RESOURCE

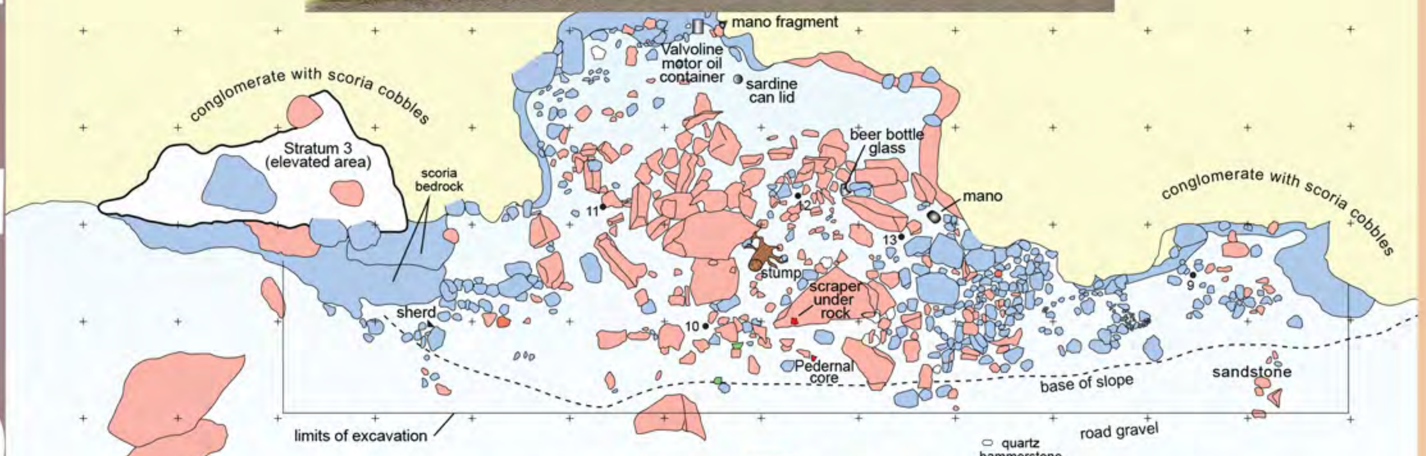
CULTURAL

TECHNICAL SERIES 2017-1

NMDOT

Coyote Canyon Rockshelter (LA 139965): A Specialized Hunting Camp along NM 434, Mora County, New Mexico

Nancy J. Akins



Office of Archaeological Studies
Museum of New Mexico
Archaeology Notes 477
2017

NMDOT Project CN 4100381
NMCRIS Activity No. 132345

NEW MEXICO DEPARTMENT OF TRANSPORTATION

NMCRIS Activity No.: 132345

MUSEUM OF NEW MEXICO
~
OFFICE OF ARCHAEOLOGICAL STUDIES

Coyote Canyon Rockshelter (LA 139965): A Specialized Hunting Camp along NM 434, Mora County, New Mexico

BY

Nancy J. Akins

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NMDOT Project CN 4100381,
CO5488/Task 25 [FY12-25]

ARCHAEOLOGY NOTES 477

SANTA FE 2017 NEW MEXICO

NMCRIS INVESTIGATION ABSTRACT FORM (NIAF)

1. NMCRIS Activity No.:	2a. Lead (Sponsoring) Agency:	2b. Other Permitting Agency(ies):	3. Lead Agency Report No.:
132345	US Department of Transportation, Federal Highway Administration		Museum of New Mexico, Office of Archaeological Studies, Archaeology Notes 477

4. Title of Report: *Coyote Canyon Rockshelter (LA 139965), A Specialized Hunting Camp along NM 434, Mora County, New Mexico*
Author(s): Nancy J. Akins

5. Type of Report
☐ **Negative** ☒ **Positive**

6. Investigation Type
☐ Research Design ☐ Survey/Inventory ☐ Test Excavation ☒ Excavation ☐ Collections/Non-Field Study
☐ Overview/Lit Review ☐ Monitoring ☐ Ethnographic study ☐ Site specific visit ☐ Other

7. Description of Undertaking (what does the project entail?): Excavation of cultural deposits within NM 434 highway right-of-way prior to road improvements.

8. Dates of Investigation: August 18–November 6, 2014

9. Report Date: 2017

10. Performing Agency/Consultant: Office of Archaeological Studies
Principal Investigator: Eric Blinman
Field Supervisor: Nancy J. Akins
Field Personnel Names: Isaac T. Coan, Susan M. Moga, Ann L. W. Stodder, Mary Y. Weahkee, Karen Wening, and C. Dean Wilson

11. Performing Agency/Consultant Report No.: Office of Archaeological Studies, Museum of New Mexico, Archaeology Notes 477

12. Applicable Cultural Resource Permit No.: State Permit Nos. SE-337, BE-051, ABE NM 14-027

13. Client/Customer (project proponent):
Contact: Steven A. Lakatos
Address: NM Dept of Transportation
PO Box 1149, Santa Fe NM 87504
Phone: (505) 827-5513

14. Client/Customer Project No.: NMDOT Project Nos.: CN 4100381, CO5488/Task 25 (FY12-25)

15. Land Ownership Status *(Must be indicated on project map):*

Land Owner	Acres Surveyed	Acres in APE
NMDOT	**.3**	**.3**
TOTALS	**.3**	**.3**

16 Records Search(es):

Date(s) of ARMS File Review 6/8/14; 7/2015	**Name of Reviewer(s)** Nancy Akins; Ann Stodder	**OAS**
Date(s) of NR/SR File Review	**Name of Reviewer(s)**	
Date(s) of Other Agency File Review	**Name of Reviewer(s)**	**Agency**

17. Survey Data:

a. Source Graphics

☐ **NAD 27** ☒ **NAD 83** **Note: NAD 83 is the NMCRIS standard**

☐ **USGS 7.5' (1:24,000) topo map** ☐ **Other topo map, Scale:**

☒ **GPS Unit** **Accuracy** ☒**<1.0m** ☐ **1-10m** ☐ **10-100m** ☐**>100m**

b.

USGS 7.5' Topographic Map Name	**USGS Quad Code**
Guadalupita, NM	36105-B2

c. County(ies): Mora

17. Survey Data (continued):

d. Nearest City or Town: Mora

e. Legal Description:

Township (N/S)	Range (E/W)	Section	¼ ¼ ¼
			, , .
			, , .
			, , .
			, , .
			, , .
			, , .
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Projected legal description? ☐ **Yes** ☐ **No** ☒ **Unplatted**

f. Other Description (e.g., well pad footages, mile markers, plats, land grant name, etc.): mm 17.3 NM 434

18. Survey Field Methods:

Intensity: ☐ 100% coverage ☐ <100% coverage

Configuration: ☐ block survey units ☐ linear survey units (l x w):

☐ other survey units (specify):

Scope: ☐ non-selective (all sites recorded) ☐ selective/thematic (selected sites recorded)

Coverage Method: ☐ systematic pedestrian coverage ☐ other method (describe)

Survey Interval (m): **Crew Size:** **Fieldwork Dates:**

Survey Person Hours: **Recording Person Hours:** **Total Hours:**

Additional Narrative:

19. Environmental Setting (NRCS soil designation; vegetative community; elevation; etc.):

20. **a. Percent Ground Visibility:**
b. Condition of Survey Area (grazed, bladed, undisturbed, etc.):

21. CULTURAL RESOURCE FINDINGS ☒ **Yes, see next report section**
☐ **No, Discuss Why:**

22. Required Attachments (check all appropriate boxes): All of the information below is included in the attached report.	**23. Other Attachments:**
☒ **USGS 7.5 Topographic Map with sites, isolates, and survey area clearly drawn**	☐ **Photographs and Log**
☐ **Copy of NMCRIS Mapserver Map Check**	☐ **Other Attachments**
☐ **LA Site Forms - new sites (*<u>with sketch map & topographic map)</u>***	***(Describe)*:**
☒ **LA Site Forms (update) - previously recorded & un-relocated sites (*<u>first 2 pages minimum)</u>***	
☐ **Historic Cultural Property Inventory Forms**	
☐ **List and Description of isolates, if applicable**	
☐ **List and Description of Collections, if applicable**	

24. I certify the information provided above is correct and accurate and meets all applicable agency standards.

Principal Investigator/Responsible Archaeologist:

Signature **Date 5-8-17** **Title (if not PI):**

25. Reviewing Agency:	**26. SHPO**
Reviewer's Name/Date	**Reviewer's Name/Date:**
Accepted ( ) **Rejected ( )**	**HPD Log #:**
	SHPO File Location:
Tribal Consultation (if applicable): ☐ **Yes** ☐ **No**	**Date sent to ARMS:**

CULTURAL RESOURCE FINDINGS

[fill in appropriate section(s)]

1. NMCRIS Activity No.:	**2. Lead (Sponsoring) Agency:**	**3. Lead Agency Report No.:**
132345	US Department of Transportation, Federal Highway Administration	Archaeology Notes 477

SURVEY RESULTS:
Sites discovered and registered:
Sites discovered and NOT registered:
Previously recorded sites revisited (*site update form required*):
Previously recorded sites not relocated ***(site update form required):***
TOTAL SITES VISITED:
Total isolates recorded: **Non-selective isolate recording?** ☐
HCPI properties discovered and registered:
HCPI properties discovered and NOT registered:
Previously recorded HCPI properties revisited:
Previously recorded HCPI properties not relocated
TOTAL HCPI PROPERTIES (visited & recorded, including acequias):

MANAGEMENT SUMMARY:
IF REPORT IS NEGATIVE YOU ARE DONE AT THIS POINT.
SURVEY LA NUMBER LOG
Sites Discovered:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)

Previously recorded revisited sites:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)

MONITORING LA NUMBER LOG *(site form required)*

Sites Discovered (*site form required*) **:** **Previously recorded sites** ***(Site update form required):***

LA No.	Field/Agency No.	LA No.	Field/Agency No.

Areas outside known nearby site boundaries monitored? Yes ☐**, No** ☐ **If no explain why:**

TESTING & EXCAVATION LA NUMBER LOG (*site form required)*

Tested LA number(s)	Excavated LA number(s)
	LA 139965

Coyote Canyon Rockshelter (LA 139965) is located along NM 434 just north of Coyote Creek State Park (Fig. 1.1; Appendix 6), in Guadalupita, Mora County, New Mexico. It was excavated at the request of Laurel T. Wallace, Cultural Resources Coordinator, NM Department of Transportation (NMDOT). The site, which was determined "eligible" for inclusion in the *State* and *National Registers* under Criterion 'd' (July 2, 2014, HPD Log No. 99483), is entirely within the highway right-of-way and would be impacted by planned road improvements. NMDOT, in cooperation with the Federal Highway Administration, plans to widen the highway to provide for two 11 ft (3.35 m) driving lanes, 2 ft (0.6 m) shoulders, and drainage features that will meet current NMDOT design standards.

A data recovery plan was approved in August 2014 (Akins, Moore, and Wilson 2014) and the Office of Archaeological Studies (OAS) began investigations at Coyote Canyon Rockshelter (LA 139965) soon afterward. Surface investigations were conducted August 12–20 and November 5–6, 2014; subsurface investigations took place between August 25 and October 31, 2014.

Excavation of 463 levels of fill in 137 grid units or partial grid units recovered a large sample of cultural materials and exposed multiple stratigraphic profiles. Results indicate that only a portion of the site escaped modern disturbance. Road construction removed the cultural deposits and underlying bedrock talus between Coyote Creek and the face of a rock outcrop or cliff where the rockshelters were formed. The road excavation created what appeared to be a talus slope between the base of the cliff and the current highway. The resulting road-cut slope was eventually covered by a layer of artifact-bearing fill, some of which had eroded down from deposits in the shelters and along the cliff edge. Other cultural deposits on the talus slope and the road edge were pushed or dumped into the area from parts of the original site by mechanical equipment. All of the potential in situ deposits within and in front of the shelters have been excavated, as have most of the redeposited cultural materials within the talus areas. Radiocarbon, ceramic, and projectile point data indicate the shelters and area adjacent to the shelters were utilized by groups traveling along the eastern edge of the Sangre de Cristo Mountains from at least AD 500 until AD 1400, and again in the late nineteenth and early twentieth centuries. Its prehistoric use was mainly as a hunting camp occupied by family groups who focused on hunting deer but who also utilized smaller animals and native plants found in the vicinity.

NMCRIS Activity No. 132345
NMDOT Project Nos. CN 4100381; CO5488/Task 25 (FY12-25)
MNM Project No. 41.1011
State of NM Permit Nos. SE-337, BE-051, ABE NM 14-027

Acknowledgments

The setting, weather, and local interest in the project made excavating at Coyote Canyon Rockshelter a unique experience. We would like to thank Laurel Wallace, Blake Roxlau, and District 4 of the New Mexico Department of Transportation for their support for the project. We would also like to thank the Duke family of Sierra Bonita and the many residents and visitors who stopped by the site to inquire about our findings and talk about the history of the surrounding area.

In addition to the excavators and report authors, others contributed to the project. Doris Glassey, Pauline Romero Herrera, and Emma Easley helped in the field. Mary Weahkee analyzed the bulk of the chipped stone collection. Jessica Badner and Isaac Coan provided GIS support. Jeff Cox and Marvin Rowe worked to provide additional AMS dates for the site and Jeff Cox produced the plasma calibrated date plots. Ann Stodder aided in checking notes and photographs and with background research. Lynette Etsitty managed the lab and curation aspects. Lynne Arany edited and composed the report, Rob Turner produced the illustrations, and Melissa Martinez formatted the tables. Kathy McRee and Mimi Burling photographed the ground stone, chipped stone, and historic artifacts.

