblage-level consequences. Few of these are satisfied in the Monitor Valley lowlands:

Generally high assemblage diversity. Not verified: Although lowland assemblages are more diverse than those of uplands, no statistically significant level of diversity is apparent in any of the lowland samples (table 67).

High proportion of fabrication tools. Not verified: Fabrication tools are rare on the valley bottom.

High proportion of tool manufacture debris. Not verified at valley springs or hunting sites, where processing debris occurs in proportion to the overall Monitor Valley assemblage. Partially verified at Monitor Lakebed: Fabricating and processing debris conspicuous, but only the middle portion of the reduction sequence is present.

High proportion of debris from ceremonial activities. Not verified: Luxury goods, ceremonial paraphernalia, and recreational devices are completely absent from our lowland sample in Monitor Valley (and similarly lacking in the CRM surveys of this area).

High proportion of discs from artifact repair. Not verified: Weapons (particularly projectile point fragments) are relatively rare throughout the lowlands; the only exception is Box Spring, where the bifacial discs approximate a distinctive artifact repair curve.

High proportion and diversity of domestic equipment. Partially verified: Ceramics are relatively abundant at White Sage Spring and Hickison Summit, thereby inflating the overall proportion of domestic equipment. This perceived abundance probably reflects (1) the importance of water storage in a water-tethered settlement pattern and (2) the skewing effects of differential fragmentation of ceramics relative to lithic artifacts. Milling equipment (metates, manos, and pestles) and ornaments (beads, pendants, and worked turquoise) are significantly underrepresented in the lowlands. The absence of metates is particularly noteworthy, suggesting either (1) that little domestic activity occurred here or (2) little area-specific plant processing occurred in the lowlands (and hence grinding stones were not cached for anticipated seasonal utilization).

Such structural and assemblage-level criteria all but eliminate the possibility of significant residential utilization of the areas around the lowland springs. But the evidence is not foolproof. In the Hickison Summit area, for instance, a relative abundance of water, the channeling effect of local topography, availability of ridgetops and relatively flat ground, and the contemporary piñon-juniper ground cover, lead one to expect at least some residential utilization. Our survey coverage of Hickison was not as comprehensive as elsewhere in Monitor Valley, and perhaps subsequent archaeological research will disclose a residential record comparable to, say, that evident in the Petes Summit area.

The situation at Monitor Lakebed may also be considerably more complex. None of the available evidence suggests the existence of a major lacustrine village complex adjacent to Monitor Lake, but the lack of subsurface excavation may have kept the archaeological
evidence invisible. We think it likely that the Monitor Lakebed site was periodically used residentially, probably as short-term, non-winter base camps and field camps. But until additional research is conducted on this important site, the tangible evidence is not compelling.

To summarize in terms of the five middle range procurement strategies posited earlier (Thomas, 1983a: chaps. 8 and 11), we conclude the following for the Monitor Valley lowlands:

STRATEGY I. HIGH RESIDENTIAL MOBILITY. Base camps established in the woodland, with foraging groups ranging throughout the lowlands: possible, but if so, such foraging was water-tethered and of extremely low archaeological visibility. Short-term lowland base camps: possible, but only in the immediate vicinity of Monitor Lake, Hickison Summit, and Box Spring.

STRATEGY II. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE CAMP/FORAGING RADIUS. Fusion base camps in the lowlands: no evidence for this proposition. Summer dispersal base camps: possible, but only in the immediate vicinity of a water source.

STRATEGY III. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE LOGISTICAL RADIUS. Logistic procurement in the lowlands: evidence of animal procurement at Box Spring and Hickison Summit; possible additional procurement immediately proximate to springs or lakebed. Field camps in the lowlands: likely, but only immediately proximate to springs or lakebed.

STRATEGY IV. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE CAMP/FORAGING RADIUS. Nearly sedentary base camps in the lowlands: no evidence to support this proposition. Foraging procurement in the lowlands: evidence of animal procurement at Box Spring and Hickison Summit; possible additional procurement immediately proximate to springs or lakebed.

STRATEGY V. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE LOGISTICAL RADIUS. Field camps in the lowlands: likely, but only immediately proximate to springs or lakebed.

THE MOUNTAINS OF MONITOR VALLEY: EXPECTATIONS

Middle range considerations, set out elsewhere (Thomas, 1983a: chap. 10), led us to suspect that the piñon-juniper woodland held greater potential for residential usage than any other landscape in Monitor Valley. This zone most adequately satisfied the requirements of nonagricultural human lifespace for several reasons.

Specifically, the piñon-juniper zone tends to have more moderate winter temperatures and is subject to neither the high daily temperatures of the valley flats nor the diurnal temperature extremes of the high country. Unlike these adjacent zones, the woodland likewise contains relatively abundant water sources and a year-round fuel supply. Snow-free areas can usually be found, even during the winter. The piñon-juniper woodland contains several important food resources (especially pine nuts, seeds, roots, berries, and greens), and additional food resources from both upland slope and valley bottom area available within the woodland village foraging radius. The woodland provides ancillary resources (for basketry, lithic reduction, turquoise sources, and other deposits). It also contains several naturally sheltered areas.

While the resource and topographic mosaic of piñon-juniper woodland can hardly be said to foster sedentism, the potentially exploitable resource base in the woodlands is diverse and rich—considerably richer and more diverse than anywhere else in Monitor Valley.

In other words, lifespace conditions in the piñon-juniper woodland were as good as they got in the prehistoric Monitor Valley. Given this environmental baseline, it is possible to enumerate the major ways in which hunter-gatherers could have exploited the woodland.

If base camps were commonly established in the Monitor Valley piñon-juniper woodland, then their archaeological visibility should be high.

If, on the other hand, the woodland was exploited mostly for logistic purposes, then these activities should have relatively high archaeological visibility: game procurement and meat caching, raw material procurement for tool manufacture, and plant procurement (visible mostly as pine nut caches). The
woodland contains a number of natural caves and rock-shelters, probably most suitable for caching and temporary field camps. Logistic sites should be found close to procurement locations, with major bias toward either plants or animals, rarely both. Food consumption at logistic sites should be primarily as "snacking," and faunal assemblages should be skewed toward low utility elements.

Logistic assemblages should have low relative diversity, consisting mostly of curated personal "gear," specialized implements for extraction, and debris resulting largely from artifact repair (rather than primary manufacture). Field camps should contain few high-bulk implements, except those left as site furniture. Specialized artifact caches are expected only in highly logistic systems.

These overall expectations for the Monitor Valley woodland can be translated into the five midrange aboriginal procurement strategies discussed above (see also Thomas, 1983a: chaps. 8 and 10).

**STRATEGY I. HIGH RESIDENTIAL MOBILITY.** Quite likely; foraging base camps can be expected to occur at selected spots within the woodland, critically positioned relative to local resource and topographic factors. Evidence of satellite procurement locations should also be present.

**STRATEGY II. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE CAMP/FORAGING RADI.** Dispersed residences are a possibility, but the resource distributions make large settlements (fusion camps) unlikely; base camps should be those resulting from the strategy of high residential mobility (Strategy I); extraction locations should be similar as well.

**STRATEGY III. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE LOGISTICAL RADIUS.** This, with strategies I and V, is the most likely possibility; evidence of logistic usage is quite visible, primarily as field camps and game procurement activities (and the absence of base camps).

**STRATEGY IV. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE CAMP/FORAGING RADIUS.** Quite unlikely; any nearly sedentary base camps established in Monitor Valley should occur in the piñon-juniper zone, but resource densities and local topography make this possibility a long shot.

**STRATEGY V. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE LOGISTIC RADIUS.** Highly likely; game and plant procurement locations and the occasional field camps would be identical with those of Strategy III. The major factor limiting this possibility is whether any set of microenvironments was sufficiently productive and diverse to permit nearly sedentary base camps to be established close enough so that Monitor Valley would fall within the logistical radius of that camp.

Strictly speaking, these expectations pertain strictly to the Monitor Valley woodland, operationally defined as that landscape contained between 2250 and 2500 m. But for present purposes, we will combine analysis of the archaeological record of the woodland with that for the adjacent upland and lowland slopes. In a sense, both slopes form a continuation of the woodland pattern, but some important differences exist as well.

**Analysis of Bias**

Before generalizing our findings, we reconsider the major sources of bias introduced in the process of generating our data.

**The Lowland Slope:** The Monitor Valley landscape contained between 2100 and 2250 m. Triple T and Jeans Spring shelters, stratified archaeological sites on the lower slope of the Toquima Range, were extensively excavated; Hunts Canyon Shelter, located at the extreme southern end of Monitor Valley, was also tested. We estimate that 62 m$^3$ of archaeological deposit was excavated from these lowland slope shelters.

The surface archaeology of the lowland slope was examined in several ways: three randomized 1 km spring catchment surveys, four fully recorded rock art localities (two of which were examined in 1 km catchment surveys), one hunting barrier, two 100-m-wide transects across the lowland slope south of Mill Canyon, and five randomized 500 m quadrats (see table 63).

In chapter 7, we tested the adequacy of our
fieldwork against the available, independent data from cultural resource management studies. We concluded that no major sampling bias exists for the lowland slope, although there remains the distinct possibility that postdepositional geomorphic processes have severely disrupted the surface archaeological record, particularly on the alluvial aprons that border the Toquima and Monitor ranges.

The Piñon-Juniper Woodland: The Monitor Valley landscape contained between 2250 and 2500 m. Five sheltered sites were tested and/or fully excavated in the Toquima Range woodland: Gatecliff Shelter, Toquima Cave, Grenouille Verte Cave, Northumberland Cave, and Ny1059. Two additional woodland sites—Butler Ranch Cave and Little Empire Shelter—were excavated in the Monitor Range. Roughly 600 m³ of archaeological deposit were excavated at Gatecliff Shelter; excavations at the other six sites totaled approximately 25.7 m³.

The woodland zone of the Toquima Range was also explored in three 1 km spring survey catchments, eight randomized 500 m square quadrats, and three 1-km-wide streamside surveys in Stoneberger, Ikes, and Mill canyons. The 1 km survey catchment surrounding Toquima Cave also falls into the woodland zone. The Monitor Range woodlands were systematically surveyed only in the Butler Ranch Cave catchment, although extensive reconnaissance was conducted in the upland reaches (chap. 1).

In sum, the woodland zone accounted for roughly half of our systematic survey undertaken in Monitor Valley. If we include our research at Gatecliff Shelter, slightly over 80 percent of the stratigraphic excavations in Monitor Valley occurred in the woodland zone.

This coverage provides a large, relatively unbiased sample of the prehistoric archaeological record for this area (see chap. 7). There remain, to be sure, geomorphic biases coloring our perception of this archaeology, but sampling bias seems not to be a significant problem here.

The Upland Slope: The Monitor Valley landscape contained between 2500 and 2750 m. No archaeological excavations were undertaken on the upland slope, but American Museum crews covered approximately 1830 ha of the Monitor Valley uplands in intensive, close interval, systematic survey. Several thousand additional hectares were surveyed in extensive fashion for rare elements.

The Toquima Range survey was primarily conducted through examination of spring catchments, with 6 of the 15 randomly selected springs falling into the upland slope sample. Although the Toquima uplands were included in the universe of the systematic quadrat sampling, this area contained none of the random quadrats.

We conducted an initial horseback survey in 1976 throughout much of the upland slope in the Monitor Range (chap. 1), finding the density of archaeological materials to be considerably lower than in comparable areas of the Toquimas. The most visible surface assemblages seemed to be clustered near permanent water sources. Based on these preliminary observations, we decided to concentrate survey efforts in the Toquimas, and no further systematic reconnaissance was conducted in the uplands of the Monitor Range. We did, however, return for additional work at the Table Mountain rock alignment.

Because we elected not to survey these arid uplands—and because relatively little systematic CRM fieldwork has taken place in these areas—the regional sample presented in this volume does not adequately describe the nature of the upland slope assemblages in the Monitor Range. We can draw some conclusions about specific archaeological complexes (such as that at Table Mountain), but even a first-generation synthesis of this area is beyond the present scope.