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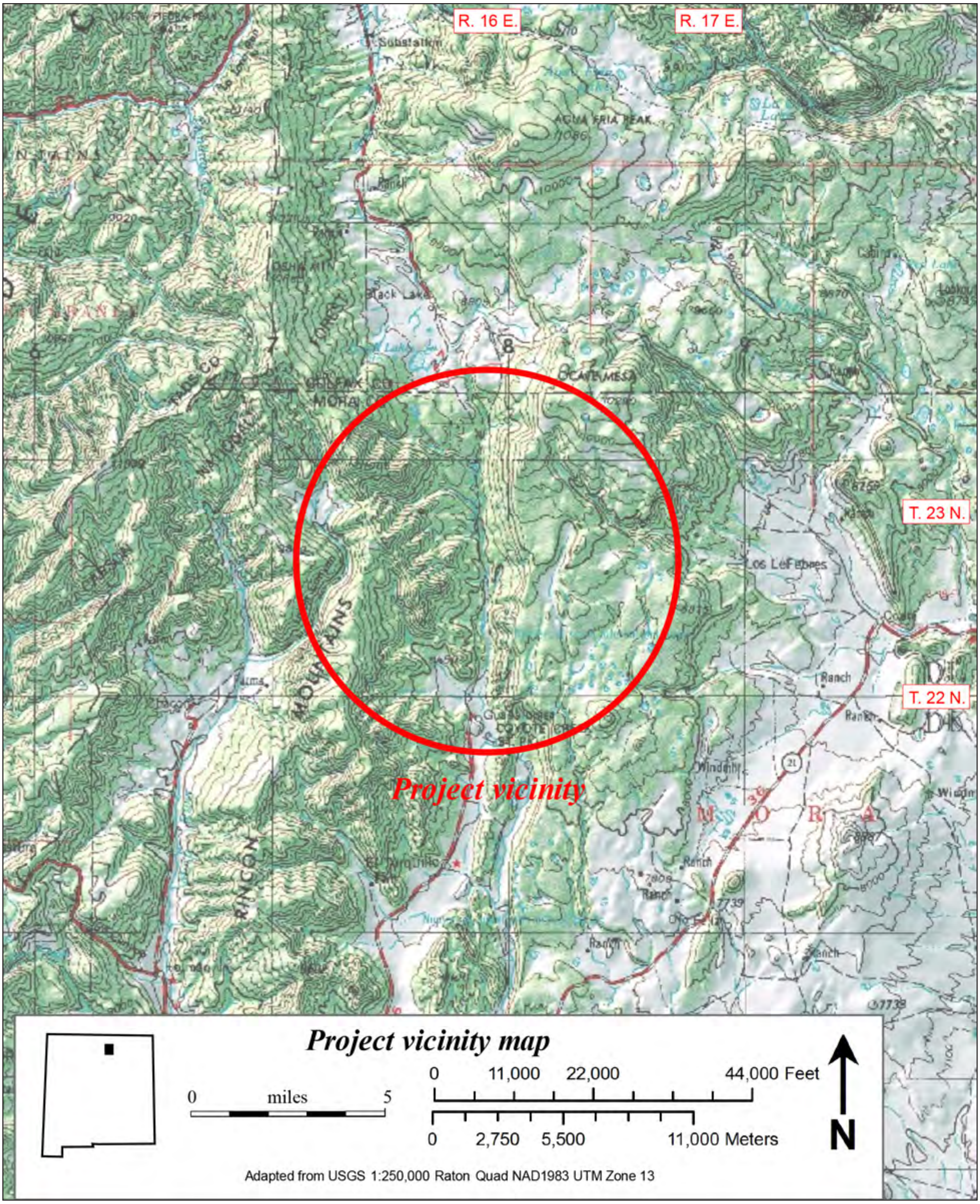

Figure 1.1. LA 139965, project vicinity map.

1 Introduction

Excavations at the Coyote Canyon Rockshelter (LA 139965) were part of the first phase of improvements along an 8.25 mi stretch of NM 434 north of Coyote Creek State Park (Fig. 1.1; App. 6.1, 6.2), in Guadalupita, Mora County, New Mexico. NM 434 is a narrow, two-lane paved road that lacks shoulders and poses a safety hazard. NMDOT, in cooperation with the Federal Highway Administration, plans to widen the highway to provide for two 11 ft (3.35 m) driving lanes, 2 ft (0.6 m) shoulders, and drainage features that will meet current NMDOT design standards. Construction will impact portions of the site area between the pavement and the cliff face and will make the two shelters that comprise this site subject to erosion and more visible and accessible (Fig. 1.2; App. 6.2). For this reason, NMDOT requested complete excavation of the site within the right-of-way. The right-of-way in the site area is 80 ft (24.4 m) wide (Walley et al. 2014:1) and encompasses the entire site. The area investigated lies

Figure 1.2. Coyote Canyon Rockshelter (LA 139965), view north.

within the NMDOT owned right-of-way, and the project was funded by the Federal Highway Administration.

The current route of NM 434 in the vicinity of the shelters has a long history as a trail or transportation corridor. Prehistoric groups camped or passed through the site area from at least the AD 500s, and probably earlier based on the four En Medio projectile points found at the site. Historic-period artifacts document sporadic use in the late 1800s and early 1900s. A 1914 New Mexico highway map shows no roads in the area, but Wallace (2004:140) notes there was a gravel and unimproved road that extended from Black Lake to Lucero east of Mora, which was realigned to end at Mora by 1930. The 1942 state highway map (Wallace 2004:187) indicates it (originally known as NM 38) was improved from Mora to Guadalupita. The 1956 state highway map (Wallace 2004:188) has a gap between Guadalupita and Black Lake with both segments labeled NM 38, indicating it was still not an improved or paved road. The road in the vicinity of Sierra Bonito was paved in the late 1960s (Ebright 2010:5), when the area was subdivided and incorporated (Kelly Powell, personal communication, October 31, 2014).

After a brief visit to the site, a data recovery plan was prepared (Akins et al. 2014); it was approved with modification on August 19, 2014. The plan proposed complete excavation of the two shelters and a sample of the talus and cliff-edge areas. Excavation was to be in 5 cm levels with all fill screened and a sample of each grid unit screened through 1/8-inch hardware mesh. Pollen and flotation samples were to be collected from each level of excavation and charcoal collected for dating. During data recovery, a request to eliminate excavation in the adjacent bar ditch (drainage) and to increase excavation levels to 10 cm was approved (HPD Log 100029).

Prior to excavation, a plant inventory was conducted by Pamela J. McBride (August 12, 2014), and the staining of rock surfaces within and around the shelters was examined by Marvin Rowe and J. Royce Cox using a hand-held pXRF (August 18, 2014). Vegetation was removed, datums were set, and a grid system was established August 18–20, 2014. Excavation under State Permit No. SE-337 began on August 25, 2014, and was completed on October 31, 2014. Final mapping of the site area was completed on November 6, 2014. Nancy J. Akins was the project and field director, and the field excavation crew included Isaac T. Coan, Susan M. Moga, Ann L. W. Stodder, Mary Y. Weahkee, Karen Wening, and C. Dean Wilson. Jeffrey L. Boyer described the soil and drew soil profiles of the North and South Shelters. Stephen A. Hall provided insight into depositional process and made suggestions about dating the fill comprising the site. Eric Blinman was the principal investigator for the project.

2 ⩡ Natural Environment

Coyote Canyon Rockshelter is located along Coyote Creek near the south entrance of Guadalupita Canyon and is just north of Coyote Creek State Park. Black Lake is about 13 km (8 mi) to the north and the village of Guadalupita is 4 km (2.5 mi) to the south. The rockshelters are approximately 50 m (164 ft) west of Coyote Creek at the base of a volcanic cliff at an elevation of 2,347 m (7,700 ft). Oak, gooseberry, chokecherry, current, juniper, ponderosa pine, willow, alder, grass, and mullein occur on and around the site. A grassy meadow and riparian vegetation are present on the opposite side of NM 434 from the site (Figs. 1.2, 2.1, 2.2; App. 6.2), as is Coyote Creek.

The Rincon Mountains lie to the west and Ocate Mesa to the northeast. The Rincon Mountains are in the eastern portion of the Sangre de Cristo Mountains and consist of an asymmetric anticline that is

Figure 2.1. Vegetation in the vicinity of the site, view south. The site, on the west side of the road (NM 434), is up ahead, to the right of the grassy area at the bend (Coyote Creek, not visible here, is off the east side of the road).

flat-topped with a steep cliff face in the site area. Ocate Mesa is a basalt-capped volcanic field that lies between the Rocky Mountains and the Plains. Lava flow deposits in the Black Lake/Guadalupita area along Coyote Creek are olivine basalt; they can be more than 46 m (150 ft) thick (Brown 2004:13–14).

The site lies at the intersection of two soil groups. To the west are Moreno-Brycan-Hesperus soils described as deep, nearly level to sloping, and well drained. Vegetation is mainly grass with some conifers and brush at the edge. To the east are Dargol-Rock outcrop-Vamer soils described as shallow to-deep, gently sloping-to-very steep well-drained soil on mountainsides, mesas, ridges, benches, and foothills. These tend to be covered with coniferous trees and grasses (Sellnow 1985:11).

At Coyote Creek State Park, the average daily high temperatures range from 9° C (49° F) in January to 30° C (87° F) in July and the lows from -9° C (15° F) in January to 11° C (52° F) in July (Brown 2004:16). Most of the moisture comes in May through October (56 cm [22 in]) with 1.5 to 1.8 m (5–6 ft) of snow falling in the mountains in winter (Houghton 1985:2).

Coyote Creek is a tributary of the Mora River and originates near Black Lake. Flow varies by season with most of the runoff coming from summer thunderstorms and melting snow; it can be barely a trickle in July and August (Ebright 2010:A–3).

Located at the southern end of the Rocky Mountain Physiographic Province, vegetation is Mixed Conifer Forest in the uplands and Montane Riparian Forest in the canyon bottom along Coyote Creek. Surveys along NM 434 have documented 54 species of birds and 15 of mammals, two reptile, one amphibian, and eight fish species. Mammals include deer, elk, bear, coyote, raccoons, pocket gophers, woodrats, cottontail, chipmunks, meadow voles, deer mice, long-tailed voles, and the New Mexico meadow jumping mouse. Three birds of prey were observed (red-tailed hawks, peregrine falcons, and the northern goshawk). Swallows nest within the cliff faces (NMDOT 2014:3–18, 3–23–3–24).

Figure 2.2. Coyote Creek and vegetation, view south, along the east side of NM 434.

3 Cultural Setting

Nancy J. Akins and James L. Moore

Located on the eastern edge of the Sangre de Cristo Mountains, the general area of Coyote Canyon Rockshelter (LA 139965) is complex both environmentally and culturally and has the potential for providing information on the interaction between Southwestern and Plains groups. Few archaeological investigations have taken place in Mora County, resulting in a limited record for the project area. This background chapter is therefore based on more general information from the northeastern portion of New Mexico and relies on the cultural overview in Marshall and Marshall (2004:19–20; Brown and Marshall 2004:24–33), regional overviews, and a record search of the area east of the Sangre de Cristo Mountains. Based on Marshall and Marshall's (2004:39) suggestion of a probable Jicarilla Apache occupation and a possible Puebloan occupation at LA 139965, or trade with the Jicarilla Apaches who used the site, the Coyote Canyon Rockshelter data recovery plan (Akins et al. 2014) focused on the possibility of a Jicarilla Apache component there. However, project-generated radiocarbon dates and artifact analysis indicate that use of the shelters predates the arrival of Jicarilla Apaches in the area.

Paleoindian Period

Humans entered the New World by about 16,000 years ago, well before the earliest recognized group or Clovis tradition. No unequivocally ancestral Clovis sites have been identified, but pre-Clovis sites such as the Debra L. Friedkin site in central Texas suggest they differed in technological organization (Jennings and Waters 2014:25–44).

In the Southwest, the earliest well-documented groups were mobile hunter-gatherers who hunted now-extinct fauna in the late Pleistocene and early Holocene. Distinctive projectile point styles are used to divide the period into three groups: Clovis (10,000–9,000 BC), Folsom (9,000–8,000 BC), and Plano (8,000–5,000 BC). Dated Clovis sites tend to be found in the High Plains along the Rocky Mountains; the distinctive Clovis points and blade technology may have originated in the southeast and moved northward and eastward. The Rocky Mountains appear to have been a significant barrier (Beck and Jones 2010:84–86). Clovis technological organization included bifacial and blade core-reduction strategies and the tool kit had scrapers, gravers, notches, and other flake tools (Jennings and Waters 2014:26), as well as shaft straighteners, and bone points and foreshafts (Gunnerson 1987:10). Folsom and Plano groups hunted early forms of bison, while relying more on plant resources toward the end of the period. Finely made fluted projectile points are typical of Folsom assemblages, while Plano complexes are characterized by a variety of projectile point and knife forms (Brown and Marshall 2004:24).

A variety of Paleoindian points—Clovis, Folsom, Planview, and Cody—have been found along the foothills of the Sangre de Cristo Mountains. Specifically, two sites located between Mora and Las Vegas had these points: LA 4558 had Clovis, Folsom, Cody, and Eden points; LA 12586 had Folsom material. In addition, LA 3647 near Tecolote had Clovis, Folsom, and Planview points. Other sites have Paleoindian components (Brown and Marshall 2004:24–25). Given its location, Paleoindian groups may have followed Coyote Creek and passed through the area now known as LA 139965.

Archaic Period

The Archaic period in the northeastern part of the state is also poorly known. This is due in part to our inability to date lithic scatters that lack diagnostic artifacts; that many of the known sites are multi-component is another factor. Subsistence during the Archaic is generally considered to be oriented more toward plants, but it also included hunting small and larger game, such as deer. Distinctive artifacts include stemmed or corner-notched projectile points, basin metates, one-hand manos, scrapers, drills, choppers, and knives (Brown and Marshall 2004:25).

More is known about the Archaic in the northern Rio Grande Valley on the west side of the Sangre de Cristo Mountains, where a drier climate decreased lake and creek levels after about 6050 BC and may have shifted game distributions northward. Moister conditions in the Middle Archaic (4050–1550 BC) expanded the piñon-juniper woodlands, causing some shift of hunter-gatherer residences into the uplands to facilitate collection of pine nuts and hunting deer. The Late Archaic (1550 BC–AD 450) was characterized by seasonal movement from the juniper savanna in early summer to ponderosa pine/mixed conifer forests in mid- to late summer and piñon-juniper woodlands in the fall. Winter camps were in riverine settings (Vierra 2013:147–148).

En Medio projectile points were recovered during excavations at the Coyote Canyon Rockshelter. While these could have been curated objects that were lost or purposefully left at the site, this is unlikely since they were all basal fragments. As suggested for the Northern Rio Grande, the presence of En Medio points could indicate Archaic use of the site area during the mid- to late summer.

Ancestral Pueblo Period

The influence of Rio Grande Puebloan and Plains groups overlaps in northeastern New Mexico during this era. Reliance on cultigens, pottery manufacture, the bow and arrow, and a more sedentary lifestyle characterize some groups while others continued a mobile hunter-gatherer lifestyle. Sites considered Puebloan are present in the Cimarron, Waltrous Valley, and Tecolote-Ribera areas (Brown and Marshall 2004:25), as well as to the northwest, at Pot Creek, and to the north, in the Taos valley.