The Summit Crest: The Monitor Valley landscape higher than 2750 m (9025 ft). This volume deals with the summit crest only peripherally (table 63). Roughly 440 ha (1090 acres) were completely surveyed in the White Rock Springs catchments, and we recorded the San Juan Canyon rock blind as part of the 1970 Reese River systematic survey. Note that the excavations at Alta Toquima Village and the intensive survey of the Mt. Jefferson area, covering roughly 1580 ha (3900 acres), are excluded from this analysis (see Thomas, 1982c).
ARCHAEOLOGY OF THE MONITOR RANGE

The Monitor Range extends approximately 150 km along the eastern margin of Monitor Valley. Both its geology and archaeology are still rather poorly documented, due in large measure to the difficulty of access and lack of permanent roads on the eastern side of Monitor Valley.

As detailed above, American Museum research was restricted to excavation and limited survey work in the lower reaches of the middle and southern Monitor Range. Too little systematic coverage exists to allow analysis on a corridor-by-corridor basis. The following discussion of the archaeological record in the central Monitors will not only reinforce and clarify patterns perceived in the Toquima Range, but will also emphasize the diversity of distinctive mountain ranges of the central Great Basin.

THE BUTLER CANYON CUL-DE-SAC

Central Monitor Valley is flanked by two arid tablelands. Along the western margin is the upland Stoneberger Basin. On the eastern side is Butler Basin, perched high in the Monitor Range, origin of the steep headwaters of Butler Creek. Not far from where this stream flows down onto the Monitor Valley floor are the marshy meadows, first homesteaded in the early 1870s as a hay ranch. Butler Ranch Cave, immediately to the east of the abandoned farmstead, was extensively excavated, and nearby Little Empire Shelter was also tested. American Museum crews surveyed a 1 km catchment surrounding the Butler Ranch.

The key site in this analysis is Butler Ranch Cave, a small, south-facing cavity located in a sheer protruding tuff cliff. Intrasite structure changed dramatically through time. In the lower stratum, debris size sorting is pronounced, both artifact and debitage distributions approximating a rear/central drop zone model, with hearths constructed near site center. During this period, Butler Ranch Cave functioned like several other caves and shallow shelters encountered in Monitor Valley.

Fig. 221. This weather wall, constructed across the mouth of Butler Ranch Cave, minimized downcanyon cold air drainage, reduced the loss of radiant heat, and enhanced efficiency of interior hearths by reducing the volume of space to be heated. With this relatively modest labor investment, the Yankee Blade phase inhabitants significantly enhanced the residential potential of Butler Ranch Cave.

The largest concentration of debitage occurs in this lower stratum, apparently in Reveille phase contexts. This assemblage is markedly skewed toward the early stage of biface reduction. Mean flake size is also much larger in this stratum, further suggesting that quarry staging was a primary activity.

Sometime within the past 600 years, the configuration of Butler Ranch Cave was significantly changed by the addition of a weather wall (fig. 221). This construction implies that the upper level was utilized (at times) residually, an impression reinforced by the artifact content. Ceramics appeared in the assemblage (an impossibility in earlier times); both unifacial tools and grinding stones became relatively more abundant. The absolute quantity of debitage decreased, as did the mean flake size.

Due to these shifts in the Yankee Blade stratum, the overall Butler Ranch Cave assemblage shows a somewhat greater relative
diversity than those from the other caves and shelters in Monitor Valley. Although this small assemblage is not functionally distinctive, general utility tools and domestic equipment are rather abundant. The lithic reduction profile at Butler Ranch Cave rather closely approximates a quarry curve, with all later reduction stages less common than expected. Fabricating tools and ceremonial items were totally absent.

The rock wall did not markedly change the rear/central drop zone pattern of the lower stratum, but hearth positioning shifted toward the rear. Particularly during this Yankee Blade phase occupation, Butler Ranch Cave shows ample evidence of nocturnal utilization, concern with heat retention, and apparent maximization of interior light.

Even prior to construction of the wall, Butler Ranch Cave was an effective natural heat sink, and hearths were apparently positioned to create heated corridors along the rear and lateral walls; the site was clearly used (at least in part) as a residential base.

Nearby Little Empire Shelter was not as heavily utilized as Butler Ranch Cave, probably due to its open and airy, heat-inefficient configuration. Although Little Empire enjoyed a certain degree of solar gain and storage, downcanyon winds whistling through would probably have canceled the natural insulation, and extensive weather walls would have been necessary to retain much heat inside. Proximity to the better insulated Butler Ranch Cave further decreased Little Empire’s desirability.

Assemblages from four sites in the Butler Ranch catchment survey are dominated by late-stage bifaces, many manufactured of pink/reddish chert and small obsidian nodules, both common to this area. Domestic diagnostics are relatively common in these assemblages. The largest of these sites, Ny922, is clearly residential; both the other assemblages are not sufficiently diagnostic to indicate site function.

Clearly the Butler Canyon cul-de-sac shows evidence of limited residential utilization. But this isolated, dead-end drainage never approached the major corridors of the Toquima Range in terms of either residential or logistic potential.

Not far to the south lies Dobbin Summit, another natural corridor permitting relatively easy access between intermountain valleys. Although we only conducted casual survey in this area, Dobbin Summit is clearly a likely place to find residential settlements and game procurement facilities. We anticipate that future research here should generate an archaeological record like that found in the Petes Summit and Northumberland corridors to the west.

**THE TABLE MOUNTAIN HUNTING COMPLEX**

South of Dobbin Summit, the Monitor Range is dominated by Table Mountain, which reaches a maximum elevation of 3312 m. Limited horseback survey throughout the Table Mountain uplands failed to disclose any sign of high-altitude utilization comparable to that recorded in the Mount Jefferson area of the Toquima Range.

But along the southern flank of Table Mountain, atop a massive volcanic mesa, is a complex network of low-lying stone walls, running in all directions, repeatedly intersecting, and in places culminating in stone blinds. The Table Mountain rock alignment is a rather high-cost, labor-intensive facility that implies relatively predictable, high-bulk return.

The Table Mountain rock walls were apparently constructed and utilized for intensive logistic harvesting of sage grouse (chap. 5). The largest alignment occurs on a primary sage grouse wintering and strutting ground. During the mating season, the birds could be driven with relative ease; modern sage grouse merely scurry away when pursued (provided that they are not frightened into flight). The rock alignments and blinds function not only to conceal hunters, but also as directional barriers to the movement of the strutting birds. The objective was to move slowly, gradually driving the grouse toward concealed hunters or into awaiting snares. Dozens of the large birds could be taken during the late winter–early spring booming season.

Artifacts associated with the Table Mountain rock alignment support this opinion. Compared to the aggregate Monitor Valley assemblage, Table Mountain has an inordinate frequency of general utility tools, and relatively few projectile points. Domestic de-
bris and fabricators were totally absent. Cores and roughouts were rather rare, but rough percussion blanks were more common than expected.

The temporal structure of the Table Mountain assemblage is decidedly “early,” comparable to Horizons 8 and 9 at Gatecliff Shelter. Although Devils-Gate-specific assemblages are rare in Monitor Valley, this evidence conforms to the Early Neoglacial pattern noted at other labor-intensive hunting features in the Great Basin.

THE BARLEY CREEK SUBCORRIDOR

A moderately well-defined natural pass through the southern Monitor Range occurs at Barley Creek. The steep, 10.5 percent gradient begins in Monitor Valley, at an elevation of about 2245 m, winds up the western Monitor Range for a distance of 3 km, and crosses the summit at 2560 m. The eastern descent is considerably more gradual, defining a gradient of 5.4 percent (490 m elevational loss in 9 km). An unimproved road and a jeep trail today follow the Barley Creek subcorridor.

A major rock art site is located immediately south of where Barley Creek enters the floor of Monitor Valley. The positioning of the Barley Creek petroglyph panels is reminiscent of Hickison Summit and East Northumberland. All three sites contain the key elements for an intercept strategy hunting locus. Three distinct petroglyph panels flank the dry wash to create a natural funneling effect. The adjacent box canyon provides a first-rate change of pace factor, flanked on one side by a 10 m dropoff and on the other side by the boulders containing the rock art.

THE WHITE ROCK CANYON CUL-DE-SAC

White Rock Canyon is a short, narrow spur along the southeastern margin of Monitor Valley, dead-ending about 5 km upcanyon. Given the relatively difficult access from here into the Monitor Range, we were surprised to find several petroglyph-embellished boulders near the mouth of White Rock Canyon. Like the setting in East Bald Mountain Wash (due west across the floor of Monitor Valley), the central boulders create a natural ambush area for game funneled either up- or down-canyon. But the absence of easy east-west access makes Ny22 somewhat of an exception. Its hunting pattern is more like that in Mill Canyon, where hunters apparently concentrated on seasonally massed overwintering herds rather than attempting to intercept migrating groups.

THE HUNTS/MCCANN CANYON CORRIDOR

This corridor through the southern Monitor Range commences in the Monitor/Ralston Valley lowlands and follows Hunts Canyon until it branches in the McKinney Mountains, at an elevation of about 2085 m. Primary access continues through McCann Canyon, which ultimately winds its way eastward into West Stone Cabin Valley. The Monitor Valley end of the pathway follows a broad, well-defined corridor, with a gentle gradient of only 2.9 percent (440 m elevational gain in 15 km). The eastern route is somewhat more circuitous, particularly near the summit, following a gradient of 4.3 percent (475 m elevational gain in 11 km). Today, a modern, all-weather road uses the Hunts/McCann Canyon route to connect Monitor and Stone Cabin valleys.

Near the McCann Canyon summit is a boulder with several petroglyph motifs (Ny926). Despite relatively easy access from either flanking valley, McCann Canyon is tightly constricted here, providing both funneling and change of pace factors suitable for intercept/ambush hunting. These naturally favorable conditions were enhanced by construction of an isolated soldier cairn directly across the bottleneck.¹

The American Museum did not intensively survey the Hunts/McCann corridor, but we did test Hunts Canyon Shelter, a narrow southwest-facing overhang located in a massive tuff outcrop in the Canyon bottomland. Although no radiocarbon dates are available from our test excavations, statistical analysis of time-marker frequencies suggests that the median occupation of Hunts Canyon Shelter may be later than apparently comparable Monitor Valley shelters (particularly Toquima Cave and Jeans Spring Shelter).

Our excavation strategy at Hunts Canyon insufficiently explored the longitudinal and
lateral variability within the overhang, so little can be said about intrasite patterning at this extremely broad, symmetrical rock-shelter. The single excavated hearth is consistent with both workshop and sleep zone models, and the debitage tends to be slightly size sorted, with smaller flakes occurring near the dripline and becoming larger toward the rear of the overhang. Although these findings might reflect reverse size sorting, it is more likely that the small, biased sample is responsible for the apparent trends.

Hunts Canyon Shelter contains a large trap cache containing seasonally specific gear, left in passive storage for anticipated use.

The Hunts Canyon assemblage could not be functionally differentiated from the aggregate Monitor Valley assemblage. It is clear, however, that this site contains a relative abundance of domestic equipment, and the generally adequate lifespace conditions suggest some degree of residential utilization of Hunts Canyon Shelter.

ARCHAEOLOGY OF THE TOQUIMA RANGE

McKee (1976: 46) describes the Toquima Range as "a rather discrete tectonic block . . . cut by many small high-angle faults." An analogy to this geological structure—as a single "discrete block" cut by specific zones of alteration—rather accurately describes the cultural geography of this range as well.

Monitor Valley is, in effect, a high-altitude topographic isolate, connected to neighboring valleys by very few east–west montane pathways. The trails blazed by the earliest Euro-American explorers, Jedediah Smith and John C. Frémont, were heavily conditioned by its fortresslike character. When each party encountered Monitor Valley, potential routes of travel were restricted to the few naturally available channels of access (Thomas, 1983a: 150).

Endemic game animals have adapted to this topography for millennia. Wintering in the lowlands of nearby valleys and summering in the Monitor Valley highlands, both bighorn and mule deer have pursued a seasonal round integrating these biogeographically distinct ecosystems. Potential routes of migration between Monitor Valley and the surrounding lowlands were tightly circumscribed by the natural distribution of the few passes that cut through the Toquima and Monitor ranges. Aboriginal cultural geography was also closely attuned to the channeling effect of the high-altitude mountain passes.

The Toquima Range extends for 125 km to define the western margin of Monitor Valley. Figure 169 indicates the few east–west pathways that penetrate these mountains. Historical and contemporary observations demonstrate how these topographically restricted zones of access have conditioned settlement patterns in Monitor Valley over the past 125 years. Independent archaeological data illustrate that topography has been a powerful factor conditioning land use patterning for millennia.