With the exception of the Cimarron area, evidence for the Puebloan occupation of the northeastern part of the state began around AD 1000 (Brown and Marshall 2004:25). In the Cimarron area, Vermejo-phase sites date as early as AD 400–700 and are similar to Basketmaker II sites elsewhere in the state. These have: simple above-ground structures; sparse, very small corner-notched projectile points; and corn, but no ceramics. Crude thick-walled ceramic vessels appear in Pedregoso-phase sites dating around AD 700–900, along with a variety of roasting and storage pits. Escritores phase (AD 900–1100) sites have Kiatuthlanna and/or Red Mesa Black-on-white ceramics and neckbanded gray ware. The only structure reported for this phase was a circular pithouse similar to others in the northern Rio Grande area. Above-ground structures reappear in Ponil-phase sites (AD 1100–1250) along with the occupation of rockshelters. Ceramic types associated with these latest sites include Taos Gray, Taos Black-on-white, and Kwahe'e Black-on-white. A site excavated by Lutes in 1956–1957 (Lutes 1958) had a three room slab-lined structure with upright posts. Ceramics were plain utility ware with sand temper (some incised) and some back-on-white wares. Projectile points were common (n = 111) and were side- and corner-notched with concave and convex bases. Drills, scrapers, knives, bone beads, clay pipes, and burials were also found. Based on the stone tools, Lutes believed it represented an unspecialized hunting and gathering group. Large multi-room pueblos with Cimarron Plain, neckbanded, and Santa Fe Black-on-white ceramics are documented for the Cimarron phase (AD 1200–1300). Projectile points, that remained small and corner-notched until this period, became larger with side notches. The change in architectural form is accompanied by a movement from upper canyons at higher elevations to the mouths of lower canyons at the margin of the plains during the later period. No sites are attributed to the AD 1300–1550 time period (Campbell 1984:78–79; Glassow 1980:70–75; Brown and Marshall 2004:26-27; Simmons 1989:100–101).

To the southeast of Coyote Canyon Rockshelter, Watrous area sites date between AD 1100 and 1300. Rockshelters along the Sapello River were generally shallow, but some had cultural deposits including slab metates and one-hand manos. One had corncobs scattered below the shelter. Many area sites have structures, and the partially excavated Lynam site, which is adjacent to the Mora River, is an adobe masonry L-shaped pueblo with Santa Fe Black-on-white and a wide range of other imported ceramic types, a trough metate, bone awls, bone beads, and projectile points found in the only room excavated. Another 111 small projectile points were found on the surface. Points include side-notched, side-notched with basal notches, and triangular forms, mainly made of local quartzite. Also to the south, sites in the Tecolote-Ribera area date slightly later than in the Watrous area. The Tecolote site (LA 296) has 10 house mounds and dates from the late AD 1100s to the mid-1200s (Brown and Marshall 2004:26; Campbell 1984:77; Lister 1948:38–40).

Occupation of the Taos area to the northwest was sparse before the Valdez phase (AD 1100–1225). This phase is characterized by the presence of Taos Black-on-white, Kwahe'e Black-on-white, and Taos Gray ceramics and by scattered villages comprised of two to four deep pithouses with jacal surface structures concentrated along river drainages. The Pot Creek phase (AD 1200–1250) is identified by the presence of Santa Fe Black-on-white ceramics and small unit pueblos. After AD 1250 until AD 1350, the Talpa phase—which is known only from excavations at Pot Creek Pueblo—was a period of aggregation into large villages, along with the presence of locally made Talpa Black-on-white ceramics. Pot Creek Pueblo was abandoned and replaced by large pueblos at Cornfield Taos and Picuris in what is known at Picuris as the Vadito phase (Boyer 1994a: 45–47; Boyer 1994b:379–380).

Herbert Dick's work at Picuris uncovered a Valdez phase pit structure and he suspected others were present. A site to the south with multiple pit structures from this phase was also noted. The Talpa phase occupation at Picuris is poorly represented due to subsequent remodeling and construction that continues today (Dick et al. 1999:48–50).

Taos considers Black Lake Peak as the southeastern corner of the old Taos traditional use area. They took ducks from Black Lake for religious and domestic use and used the area for hunting turkey, deer, elk, and bear (Ellis 1974:129, 143, 145). In addition to the Tiwa groups from Taos and Picuris, Tewa groups also undoubtedly traveled through the Coyote Creek area. According to Hill, Tewa groups were in the area east of the Sangre de Cristo Mountains after AD 1000 but shifted to the west by AD 1200 (1982:6). Historic Tewa groups used the Mora area for hunting. When bison meat was scarce, San Ildefonso groups hunted elk, antelope, and bear in the mountains around Santa Fe, Pecos, and Mora (Stanley 1969:17).

Plains Woodland Period

Researchers have identified a Plains Woodland period presence in areas of northeastern New Mexico beginning around AD 200 and characterized by the appearance of corn, cord-marked pottery, the bow and arrow, and a continuation of an Archaic subsistence strategy based on hunting and gathering. Most of what we know about this period comes from sites in Colorado, caves, and occasional circular masonry dwellings. Artifacts include small corner-notched points, one-hand manos, and cord-marked pottery (Stuart and Gauthier 1981:302–303).

While not overtly labeling the sequence as Plains or Pueblo, Cordero and Cribbin (2010:11–15), citing the unpublished work of Mack (2009) for the Park Plateau, describe a sequence that includes some of the same phases used by Glassow (1980) . The earliest, or Vermejo, period (AD 250/300 to AD 950/1000) is equivalent to the Rio Grande Developmental period. It is characterized by cord-marked ceramics later in the period, use of the bow and arrow after about AD 300, more reliance on wild plants than domesticates, and a diverse range of animal resources. The Vermejo period can be divided into two phases: Ancho and Pedregoso. Ancho phase (AD 250/300–600/650) sites have shallow pit structures excavated into south-facing hill slopes and on ridges and benches. Evidence for cultivation of corn is limited. Manos associated with this phase were small and metates were flat or basin. Projectile points varied with some resembling dart points. Pedregoso phase (AD 650/700—950/1000) sites indicate that canyon floors were used for growing corn, beans, and possibly cheno-ams and marsh elder. Pottery was made from untempered sandy-silt clay or silty clay with coarse temper and often had basket impressions. Pottery and deep storage pits found after AD 770–880 indicate storage of bulk foods. Circular masonry structures with enclosing walls further suggest larger households, but pit structures continued to be used (Cordero and Cribbin 2010:11–12).

This was followed by the Culebra or Diversification period (AD 1050–1450), which was characterized by population growth, aggregation, and continued reliance on both wild and domestic resources. Structures were larger and more complex. This period is divided into two phases that overlap in time, with the Apishapa phase showing more Plains influence and the Sopris phase more Pueblo influence.

Apishapa phase (AD 1050–1450) sites are generally north of Coyote Canyon Rockshelter, and as far south as the Cimarron River Valley (at least 40 km [25 miles] northeast of Guadalupita). They were located in open settings and rockshelters. Open sites have curved rock walls and perimeter postholes. Plains influence is seen in cord-marked ceramics, side-notched projectile points, and some bone tool types. Ceramic trade wares included Puebloan, Plains Village, and possible Sopris phase wares. Lithic materials were mainly from local sources with small amounts of Alibates chert and Jemez obsidian. Manos tended to be expedient and one-handed and associated with flat slab or shallow basin metates. The subsistence economy continued to be mixed, with corn found consistently but beans and squash absent. A wide range of wild plants was exploited as were large and small animals. Some of the limited faunal data suggests a shift to the use of primarily small forms, especially rabbits (Cordero and Cribbin 2010: 12–14).

The Sopris phase (AD 950/1000–1250/1300) was first defined by Dick in 1963. Today it is considered a cultural phase found from at least the Cimarron area north into Southern Colorado. It is characterized by rectilinear masonry structures and Puebloan pottery, including Taos Black-on-white, Taos Incised, and Taos Gray as well as locally made Sopris Plain (see Chapter 9 for a discussion of the similarities and differences between these wares). Like the Apishapa phase sites, lithic assemblages contain mainly local rocks along with small amounts of Alibates chert and Jemez obsidian. Projectile points are small corner-notched types with some larger dart points. Manos include expedient one-hand and more modified two-hand types, and metates of all three types—slab, basin, and trough—are found. Wild plants remained an important part of the diet and animals of all sizes and types were exploited (Cordero and Cribbin 2010:14).

Some consider the AD 1300 to 1450 occupation of northeastern New Mexico to be the Antelope Creek focus reflecting the Great Plains orientation of this period. As in the Sophris phase, sites are characterized by contiguous room pueblos with rows of upright slabs ranging from 6 to 80 rooms in size. Subsistence was a mix of agriculture and bison hunting and ceramics a mix of cord-marked wares and Pueblo tradewares. By AD 1450 most of these groups had left the area (Brown and Marshall 2004:27; Simmons 1989:101).

Protohistoric and Early Historic Periods

A number of groups occupied northeastern New Mexico after AD 1500. The Apaches are the best known and documented due to their contact with the Spanish explorers. The Jicarilla Apache are the group most likely to have occupied and used the project area; their history and what we know archaeologically is detailed below. Other groups who could have passed through or used the area include the Utes, Kiowa, Kiowa Apache, and the Comanche in the 1700s and 1800s, and Hispanics who settled on the western slopes of the Sangre de Cristo Mountains and used the area for trapping or as a route between the Plains and upper Rio Grande (Marshall and Marshall 2004:27–31).

Jicarilla Apaches

Jicarilla Apaches currently occupy a reservation in north-central New Mexico but formerly roamed across most of northeastern New Mexico and well out onto the Plains. Speaking a Southern Athabaskan language, Jicarillas are linguistically and culturally related to other Apache groups, including Mescalero, Lipan, Chiricahua, Kiowa, and Western Apaches, as well as Navajos. Southern Athabaskans appear to have entered the Southwest around 1450, shortly before the first Spanish expedition into the region (Wilshusen 2010:195). Citing Spanish documents, Gunnerson (1979:162) suggests that Southern Athabaskans arrived in the Southwest shortly before the Coronado expedition of 1540–1542. However, as related in Pedro de Castañeda's memorial of that expedition, Coronado was told at the village of Cicuye (Pecos Pueblo) that a people called the Teyas had first arrived in the area about 16 years earlier (Castañeda 1990 [1904]:148). During his journey onto the plains in search of the land of Quivira, Coronado encountered two groups of nomadic peoples, the Querechos and the Teyas, who moved around with their goods carried by dogs. Querechos have long been accepted as early Apaches, and a linguistic and ethnohistoric analysis by D. Gunnerson (1974) suggests that Teyas were Apache as well. This documents the entrance of Apaches into the Southwest in the early years of the sixteenth century. Archaeology appears to support this scenario, suggesting that Apaches arrived in northeastern New Mexico and on the Llano Estacado of Texas and Oklahoma by ca. AD 1450–1500 (Eiselt 2006:57).

Jicarillas were living in rancherías and growing crops in northeastern New Mexico when contacted by Ulibarri in 1706 (Tiller 1983:449), though they also maintained a Plains hunting tradition (Noyes 1993:xxiii). Beginning around the turn of the eighteenth century, the Comanches—a Shoshonean tribe—began moving south from the Northern Plains, probably to obtain better access to Spanish settlements and the rich wildlife of the Southern Plains (Noyes 1993:xix). By 1706, the Comanches had allied with the Utes and were threatening Taos; later that year they were raiding the Jicarillas (Noyes 1993:xix). Most Jicarillas were driven from their homeland in the 1720s and 1730s, moving to an area south of Taos Pueblo near modern Ranchos de Taos, though a few remained in their homeland until the 1740s (Eiselt 2006:105). Most of the members of the Carlana, Palomas, and Cuartelejo Apaches joined together and became the Llanero band of the Jicarillas between about 1730 and 1750 (Gunnerson 1979:163; Tiller 1983:450). The Llaneros resided mainly in Mora, San Miguel, and Colfax counties and along the foothills of the Sangre de Cristo Mountains. Some were based north of Mora and others north of Ocate, and moved out onto the plains living in seasonal camps (Tiller 1992:13).

Governor Anza negotiated a treaty of peace with the Comanches in 1786, bringing to a close the period of continual warfare. The terms of this treaty also made peace between the Jicarillas and Comanches. With peace, Spanish settlers began encroaching on the traditional Jicarilla homeland. Still, despite this encroachment and the creation of numerous land grants in Jicarilla territory by the Mexican government after 1821, the Jicarillas continued to live undisturbed in their traditional homeland throughout the Mexican period (1821–1846 [Tiller 1983:450]). However, this situation began to change after New Mexico was acquired by the United States in 1846. American settlers began moving into Jicarilla territory and upsetting the economic balance between the Jicarillas and the Hispanic settlers who were already living there (Tiller 1983:451). Hostilities began with the Jicarillas and other Indian groups that continued for many years, though there were several failed attempts to establish peace. In 1854, the acting governor of New Mexico declared war on the Jicarillas and their Ute allies (Tiller 1983:451). After two years of war the Jicarillas and Utes negotiated a peace treaty. The Jicarillas occupied lands near Cimarron and Abiquiu, though an official reservation was not created for several decades. After years of negotiation and a brief relocation to the Mescalero reservation in the south, a reservation was finally established for the Jicarillas in 1887 (Tiller 1983:452), allowing them to live on part of their original lands in northeastern New Mexico.

Jicarilla Apache Archaeology

Gunnerson (1969) was one of the first archaeologists to describe probable Jicarilla Apache sites in northeastern New Mexico. During a 1719 expedition against the Comanches and Utes, Antonio de Valverde provided a description of Jicarilla houses, describing those at one settlement as made of adobe with flat roofs (Thomas 1935:113–114). At a second settlement, the houses were described as terraced, and Valverde noted that the Jicarilla's crops were irrigated by canals and ditches (Thomas 1935:115). By the late 1740s, the Apaches were apparently no longer able to live in such semi-permanent residences, and were living in "houses, palisade huts, and other shelters," as described by Governor Codallos (Twitchell 1914:150, as cited by Gunnerson 1969:3). Using descriptions like these in conjunction with surveys, Gunnerson (1969) defined several probable Jicarilla residential sites in northeastern New Mexico. The Glasscock Site is along Ocate Creek, a tributary of the Canadian River, and contained a seven room L-shaped structure of coursed adobe that probably had a flat roof and lacked a prepared floor. Hard-fired baking pits, similar to those used until recently by the Jicarilla for baking green corn, were found at both the Glasscock Site and the Ponil Bend Site (Gunnerson 1984:63). The ceramic assemblage at the Glasscock Site was dominated by Ocate Micaceous, but also contained a small number of historic Pueblo sherds including Ogapoge Polychrome and Tewa Polychrome, and two glaze ware sherds that may have originated at Pecos Pueblo (Gunnerson 1969:27). Projectile points include specimens made from obsidian and Alibates chert. Ground stone and bone tools were also recovered. A few majolica sherds and a single metal tool, possibly an awl, were the only artifacts found that were of European manufacture. Similar adobe structures were alluded to by Hurtado in the Mora Valley in 1715 (Gunnerson 1969:36; Thomas 1935).

The Sammis Site, near Cimarron, contained a single pit structure, or structure in a pit, that was attributed to a Jicarilla occupation, and yielded numerous Ocate Micaceous sherds as well as a single majolica sherd. Two probable Jicarilla occupations were defined at the Chase Bench Site in Ponil Canyon. An early, pre-1750 occupation was represented by two structures that both held Ocate Micaceous sherds. One structure consisted of a shallow depression nearly 3 m in diameter bounded by rocks and containing chunks of adobe that originated either in the walls or the roof, while the second structure was not well defined. In contrast, a post-1850 occupation was represented by seven probable tipi rings associated with Cimarron Micaceous sherds, as well as metal and glass artifacts (Gunnerson 1969:32–35). Both obsidian and Alibates chert were found at this site.

A small jacal structure was documented by Gunnerson (1984:64) in the lower Vermejo Valley. This structure was a surface house measuring 3.3 m in diameter, outlined by vertical posts set about a meter apart, and which contained a well-prepared hearth. Three storage pits, the largest of which was 1.5 m deep and 1.4 m in diameter, were also found at this site (Gunnerson 1984:64).

Gunnerson (1979:168) also reported on the John Alden Site, located on a mesa top north of Villanueva, with a reported 100 crude structures. The structures appear to consist of shallow depressions ringed with stone walls that were possibly as much as a meter tall, and are a bit larger than 3 m in diameter, with a hearth in the center. One structure may contain three rooms, and the best-preserved example is L-shaped with a corner fireplace near the top of the "L." Artifacts are sparsely distributed, suggesting a brief occupation, and are dominated by a non-micaceous ware that is otherwise similar to Cimarron Micaceous. Some sherds of Powhoge Polychrome were also identified and, in association with a dateable military button, suggest an occupation around 1850.

Glassow (1980:75–77) investigated Jicarilla sites in the Cimarron district, representing multiple periods of occupation. The early period is known as the Cojo phase and may pre-date the early 1700s. Among the sites dating to this period of occupation in Ponil Canyon, at NP-12 he encountered three wickiup-like structures, a bottle-shaped roasting pit, non-random rock scatters, numerous ground stone tools, some corn, and a low density of other artifact types. The pottery at this site was mainly Ocate Micaceous, but some Pecos Glaze Polychrome and Kotyiti Glaze-on-red sherds were also found, dating the site to the early 1600s. Other sites in the area contained Sankawi Black-on-cream or unidentified Rio Grande glaze wares in addition to Ocate Micaceous sherds. Some evidence of contemporary occupations was found in rock shelters. The later period of occupation is the Jicarilla phase, which appears to post-date 1800. Only a few sites dating to this period were found, and they contain sparse scatters of cultural debris. Jicarilla-phase sites were defined by the presence of Cimarron Micaceous sherds, and include the Chase Bench Site that was previously excavated by Gunnerson (1969), as discussed earlier.

Eiselt (2006:238–244) has investigated mid-1800s Jicarilla sites in the Rio del Oso, a tributary of the Chama River. Nineteen residential sites were recorded, each containing multiple rock rings that probably represent extended family base camps. Base camps occur in what Eiselt (2006:239) terms settlement areas, and form non-overlapping clusters of features and artifacts separated by 20–100 m. The base camps contain three to 10 rock rings as well as other features, and low-density artifact scatters and trails surround the camps. Most of the rock rings appear to represent wickiup bases, though tipis and square army tents also appear to have been used (Eiselt 2006:251). Extramural features include thermal features, rock alignments, agricultural terraces, corrals or pens, shrines, trails, and artifact scatters (Eiselt 2006:258). Artifact assemblages consist primarily of chipped stone debitage and tools, micaceous schist debris, Cimarron Micaceous sherds, and ground stone (Eiselt 2006:285). Euroamerican artifacts occur, but only make up about 4 percent of assemblages.

Girard (1988) investigated 19 probable Jicarilla sites clustered in five areas between the mouths of the Rio Chiquito and the Rio Grande del Rancho in the Taos area. These sites are characterized by micaceous pottery made by Apaches and also include chipped and ground stone artifacts and Euroamerican items. Unfortunately, cultural features were only found at two sites. In one case, there is a small, shallow roasting pit, while the other site contains the remains of a pole and brush shelter and a sandstone chimney over a hearth. Archaeomagnetic and tree-ring dates indicate that the latter site was occupied in the 1860s.

Hispanic and Anglo

Located within what was the Mora Grant and probably the Guadalupita Grant common lands, the LA 139965 area could have been used by residents of either or both communities. The Town of Mora Grant was issued by the Mexican Territorial Governor to 26 citizens of the Republic of Mexico on September 28, 1835. On October 20, the petitioners were lawfully placed in possession of 827,621 acres, but Spanish settlers were in the area as early as 1818 or 1820 (Marshall and Marshall 2004:31; Westphall 1983:41). In 1851, after the Treaty of Guadalupe Hidalgo conveyed the land from Mexico to the United States, the grant residents petitioned the Surveyor General for confirmation of the community grant. While the grant was approved in 1860 (Westphall 1983:157), problems with the survey and objections by the succeeding Survey General delayed acceptance of the survey until 1871. In the meantime, Anglo-American lawyers, politicians, merchants, and land speculators with connections to the Washington establishment and the Republican Party found investors willing to purchase portions of land grants in New Mexico. Stephen B. Elkins and Thomas B. Catron bought up as many rights to the Mora Grant common lands as they could. When the survey was finally accepted, the patent was issued to Catron and Elkins even though they owned only a small portion of the land. Thus, by the late 1880s, the grant common lands were primarily owned by Catron and two Massachusetts residents (Benjamin Butler, a politician and Adelbart Ames, a businessman) who divided the land and filed suit to partition the common lands in 1876. The local Hispanic and Anglo residents of the grant lands ignored the claims of Catron and his partners and continued to use the common lands for livestock, refusing to pay royalties or move from the land. Catron was never able to establish clear title to his portion of the land and in 1913 his interests were sold at the Mora County Courthouse door for failure to pay property taxes. A resident of Las Vegas bought the land, but in 1915 the partition suit of 1876 was resurrected in the local court—without informing the people living on the grant. The land was again sold at the Mora County Courthouse door. As a result, the descendants of the original grant members lost their claim to the common lands (Goodman 1993:35–38). The Guadalupita Grant was one of five small land grants that overlapped portions of the Mora Grant. It was initiated with permission from the principal Mora grantees in 1837 and settled in 1851 (Ebright 2010:A–1).

The 1860 census places 185 families, or about 830 people, in the greater Guadalupita area. Most lived in Guadalupita Canyon along Coyote Creek and were mainly farmers and farm laborers. Farmers raised corn, wheat, oats, barley, and potatoes. The 1880 census divided the greater Guadalupita into three areas (Upper Coyote, Lower Coyote, and Guadalupita). It lists 31 herders and a range of other occupations such as freighters, seamstresses, a teamster, carpenters, and a wool worker for Guadalupita (Ebright 2010:12.2–12.4).

The most likely Hispanic use of the LA 139965 area would have been related to farming or sheepherding. Located along Coyote Creek, the site had access to water, a grassy area across the creek, and a steep cliff to provide some protection from the environment; it would have made an ideal sheep camp. If there were farming households in the vicinity, these would have been located across the creek and would be less likely to contribute deposits to the rockshelters. Sheep camps in the Mora and Guadalupita grant area could have resembled those described by Carrillo for the Chama Valley (1992:158–160). In addition to jacal summer dwellings near communities, some had large canvases that were made into temporary tents. The canvases were held down by stones and pegs and formed a circular structure. Access was through an unstaked corner of the canvas. Cooking was done outdoors. Shepherds carried few personal items and were armed with bows and arrows. Mules and horses were used for transport until wagons became available. Hispanics in general tended to rely on hunting native wildlife to minimize the number of domesticated animals consumed. Deer and elk meat was made into jerky and at times pounded into a fine powder on a metate.

Anglo presence is documented just north of LA 139965 at the Shollenbarger Camp Ranch Headquarters (LA 139967), a logging camp used by the Fort Sumner Lumber Company and probably by earlier owners since the 1920s. The lumber company camp was a small community with a foreman's house, a cook and mess hall, a repair shop and garage, workers' cabins, a washroom, a store, a well, corrals, and possible dance hall (Marshall and Marshall 2004:48).

4 Previous Research

A 2003 record search covered the area within 1.0 km of the NM 434 right-of-way from Mora to Black Lake (41.4 km [25.75 mi]) (Marshall and Marshall 2004:19–21). At that time, six sites and the Village of Guadalupita and Town of Mora had been recorded within that area. The previously documented sites include: LA 78461, a Hispanic or Anglo root cellar or dugout dating to around 1920; LA 78460, an Apache camp with ceramic and chipped stone artifacts, probably dating to the Protohistoric period; LA 85164, late nineteenth- to early twentieth-century water control features; LA 85163, a Valdez-phase habitation site; LA 85162, a Middle and Late Archaic, Anasazi, and Apache site with hearths and an artifact scatter; and LA 47911, a stone circle and cairn of unknown affinity. None of these archaeological sites are in the vicinity of LA 139965. The only *State* and *National Register* properties in the area are the Mora Historic District and the adjacent Ceran St. Vrain Mill (Marshall and Marshall 2004:20–21).

More recent NMCRIS records, as searched in 2014 (Akins, Moore, and Wilson 2014), indicate three projects have taken place in the vicinity of LA 139965. The first was the 2003 cultural resources survey for the proposed NM 434 improvement project conducted by Cibola Research Consultants for Marron and Associates (Marshall and Marshall 2004). The other two, both at Coyote Creek State Park in 2007, were also Marron and Associates projects. NMCRIS has three site records for the 2007 studies. Two (LA 156550 and LA 156551) are Historic; no other information was available. The third is the Historic Eusebio and Theodora Romero Acequia, which was mapped and reported (NMCRIS, accessed June 18, 2014).

The Marshall and Marshall survey recorded LA 139965 and 10 additional new cultural resources, as well as 31 isolated occurrences (IOs). Only one of the sites and nine of the IOs are located within a 4.8 km (3 mi) radius of LA 139965. The site, LA 139967, is over 3.3 km (2.1 mi) to the north and is the remains of a lumber camp and ranch headquarters. The IOs include a stock tank, a highway accident memorial, the gateway to Coyote Creek State Park, a modern hearth ring, a chipped stone artifact, an isolated historic artifact, a pump/well house, and a logging road (Marshall and Marshall 2004:8, 48). The chipped stone artifact was found a considerable distance south, nearly 3.2 km (2 mi) from LA 139965.

Marshall and Marshall described LA 139965 as two shelters or overhanging shelter areas that contained cultural deposits and suggest that before the earlier NM 434 construction, the shelter areas may have been contiguous. They identified the shelters as the North Shelter and the South Shelter. The North Shelter was described as 3.0 m from the highway pavement and occupying an area 5 by 10 m. Numerous artifacts were observed adjacent to the main shelter area including bones—mostly from middle-sized mammals, a human incisor, two one-hand manos, chipped stone artifacts, and a ceramic artifact. The chipped stone artifacts were a large obsidian biface, a large obsidian side-scraper, a gray chert flake, and five projectile points (one triangular and four corner-notched) made from basalt, El Rechuelos obsidian, gray chert, and gray quartzite. They felt the points suggest probable Athabaskan, perhaps Jicarilla Apache affinity. The sherd was from the rim of a medium-sized utility jar and similar to Faint Blind Corrugated ware identified at Pecos Pueblo, suggesting it may have been imported from that area (2004:40, 43).

The South Shelter was described as 5.0 m from the pavement and was larger, 40 m long with cultural material as much as a meter deep. Artifacts observed in this area were more scattered and less abundant. They noted nine pieces of bone (large ungulates, some burned), five pieces of chipped stone (4 chert, 1 quartzite), a quartzite cobble fragment, three sherds, a ground stone anvil, and two historic artifacts (an aqua bottle-glass fragment and an unspent rim-fire cartridge). The ceramics include a plain micaceous smoothed-neckband utility jar sherd and two plain gray non-micaceous sherds that could be a prehistoric Taos plain ware. The micaceous sherds were described as representing a general Sangre de Cristo micaceous tradition that includes Taos, Picuris, Jicarilla, and Hispanic traditions (2004:40, 43).

Marshall and Marshall felt the site retained stratified cultural deposits as much as a meter deep. The site was recommended as eligible to the *National Register* under Criterion 'd' because it is of archaeological and historical interest and has considerable potential to provide information on the prehistoric and historic occupation of the Coyote Canyon area (2004:43).

Marron and Associates revisited the NM 434 site in 2012. New boundaries were mapped for LA 139965 but no further analysis or observations were made (Walley et al. 2014). Boundaries filed with ARMS extend the site slightly to the north and south, and across the pavement to the creek.

5 Research Questions

Nancy J. Akins and James L. Moore

Little is known about the prehistory and early history of the area where LA 139965 is located. As a result, the research questions proposed for this project are general but designed to contribute to our knowledge of the region. The three interrelated research questions for this project include: chronology, ethnicity, and how and why the site was occupied. Marshall and Marshall (2004:39) suggest that the site might represent a multioccupational locale with possible Jicarilla Apache and prehistoric Pueblo occupations based on the types of sherds noted. Establishing when the shelter was used and by whom are critical concerns. It is also important to establish why the site was used, and how it was occupied by the groups that lived there. These points of inquiry are presented below as a series of research questions.

Research Question 1: Chronology

Before questions of ethnicity and site structure can be addressed, when the site was occupied and the time span covered by the occupation(s) need to be determined. Groups from the Paleoindian period on could have followed Coyote Creek as they traveled through the foothills of the Sangre de Cristo Mountains. Uses such as short-term hunting, hunting and gathering, and sheepherding camps may have left little evidence, so it is essential that multiple lines of evidence are investigated to determine when the site was occupied.

Research Question 2: Ethnicity of Site Occupants

The possible ethnicity of groups using the rockshelters is closely tied to chronology. Chronometric dating of the deposits can document when the site was used, but not necessarily eliminate use during other time periods. Whether the site was used by Ancestral Pueblo groups, later Athabaskan groups, Hispanic herders, or more contemporary Anglo travelers and hunters is an important aspect of this research, can be very difficult to establish with any degree of certainty. Evidence of ethnicity can often be found in materials like textiles or basketry, and is often apparent in how people decorate themselves, their clothing, their weapons, and their houses. Unfortunately, few of these items are preserved in the archaeological record or are in good enough shape to allow such an analysis. House types can be indicative of the ethnicity of those who lived there, but multiple groups in the Southwest used the same kinds of houses and no evidence of housing was found at LA 139965. Normally, archaeologists are left with the more durable items of material culture that were discarded at a site during its occupation. Rarely are any of the more durable items indicative of ethnicity in and of themselves; however, by examining the content and structure of entire assemblages and considering chronology, it is often possible to estimate the ethnicity of site occupants.