The Toquimas are bounded to the north by Hickson Summit, which has already been discussed. Because of its low absolute elevation, Hickson Summit was grouped with other lowland facilities in Monitor Valley; in this sense, Hickson is merely a northern extension of the extensive bottomlands which define the central portion of Monitor Valley. But in another sense, Hickson Summit is a major montane corridor, and could readily be described in the context of similar corridors through the Toquima Range.

Whether viewed as a continuation of the lowland expanses or a discrete upland mountain pass, Hickson Summit clearly functioned as a primary biogeographic corridor skirting the northern Toquima Range. The archaeological record here reflects movement: seasonally migrating antelope and bighorn; hunters planning and celebrating the occasional ambush of the migrating game; short-term diurnal refuge and secure cache location for people simply passing by. Judging by the available archaeological record, Hickson Summit provided little more than a temporary stopover for the seasonal traveler moving between the high ground of Monitor Valley to the lower flats of Big Smoky Valley.

The importance of the natural corridor in channeling human and nonhuman movement is a common theme in the archaeolog-
ical record of Monitor Valley. Hickison Summit is the northernmost example of this pattern.

**THE TOQUIMA RANGE NORTH**

For the next 15 km to the south, between Hickison Summit and Petes Summit, lies an archaeologically little-known and relatively inaccessible stretch of the Toquima Range having only one relatively minor pass, roughly 5 km south of Hickison Summit, where a little-used jeep trail crosses from Monitor Valley to Big Smoky Valley over an unnamed summit.

The approach from Big Smoky Valley is short and steep, defining a gradient of 5.4 percent (91 m elevational gain in 1.7 km). Although the Toquima Range is relatively low at this point, and the maximum elevation here is only 1981 m, the unnamed pass is poorly developed and difficult to follow. Access from Monitor Valley is rather easy, rising only 1.6 percent (31 m elevational gain in 2 km).

We conducted no archaeological reconnaissance in this northern reach of the Toquima Range, and we are unaware of any subsequent CRM fieldwork. But given the findings in the rest of Monitor Valley, we suspect that when surveyed, this zone will disclose evidence of ephemeral human travelers, groups-on-the-move. Limited prehistoric intercept hunting and even more limited plant procurement remain likely possibilities for this area; base camp structures and assemblages are considerably less likely.

**PETES SUMMIT/CLIPPER GAP: A CENTRAL CORRIDOR**

Several kilometers farther south of Hickison Summit is a second major conduit between Big Smoky and Monitor valleys. This naturally defined crossroads funneled people and game through two parallel montane passes, Petes Summit to the north and Clipper Gap, only a few kilometers to the south. Both passes have been heavily utilized by travelers during prehistoric, early historic, and contemporary times. Each group has contributed a distinctive archaeological record which, properly read, chronicles its impact on the area.

The Petes Summit corridor has a maximum elevation of 2408 m. Access from the west (past Spencer's Hot Spring and up Petes Canyon) is relatively gradual, following a gradient of about 3.4 percent (671 m elevational gain in 20 km). From the Monitor Valley side, one approaches Petes Summit through Sams Canyon, along a relatively easy gradient, rising 3.9 percent (274 m elevational gain in 7 km).

The route across Petes Summit is the most gradual direct corridor through the Toquima Range. From the earliest Euro-American settlement of central Nevada, this natural artery has connected the booming mining settlements near Austin with Belmont and Hot Creek to the east (Thomas, 1983a: 135). Today, a well-maintained dirt road over Petes Summit provides the primary access west from northern Monitor Valley (fig. 222).

Seven km to the south is Clipper Gap, a less satisfactory breach in the northern Toquima Range. Clipper Gap Summit is about 50 m higher than Petes Summit. The only access from the west, through the steep and narrow Clipper Gap Canyon, follows a gradient of 5.4 percent (762 m elevational gain in 14 km). Travel on the eastern side is considerably easier, passing through Corral and Stoneberger canyons to the valley floor (near the modern Monitor Ranch). The eastern gradient rises only 3.0 percent (457 m elevational gain in 16 km).

Euro-American settlers attempted to use the Clipper Gap corridor relatively early in the colonization of central Nevada. A toll road, in operation sometime prior to 1866, began in Austin, followed the Overland Trail, then turned down Smoky Valley and passed through the Toquima Range at Clipper Gap (Thomas, 1983a: 135). The trail narrows considerably through the Toquima Range, containing a very steep ascent which limited its effectiveness as a route of communication (Stetefeldt, 1866). The importance of the Clipper Gap pass was short-lived, as the favored route shifted to Petes Summit (the major access today).

Regardless of the specific pathway chosen, semimigratory game and prehistoric hunter-
Fig. 222. The Petes Summit/Clipper Gap corridor, the major pass through the northern Toquima Range, provides the most compelling evidence of prehistoric residential activities in Monitor Valley. Because this naturally defined crossroads funneled both people and game, this narrow east–west pathway also became an important area for seasonal, intercept strategy hunting.

gatherers could pass freely through these wide, gradual intermountain corridors. At present, more than a dozen year-round springs occur here, making water more abundant along this corridor than anywhere else in the Toquima Range; one is never more than 4 km from water anywhere in the Petes Summit/Clipper Gap corridor.

Not coincidentally, the prehistoric archaeological record of Petes Summit and Clipper Gap is among the richest and most diverse in Monitor Valley. Although prehistoric house foundations are not common in the Monitor Valley area, 10 were recorded in the 1 km catchment survey of the Petes Summit/Toquima Cave area. This is the densest house concentration noted in Monitor Valley, representing more than 40 percent of the house remains encountered throughout the Toquima Range survey.

The archaeology of nearby Petes Spring is also distinctive. Situated at the western gateway to this much-traveled east–west corridor, Petes Spring is arguably the most intensively utilized point water resource in Monitor Valley. Its 1 km catchment had the highest site/locus ratio (0.42) in Monitor Valley; 19 of the 45 potential loci were utilized as sites. Petes Spring also had the highest artifact density (0.5 artifacts per ha) in the sample of Monitor Valley montane springs. An isolated house foundation occurred here as well. The archaeology of other point water sources in this area is similar. On the eastern side of Petes Summit is Deer Spring, characterized by an extremely high artifact density (0.48 artifacts per ha searched). The site/locus ratio at Deer Spring (0.35: 9 of the 26 loci used as sites) is likewise among the highest in Monitor Valley.
The same pattern holds for Sage Hen Spring, in the Clipper Gap corridor. Both artifact density (0.43 artifacts per ha searched) and the site/locus ratio (0.35: 6 of the 17 loci utilized as sites) are very high.

The Petes Summit/Clipper Gap corridor also has an important linear water resource, Stoneberger Creek, but its associated archaeology is very different. By the polythetic criteria employed here, Stoneberger Creek has only six potential loci (within the 1 km linear catchment); but significantly, five of these six loci had been utilized as sites (the highest intensity of utilization anywhere in Monitor Valley).

All the Stoneberger Creek sites are found on ridgetops which overlook the Clipper Gap corridor as it snakes toward Monitor Valley. Assemblages from these sites are not significantly different from the aggregate Monitor Valley assemblage with respect to bifacial staging behavior, size/diversity relationships, temporal differences, or functional differentiation. Domestic equipment and artifacts for tool fabricating/processing were relatively rare here, but the byproducts of fabrication and processing were overrepresented.

Two naturally sheltered areas also overlook the Petes Summit corridor. Toquima Cave is the most prominent of these, and today provides a minor tourist attraction. Yet despite the rather spectacular polychrome pictographs, a favorable south-facing aspect, and immediate east–west access, Toquima Cave was not a desirable place to live. The relatively high elevation brings considerably colder temperatures, and the nearest water source is at least 2 km away. More important, the enclosure differs in shape from the more common exogene configuration. Toquima Cave is relatively deep and narrow, a shape vitiating the effects of passive solar heating enjoyed by many other shelters in Monitor Valley.

The archaeological site structure of Toquima Cave is also unique for Monitor Valley. Faunal, debitage, and artifact sorting point up a cultural patterning defined along the longitudinal axis, differing significantly from the lateral spatial structure common to other Monitor Valley shelters. Well-defined workshop and hearth zones occurred near the site midpoint of Toquima Cave, with the rear recesses serving as a zone of primary discard. A peripheral secondary toss zone also appears toward dripline. Toquima Cave lacks lateral size sorting of debris, indicating that the toss zone did not extend along the sides of the site. Hearths seem to be absent along the lateral margins (although due to our excavation strategy, we cannot preclude the presence of bedding areas along one or both sides of the central workshop/hearth area).

Although the artifact assemblage cannot be functionally differentiated from the aggregate Monitor Valley sample, domestic equipment is relatively common at Toquima Cave, and byproducts of lithic artifact fabrication are relatively rare. The lithic reduction profile is somewhat curious, with both early- and late-stage byproducts more common than intermediate stages.

We think that Toquima Cave was primarily a workshop. The long, narrow configuration derives little solar gain as a heat sink, and no effort seems to have been expended to create artificially heated corridors near the walls. This suggests that people used the site mostly during the daytime. Toquima Cave was not a good place to spend the night, except perhaps in warm weather.

Nearby Grenouille Verte Cave provided a
very different potential prehistorically. This small alcove encloses fewer than 9 m², and the ceiling is everywhere less than 1 m high. Not unexpectedly, this small cave showed minimal cultural utilization; our excavations produced only a few artifacts, some debitage, and no evidence of intrasite debris patterning. A charcoal concentration suggests that a small hearth probably heated a single bed sleeping area, probably during the winter.

Despite such “negative findings,” Grenouille Verte Cave was, in a sense, more desirable than nearby Toquima Cave for use as a short-term rest stop. Grenouille Verte Cave was probably utilized in the same way as Bor-ing-as-Hell Shelter. Both sites provide ideal trailside shelter for small groups of travelers. The interiors are naturally cool in summer and cheap to heat in the winter. Each cave is proximate to a major transport corridor: Bor-ing-as-Hell Shelter overlooks Hickson Summit, the primary access to northern Monitor Valley, and Grenouille Verte is less than 500 m from the Petes Summit corridor, the major east–west pass into central Monitor Valley. Both caves probably functioned as temporary diurnal stopovers.

Boring-as-Hell Shelter is another cache spot where travelers placed temporally irrelevant gear into passive storage, to be retrieved on the way back (into or out of Monitor Valley). Grenouille Verte and Toquima caves could—and probably did—serve this caching function as well.

**The Middle Toquima Block**

The Middle Toquima block consists of a relatively impenetrable upland montane block extending roughly 15 km north–south. This topographic isolate is bounded on the north by the Petes Summit/Clipper Gap corridor, and on the southern margin by Northumberland Canyon.

Our archaeological coverage of the Middle Toquima block was relatively complete. We excavated Gatecliff and Jeans Spring shelters, and conducted a variety of archaeological surveys: the Jeans Spring catchment survey, 13 montane spring catchment surveys, streamside surveys in Mill and Ikes canyons, plus randomized quad survey covering eleven 500 m squares.

**Assemblage-level Evidence:** The Middle Toquima Block contains a rich and diverse archaeological record. Weapons in general are overrepresented here: Gatecliff and Humboldt series points, untypable point tips and other fragments, and Promontory pegs. Domestic equipment is well-represented, with an unusually high frequency of metates being recovered. All stages of lithic reduction are quite common here, as well as incised stones.

But these patterns come into considerably finer focus when Middle Toquima block assemblages are analyzed individually. In chapter 12, we found that projectile point fragments, rough percussion blanks, and pressure flaked bifaces were nonrandomly associated with the montane springs. Incised stones also occurred near such springs, but they were concentrated toward the lower elevations.

Streamside assemblages—two of three of which occur in the Middle Toquima block—were characterized largely by projectile point fragments and fine percussion blanks. Ceramics were totally absent at such sites.

Similarly, we found that the aggregate assemblage from the Middle Toquima Block manifests an artifact level diversity comparable to the rest of Monitor Valley (chap. 8). But when the overall assemblage is subdivided into component samples, we find a significant degree of variability. We know through regression analysis that the montane spring assemblage is less diverse than almost anywhere else in Monitor Valley (table 66); moreover, diversity within the montane spring assemblages decreases with increasing elevation (table 67). A similar lack of diversity also characterized the streamside assemblages.

As discussed below, assemblage content and assemblage diversity within the Middle Toquima block are heavily conditioned by logistic (rather than residential) considerations. This is not to say that residential activities did not occur in the Middle Toquimas, but rather to emphasize the extent of nonresidential activities within this topographic isolate.