Current evidence suggests that LA 139965 was primarily used by Ancestral Pueblo peoples. Use by Jicarilla Apaches and other more transient groups—likely to leave a light footprint—is more difficult to discern but evidence for occupation by Hispanic sheepherders and possibly by Anglo travelers is present.

Research Question 3: Why Was the Site Occupied and How Did It Function in Its Settlement System?

All that remains of LA 139965 is the rockshelters and modified talus fronting the shelters and cliff edge. We cannot know what may have lay under the pavement of NM 434, where potential evidence of temporary shelters (pit structures, tipis, rock rings, sheepherder tents) and features, such as fire pits, has been removed. This limits our ability to fully assess how the rockshelters were used and whether or not this use was in conjunction with now lost structures and features.

Still, the "why" portion of the question may be the easier one to answer. Protected by the cliff on one side and the creek on the other, the site provided a good location for observing the grassy meadow to the east for either hunting or grazing sheep. Stands of oak, fish in the creek, and other natural resources could also contribute to area use. Faunal and macrobotanical assemblages help us recognize resources that contributed to the "why" groups chose to stop at this location; they also provide information on how the site functioned within the settlement system. The function part is addressed through the types of stone tools and ceramic vessels that were used, whether there are thermal or storage features, and the foods that were prepared. Plants and animal remains help determine the time of year of an occupation and whether the focus was on hunting, gathering, or herding.

6 Excavation Methods and Procedures

X-ray Fluorescence Study

On August 18, 2014, Marvin Rowe and J. Royce Cox used a handheld X-ray fluorescence spectroscopy device (pXRF) to examine black stains on the rock surfaces of the cliff face and shelter ceilings. The purpose was to determine whether the stains were a mineral-derived weathering product or could include carbon sooting from camp fires. Readings were taken from overhanging surfaces throughout the site area. Darkly stained areas (Fig. 6.1) and adjacent unstained areas were tested from vertical and overhanging surfaces that were smooth or roughly textured (Fig. 6.2). Four rock samples were also taken and tested in the laboratory (Table 6.1). Rock Sample 1 is from a smooth blackened face at North Shelter and the others are from roughened surfaces in South Shelter.

A wide range of elements were detected (Table 6.1). No metallic elements such as manganese and iron were consistently higher in the stained areas than the background unstained areas. The lack of a mineral explanation for the staining and the observation that lichen was growing on the rocks in some of the stained areas suggested to Dr. Rowe that organic material (foliose lichen) was contributing to the black staining in these areas. Lichen is known to weather rocks by excreting oxalic acid and amorphous alumino-silica gels that can result in a black stain (Chen et al. 2000), making lichen staining the most likely explanation for the black staining on the basalt. Careful inspection of the stains revealed one area of carbon sooting (creosote condensation) in the South Shelter. The rest of the stains appear to be noncultural.

Excavation Methods

Three datums were placed during the pXRF study, two on the east side of the road and one on the west side in a flat area between the talus and road berm. Readings were taken with a Trimble Geo-X 2005 series and were post-processed to improve accuracy. Using these datums, a total station was used to establish a grid system linked to NAD 83 UTMs. Several of the northing and easting grid lines were marked with nails for use in locating individual grid units. The last three digits of the UTMs identify the grid lines. Grid units were identified by the northing and easting of the southwest grid corner.

Elevations based on the Trimble readings were too inaccurate to use for measuring true elevation. Mapping Datum 1 [240N/150E] was assigned an elevation of 10.00 and all datum and subdatum elevations were set with respect to that point. As with true elevations, larger numbers indicate higher points. Initially, 17 subdatums were established for elevation control and another eight subdatums were added as needed during excavation. Due to the steep slope and heavy presence of boulders, numerous datums were required to navigate the site.

Unlike in 2003, when Marshall and Marshall surveyed the site and observed numerous artifacts (2004:39–40), few artifacts remained on the surface at the time of this study. These were flagged and collected using the total station. Excavation within the North and South Shelter was generally in 5 cm levels, although this is not always clear from the measurements due to the abundance of rocks and the slope. Initially, the talus was excavated in five cm levels following the contour of the slope. However, it soon became clear that the fill was one uniform stratum that was heavily bioturbated. In addition, excavation indicated that the slope had

Figure 6.1. Dr. Marvin Rowe sampling a dark vertical surface.

Figure 6.2. Dr. Marvin Rowe sampling a rough surface.

Table 6.1. *X-ray fluorescence results for samples taken at LA 139965, from south to north, on August 12, 2014.*

Sample	Titanium	Ti +/-	Manganese	Mn +/-	Iron	Fe +/-	Cobalt	Co +/-	Copper	Cu +/-	Zinc	Zn +/-	Rubidium	Rb +/-	Strontium	Sr +/-	Zirconium	Zr +/-	Barium	Ba +/-	Comments
Black stain	8836	660	4169	125	55426	779	<LOD	319	63	12	88	8	36	3	1037	17	167	6	1064	317	Chromium 246±76; Nickle 212±27
Background for black stain	10584	732	3402	116	93045	1256	877	139	721	26	126	10	26	2	764	13	203	6	1245	352	Nickle 276±32
Black spots on rough surface	7418	574	817	61	46872	652	456	97	105	13	101	8	40	3	913	15	165	5	<LOD	806	Chromium 222±68; Bromine 14±2; Lead 17±5
Black stain on underside	<LOD	1072	<LOD	92	9001	185	440	53	<LOD	33	25	6	18	2	797	14	127	5	<LOD	609	–
Lichen?	1296	366	190	34	10103	184	420	51	<LOD	32	51	6	20	2	1225	19	123	5	<LOD	608	Bromine 7±2
Lichen?	4646	540	540	56	39966	596	380	94	93	13	61	7	34	3	833	14	145	5	<LOD	819	Lead 31±5
Gray lichen	1231	247	166	25	12802	165	261	41	24	7	65	5	32	2	300	5	101	3	<LOD	397	Molybdenum 33±3; Bromine 142; Lead 25±3
Black stain on overhang	11212	733	1369	80	56982	833	429	113	88	13	87	8	37	3	1050	17	180	6	<LOD	1007	Chromium 264±78; Cadmium 5719
Black stain on vertical	6062	584	1128	69	45506	640	544	97	142	14	79	8	42	3	1211	19	189	6	1245	295	Arsenic 13±4; Nickle 85±23
Background for black stain	13891	782	1382	79	67706	938	477	118	81	13	68	8	37	3	1033	17	185	6	1264	355	Chromium 241±78; Nickle 95±26
Black stain on overhang	1365	375	268	39	13105	229	432	57	56	12	47	6	30	3	961	16	147	5	<LOD	619	–
Black stain (drip)	3859	473	767	57	31609	462	585	83	635	24	88	9	31	2	971	15	195	6	<LOD	719	Lead 18±5
Black spot; possible soot?	10422	665	1013	68	69349	911	564	115	208	15	80	8	55	3	1132	17	202	6	<LOD	928	Nickle 90±25; Lead 26±5
Background of possible soot	11490	741	1552	83	81016	1084	730	128	136	14	138	10	40	3	1168	18	214	6	1614	354	Chromium 355±83; Lead 36±6
Small bulb	2471	384	563	47	21866	321	690	69	61	11	84	7	24	2	1218	18	153	5	<LOD	595	Nickle 78±20; Bromine 122; 13±4
Rock Samples																					
Sample 1	4963	483	1441	70	37945	518	677	87	46	11	53	6	29	2	1089	16	152	5	<LOD	709	Nickle 81±22; Bromine 112; Lead 17±5
Sample 2	7581	622	2160	91	56586	790	340	107	136	14	104	9	33	3	1004	16	202	6	<LOD	904	Nickle 200±27; Lead 27±5
Sample 3	2749	417	1138	62	27512	394	562	75	51	11	46	6	24	2	933	14	141	5	<LOD	651	Molybdenum 13±4; Bromine 162; Lead 28±5
Sample 4	6475	–	1298	–	43133	–	521	–	165	–	77	–	33	–	980	–	166	–	–	–	–

been created by bulldozers constructing the road through the site. As a result, the fill and artifacts on the talus slope came from elsewhere. Erosion could have moved artifacts deposited along the cliff edge or within the shelters onto the slope, while other fill and cultural material could have been pushed onto the slope during construction activities. Fill in the highway bar ditch was a thick mat of grass covering wet clay that was mixed with road gravel. The clay was difficult to screen and contained only a few artifacts. This fill lay over a mass of boulders that extended from the base of the bulldozer-cut face of the talus, beneath the bar ditch, under the road berm, and was visible at the edge of the creek, all of which suggests the boulders were placed there to stabilize the roadbed. Based on these observations we requested an amendment to the data recovery plan (approved HPD log 100029; October 3, 2014) that would eliminate the proposed excavations at the talus base and in the bar ditch—generally east of the 145E or 146E lines to the south and 144E to the north. The amendment also allowed for excavation in 10 cm levels in the talus area.

Excavations were all accomplished by hand tools, generally a trowel and scoop. Except for two-gallon samples of fill that were passed through 1/8-inch hardware cloth, fill was passed through 1/4-inch hardware cloth. Different FS numbers, based on screen size, were assigned to the recovered artifacts. In most instances, excavation was continued until bedrock was reached. Exceptions included grid units along the lower boundary of the talus slope that were excavated to the scoria bedrock at the west side of the grid unit but not into the boulder mass on the east side of the unit. Pollen and flotation samples were taken from each level and grid unit in the shelters and from a sample of the talus grid units. Grid unit forms were completed for each grid unit and level. Elevations were taken from all four corners of the grid unit and the southwest corner elevation was generally used for the FS elevation. However, given the slope and presence of bedrock and boulders, it was often necessary to change the corner used for this purpose, resulting in some seemingly overlapping level elevations. Over 800 digital photographs were taken to document the excavations.

Three main east–west trenches provide the primary documentation of the fill stratigraphy. These were placed through the South Shelter and South Talus along the 244N grid line, in the Central Talus area along the 258N grid line, and through the North Shelter and North Talus along the 273N grid line.

7 Geomorphology and Soils

Stephen A. Hall | Jeffrey L. Boyer

Geology of the Coyote Canyon Rockshelter, Mora County, New Mexico

Stephen A. Hall
Red Rock Geological Enterprises

Introduction

The Coyote Canyon Rockshelter (LA 139965) was examined on October 23, 2014, with the task of providing an overview of the shelter, its origins, and geologic history. As it turned out, the sediments in the shelter had been severely disturbed, leaving almost no record of the original stratigraphy of the deposits. Nevertheless, it was possible to draw some conclusions, presented below, concerning the formation of the shelter and the deposition of the sediments that occur there.

Sediment Analysis

Six sediment samples from the fill material in the rockshelter were analyzed by the OAS staff. Particle sizes and brass sieves followed the ASTM standard, which, although different from the Wentworth scale, provide a general picture of particle-size distribution. The percentages of silt and clay (measured together without differentiation) were determined by "washing." The organic content was determined by loss-on-ignition. The dry Munsell color was determined by myself.

Rockshelter Formation

The geology of Guadalupita Canyon where the

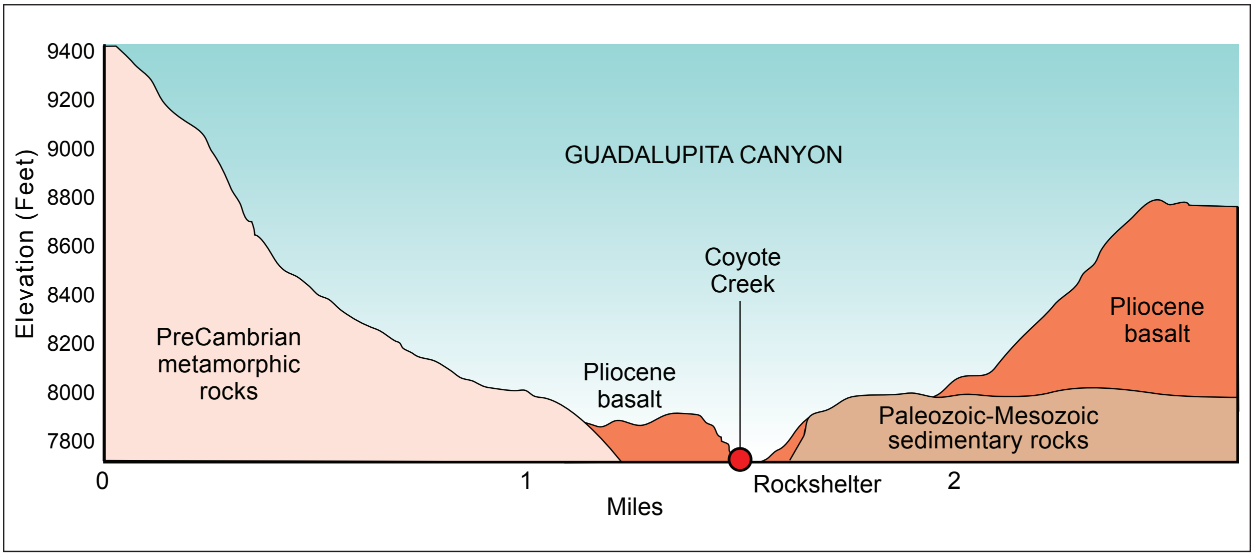

Figure 7.1. Topographic cross section of Guadalupita Canyon, at the location of LA 139965.

Figure 7.2. Pliocene olivine basalt flow with rockshelter just above the road, NM 434; Coyote Creek is off to the right, next to the road; view to the north; this flow yielded a K-Ar age of 4.7 ± 0.3 m.y. (O'Neill and Mehnert 1988:B7) (photo: Stephen Hall).

rockshelter occurs is diverse. However, the rocks at the location of the rockshelter are Pliocene-age volcanics (Figs. 7.1–7.2). The rockshelter formed at the contact of a thick olivine basaltic flow overlying a weathered volcanic breccia, scoria, and blocky flow. The K-Ar age of the olivine basalt, sampled along the highway about 3.7 miles (6 km) north of the shelter, is 4.7 ± 0.3 m.y. (O'Neill and Mehnert 1988:B7).

The contact of the two different flows has resulted in a zone of weakness where, upon weathering at the cliff face, the blocks are loosened and peel away from the outcrop, resulting in a cavity that eventually became the rockshelter (Fig. 7.3). The fractured condition of the basalt also facilitates infiltration of surface water down to the contact with the blocky volcanics, thereby producing a weak flow of water around the blocks at the contact. As a consequence, the volcanic blocks are chemically weathered and rounded. The decomposition of the rocks in turn enhances the formation of the shelter. High-discharge events during the late Pleistocene along nearby Coyote Creek may have moved some blocks from the contact zone, thereby enlarging the shelter-forming cavity.