We begin this synthesis with an overview of the upland pattern, then move into a discussion of archaeology in the woodland zone. In general, our functional analysis showed that upland slope assemblages were domi-
nated by reduction stage bifaces, and the staging profile was particularly skewed toward early-stage reduction (chap. 10). Weapons (especially Rosegate series points) were generally rare in the uplands, as were items of domestic and ceremonial equipment.

SITE POSITION EVIDENCE: Detailed spring catchment surveys in the Middle Toquima uplands turned up a limited archaeological record. Spring 23, located in the Stoneberger Basin at an elevation of 2710 m (8900 ft) is characterized by a very low intensity of loci utilization (16%: 3 sites on 19 potential loci), and the assemblage density was merely 0.18 artifacts per ha searched. At Copper Mine Spring, standardized survey procedures followed elsewhere in the Toquima Range failed to produce a single archaeological artifact.

We also examined the archaeology of the Middle Toquima block by exploring various site positioning strategies. From this evidence, we know that sites on both sides of the central Toquima woodland and—to some extent the uplands—were utilized at least sometimes as residences.

The positioning strategy on the eastern Toquima slope was heavily influenced by inter-valley access, optimal spacing from water, and deliberate selection of low-elevation loci. As at Reese River, site selection maximized the edge effect by maintaining access to several adjacent biotic communities. Deliberate use of lower elevations also avoided extreme temperatures.

Although numerous archaeological sites exist on the western flank of the Toquimas, they tend to be smaller than other Toquima sites. Fewer houses are located here, and site positioning maximizes neither access to water nor edge effect. Some degree of residential activity is implied by the deliberate selectivity for flat ground slope, in agreement with the principles behind the probabilistic model on figure 203. As on the eastern side, inter-valley access seems to be the primary positioning factor. The predominantly east-facing site position here parallels the eastern orientation of doorways in Monitor Valley, suggesting a pattern of maximizing favorable summertime insolation.

Whereas some western Toquima surface assemblages were undoubtedly generated by base camps and temporary field camps, others seem to have resulted from procurement activities. Potential loci on the western slope occur in haphazard distribution relative to water, and a similar lack of patterning is evident in the loci actually utilized. Site positioning was clearly conditioned by factors other than optimal distance to water.

Sites in the western Toquimas favor loci some distance from the lower foothill margin. Dozens of otherwise satisfactory loci were available much closer to the ecotone margin. Site positioning in the western Toquimas apparently maximized the distance from lower foothill margin, thereby ignoring any potential edge effect. This pattern stands in direct opposition to that observed on the eastern slope. We suspect that residential utilization was proportionately less important on the western Toquima slope than on the eastern slope or in the ecotone sites of the Reese River Valley.

The relatively impoverished archaeological record in the uplands accumulated largely from logistic activities: the universal absence of upland house foundations, the generally low proportions of domestic artifacts, the proportionately lower utilization of loci, the absolutely lower artifact density, and the significantly higher proportion of the upland assemblage occurring as off-site isolated finds.

While this conclusion is undoubtedly true, the prehistoric residential utilization of the uplands cannot be completely disregarded. Locus-controlled survey data make it clear that deliberate decisions maintained the specific site spacing. Despite the less intensive utilization of the upland landscape—and an obvious preference for the lower reaches—we find sufficient planning in the archaeological record of the central Toquima uplands to suggest that human lifespace was of concern here as well: optimal water spacing, relative ground slope, and solar aspect. Similarly deliberate selection of flat ground is not expected in most logistic endeavors.

Upland sites also maintain optimal positioning relative to nearest water, following the expected concentric probability distribution on figure 205. Solar aspect is also non-randomly selected on the upland slope. Not only are many more south-facing loci utilized as sites, but sites with a southern exposure had significantly higher artifact densities than
The archaeological record of somewhat more accessible areas such as dead-end canyons and minor trans-Toquima trails show evidence of more intensive prehistoric utilization than isolated upland springs.

Evidence from the Willow Canyon Cul-de-Sac: Willow Spring is located at the head of Willow Canyon, on the Big Smoky Valley side of the Toquima Range. Several of the potential loci contained archaeological sites, as high as 31 percent intensity of utilization (4 sites on 13 potential loci). But the artifact density of the Willow Spring catchment is extremely low (only 0.11 artifacts per ha searched).

Evidence from the North Wildcat/Ikes Canyon Trail: A relatively poor upland access route between Monitor and Big Smoky valleys begins in the North Fork of Wildcat Canyon, passes across the Stoneberger Basin (at an elevation of 2873 m), and drops into Monitor Valley through Ikes Canyon. The western approach is winding and steep, following a gradient of 9.2 percent (923 m elevational gain in 10 km). Access from the Monitor Valley side is likewise difficult, rising approximately 7.2 percent (648 m elevational gain in 9 km). Today, this route contains only a discontinuous primitive road on either side, joined by a trail across the summit.

Jeans Spring Shelter is near the mouth of North Wildcat Canyon. Except for ready access to spring water, this small overhang provides little in terms of lifespace considerations (fig. 224). Its small size affords temporary shelter to no more than a couple of people. Nowhere inside the overhang does the ceiling exceed 1.5 m or so. The cave opens toward the northwest, hence benefiting little from the warming effects of insolation. Small size did, however, aid in retaining artificial heat, the central hearth defining an easily heated U-shaped sleep/work area.

The Jeans Spring Shelter artifact assemblage contains a disproportionate number of weapons (especially trapping tools.) These seasonally specific artifacts seem to have been ad hoc caches, left in passive storage for anticipated future use. Jeans Spring Shelter probably also served as a foul weather and nocturnal stopover for travelers moving across the North Wildcat/Ikes Canyon trail between Big Smoky and Monitor valleys.

Although this artifact sample was too small for intrasite analysis, the debitage was significantly size sorted, following a rear/lateral drop zone model (smaller flakes near the rear alcove and larger debitage toward the drip-line). This rear/lateral zone was probably used as a temporary bedding area; workshop and consumption activities were probably also conducted here.

The cave itself is well positioned as an ambush locale, and several of the artifacts recovered probably accumulated during boredom reduction and artifact repair conducted
as hunters hid within the small overhang, watching for game—probably artiodactyls, but perhaps also seasonal waterfowl—attrac-
ted to Jeans Spring, 200 m to the northeast. The numerous rifle cartridges scattered about the cave interior testify to similar usage by contemporary deer hunters. In this sense, the shelter serves both as an information-gath-
erg ing locus (a station) and a procurement location for encounter strategy hunting.

The overall archaeological record in this area is not impressive. Spring 22 flows down the north fork of Wildcat Canyon, roughly 1 km east of Jeans Spring Shelter. Although the intensity of utilization is a relatively high 14 percent (3 sites located on 22 potential loci), the artifact density is low (only 0.20 artifacts per ha searched).

Despite the overall paucity of artifacts, the relative abundance of domestic artifacts and house foundations make it clear that the north Wildcat Canyon area was used residentially at times. Interestingly, the major site in this area, Ny892, was not positioned on a locus; two house rings were found here (one with a metate embedded in the northeastern quad-

rant). Two additional house circles were located and mapped (at Ny829) during the informal survey to the west of Jeans Spring.

We conducted several intensive archaeo-
logical surveys in the Ikes Canyon cul-de-sac, and the results demonstrate that this area was little utilized during prehistoric times. Al-
though 27 potential loci were mapped in the combined Sawlog Ridge Springs (nos. 24 and 25) survey, only four of these contained ar-
chaeological sites, defining a relatively low (14.8%) intensity of utilization; artifact den-
sity in this area is also minimal (0.04 artifacts per ha searched). A stone hunting blind (Ny910) was also recorded in this catchment.

The same pattern holds for the White Rock Springs (nos. 17 and 18), located high in the Toiyabes, bordering the Ikes Canyon drain-
age. Only a single archaeological site was found here, and the intensity of utilization (1 site for 11 potential loci) is among the lowest recorded in Monitor Valley; artifact density is only 0.03 artifacts per ha searched.

The streamside survey of Ikes Canyon fur-
ther confirmed the spotty occupation in this cul-de-sac. Due to the steep canyon config-
uration, only a single locus was recorded in the streamside survey, and an archaeological site (Ny1229) was found here.

**Evidence from the South Wildcat/Mill Canyon Trail:** Another poorly defined access route from Monitor Valley to the west passes from the South Fork of Wildcat Canyon, skirts Wildcat Peak (at a minimum elevation of about 2650 m), then drops into Monitor Valley through Mill Canyon. The western access is steep and discontinuous, defining a gradient of 8.6 percent (1037 m elevational gain in 12 km). Access from Monitor Valley is also difficult, rising approximately 8.0 percent (762 m elevational gain in 9.5 km). Today, a primitive road snakes up Mill Canyon (and a trail passes through the lower part of South Wildcat Canyon); but there is no contemporary utilization of the South Wildcat–Mill Canyon route.

Our Mill Canyon streamside survey extended from the mouth of Mill Canyon upstream to the head of the canyon. Apart from Gatecliff Shelter, only a single additional archaeological site was recorded along the canyon (although it is likely that additional deeply stratified sites like Gatecliff Shelter lie buried beneath the Mill Canyon alluvium). Ny926 is a ridgetop site at the mouth of Mill Canyon; although positioned like the piñon ecotone sites of Reese River, the artifact inventory of Ny926 lacked any evidence of residential activities (viz. ground stone, features, and house foundations).

Limited residential activities are, however, chronicled in the deep deposits of Gatecliff Shelter. Located on the north side of Mill Canyon, Gatecliff is a south-facing overhang containing more than 10 m of sediments, deposited in a well-defined stratigraphic sequence of 56 geological units and 16 cultural horizons. People first visited Gatecliff Shelter about 5500 B.P. and the uppermost strata were deposited within the past few centuries.

The size and configuration of Gatecliff Shelter changed significantly during these five millennia. Previous analyses (Thomas, 1983b) emphasized the redundant usage of space at Gatecliff; in this monograph, we have developed new techniques for looking at more subtle variability in hearth positioning and debris disposal.

Hearth positioning at Gatecliff was relatively constant throughout the human occupation of the site because similar spatial strategies were played out again and again. We can document at least nine wholly independent surfaces created during the Middle Holocene/Early Neoglacial periods at Gatecliff. In effect, each cultural horizon at Gatecliff was geomorphically sealed from previous strata, and the internal structure of each living surface is hence independent of patterns in earlier horizons. The observed spatial redundancy results directly from coping behavior rather than rote imitation.

Gatecliff Shelter is the largest excavated site in Monitor Valley, and the hearths at Gatecliff are significantly larger as well. In general, we find that hearth size decreases through time—particularly above Horizons 4–6 (chap. 13); hearth size closely correlates with the rising environmental temperatures during the occupation of Gatecliff.

Once established, hearth positioning further conditioned refuse disposal patterns. The archaeological debris was heavily size-sorted; almost without exception, debris found toward the rear of the site was significantly smaller than materials near the hearthline.

To summarize the intrasite patterning, we know that Gatecliff Shelter was relatively small during middle Holocene times (5000–2500 B.C.), enclosing between 30 and 44 m². The climate during this interval was warmer than at present, dominated by summer-wet conditions with intense storms (Thomas, 1983b: table 90); the piñon-juniper woodland had begun to invade the Monitor Valley area. During the Middle Holocene, the western wall was located rather near the dripline. Since this part of the site provided little natural shelter, it was little utilized, and both hearths and debris disposed here reflect little systematic patterning. But the northern and rear walls were recessed from the dripline and this natural protection from the elements was enhanced by distinctive hearth corridors, suggesting nocturnal and/or foul weather utilization of the site.

During the Middle Holocene, Gatecliff Shelter was probably a field camp, a place where small, task-specific groups spent no more than a few days. Most visitors to Gate-
cliff during this period were hunters (presumably male), although women may have also happened by.

During the first part of the succeeding Early Neoglacial period (2500–1350 B.C.), temperatures decreased and summer precipitation declined, to a level of less effective precipitation than at present. Although Gatecliff Shelter still enclosed between 36 and 48 m², the progressive infilling had significantly modified the position of the western wall relative to the dripline. This now-naturally protected western portion was artificially heated by a broad, well-defined hearthline. Hearths along the rear and northern walls were no longer utilized.

The occupational tempo of Gatecliff Shelter changed about 1500 B.C. Although men continued to hunt and butcher artiodactyles and to manufacture and repair chipped stone tools, they also started carrying large chunks of limestone and sandstone into the site, where they made grindings labs and grinding stones. Women also began to visit Gatecliff more frequently, using the grinding stones manufactured there for processing seeds collected not far away. Women also made basketry and hide clothing at Gatecliff.

During the later part of Early Neoglacial times (ca. 1300 B.C.), temperatures were rather cooler than today. As sediments continued to accumulate, the western wall of Gatecliff advanced toward the dripline, thereby once again decreasing protection from the elements in this part of the site. No longer was a heated corridor constructed along the western wall, and artifact distributions suggest that this zone was used mostly for activities producing bulky discards. But simultaneously, the northern wall retreated rather dramatically, creating a sheltered zone at the rear of the site. During this period of decreased temperatures, intrasite patterning shifted toward the well-protected northern wall, which was warmed both by the solar radiation entering this south-facing shelter, and also by a well-defined line of firehearts.

Hearths built during this period were relatively large and several heat-efficient, rock-filled hearths were constructed during Reveille times. Specifically, the largest hearths constructed during this period averaged nearly 70 cm in diameter. Hearths built previously were slightly smaller and those constructed after Reveille times were considerably smaller.

As Gatecliff Shelter continued to fill up during the early part of the Late Neoglacial (between 1250 B.C. and A.D. 700), the sheltered area increased to 60 and 65 m². Perhaps in response to a warming climate during this period, the protected hearth corridor shifted once again toward the western wall, a pattern which appears to have diminished incoming solar heat.

Despite the quickened tempo of utilization during the Early Neoglacial period, the basic character of Gatecliff Shelter remained unchanged. Gatecliff remained a field camp serving as a stopover for those moving into Mill Canyon. Sometimes hunters spent the night there, and women occasionally ducked inside to escape the heat of the day, or to avoid a sudden thunderstorm as they gathered plant crops nearby.

During the rest of the Late Neoglacial, climate approximated modern limits. By Horizon 3 times, the shelter enclosed only 56 m² and small hearths were still built to heat the corridor against the western wall. No such hearthlines occur along the rear and northern portions of the site. Hearths began to decrease in size through time, the smaller hearth size closely correlating with increasing temperatures.

Site structure changed dramatically in Horizon 2. The Mill Canyon landscape is well suited for late winter hunting, with local herds of bighorn commonly overwintering in the lower reaches of the Toquima Range. Site structure for Horizon 2 suggests that bighorn bones were discarded in a central work/walk pattern, with the bulkiest debris piled up in the center of the site, ringed by a relatively debris-free periphery. Horizon 2 shows a blatant disregard for preserving adequate life-space within Gatecliff Shelter. Little room was left for constructing hearths, for warming sleeping areas, and for other specialized intrasite use. This evidence is particularly striking, given that the most probable season for this activity was February through April—chilly months indeed at an elevation of 7600 ft. During Horizon 2 times, Gatecliff became
a very short-term field camp, located within the logistic radius of a more distant base camp.

Sometime shortly after A.D. 1300, the roof of Gatecliff Shelter caved in, decreasing the sheltered area to a semicircular rear zone of 26 m². Hearth corridors were no longer utilized, and overall site utilization dropped off markedly.

The archaeology of Gatecliff Shelter demonstrates ample concern with nocturnal and/or foul weather utilization. Hearths were usually spaced a couple of meters from the cave wall, creating heated corridors which, in turn, shifted to take full advantage of the changing internal cave configuration (due to in-filling).

Despite the fact that Gatecliff Shelter was utilized as a field camp for more than five millennia, the actual residential potential of this site was severely limited. Located halfway up the Mill Canyon cul-de-sac, access was decidedly restricted. Only two small springs presently exist nearby and the ephemeral stream runs through Mill Canyon only seasonally.

**THE NORTHUMBERLAND CORRIDOR**

Northumberland Canyon provides the primary route of intervalley access south of the Middle Toquima block; it is roughly 30 km north to Pete's Summit. The Northumberland summit is 2652 m above sea level. Access from Big Smoky Valley, through the relatively wide West Northumberland Canyon is steep, with a gradient of 8.3 percent (700 m in 8.5 km). The route to Monitor Valley along East Northumberland Canyon is much more gradual, a gradient of 3.8 percent (457 m elevation gain in 12 km). European utilization of this important mountain summit began early in the historic period, when silver was discovered at East Northumberland in 1866; the mining camp at Leavville was readily connected to the west through the Northumberland Canyon route. Silver and gold mines flourish here today, and the heavily traveled Northumberland Canyon road is the major access route to central Monitor Valley. A second relatively serviceable access road exists 10 km to the south of Northumberland, traversing the Moores Creek drainage.

In general, the Northumberland corridor assemblage contains an inordinately high frequency of the byproducts of lithic fabrication. The Northumberland assemblage is also conspicuously lacking in several categories. Weapons are relatively rare, despite the fact that this frequency is inflated by the unusually large number of Promontory pegs cached at Triple T Shelter. Particularly rare are projectile point fragments and Gatecliff series points. Domestic equipment of all kinds is also rare here, as are incised stones, unifaces, and the products of intermediate-stage lithic reduction.

Patterning within the Northumberland corridor is clarified by analyzing individual assemblages. The most important archaeological site is Triple T Shelter (chap. 3). This small, south-facing, domelike concavity occurs at the base of a highly weathered tuff outcrop in West Northumberland Canyon.

The Triple T assemblage is functionally distinctive, characterized by a superabundance of weapons, particularly projectile points, foreshafts, and trapping equipment. Some of this abundance must, of course, be attributed to superior preservation in the upper strata at Triple T, but the fact remains that relative to the general Monitor Valley assemblage, little domestic equipment was recovered, and ceremonial items were almost completely absent.

The bifacial staging profile at Triple T Shelter generally follows a quarry curve, except that the frequency of finished products is unexpectedly high. We suspect that this profile reflects a combination of (1) primary artifact manufacture from local sources and (2) discard of broken lithic artifacts during repair and retooling.

The interior of Triple T Shelter follows a typical rock-shelter configuration, with near perfect bilateral symmetry (fig. 227). Although the 22 hearths at Triple T Shelter did not define precisely spaced hearth corridor constants (chap. 14), there is firm evidence of deliberate hearth positioning and related site structural planning. We find, for instance, a definite relationship between hearth size and microtopographic positioning. Hearths larger than about 60 cm in diameter are always built more than 2 m from the rear wall. Smaller hearths can occur anywhere within 3 m of the rear of the shelter. A similar relationship can be observed at most other
Monitor Valley sites (although interestingly, this relationship does not occur at Gatecliff Shelter).

Hearth at Triple T Shelter are generally smaller than those at Gatecliff Shelter, and this relationship may be a simple function of site size. Although the size of Gatecliff Shelter changed significantly through time, it enclosed an average of about 40–50 m² (Thomas, 1983b: fig. 229). Triple T Shelter retains a more constant size, never more than 15–20 m². It is also possible that the hearths are smaller because of the lower absolute elevation of Northumberland Canyon.

But we think that site structure was also directed toward energy conservation. The site opening faces due south, passively maximizing solar input during the day, and heat retention during the night (chap. 17). The distribution of Stratum IA hearths suggests that fires deliberately created a heat sink toward the rear wall.

These small hearths seem to be constructed to conserve firewood. This strategy makes good sense in the West Northumberland Canyon area, where today the nearest woodland vegetation occurs more than 500 m away.

Triple T Shelter is situated at the base of welded tuff outcrops which have well-developed talus slopes hosting only Ephedra, rabbitbrush (Chrysothamnus), sagebrush (Artemisia tridentata and A. spinescens), and occasional isolated juniper trees. In other words, only the occasional, relatively small vegetation is immediately available for fuel. Unlike the situation at Gatecliff, adequate firewood seems to have required considerable transportation costs at Triple T Shelter.

The south-facing, bilaterally symmetrical, and laterally expanding configuration of Triple T Shelter is well suited for use as a workshop and overnight stopover by small groups. Both hearth positioning and debris disposal patterns strongly suggest that at least the upper portion of Triple T was so used.

The rear/central portion of the site was delineated from the rest of Triple T Shelter by a distinct line of both small hearths and stone enhanced hearths. As at Gatecliff, shallow-pit hearths were constructed toward the lateral site margins, at an average distance of one meter from the side walls. Rock-filled hearths occur toward the center, averaging more than 2 m from the sides.
Behind this hearthline was a well-heated zone of deliberate preventive maintenance. An open-twined *Artemisia* mat found in the rear corridor almost certainly served as bedding or flooring. Relatively bulky manos and artifact fabricators were left at the shelter periphery as passive site furniture. We think that the enclosed rear zone functioned as both a sheltered workshop area and a nocturnal sleep zone. A less well-defined toss zone occurred outside the hearthline (but still within part of the sheltered area). A more confusing picture exists below Stratum IA.

We tested a second naturally sheltered site, Ny1059, which was little utilized. The overhang encloses less than 6 m², and little prehistoric cultural debris was contained therein. Although Ny1059 was well-positioned at the eastern end of Northumberland Canyon—the primary east–west access through the central Toquima Range—several factors limited its usefulness to prehistoric travelers. Its north-facing aspect virtually eliminated passive heat retention, and the small size restricted its suitability. Positioning of the single hearth is, however, consistent with both occasional sleeping and workshop utilization. Doubtless the availability of Triple T Shelter—less than a two-hour walk to the west through Northumberland Pass—further diminished the desirability of Ny1059.

Across the canyon from Ny1059 is a major petroglyph site, located in the natural bottleneck of East Northumberland Canyon by American Museum survey crews in 1974 (fig. 228). Fourteen separate clusters of rock art motifs were pecked and incised into the soft welded tuff boulders; a series of steps, leading to a flat lookout were carved into the steep side of one of the undecorated boulders (T. Thomas, 1976: 66). At least 600 individual elements were recorded at the Northumber-
land site. Game undoubtedly used this corridor to travel between Monitor and Big Smoky valleys, and the topography makes this a near perfect ambush locale for migrating game. Details of the motif distribution and implied hunting strategy at this important site have been discussed by T. Thomas (1976).

Our knowledge of the Northumberland Pass corridor is enhanced by subsequent CRM fieldwork. We know that this area contains a large number of apparently discrete, large, and diverse lithic assemblages. Furthermore, Forest Service site records demonstrate that most such assemblages in this area are not water-tethered (the mean distance to water being nearly 2500 m).

THE SOUTHERN TOQUIMA RANGE

Moving southward from the Northumberland/Moores Creek corridor, no further topographic access exists until one reaches Belmont, at the southern end of Monitor Valley. From here, a number of divergent passes can be found (Thomas, 1983a: 135), but regardless of the specific route, access westward requires circumnavigation of the southern end of the Toquima Range.

Our archaeological coverage of this area was minimal, but we can make some observations based on reconnaissance at Ny1, a large petroglyph-inscribed boulder isolated in the middle of East Bald Mountain Wash. First reported by Mallery (1893: 94) as "an immense rock . . . so high that a man on horseback can not reach the top." This boulder occurs in a natural bottleneck, where the canyon narrows significantly. Both intercept and encounter strategy hunting could readily be conducted here; the natural funneling effect of the canyon walls could be artificially enhanced by construction of wing walls running across the canyon (none were discovered). As discussed in the next section, this hunting pattern can be identified at most of the rock art sites of Monitor Valley.

We conducted a 1 km catchment survey around Ny1, and located Ny925, a major ridgetop site 200 m west of the East Bald Mountain Wash petroglyph boulder. It is a very dense artifact and chippage concentration on a flattened area near the end of the ridge that continues for at least 100 m along the top of the ridge. A rock cairn, probably a piñon storage feature, and an isolated stone circle, were also recorded. This evidence, coupled with the large concentration of Shoshone ceramics, leaves little doubt that Ny925 was partially used residentially during the late prehistoric period.

THE MOUNTAINS OF MONITOR VALLEY: MOST PROBABLE INTERPRETATIONS

WHERE WERE THE BASE CAMPS IN MONITOR VALLEY?

Based on middle range expectations (set out in Thomas, 1983a: chap. 10; summarized earlier in this chap.), we thought that the requirements of human nonagricultural lifestyle were most adequately met in the piñon-juniper woodland; because of this, we expected to find greater archaeological evidence of residential usage in the woodlands than in any other landscape of Monitor Valley.