Sediments in the Shelter

The fill sediment in the shelter is generally less than 50 cm in thickness and rests directly on the sloping surface formed by blocky volcanics (Fig. 7.4). The sediment is fine-textured, massive, and lacks soil development. The sediment is very dark gray to dark brown (10YR 2–3/1–3). The fill is characterized by small gravel that is 6 to 54 percent of the sediment by weight with higher amounts of small gravel occurring in the upper-most level of the sediment column. Sieve analysis indicates higher

Figure 7.3. Basal contact of olivine basalt flow with underlying weathered and decomposed volcanic breccia, scoria, and blocky flow; 1 m scale.

Figure 7.4. North Shelter, dark-colored fill sediment covering blocky volcanics; 0.5 m scale.

percentages of very fine to fine sand. Silt and clay content ranges from 19 to 46 percent. The massive sediment is also calcareous. Although the amount of carbonate was not measured quantitatively, the degree of reaction to 10 percent hydrochloric acid (HCl) ranges from no reaction to strong reaction. Visible carbonate in the form of filaments or grains coats, however, was not seen. Inspection by binocular microscope reveals that the sediment has about 1 to 2 percent occurrence of muscovite; the small mica particles are very fine sand size. The fill sediment is severely bioturbated by worms; worm fecal pellets are abundant throughout the fill.

Disturbance of the Sediment Column

The most important finding of the archaeological investigation, with regard to the geology of the rockshelter sediment fill, is the presence of glass, foil, plastic, pea-sized road gravel, and small pieces of asphalt. These recent materials were recovered throughout the fill, down to the lowest levels of the sediment columns (Akins and Boyer 2015:17). The implication of this discovery is that the sediment fill is thoroughly mixed and that sediment and soil samples collected from a vertical column have no stratigraphic significance with regard to sedimentology or soils. Nevertheless, the analytical results of the sediment samples, even though the stratigraphy is gone, reveal general properties of the sediment-fill environment.

Alluvial Origin of the Rockshelter Fill

The fill sediment is alluvium. It represents the deposition of overbank muds and fine sand in the shelter cavity during flood events of Coyote Creek. The fine texture of the sediment is consistent with overbank fluvial sedimentation. The dark color of the shelter fill is natural and is similar to the 10YR hue of the upper sediment and A horizon on the floodplain of Coyote Creek in front of the shelter (Sellnow 1985). The high percentage of organic matter is natural as well, although cultural activity in the shelter may have increased the amount of organics in the sediment. The small gravel in the shelter sediments are road gravel from late twentieth-century highway construction and disturbance, unrelated to the fluvial origin of the fine-textured fill.

The fine-textured sediments incorporate very fine sand-sized particles of muscovite. The mica originates from the Precambrian metamorphic rocks that occur west of the rockshelter. Tributary streams that enter Coyote Creek from the west, upstream from the shelter, are the source of the muscovite-bearing alluvium.

The $\delta^{13}C$ values of the radiocarbon ages from the shelter fill range from 23.5 to -22.5 percent (Table 7.1). These values are all from C_3 woody plant species, verifying that the organic particles in the alluvium are derived from forest vegetation that dominates the watershed of Coyote Creek upstream from the rockshelter.

Radiocarbon Dating of the Rockshelter Fill

Six samples of fill sediment were AMS radiocarbon dated. Each sample had a high content of organic matter. Any charcoal recovered from the sediment samples during laboratory processing was specifically excluded from dating, assuming that the charcoal could be cultural in origin. The

Table 7.1. Radiocarbon dates (archaeomagnetic) of sediment fill at LA 139965, by field and lab sample numbers.

Field No.	Lab No.	Material dated	Measured Age	$d^{13}C\%$	Corrected Age	2-Sigma Calibrated Age
NS-622	Beta-405311	Organic sediment	820 ± 30	-23.3	850 ± 30	AD 1155-255
NS-621	Beta-405312	Organic sediment	680 ± 30	-23.3	710 ± 30	AD 1265-1295, AD 1370-1380
SS-657	Beta-405313	Organic sediment	510 ± 30	-22.5	550 ± 30	AD 1315-1355, AD 1390-1430
SS-387	Beta-405314	Organic sediment	700 ± 30	-23.5	720 ± 30	AD 1260-1295
SS-382	Beta-405315	Organic sediment	1140 ± 30	-23.3	1170 ± 30	AD 770-905, AD 920-965
CT-567	Beta-405316	Organic sediment	1650 ± 30	-23	1680 ± 30	AD 260-280, AD 325-20

sediment ages range from 1680 ± 30 to 550 ± 30 ^{14}C years BP (cal AD 260 to AD 1430) (Table 7.1). The ages probably bracket reasonably well the period of fluvial deposition in the shelter, although the specific influence of sample disturbance on these ages is unknown. Also, the impact of worm activity in the rockshelter sediment is also unknown, although it could result in radiocarbon ages that are slightly younger than the age of the sediment itself.

Correlation of the Rockshelter Alluvium

The span of time represented by the six AMS dates, AD 260 to AD 1430, overlaps three periods of past climate that were very different from each other. First is the late Holocene wet period that began weakly around 2500 BC and ended about AD 1000 in the Southwest. On the heels of that, the warmer-drier Medieval Warm Period extended from about AD 900–1000 to about AD 1300, followed by the Little Ice Age with cooler-wetter climate from AD 1350 to AD 1850 (Hall 2015). Thus, the deposition of alluvium in the rockshelter spans wet and dry periods alike. Elsewhere in the Southwest and southern Great Plains, the late Holocene wet period resulted in broad flooding of alluvial valleys and the deposition of cumulic Mollisols, especially during the period between about 500 BC and AD 1000. The first half of alluvial deposition in the rockshelter probably occurred during this wet period. The presence of the rockshelter at comparatively high elevation may also mean that the Coyote Creek drainage basin was less susceptible to decreased flow and fewer flooding events that we see in other streams during the Medieval Warm Period. Annual spring snow melt may have produced flooding along the creek. Unfortunately, paleoenvironmental information from Coyote Creek alluvium that could tell us more about what was going on with the rockshelter is not in hand.

Summary and Conclusions

- The rockshelter occurs at the contact of two flows of Pliocene volcanics, olivine basalt above and volcanic breccia and scoria below; the basalt is dated 4.7 ± 0.3 m.y.
- The rockshelter sediments are dark-colored, organic-rich, fine-textured alluvium. The alluvium was deposited in the shelter during flood events along Coyote Creek, beginning by about AD 260 and ending by AD 1430. During floods, over-bank muddy water entered the shelter, and thin layers of very fine sand, silt, and clay were deposited.
- The early half of the period of alluvial deposition, ca. AD 260 to AD 1000, correlates with the late Holocene period of wet climate during which time streams and rivers in the broad region flooded frequently.
- The bedding and stratigraphy of the alluvial deposits in the shelter have been lost because of twentieth-century disturbance; glass, plastic, and roadbed materials occur throughout the shelter deposits.

Sediments and Site Stratigraphy

Jeffrey L. Boyer

Three strata of natural, alluvial sediments were recorded at LA 139965 during data recovery investigations. Samples of the sediments were collected for laboratory analyses to aid in their accurate characterization. In the following section of this chapter, field recording and laboratory analysis methods are described. Then descriptions of the strata are presented and related to formation of the site as it was found during excavations. Samples of sediments as well as charcoal from the sediments were collected for radiocarbon dating. Dating results are described in detail in Chapter 16 of this report.

Field Recording Methods

A variety of physical information about strata—natural and cultural—encountered on archaeological sites are recorded in the field according to standards for soils and sediments derived from the USDA Natural Resource Conservation Service (NRCS; Schoeneberger et al. 2002; Soil Survey Staff 2003). The recording format follows Birkeland (1974, 1984, 1999), and is similar to formats presented in archaeological field manuals for the OAS La Plata and US 84/285 data recovery projects (Toll and Blinman 1990; Boyer et al. 2001), as well as the Fruitland data recovery project (Sesler and Hovezak 1992) and the Crow Canyon Archaeological Center (Crow Canyon Archaeological Center 2001). It allows the recorder to provide descriptions of strata that meet NRCS standards. Texture is determined using Thien's (1979; Presley and Thien 2008) texture-by-feel procedure. Color is identified using Munsell soil-color charts. Calcium carbonate presence is tested using dilute hydrochloric acid (HCL) and stages of carbonate development in calcic horizons are assigned following Gile and others (1966) and Machette (1985). Sediment acidity (pH) was not recorded in this case.

Laboratory Analytical Methods

Because analyses of earthen materials at OAS have, to date, focused on architectural building materials, we use Teutonico's (1988) *A Laboratory Manual for Architectural Conservators* for analytical procedures and interpretation of results. For the LA 139965 samples, per the request of Dr. Stephen Hall, of Red Rock Geological Enterprises, who was tasked with providing a regional geological context for the site location, analyses included particle-size characterization and organic material content. Particle-size analyses involved mechanical (sieve) sorting but did not include sedimentation/hydrometer sorting. Consequently, very fine materials are presented here as silt/clay rather than silt vs. clay fractions. Following mechanical sorting, discussions with Dr. Hall (S. Hall, personal communication, September 2–3, 2015) revealed that, while particle-size laboratory methods in Teutonico's manual follow ASTM standards (ASTM D422) that are commonly used by engineers, ASTM particle-size categories (gravel, sand, silt, clay) do not exactly match those used by geologists and soil scientists (see, for instance, National Employee Development Staff [1987:7] for a comparative chart). In this report, results of particle-size analyses are presented relative to ASTM standards.

Organic material contents were determined by the weight loss-on-ignition (LOI) method (Reddy 2002:13–19; see also https://uwlab.soils.wisc.edu/files/procedures/organic_matter.pdf, accessed August 3, 2015; http://www.sfu.ca/soils/lab_documents/Estimation_Of_Organic_Material_By_LOI.pdf, accessed August 3, 2015). LOI results have been considered to be rough, inaccurate estimates of organic carbon content (Goldin 1987) but tests comparing LOI results with those from the Walkley-Black titration method (e.g., Ball 1964; Hoskins 2002; NRM Laboratories [n.d.]) have shown overall insignificant differences in results:

> Comparison of organic matter results by the colorimetric WB and TGA LOI method over a wide concentration range (approx 2–60%) showed an overall correlation coefficient of 0.95 (n = 317). In general, the values produced were higher for LOI than WB (by an average of around 10%) but there was not a consistent bias and several samples gave a lower LOI result. Overall, the difference in the result produced did not appear to be 'significant' in assessing the level of soil organic matter (low/medium/high/very high). (NRM Laboratories n.d.:4)

A procedural alteration was made during testing because the oven used did not heat to 360+ degrees C (680+ degrees F; laboratory standards differ: see Goldin 1987; NRM Laboratories [n.d.]), but instead heated to 288 degrees C (550 degrees F). Procedures provided by Reddy (2002) call for placing a sample in the heating oven and leaving it the oven overnight after maximum temperature is reached before removing and allowing to cool. Instead, the samples were placed in the heating oven and left for 24 hours after reaching maximum temperature. Soil ignition might be incomplete at 288 degrees C, leading to underestimating carbon content, while extended heated time at high heat can drive out water content, leading to overestimating carbon content (Goldin 1987:1111). NRM Laboratories (n.d.:3) cite Hoskins (2002) in insisting that an initial drying stage at a lower temperature (105 degrees C, 221 degrees F) be used to drive off residual moisture in the sample. It is for that reason that Reddy's (2002) procedures include an initial drying stage before samples are placed in the oven at high heat; that process was followed for the samples from LA 139965.

Additionally, sample colors were recorded using Munsell soil-color charts, after the samples had been oven-dried to remove any existing ambient moisture.

Strata Field Descriptions

Formal strata descriptions begin with Stratum 3. Strata numbers 1 and 2 were assigned during preliminary excavations to layers of what was later identified as variations of Stratum 3, first encountered in a grid unit placed in the highway bar ditch. When Stratum 3 was determined to include colluvium deposited in the bar ditch after earlier road construction, Strata 1 and 2 were discontinued.

Stratum 3

Black to very dark brown (10YR2/1–2/2, dry) clay loam; weak, fine to coarse, granular structure; hard when dry, firm when moist, sticky and plastic when wet; weakly cemented; very well to well sorted; massive bedding; very fine to fine, rounded sand; pebble to cobble size rocks, mostly very angular natural flakes of on-site olivine basalt, ca. 10 percent; many, very fine to medium pores from roots of grasses and small plants; no clay films; not effervescent; no calcic horizon development; 16 to 45 cm thick; very abrupt to wavy boundary to scoria bedrock.

Stratum 3 is a deposit of alluvium along the west side of the Coyote Creek floodplain. It corresponds to soils in the Moreno-Brycan association recorded in the narrow floodplain of Coyote Creek in the project vicinity (http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx, accessed September 18, 2014). The association is generally composed of about 45 percent Moreno (and similar soil) and 35 percent Brycan (and similar) soil. Moreno soil forms in fine-textured alluvium derived from sandstone and shale in mountain valley settings with about 8 to 15 percent slopes. It can be more than 2 m (80 inches) deep, is well drained, and essentially non-calcareous (< 1 percent). A typical profile consists of sandy clay loam to about 33 cm (13 inches) over clay loam to depths of 1.5 m (60 inches) or more. Brycan soil differs from Moreno soil in forming on 0 to 8 percent slopes, with a typical profile of loam to about 40 cm (16 inches) over sandy clay loam to depths of 1.5 m (60 inches) or more. Both are characteristic of Mountain Grassland ecological sites.

Although the deposit supports plants, including grasses, weedy annuals, and stands of willow in the highway bar ditch, no clear evidence of pedogenesis was observed in Stratum 3; horizonation was not present nor were signs of eluviation or illuviation. This likely reflects continual processes of seasonal inundation and alluvial deposition at the edge of the Coyote Creek floodplain over the course of centuries or longer. Those processes were curtailed at the site by construction of the highway that isolated a strip of floodplain at the base of the basalt flow outcrop. While pedogenic processes might have begun after the site area was no longer subject to inundation, they were not evident during excavation.

The upper 10 to 15 cm showed evidence of significant bioturbation from plant growth as well as worms—castings are very common—and rodents. This is also consistent with the relative stability of Stratum 3 within the site in contrast to the active floodplain. There was also no clear evidence of anthropogenic disturbance, although excavators speculated that some small pockets of charcoal observed within the shelters represented debris from fire features while these and more compacted areas could result from human activities. Nonetheless, artifacts and charcoal were plentiful throughout.

This description of Stratum 3 generally applies across the site. Minor variations were observed both by excavators and during recording but are not, with the exception of Stratum 3A described below, considered significant differences in deposition or nature of the stratum. Indeed, it is important to note that Stratum 3 as encountered on the slope between the overhangs and the highway bar ditch, which represented colluvial redeposition of Stratum 3 following highway construction, was not significantly different in color, texture, or other characteristics than Stratum 3 recorded within the shelters. Stratum 3 is shown in Figures 7.5, 7.6, and 7.7.