This pattern clearly emerged from the archaeological record. In strictly elevational
terms, there is no doubt that the major residential activities centered on the piñon-juniper woodland. Nearly two dozen stone house foundations were found in the Monitor Valley survey. Fifteen of these occurred in piñon-juniper woodland and 6 were located on the lowland slope, but none were found on the upland slope. These house foundations are perhaps the most concrete evidence of prehistoric base camps.

Although the Monitor Valley excavations demonstrate that several caves and rockshelters were, at one time or another, used residentially, the intrasite and assemblage patterning is probably best attributed to infrequent usage by task groups. Only the upper stratum at Butler Ranch Cave—a Yankee Blade component—provides firm evidence of base camp residence.

Based on assemblage-level expectations listed at the beginning of this chapter, we find independent confirmation of the importance of the woodland as a hub for prehistoric residential activity:

1. The upland slope assemblage showed an extremely low level of artifact diversity, lower than either woodland or lowland slope assemblages (table 67). We interpreted this trend as indicating relatively more logistic (and relatively fewer residential) activities took place in the uplands.

2. Byproducts of lithic fabrication and processing are especially common on the upland slope (chap. 10). From the lithic staging analysis, we know that early-stage reduction byproducts (especially rough percussion blanks) are particularly noteworthy here. Several artifact categories are underrepresented on the upland slope: weapons in general, domestic equipment (ceramics being totally absent), and ceremonial equipment. This skewed assemblage is further evidence of the predominantly logistic activities that took place in the uplands.

3. The Monitor Valley woodland is characterized by an abundance of domestic equipment (primarily metates). The woodland contains an abundance of late stage lithics, especially projectile point tips and fragments. “Ceremonial” equipment—in this case, a large array of incised stones—is also overrepresented here. This assemblage strongly suggests that considerable residential activity took place in the Monitor Valley woodland.

4. The lowland slope assemblage contained a rather high frequency of weapons of all kinds. We also found early-stage byproducts of lithic reduction (that is, cores, roughouts, and rough percussion blanks) to be common; incised stones are also common here. Several artifact categories are underrepresented on the lowland slope: Gatecliff and Humboldt series points, ceramics, and later-stage byproducts of lithic reduction (especially fine percussion blanks).

This assemblage-level evidence shows that whereas some residential activity took place in the lowlands, such activity was most pronounced in the woodlands.

The diversified archaeological data generated in the surveys and excavations allow us to sharpen the patterns beyond mere elevational criteria. In macrogeographic terms, prehistoric people clearly chose to live as close as possible to major corridors of potential east-west mobility.

The Petes Summit/Clipper Gap corridor provided the most compelling evidence of prehistoric residential activities in Monitor Valley. This naturally defined crossroads funneled people and game through two parallel montane passes: Petes Summit to the north and Clipper Gap, only a few kilometers to the south. Both were heavily utilized by prehistoric, early historic, and contemporary travelers, and each group has left a distinctive archaeological record to chronicle its impact on the area.

Indisputably prehistoric residential settlements were found in the Petes Spring and Spring 22 catchments, each of these rather low-elevation settlements being naturally buffered against extreme winter temperatures, and each catchment straddling a major east-west pathway. Archaeological sites along the eastern extension are less abundant than elsewhere in the corridor, but they seem to be relatively larger. Some sites, especially those near Petes Summit and several in the Deer Spring catchment, are clearly base camps. The relatively low-altitude Johnny Potts area was also partially used residentially.
The relative abundance of water, the channeling effect of local landform, the ridgetop topography, availability of relatively flat ground, and the contemporary piñon-juniper ground cover lead one to expect that the Hickson area might also have been used residually, although the direct evidence is not compelling. Similarly, although we conducted only an informal survey near Dobbin Summit in the Monitor Range, this is a very likely place for residential settlements, and we fully expect that future research will disclose an archaeological record comparable to that in the Petes Summit and Northumberland corridors.

Evidence of less heavily utilized residential encampments was encountered in East Bald Mountain Wash; although locus-controlled survey was not conducted here, the southern Toquimas corridors such as East Bald Mountain Wash probably had a residential potential as high as that of Petes Summit.

Petes Summit and Northumberland Canyon effectively isolated the Middle Toquima block, where routes of east-west access are rugged, in places almost impassable. These same topographic barriers also conditioned prehistoric land utilization of the central Toquima Range, the side-canyons in some cases functioning as biogeographic and cultural cul-de-sacs. We only conducted a casual survey in this area, and found little evidence of prehistoric residences.

Although the Monitor Valley woodland was undoubtedly used residually, we must not overemphasize the degree of residential utilization in the central Toquimas. Systematic evaluation of site positioning criteria shows that the prehistoric Reese River ecotone was utilized in considerably more intensive fashion than any equivalent areas in Monitor Valley.

1. Nearly 85 percent of the available Reese River loci had been utilized as sites. Less than one-quarter of the loci in Monitor Valley had been so utilized.
2. Absolute site density is significantly higher at Reese River than in Monitor Valley.
3. Absolute density of aboriginal houses is more than four times higher in Reese River than in Monitor Valley.

4. Reese River sites contain between 1.5 and 3 times the number of time-sensitive artifacts than equivalent sites in Monitor Valley do.

Taken together, these diverse and independent indices strongly argue that the Reese River ecotone was much more densely populated than its Monitor Valley counterpart.

**WHERE WERE THE FIELD CAMPS IN MONITOR VALLEY?**

Field camps are temporary centers of operation established whenever task groups are required to travel beyond the daily foraging radius, assumed to be about 10 km. They are commonly set up near target resource areas, and positioning is not as critical as that for base camps.

Although we earlier projected a number of specific expectations for field camp structure, we cautioned that “these characteristics do not provide us with the clear-cut archaeological signature we desire. In truth, it is extremely difficult to distinguish field camps from base camps in the archaeological record” (Thomas, 1983a: 80). Areas previously used as residential base camps are often reoccupied by task groups, such as plant harvesting parties or hunters preparing for intercept ambushes, or women collecting raw materials. These short-term visits will tend to be indistinct when superimposed on one another. Simple reuse of field camps by diverse logistic groups creates a multifunction archaeological palimpsest out of discrete behavioral entities.

These problems aside, we think that a number of field camps have been detected in the archaeological record of Monitor Valley. Moreover, our sample of field camp assemblages is sufficiently large for us to appreciate something of the variability in selection criteria.

**SHELTERS WITH ADEQUATE CONDITIONS OF LIFESPACE:** With the possible exception of the upper stratum at Butler Ranch Cave, none of the caves and shelters of Monitor Valley provided adequate conditions for full-scale base camp utilization. However, several natural overhangs were suitable for short-term
the shelter to define a heated sleeping corridor along the rear and/or lateral walls. The most sheltered portion was also used as a workshop area, the toss zone of larger debris commonly forming an arc near the site dripline.

A variation on this theme is apparent in Horizon 2 at Gatecliff Shelter. In this case, the interior space was constructed along a central work/walk pattern: the bulkiest debris was discarded in the center, surrounded by a relatively debris-free peripheral zone. The exigencies of preliminary field butchering and preparation of three-quarters of a ton of big-horn meat for transport seem to have outweighed considerations of human lifespace: no room to build hearths at the rear or the side of the shelter, no warmed sleeping corridors, no specialized intrasite use areas. Horizon 2 seems to have been an extremely short-term field camp, probably located within the logistic radius.

**The Temporary Trailside Shelter:**
Monitor Valley contained a number of naturally sheltered enclosures that functioned as temporary trailside stopovers. Some are no more than small cubicles, inadequate for utilization longer than a night or two. Boring-as-Hell Shelter and Grenouille Verte Cave are tiny foul weather or overnight nests. Neither has sufficient light penetration or ventilation to permit even a couple of people to remain for more than a few hours. But, significantly, the interior of each remains cool during summer days, dry in a downpour, and is cheap to heat at night and during the winter. Each cave is near a major east–west corridor and may have been used temporarily by hunters monitoring game movement. Jeans Spring Shelter, although sometimes used as an ambush spot, served at times as a short-term billet.

Bradshaw Shelter was another short-term refuge. Floor space was severely restricted and steeply sloping, and the ceiling too low to permit more than a crawlspace. But like other small garrets, Bradshaw acted as a short-term haven from extreme heat, cold, or other inclement weather for work parties exploiting the high-quality chalcedony quarry nearby.

Monitor Valley also has a few otherwise unsuitable shelters that were utilized only in a pinch. The long, narrow configuration of Toquima Cave vitiated any degree of natural

**Fig. 229.** Gatecliff Shelter is one of several natural enclosures in Monitor Valley that served as occasional overnight stopping places. Although offering the desirable combination of southern aspect, proximity to the valley floor, shelter from foul weather, and potential to ambush game, residential potential at Gatecliff was limited by poor east–west access through the Mill Canyon cul-de-sac. Used sporadically over five millennia as a field camp, Gatecliff Shelter contains ample evidence of nocturnal and/or foul weather usage. Hearths were generally spaced a couple of meters from the cave walls, creating artificially heated corridors.

habitation—anywhere from overnight to maybe a week or two.

Butler Ranch Cave, Gatecliff, Hunts Canyon, and Triple T shelters served as advantageous overnight stopping places for millennia. To one degree or another, each offered a desirable combination of southern aspect, proximity to the valley floor, shelter from foul weather, relatively easy east–west access, and potential to ambush game that was sharing the nearby corridor.

But each shelter had its drawbacks. Triple T lacked adequate local firewood, reliable surface water, and interior space; Gatecliff was located in the Mill Canyon cul-de-sac; Butler Ranch Cave was too small.

Despite such dissimilarities, these shelters were exploited in rather similar fashion. Hearths were usually constructed near site center so that the artificial heat source combined with the natural heat sink qualities of
fewer artifacts might have been collected on uplands during the summer months, even though it was the season of maximum artifact production. Many artifacts were collected in the area surrounding the Toquima Shelter and its caves, with most upland artifacts being found in the extreme lower portion of Promontory pegs and other righteous weapons were cached in a small cache at the adjacent Boring-as-Hell Shelter. Although most of the 32 Promontory pegs were found on the site surface, they too are extremely uniform in manufacture (see Thomas, 1983a: 81–82). Three weapons caches were identified during the course of our Monitor Valley excavations. At Hunts Canyon Shelter, a cache of 81 Promontory pegs, eight wooden cylinders, and two unfinished Promontory peg blanks had been hidden beneath a large boulder. These extremely homogeneous snare triggers were probably manufactured by a single individual.

Although most of the 32 Promontory pegs at Triple T Shelter were found on the site surface, they too are extremely uniform in manufacture (once again, perhaps manufactured by the same craftsman). The Triple T Promontory pegs were probably cached deliberately, then distributed across the site by packrats. We also have evidence of on-site manufacture of Promontory pegs at Triple T Shelter. We found a small cache of arrow shafts stuffed into a fissure adjacent to the enclosed portion of Boring-as-Hell Shelter. Each cache illustrates Binford's useful distinction between active and passive weapons (Binford, 1979a: 256). Personal gear is "active" when it is currently and regularly involved in the everyday behavioral system. Such artifacts slip into "passive" status whenever they become "out of sync" with current reality. Twentieth-century American attics and garages are littered with "passive" artifacts: the skis used last February, snow tires taken off the car last spring, the fly rod primed for opening day, the plastic Christmas tree (see also Thomas, 1985: chaps. 2 and 27).

The active/passive distinction is particularly noteworthy among hunter-gatherers operating in middle- and high-latitude ecosystems—areas characterized by seasonal variability. Monitor Valley is one such land-
scape, and a wide range of gear periodically falls into passive state: milling stones, bird nets, deadfall parts, fishing equipment, and specialized items of trade and ritual.

More than 160 Promontory pegs have been recovered from various Monitor Valley sites; this total nearly doubles the numbers of these artifacts known from the Great Basin (Thomas, 1983b: 297). We think that Promontory pegs are specialized trigger pins used primarily for trapping rodents or lagomorphs; in fact, three pegs from Triple T Shelter were still “baited” with bits of cactus (Opuntia sp.). Taken as a group, the various prey species—chipsmunks, marmots, ground squirrels, cottontail rabbits, and the like—are generally available in the central Great Basin from about February through October (Grayson, 1983: 437). At this relatively high elevation, Promontory pegs are basically useless from late fall through mid-winter, making them prime candidates for passive status. In Hunts Canyon, Northumberland Canyon, and at Hickson Summit, curated, temporally passive tools were kept in repositories until upgraded to active duty.

Such tool caches—and the positioning and structure behind them—are similar to several in various Great Basin cache caves. Cache 22 at Humboldt Cave is one case in point (Heizer and Krieger, 1956; see also Thomas, 1985: chap. 27). It contained, among other items, eight large composite bone and wood fishhooks. This fishing gear was totally ineffective on the smaller, local fish endemic to the Carson/Humboldt sinks. It was suitable only for taking Lahontan cutthroat trout; to use these fishhooks, fishermen must have traveled at least 50 km to the west (probably during a spawning run).

Cache 22 stored gear both seasonally and spatially out of synchrony with the local environment. Humboldt Cave was particularly suitable for such storage because it occurs in the westernmost outcrop of the Humboldt Range. Travelers moving west from the Humboldt Sink to fish at Pyramid Lake or in the Truckee River would pass Humboldt Cave as the most westerly of the lacustrine cache caves. Similarly, fishermen returning from one of the western spawning runs found Humboldt Cave a convenient place to stash fishing gear irrelevant to edaphic conditions of the Humboldt/Carson Sink area.

Similar weapon caches were not, curiously, found at other Monitor Valley shelters (such as Gatecliff, Butler Ranch Cave, and Little Empire Shelter). Although 16 Promontory pegs and several wooden cylinders were found at Gatecliff, they are a rather diverse lot, and were almost certainly lost or discarded individually. Tool caches in Monitor Valley tend to occur only in proximity to well-traveled, interregional corridors. Because Mill and Butler canyons are relatively isolated cul-de-sacs, shelters and caves in these areas become unlikely spots in which to store passive gear (although they may have been candidates for specialized resource caches).

It is curious that no evidence of caches was found at Toquima or Grenouille Verte caves, both naturally sheltered alcoves overlooking Petes Summit (perhaps the best access in and out of Monitor Valley). Based on previous experience, we would expect most such caches to have been placed near the cave walls—precisely in the area most badly disturbed by pothunter activity at Toquima Cave. Such vandalism may have destroyed these caches, or it may simply be that our testing strategy was insufficient.

It is clear that at Triple T, Hunts Canyon, and Boring-as-Hell shelters, people had decided that their weapons were (for whatever reason) temporarily irrelevant. Each weapon cache locality shares several characteristics: rather minimal conditions of human life-space (but suitable as a trailside rest), immediate proximity to major corridors of regional intercourse, often situated on a well-traveled topographic bottleneck or “jumping off place” between vastly different ecological zones.

We think it significant that such a large proportion of the Monitor Valley trigger parts were recovered in caches. Because of their passive stage from late fall through mid-winter, we can infer that the winter base camps—wherever they were—were not in Monitor Valley. If such winter base camps had been nearby, then seasonally passive items would be stored there, not in isolated caches established along the major routes between Monitor Valley and the outside world. These
caches were almost certainly established by people moving from Monitor Valley to winter headquarters at a lower elevation in a neighboring valley.

Four resource caches are known from Monitor Valley. We have previously described the bundle of prepared *Apocynum* fibers from Gatecliff Shelter, probably a resource cache of raw materials intended for basketry and/or cordage manufacture. A bundle of grass and twigs—also probably raw material for basketry—was found buried at the extreme northeastern edge of Jeans Spring Shelter.

Shuler (1956) reported a piñon nut cache located in a small side canyon in the southern Toquima Range. The cache, last utilized during the historic period, consisted of a natural cavity, capped with a stone cover, then sealed with pitch. Although some pine nuts remained inside, most of the contents (estimated at eight bushels) had been removed.

At Disaster Spring, we located three deliberately cleared exclosures with circular rock floors, probably also piñon nut caches from which the foodstores had been removed (chap. 2). We think these features are prehistoric, since historic debris was totally absent from the area.

As with all resource caches, these features were designed to conquer problems of temporal incongruity within an ecosystem (Binford, 1980: 12). Because some resources—piñon nuts and *Apocynum* fibers in this case—can be collected only during a limited time each year, their availability can be artificially extended by protecting them from deterioration and by keeping other organisms from consuming them. In effect, such planned storage permits consumers to extend the temporal phasing of key resources. By their nature, caches usually have low archaeological visibility; undoubtedly dozens of resource caches remain undetected in Monitor Valley.

Then forming a plan of action for future procurement.

Two archaeological sites in Monitor Valley may have been involved with such information gathering. At Jeans Spring Shelter, solitary hunters or small task groups could have remained hidden, to monitor game movement to the nearby spring.

At the Northumberland petroglyph site, we found a series of steps, deliberately carved into the steep side of a massive tuff boulder (T. Thomas, 1976: 166). These steps lead to a flattened perch overlooking the entire East Northumberland Canyon mouth. Stationed there, a lookout could direct and position the various hunters concealed throughout the petroglyph-encrusted boulder field. The bluff immediately east of the Box Spring hunting facility could have functioned similarly, but we found no direct evidence of this.

**Procurement Locations as Evidence of Logistic Activities**

The location, common to both foraging and collecting strategies, is where daily activities are pursued. Locations occur within the foraging radius, generally less than 10 km from a residential base camp (Binford, 1980). Although such procurement locations are common to all hunter-gatherers, their archaeological visibility varies significantly depending on the resource exploited and how that exploitation fits into the overall regional settlement strategy (Thomas, 1983a: 84).

Plant procurement in general has low archaeological visibility. Apart from the piñon nut caches noted above, we found little direct evidence of plant procurement: a digging stick was found in Toquima Cave, a piñon hook was still hanging from a tree at Ny878 (not far from Johnny Potts Spring), and a few harvesting implements were recovered from Gatecliff Shelter (Adovasio and Andrews, 1983: table 60).

Small game procurement also has relatively low archaeological visibility. As noted elsewhere (Grayson, 1983: 436–438), we have little control over the mechanisms of deposit inside places like Gatecliff Shelter: Faunal remains are generally preserved only inside protected caves and shelters—and these areas
are shared by a number of nonhuman visitors. Sorting "cultural" from "natural" bone in such instances is an error-prone exercise, and, as a result, our interpretations at Gatecliff Shelter are significantly biased against small game procurement.

Nevertheless, we do have some evidence. Nearly a gross of Promontory pegs were recovered in Monitor Valley, providing strong evidence of small game procurement. At such elevations, rodents and lagomorphs are only available seasonally, and, as noted above, most of the trigger parts were recovered from caches (suggesting that more permanent winter base camps were established elsewhere).

The complex of low-lying stone walls at Table Mountain was probably constructed and utilized for intensive logistic harvesting of sage grouse (perhaps during Devils Gate times). This is a relatively high-cost, labor-intensive facility, implying relatively predictable recurrent return.

Artiodactyl procurement creates a relatively visible archaeological record (Thomas, 1983a). The implications of bighorn procurement at Gatecliff Shelter has been detailed above (Thomas, 1983b), particularly for the Horizon 2 sheep kill. We think that at least a ton of bighorn carcasses were carried into Gatecliff Shelter after preliminary field butchering; meat was either cached nearby or taken directly to a distant base camp. Horizon 2 at Gatecliff Shelter was probably a short-term field camp located within the logistic radius.

Most of the remaining evidence for artiodactyl procurement rests on rather indirect evidence. We see a linkage between artiodactyl procurement and the distribution of petroglyph sites. Above, we outlined our interpretations relating the Hickison Summit and East Northumberland petroglyph sites to migration strategy intercept hunting; in both cases, game employed the natural corridor to travel between Monitor and Big Smoky valleys, and the topography provided a near perfect ambush locale. People and game often find themselves in this area not because they want to be there, but because this canyon is the best way to get to other places.

The positioning of the Barley Creek petroglyph panels is strongly reminiscent of that at Hickison Summit and East Northumber-

land. At Barley Creek, three distinct petroglyph panels flank the dry wash and create a natural funneling effect. The adjacent box canyon provides a first-rate change of pace factor, flanked on one side by a 10 m dropoff, on the other side by boulders inscribed with petroglyphs.

Although the specifics vary, this same structure is seen in several other rock art sites in Monitor Valley. In the East Bald Mountain wash, near the mouth of White Rock Canyon, and at the summit of McCann Canyon we found large petroglyph-embellished boulders that created a natural ambush for game funneled either up- or downstream. Additionally, in the Toiyabe Range, we see at Ny831 (the Kingston Canyon rock art site no. 1) in a very similar topographic setting, several faint pictographs painted on a large chert boulder astride a bottleneck of Kingston Canyon. We suspect that all these sites were used in intercept strategy game procurement.

A homologous intercept ambush complex occurs in the Toiyabe Range to the west, immediately across the Big Smoky Valley: the natural topography was not intrinsically well-suited to migration hunting, so several artificial barriers were erected, apparently in prehistoric times. Two such alignments occur near Bob Scott Summit, and another well-made rock wall is visible on the south side of Austin Summit. A fourth L-shaped rock wall (La1069) occurs on Mt. Prometheus, about 3 km north of Austin Summit.

The Bob Scott/Austin Summit walls were almost certainly utilized in dispersed intercept procurement of migrating game. Although bighorn were the most likely prey species, deer and even antelope remain distinct possibilities. In fact, we suspect that these hunting barriers were, at one time or another, used to procure all three species.

THE MOUNTAINS OF MONITOR VALLEY: A SETTLEMENT SUMMARY

We conclude this integrative synthesis in terms of the five middle range procurement strategies for the mountains of Monitor Valley (Thomas, 1983a: 165). These expectations were initially expressed strictly in terms of the Monitor Valley woodland, assuming that the adjacent upland and lowland slopes
would, more or less, form a continuation of the woodland pattern.

STRATEGY I. HIGH RESIDENTIAL MOBILITY. Foraging base camps at selected spots within the woodland, with satellite procurement locations present: likely, especially in the major corridors through the Toquima and Monitor ranges. The upper stratum of Butler Ranch Cave seems to be a base camp, as do house remains clustered in the Petes Summit corridor. Assemblage analysis suggests the likelihood of base camps in the woodland and on the lowland slope (and, to a much lesser degree, on the upland slope). We emphasize that direct evidence of base camps anywhere in the mountains is quite limited.

STRATEGY II. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE CAMP/FORAGING RADII. Fusion base camps in the mountains: no evidence for this proposition. Summer dispersal base camps in the mountains: possible, but direct evidence of base camps anywhere in the mountains is quite limited (procurement locations apparent throughout the mountains).

STRATEGY III. SEASONAL FUSION-FISSION, MONITORED FROM WITHIN THE LOGISTICAL RADIUS. Logistic procurement in the mountains: confirmed. Evidence of resource caches located in the woodland; tool caches occur as well, but seem to be restricted to major routes of access through the mountains. Evidence of plant and small game procurement is present, but minimal. Artiodactyl procurement occurred throughout the mountains, and the most visible evidence comes from the rock art sites, most of which are located in well-defined east–west corridors through the Toquima and Monitor ranges.

Field camps in the mountains: confirmed for Butler Ranch Cave, Gatecliff Shelter, and Hunts Canyon Shelter; very short-term field camps also likely at Toquima Cave, Grenouille Verte Cave, Boring-as-Hell Shelter, and Bradshaw Shelter. Assemblage-level analysis further confirms presence of field camps in the woodland and on the lowland slope (also, possibly, on the upland slope, although logistic activities are more apparent here).

STRATEGY IV. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE CAMP/FORAGING RADII. Nearly sedentary base camps established in the mountains: no evidence of this proposition. Foraging procurement in the mountains: apparent throughout the mountains (see Strategy III).

STRATEGY V. MINIMAL RESIDENTIAL MOBILITY, MONITORED FROM WITHIN THE LOGISTIC RADIUS. Field camps in the mountains: confirmed for the woodlands and lowland slope (and limited field camps inferred for the upland slope; see Strategy III).

NOTES

1. Although Ny831, the Kingston Canyon rock art site no. 1, lies outside Monitor Valley proper, it deserves emphasis because of a topographic setting quite similar to that in McCann Canyon (chap. 6). At Ny831, several faint pictographs were painted on a large chert boulder in a bottleneck of Kingston Canyon, the major passageway through the central Toiyabe Range. We suspect that both sites were used in intercept strategy game procurement.
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Muto, G. R.

Nance, J. D.

Needham, R.

Nissen, K. M.

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O’Connell, J. F.

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Odum, E.