Stratum 3A

Black to very dark brown (10YR2/1–2/2, dry) loam to clay loam; weak, fine to medium, granular structure; hard when dry, firm when moist, sticky and plastic when wet; weakly cemented; moderately sorted; massive bedding; fine to very coarse, sub-angular to very angular sands; pebble to cobble size rocks, mostly very angular natural flakes of on-site olivine basalt; many, very fine to medium pores from roots of grasses and small plants; no clay films; not effervescent; no calcic horizon development; 5 to 14 cm thick; abrupt to clear, wavy boundary to scoria bedrock.

Stratum 3A was found on top of Stratum 3 at the back of the south shelter and is shown in Figure 7.5. The two strata differed primarily in the amount of coarse and very coarse sand, which was much higher in Stratum 3A and was the result of natural decay of the scoria deposit at the back and base of the overhang.

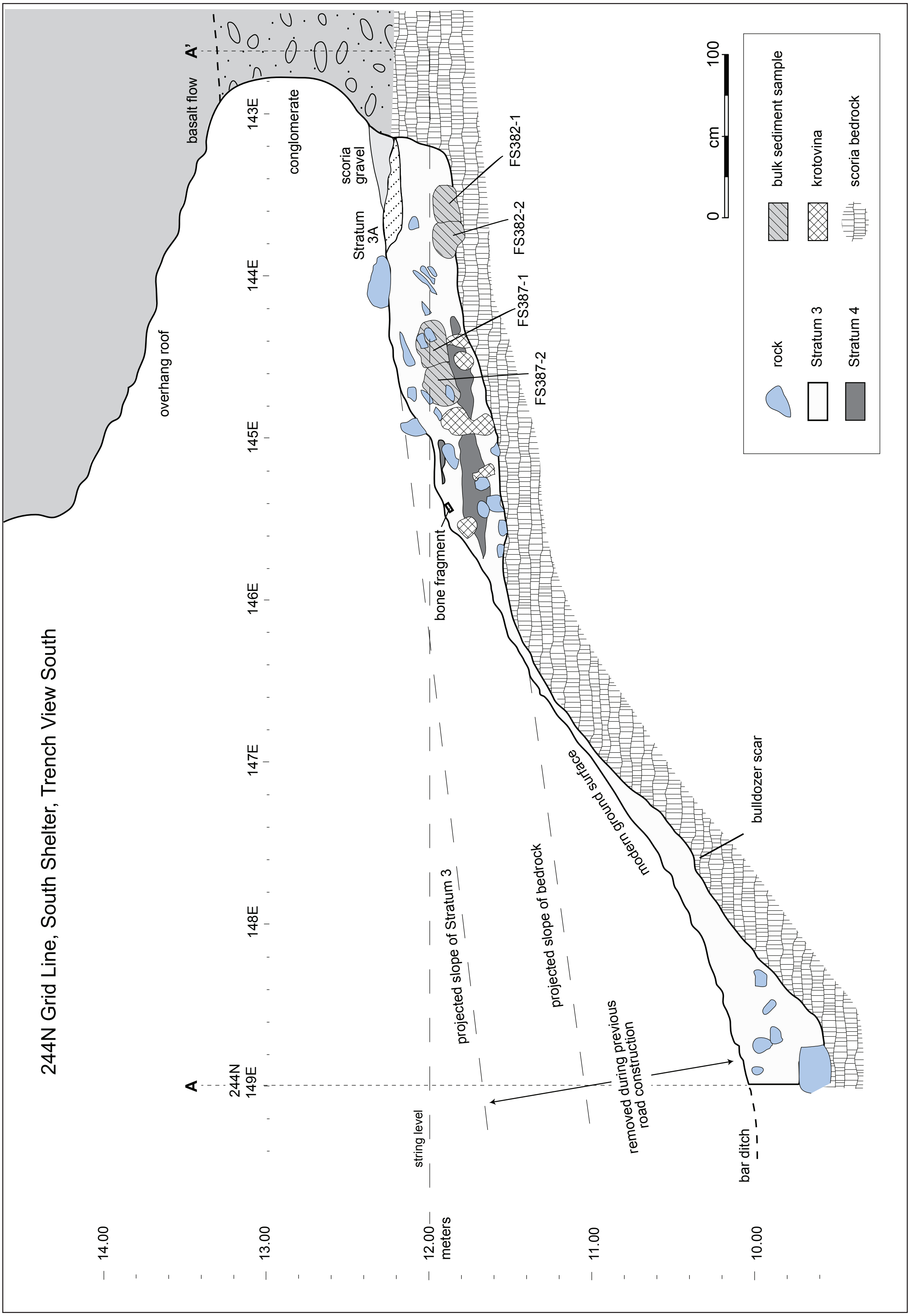

Figure 7.5. South Shelter, stratigraphic profile at 244N.

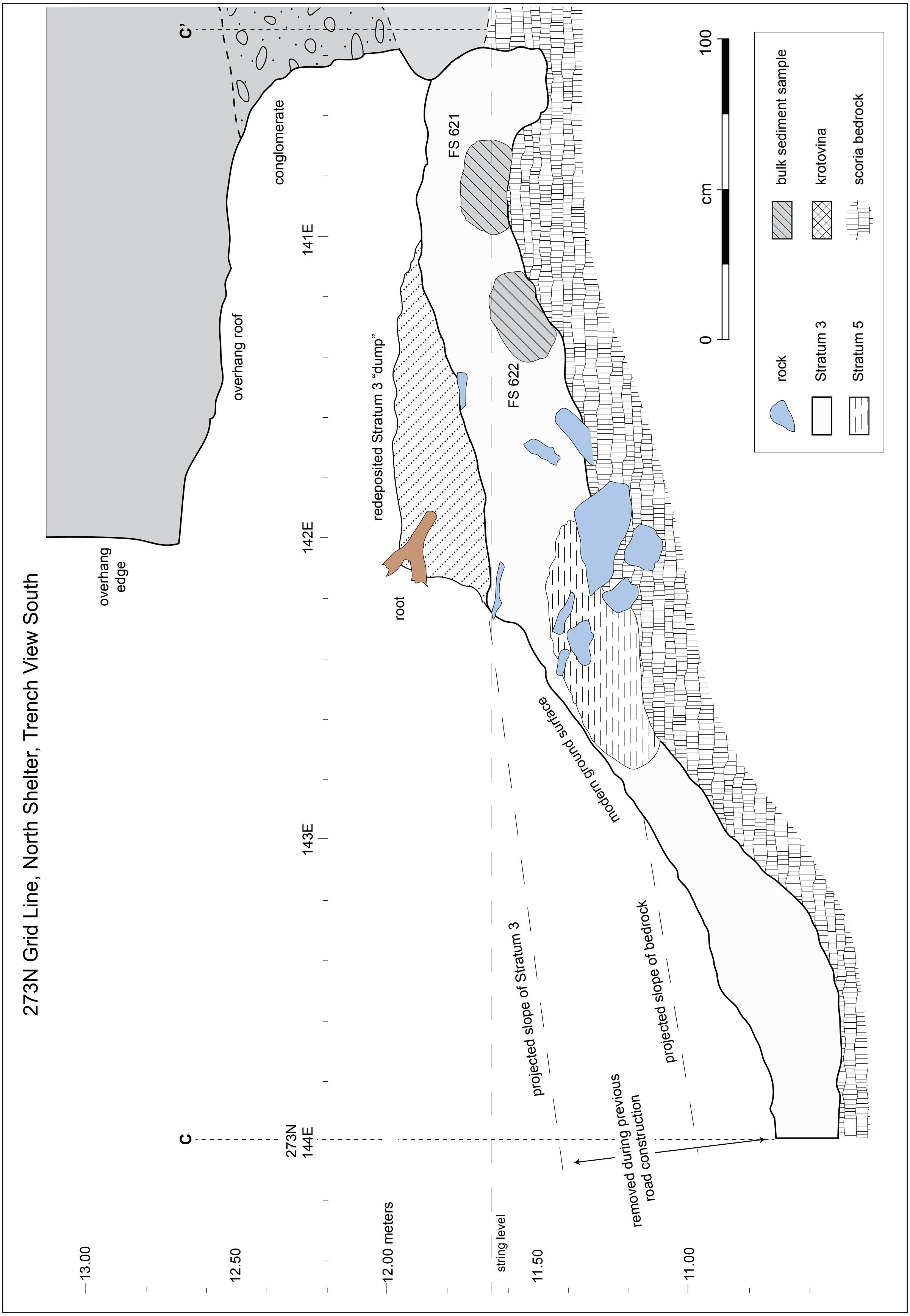

Figure 7.6. North Shelter, stratigraphic profile at 273N.

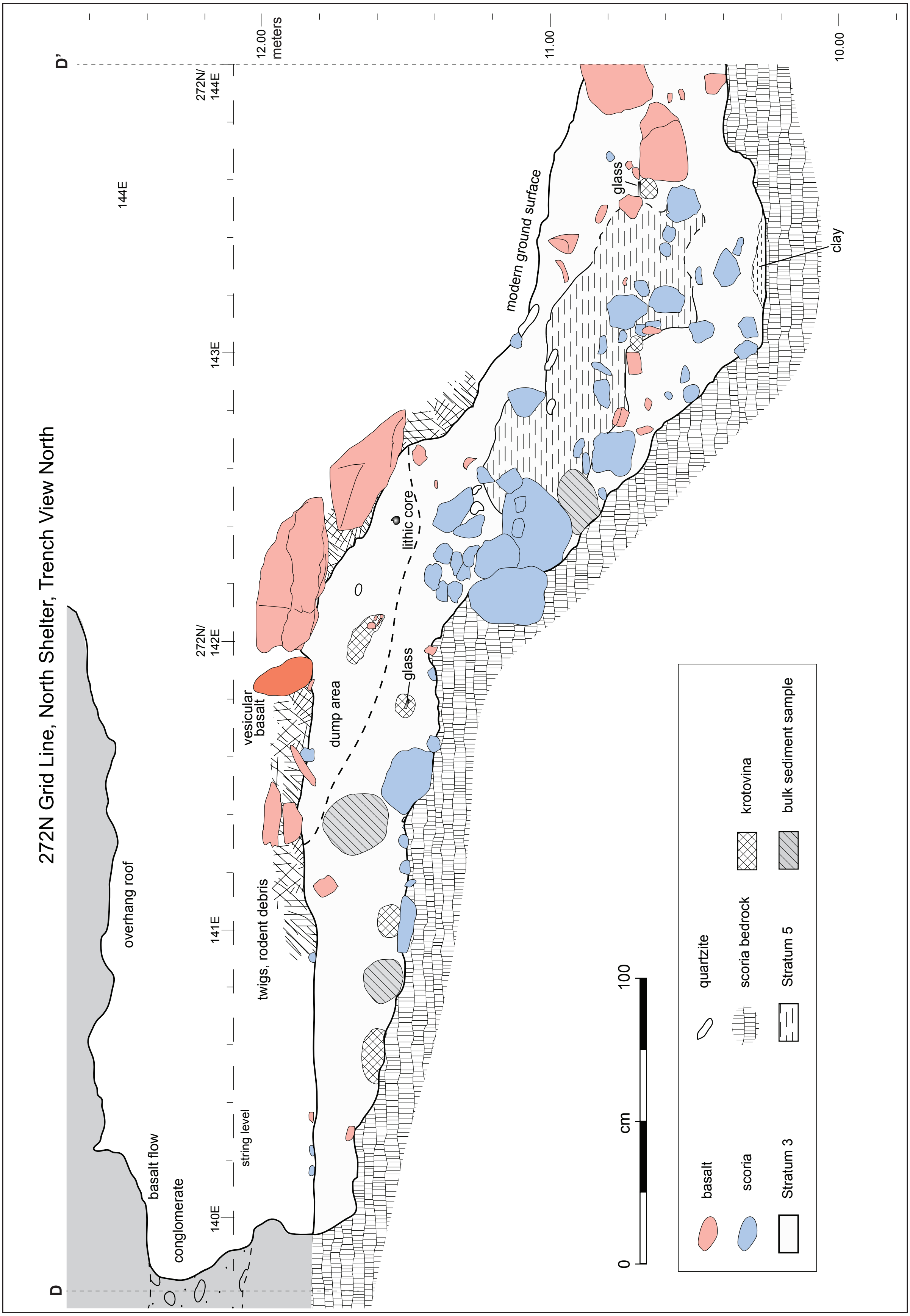

Figure 7.7. North Shelter, stratigraphic profile at 272N.

Stratum 4

Yellowish-brown (10YR5/4, dry) loamy sand; structure not recorded; loose when dry, very friable when moist, non-sticky and slightly plastic when wet; no cementation; well sorted; massive bedding; very fine to medium, well sorted sand; no gravels; no pores; no clay films; strongly to violently effervescent; no calcic horizon development; 4 to 18 cm thick; very abrupt, smooth boundary to Stratum 3.

Stratum 4 was a deposit of very fine to fine sand found directly below a fissure in the rock outcrop above the South Shelter. The exposed surface of the outcrop was yellowish brown, accounting for the color of Stratum 4. The stratum was found in the north profile at the 245N grid line (Fig. 7.8) but not in the south profile of the 244N grid line (Fig. 7.5), which was not directly below the fissure. Consequently, it is not shown in a stratigraphic profile.

Stratum 4 was deposited upon Stratum 3, which, at that time, extended under the overhang as far as a low bump in the scoria bedrock. More Stratum 3 sediments that extended to the back of the overhang subsequently covered it. No additional deposition of sand from the overhang fissure took place after Stratum 4 was covered. Rodent burrows disturbed Stratum 4. The east side of Stratum 4, like the east side of Stratum 3, was cut by road construction that created the slope from the overhang to the bar ditch. A thin layer of Stratum 3 over the east side of Stratum 4 was colluvial redeposition of Stratum 3.

Stratum 5

Red (2.5YR4/8, dry) sandy clay; weak to moderate, medium to coarse, granular to sub-angular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; weakly cemented; very well sorted; massive bedding; very fine sands, ca. 35 to 55 percent; no gravels; many, micro to very fine, vesicular pores, perhaps but not clearly from sand grains; no clay films; no to very slight effervescence; no calcic horizon development; 20 to 30 cm thick; abrupt, wavy boundary to scoria bedrock.

Stratum 5 was found as a discrete deposit that probably represented redeposition of decayed scoria from an in situ setting cut by previous road

Figure 7.8. South Shelter, Stratum 4 at the 245N grid line, view north.

construction. It was present in the north shelter (Figs. 7.7, 7.9). The very small sizes of sand and smaller grains suggest that decay of the scoria was advanced before it was moved and redeposited. The very thin layer of Stratum 3 over Stratum 5 in Figure 7.7 was colluvium deposited after road construction.