Orr, P. C.

Patterson, R. L.

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Peralta, J. T.

Piegate, J. J.

Pippin, L. D.

Plog, F., and J. N. Hill

Plog, S.


Rapoport, A.

Redman, C. L.

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Renfrew, C. A.

Rhoaeds, R. E.

Rick, J. W.

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THOMAS: MONITOR VALLEY: 3


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Thomas, D. H., and E. H. McKee

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Wheeler, S. M.

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Wylie, H. G.

Yellen, J. E.

APPENDIX: ADDITIONAL DATA ON HEARTHS FROM GATECLIFF SHELTER

In a previous volume (Thomas, 1983b: chaps. 21–23), we provided detailed descriptions of 36 hearths excavated at Gatecliff Shelter. These features were, for the most part, encountered on fine- and medium-grained living surfaces at Gatecliff, and the descriptions were integrated with the overall spatial analysis of these horizons.

Although 20 additional hearths excavated at Gatecliff Shelter were within the coarse rubble matrix of Horizons 1–6, they were not described in the previous volume because so little intrasite patterning was preserved in these Late Neoglacial levels.

We now wish to explore hearth technology and positioning strategies throughout the woodland and lowland of Monitor Valley, and Horizons 1–6 contain a great deal of pertinent information. In this Appendix we present basic descriptive data on these additional 20 hearths, data which are synthesized with other relevant hearth information in chapters 13, 15, and 16.

Horizons 4–6 (1250 B.C.—A.D. 700)

Horizons 4–6 are artificial stratigraphic divisions imposed upon the relatively homogeneous rubble of Strata 3 and 5 at Gatecliff Shelter. These distinctions were maintained during excavation to allow us to search for possible temporal and/or functional variability within this thick, undifferentiated unit. Artifact level analysis (Thomas, 1983b: chaps. 9, 10, 11, and 20) showed these differences to be minimal, and these three horizons were combined in further analysis.

Hearth 4/6-A is an oblong pit filled with ash, charcoal, and fire-cracked rock; an incised stone was also found in the hearth fill. The EW diameter is 30 cm and the NS diameter is 20 cm; the pit is roughly 30 cm deep. An ash concentration immediately to the east probably also derives from Hearth 4/6-A.

Hearth 4/6-B is a circular pit, 25 cm in diameter and 25 cm deep. Ash is thickly scattered on the surface in the area from which the hearth was excavated and into the underlying hard silt of Stratum 6. The edge of Hearth 4/6-B is 40 cm from the cave wall; the area between is littered with dozens of artiodactyl long-bone splinters. An artiodactyl mandible, cranial fragments, and teeth also occurred in this area. The bone fragments are almost all the same size, creating a feature very similar to the small bone juice dump described by Binford (1983: 154–155). An in situ metate occurred 25 cm to the northwest of Hearth 4/6-B.

A bone awl, four production stage biface fragments, a projectile point midsection, two unifaces, and a broken Hallois Disk bead (Bennyoff and Hughes, 1983: fig. 141s) were also found between the hearth and the cave wall.

Hearth 4/6-C is a dense, rock-encircled charcoal scatter positioned directly against the west wall at the rear of Gatecliff Shelter. No pit is evident. Three Elko points were found inside the hearth (illustrated in Thomas, 1983b: figs. 70s, 72i, and 73i). A hammerstone was on the southeastern margin; several long-bone fragments and red ochre were scattered in the fill. Radiocarbon date UCLA-1895F was processed on charcoal from the center of Hearth 4/6-C: 810 b.c. ± 60. Flotation sample 6-2 (Thomas, 1983b: table 30), taken from the western margin of Hearth 4/6-C, contained Pinus and Juniperus charcoal.

Hearth 4/6-D is a complex feature consisting of at least three distinct pits excavated into the surrounding rubble of Stratum 3. The pits are from 25 to 40 cm in diameter and the complex has an aggregate depth of about 45 cm. Several artifacts were contained in the pit fill: a mano, two bone tubes, an Elko Eared projectile point base (Thomas, 1983b: fig. 75u), and two production stage bifaces. Two radiocarbon dates were processed on charcoal from Hearth 4/6-D: A.D. 280 ± 80 (GAK-3609) and A.D. 370 ± 90 (GAK-3610). The hearth pits have significantly disturbed the stratigraphy, and we cannot determine in which horizon the feature originates. There is no question that this is a Reveille phase feature—from Horizon 4, 5, or 6—and the radiocarbon dates point to late Reveille times.

Hearth 4/6-E is a complex feature, 15 cm in diameter at the top and approximately 60 cm deep. The lower portion of the pit bifurcates, suggesting that it was re-excavated and reused at least once. The fill contains a mixture of ash and charcoal of Pinus and Juniperus; seeds of Juniperus, Chenopodium atrovirens; and Gramineae were also identified in the fill of the hearth (Thomas, 1983b: table 30). An Elko Corner-notched point (Thomas, 1983b: fig. 72h) was found in place 60 cm to the east of the top of the hearth, and a uniface was recovered about 75 cm to the east.

Hearth 4/6-F consists of several burnt zones, but repeated churning within the rubble matrix does not permit isolation of individual episodes of hearth construction. The top of this feature is about 90 cm below datum, and it extends to roughly 180 cm. At least 10 individual hearths are included under the rubric of "Hearth 4/6-F." Two
Radiocarbon dates were processed from Hearth 4/6-F, each sample selected from the Master Profile exposure (Thomas, 1983b: fig. 65): A.D. 220 ± 90 (GAK-3611) and 330 b.c. ± 90 (GAK-3617). The artifact inventory from Hearth 4/6-F includes six incised stones, at least 15 metate fragments (deliberately broken or fire-fractured), two mano fragments, several production stage blanks, two cores, three Elko Eared points (Thomas, 1983b: figs. 78e, g and 79q), and six Elko Corner-notched points (Thomas, 1983b: figs. 70r, m, 71f, 72j, s, and 73r). Flotation samples 4-2 and 6-5 (Thomas, 1983b: table 30), taken from various parts of this complex feature, contained sagebrush, juniper, and piñon charcoal.

**Hearth 4/6-G** is a rock-lined/rock-encircled hearth feature located at a depth of 120 cm below datum. It is 40 cm in diameter, roughly 10 cm deep, and is surrounded by a large area of charcoal scatter and burnt matrix. In the fill was an Elko Corner-notched point (Thomas, 1983b: fig. 70f). Flotation samples 4-1 and 4-5, taken from Hearth 4/6-G (Thomas, 1983b: table 30) contained charcoal of *Pinus, Juniperus,* and *Artemisia.* Recovered seeds were identified as *Juniperus,* *Wyethia,* and Gramineae (probably *Elymus* and *Festuca*).

**Hearth 4/6-H** is an oblong feature, 80 cm NS and 35 cm EW, located at a depth of 154 cm below datum. An Elko Eared point (Thomas, 1983b: fig. 79g) was found in the immediate vicinity.

**Hearth 4/6-I** is a concentration of ash and *Juniperus* charcoal, located at a depth of 72 cm below datum. The central portion measures about 125 cm EW by 150 cm NS; a ring of oxidized charcoal surrounds the southwestern portion.

**Hearth 4/6-J** is a circular pit, apparently dug from the bottom of Horizon 6. Located at a depth of 195 cm below datum, the pit is 62 cm EW by 75 cm NS. No artifacts were directly associated.

**Hearth 4/6-K** is a paired feature near the cave wall on the extreme western part of Gatecliff Shelter. The western pit is 50 cm in diameter and 112 cm below datum. The eastern pit is 40 cm in diameter and 109 cm below datum. These pits seem to have been excavated from the same surface, and the area between them is covered with a dense scatter of charcoal and burnt rubble. An Elko Eared point (Thomas, 1983b: fig. 74dd) was found immediately above the eastern pit of Hearth 4/6-K.

**Horizon 3 (A.D. 700–1300)**

Horizon 3 is a coarse-grained assemblage dating from early and middle Underdown phase. Discrete features were rare on Horizon 3 due to the rubble matrix. Although such rubble units serve as effective artifact traps, they preserve little in the way of spatial artifact patterning. Nevertheless, it was possible to isolate six distinct hearths within Horizon 3.

**Hearth 3-A** is located at the extreme rear of the shelter, roughly 50 cm from the cave wall. This is an indistinct area of concentrated charcoal and fire-cracked rock, in a shallow pit scooped into the underlying laminated silt of Stratum 2. Its diameter is approximately 50 cm, and the pit is less than 10 cm deep.

**Hearth 3-B** is located not far to the east of Hearth 3-A. The actual pit, excavated into the Stratum 2 silts, is about 35 cm in diameter and less than 15 cm deep. This hearth is surrounded by an ash scatter and zone of oxidized silt, approximately 100 cm in diameter. A bone bead was contained in the fill of Hearth 3-B.

**Hearth 3-C** is a large, diffuse zone of charcoal and burnt, oxidized silt, roughly 75 cm across. This fire hearth was scooped into the underlying silt. One football-size rock occurred on the eastern margin, but it may not be associated with the hearth proper. Radiocarbon date GAK-3608 was processed on charcoal from Hearth 3-C: A.D. 950 ± 90.

**Hearth 3-D** occurs on the middle of Horizon 3. It is an oblong pit, roughly 50 by 25 cm, excavated to a depth of about 25 cm. The bottom is extremely irregular; perhaps this hearth was re-excavated several times. Fill contains abundant charcoal and a piece of red ochre. No rocks were associated. A Rosegate series point (Thomas, 1983b: fig. 69w) was found on the northern margin.

**Hearth 3-E** is an oblong pit (ca. 55 cm NS by 25 EW), surrounded by a burnt rocky matrix. The indistinct pit was no deeper than 15 cm. Considerable charcoal from this pit is scattered both east and west.

**Hearth 3-F** is a distinct circular, ash-filled pit, 25 cm in diameter, excavated to a depth of 25 cm. Although the area had been burnt, relatively little charcoal and ash were found in the pit.

**Horizon 1 (post-A.D. 1300)**

The basal level of Horizon 1 is defined by an extensive sagebrush mat, laid down as bedding or flooring to cover the extensively burnt Horizon 2 bone bed. Within a few decades after this mat was positioned, a major portion of the ceiling of Gatecliff Shelter caved in, covering the eastern half of the site with tons of chert rubble (Thomas, 1983b: figs. 4 and 14). Two radiocarbon dates from immediately below the roof fall suggest that the cave-in occurred shortly after about A.D. 1450.

This roof fall is critical, because it obliterated half of the available lifespaces inside Gatecliff Shelter, reducing it from about 50 m² to about 25 m² during Horizon 1 times.

We can recognize only three hearths on Horizon
Lacking specific radiocarbon dates, we have no way of knowing if Hearths 1-A, 1-B, or 1-C predate or postdate the roof fall. It is also possible that additional undetected hearths could have been constructed on the eastern part of the site prior to A.D. 1450 and then obliterated by the roof fall.

Hearth 1-A is located at the extreme rear of Gatecliff Shelter, near a small overhang jutting out from the cave wall. No pit was excavated, but several football-size rocks had been piled in a U-shape, with the opening facing to the southwest. One of the rocks on the northern side is stained with red ocher, and an ocher-covered perforator was found 1 m to the northeast (illustrated in Thomas, 1983b: fig. 91m).

Hearth 1-B is a distinct pit, 65 cm in diameter and 20 cm deep. The fill contains charcoal and several fist-size rocks; a metate fragment (7 by 8 cm) was also found inside Hearth 1-B. A Desert Side-notched point (Thomas, 1983b: fig. 67 m) was found on the southern margin. A Promontory peg and two incised stones (Thomas, 1983b: fig. 112i, n) were found 50 cm to the north. The hearth rests on a former living surface, 40 cm below datum. Radiocarbon date GAK-3614 was processed on charcoal from Hearth 1-B: A.D. 1400 ± 90.

Hearth 1-C, located roughly 1 m to the southwest of Hearth 1-B, is a circular pit 30 cm in diameter and ca. 15 cm deep. The fill contains charcoal, fist-size rocks, ash, and abundant grass (perhaps more recent woodrat nest materials). A Cottonwood Triangular projectile point (Thomas, 1983b: fig. 67q) was found immediately below the bottom of Hearth 1-C. Radiocarbon date GAK-3616 was processed on charcoal from Hearth 1-C: A.D. 1480 ± 90.
Edited by
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CONTENTS OF VOLUME 66