Laboratory Analytical Results

Six samples collected by Dr. Hall, listed as "Mora 1" through "Mora 6,"were subjected to mechanical particle-size analyses, organic material content analyses, and color recording. Although more samples were collected during site excavation, the results of analyses of the Hall samples showed that differences between samples were both relatively insignificant and were consistent with differences recorded in the field. Consequently, additional samples were not analyzed.

Sediment Colors

Table 7.2 shows the Munsell dry colors of the six Hall samples. The dark gray and brown colors of samples Mora 1 through 5 are consistent with the colors recorded in the field for Strata 3 and 3A. The former are somewhat lighter than the latter because, although the strata materials were considered dry in the field, they were not as dry as after oven drying. Table 7.3 shows that moisture lost during oven drying ranged from 4.27 to 8.48 percent. Sample Mora 6 had the lightest color; this is correlated with the fact that, as discussed later, Mora 6 also had the lowest silt/clay content as well as the lowest organic material content.

Particle Sizes

Table 7.4 lists sediment particle sizes for the Hall samples. Table 7.4 section A lists the particle sizes as the percent of each sample retained in each sieve following mechanical sieving. In section B, percents for each sample are altered by the addition of percent retained in the pan during initial washing to the percent retained in the pan during mechanical sieving. This action results in the combined silt/clay fraction for each sample. Finally, section C lists the

Figure 7.9. North Shelter, Stratum 5 (center left), view west.

Table 7.2. Sediment samples, by Munsell color.

Sample No.	Munsell Color		Wet/ Moist/Dry
	Color Notation	Color Name	
Mora 1	10YR 3/3	dark brown	dry
Mora 2	10YR 3/3	dark brown	dry
Mora 3	10YR 4/2	dark-grayish brown	dry
Mora 4	10YR 3/1	very dark gray	dry
Mora 5	10YR 3/2	very dark-grayish brown	dry
Mora 6	10YR 4/3	brown/dark brown	dry

Table 7.3. Sediment samples, moisture loss during oven drying.

Sample No.	Container Weight (gm)	Total Pre-Dry Weight (gm)	Sample Pre-Dry Weight (gm)	Total Post-Dry Weight (gm)	Sample Post-Dry Weight (gm)	Moisture Loss	
						Weight	Percent
Mora 1	6.55	157.66	151.11	150.52	143.97	-7.14	-4.73
Mora 2	6.64	156.96	150.32	150.54	143.90	-6.42	-4.27
Mora 3	6.42	160.94	154.52	153.25	146.83	-7.69	-4.98
Mora 4	7.04	161.70	154.66	148.59	141.55	-13.11	-8.48
Mora 5	6.95	158.62	151.67	146.76	139.81	-11.86	-7.82
Mora 6	6.74	159.40	152.66	150.96	144.22	-8.44	-5.53

Table 7.4. Sediment samples, particle sizes as percent retained by sieve number and grain diameter.

Sieve No.	Grain Diameter (mm)	Percent Retained by Sample					
		Mora 1	Mora 2	Mora 3	Mora 4	Mora 5	Mora 6
A. Particle Size: Sieving							
4	4.750	41.17	19.16	0.00	13.52	28.66	16.63
8	2.360	13.00	7.34	5.70	5.33	3.30	8.82
16	1.180	5.27	5.65	8.59	5.56	5.99	5.25
30	0.600	5.13	8.05	14.26	8.57	9.34	8.25
50	0.300	7.12	7.78	11.74	39.97	11.52	19.10
100	0.150	0.18	0.02	14.80	24.00	18.44	28.63
200	0.075	20.55	40.61	38.39	0.42	19.12	10.72
Pan	0.000	6.67	10.72	5.45	2.30	2.15	1.60
Total		**99.09**	**99.34**	**98.92**	**99.67**	**98.52**	**99.01**
B. Particle Size: Washing and Sieving Combined							
4	4.750	25.98	11.62	0.00	9.16	20.50	13.74
8	2.360	8.21	4.45	3.55	3.61	2.36	7.29
16	1.180	3.33	3.43	5.35	3.77	4.29	4.34
30	0.600	3.24	4.88	8.88	5.81	6.68	6.82
50	0.300	4.49	4.72	7.31	27.09	8.24	15.79
100	0.150	0.11	0.01	9.22	16.27	13.19	23.66
200	0.075	12.97	24.61	23.91	0.28	13.67	8.86
Silt/Clay*	<0.075	41.10	45.89	41.12	33.78	30.02	18.68
Total		**99.42**	**99.60**	**99.33**	**99.77**	**98.95**	**99.18**
C. Particle Size Categories (ASTM Standards)							
Gravel	>4.750	25.98	11.62	0.00	9.16	20.50	13.74
Sand	0.0750 – 4.750	32.35	42.10	58.21	56.83	48.43	66.76
Silt/Clay	<0.0750	41.10	45.89	41.12	33.78	30.02	18.68
Total		**99.42**	**99.60**	**99.33**	**99.77**	**98.95**	**99.18**

*Silt/Clay fraction is sum of weight, retained during initial washing and sieving, converted to percent.

sediment from each sample by ASTM particle-size categories, per Teutonico (1988). As noted earlier, sedimentation/hydrometer testing was not performed so the results do not distinguish between silt and clay fractions.

In any case, the silt/clay fractions of each sample are relatively high, with three of the six samples being between 40 and 46 percent silt/clay. Importantly for these three samples, sand fractions are dominated by fine to very fine sand (0.15 to 0.075 mm); Samples Mora 2 and Mora 3 contain 70.5 and 74.25 percent fine and very fine sand, silt, and clay particles, while Sample Mora 1 is made up of 54.18 percent particles in the sample size range. Sample Mora 1 has the largest percentage of gravel-size particles (> 4.75 mm), 25.98 percent; that fraction is, however, represented by relatively few actual gravel particles. Still, the Mora 1 sand content greater than fine in size is dominated by very coarse particles (> 2.36 mm), so the Mora 1 very coarse sand and gravel content is 34.2 percent. The pattern shown in these three samples is that they are dominated by very small particles in the fine sand to clay size range. Sands between fine and coarse sizes make up much smaller percentages of the samples; where fractions of fine sand to clay particles are not as dominant, they are replaced by very coarse sands and gravels, most of which, I observed during analysis, are fragments of olivine basalt from the cliff face above the site and of the scoria bedrock beneath it. Otherwise, the sediments represented by samples Mora 1, 2, and 3 are mostly silt/clay with smaller amounts of fine and very fine sand. This is in keeping with the in-field loam to clay loam characterizations of Strata 3 and 3A.

A similar situation is seen in sample Mora 4. The silt/clay fraction is lower than samples Mora 1, 2, and 3 at 33.78 percent, while the sand fraction is 56.83 percent. Of that 56.83 percent, 76.8 percent (43.64 percent of the total) consists of medium to very fine sand (Table 7.4, section B). While the fraction of medium sand is higher than in samples Mora 1, 2, and 3, 77.42 percent of Mora 4 is still made up of small sands and silt/clay.

Sample Mora 5 has a silt/clay fraction of about 30 percent, the second lowest of the six samples. About 20 percent of the sample is gravel, which is the second highest of the samples (Table 7.4). The remainder, 48.43 percent, is sand, of which 55.46 percent (26.9 percent of the total) is fine to very fine sand. Taken together, 56.9 percent of sample Mora 5 is fine and very fine sand and silt/clay. If the sample had much less gravel, its fine sand to clay content would be much greater, perhaps bringing sample Mora 5 into line with Mora 1, 2, and 3.

Sample Mora 6 has the lowest silt/clay content of the samples at 18.7 percent. It also has the highest sand fraction, almost 67 percent; Table 7.4 shows that like sample Mora 4, most of the sample Mora 6 sand content (59.1 percent; 39.45 percent of the total) consists of small sands in the medium and fine sizes, followed by very fine sand. Medium, fine, and very fine sand make up 48.31 percent of the total; when combined with the silt/clay fraction, small particles make up 67 percent of the total. It seems likely that the relatively low silt/clay content is responsible for the slightly different, lighter color of sample Mora 6.

Particle-size distributions in the six soil samples collected by Hall reveal that small grain-size materials dominate them. Four samples, Mora 1, 2, 3, and 5, are dominated by fine and very fine sand, silt, and clay, while samples Mora 4 and 6 include medium sands with the smaller particles. Gravel-size particles are variable in presence and, in any case, are represented by relatively few actual fragments of basalt and scoria.

Organic Material Content

Table 7.5 shows the results of LOI testing of the six Hall samples as Percent Ash/Burned Material in the last row of the table. Under the LOI circumstances described earlier, initial drying before being in the oven at high heat removed residual moisture and the potential for overestimation for the samples. Lower than recommended high oven temperature may have resulted in incomplete ignition so the organic material content percentages are probably underestimates, although we cannot know by how much, a possibility that might be mitigated by extended time in the high-temperature oven.

Organic material content in the Hall samples ranges from 0.07 to 11.54 percent, with a mean of 4.72 percent. Generally, organic material content ranges between about 1 and 6 percent of topsoil mass and decreases with depth to, on average, less than 0.2 percent below 1 m below ground surface (Buringh 1984:96).

The lowest percent is in sample Mora 6, which also has the lowest silt/clay content and the (relatively) lightest color; the sample has, effectively,

Table 7.5. Sediment samples, organic material content (weights and percents).

	Sample No.					
	Mora 1	**Mora 2**	**Mora 3**	**Mora 4**	**Mora 5**	**Mora 6**
Weight Container (gm)	7.05	7.05	7.05	7.05	7.05	7.05
Weight Original Sample (gm)	5.02	5.06	5.01	5.00	5.01	5.00
Weight Original Sample + Container (gm)	12.07	12.11	12.06	12.05	12.06	12.05
Weight Oven-Dry Sample + Container (gm)	11.60	11.31	11.71	11.31	11.43	11.77
Weight Oven-Dry Sample (gm)	4.55	4.26	4.71	4.26	4.38	4.72
Weight Loss in LOI*	0.47	0.80	0.30	0.74	0.63	0.28
Percent Loss in LOI*	9.36	15.81	5.99	14.80	12.57	5.60
Percent Moisture Loss (Washing)	4.73	4.27	4.98	8.48	7.82	5.53
Percent Ash/Burned Material	4.63	11.54	1.01	6.32	4.75	0.07

no organic material. The highest organic material content, 11.54 percent, is in sample Mora 2, which also has the highest fractions of very fine sand and silt/clay. This percent places sample Mora 2 near the lower limit of an "organic soil," characterized by percentages between 12 and 18 percent with corresponding clay percentages between 0 and 60 percent (Buol et al. 1989:228). "Mineral soils" are those with organic material fractions less than 12 percent (Huang et al. [2009] propose a more nuanced classification for engineering purposes; there is no evidence that their classification has gained wide acceptance).

Because of Hall's collection procedures, we do not have elevations for the six samples. It is tempting, however, to speculate that sample Mora 2 came from a relatively high elevation where organic content can be expected to be relatively high, particularly in an alluvial deposition setting, because decomposition was less advanced than at greater depths. It is, in turn, tempting to speculate that sample Mora 6 came a lower elevation at which decomposition of organic materials was more advanced. Alternatively, sample Mora 6 could resemble Stratum 5, even though their colors are very different, because Stratum 5's admixture of scoria-derived sand and fine Stratum 3 sediment on the roadcut slope resulted in sandy clay that is very low in organic materials.

The other four samples fall within the organic material characteristics of mineral soils. The extent to which their characteristics are also those of the active river floodplain deposits or were created or exacerbated by isolation of the site deposits following road construction is unknown.

Stratigraphy and Site Formation

Descriptions of sediment strata at LA 139965 point to two important observations relevant to site formation. First, initial examination of Stratum 3 during excavation suggested that that it was a soil forming in sediment deposited on scoria bedrock and containing a great deal of organic material, hence its dark color. The presence of small cobbles and gravels of decaying scoria in lower portions of the stratum, particularly in the bar ditch, seemed to confirm that conclusion. Closer and more detailed assessment of Stratum 3 in the South Shelter revealed, however, that characteristics of pedogenesis were not present in Stratum 3 and that its overall homogeneity—bioturbation notwithstanding—identified it as a deposit of sediment. Only Stratum 4 in the South Shelter revealed any interruption in deposition of that sediment by showing that a surface, however short-lived, had been present; it was not sufficiently stable or long-term for appreciable plant growth that would initiate soil formation. Rather than soil, then, Stratum 3 was floodplain alluvium. Stratum 3, in turn, matches typical descriptions of soils in the Moreno–Brycan association that are formed in alluvial sediments derived from sandstone and shale.

Colors, particle-size analyses, and organic material contents affirm conclusions from in-field descriptions that differences observed in Stratum 3 are mostly variations within the thick, fine alluvial sediment that was deposited over the course of centuries or longer at the western edge of the Coyote Creek floodplain. Differences in color are related to differing particle-size distributions and organic materials content. Differences in particle-size distributions are most likely due to variation in upstream erosional conditions affecting the sources and sizes of materials carried downstream, and local depositional processes affecting energy of water flow, sediment load, and deposition at any given location. Different organic material contents may be due to sample collection depths and their effects on decomposition or to variation in amounts of organic materials during different periods of alluvial deposition and subsequent plant growth; it is not possible under the circumstances of site condition at excavation to determine which is more likely. Exceptions are Strata 4 and 5; the former represents a very localized setting in which debris from the basalt cliff face was deposited in and with Stratum 3, while the latter represents the colluvial effects of road cutting that removed scoria bedrock and considerable thicknesses of Stratum 3 in front of the shelters, resulting in a steep road cut between the shelters and the road bed. Exceptions also include mixing due to various natural bioturbation processes as well as human presence at and near the site. Still, the exceptions represent alterations of Stratum 3 rather than presence of different deposits of different origins.

Second, it seemed, at first, remarkable that a deposit of alluvial sediment 1.3 m (North Shelter) to 2.7 m (South Shelter) deep—from the Stratum 3 surface under the overhangs to the bottom of the bar ditch—would have been present, although descriptions of Moreno and Brycan soils show depths in excess of 1.5 m. However, the relative thinness of Stratum 3 on the slope between the shelters and the bar ditch as well as the presence of Stratum 5, a deposit of very mixed Stratum 3 material over Stratum 3 in the North Shelter, and the orientation of Stratum 4 in the South Shelter support the conclusion that Stratum 3 alluvium and the scoria bedrock originally extended east toward the river at a much more shallow slope. Figures 7.5 and 7.6 show projections of the original slopes of the bedrock and the upper surface of Stratum 3 based on what remained of them in the shelters during excavation. Interestingly, and unintentionally, the projected slopes in the two profiles are almost identical at about 6 to 7 degrees. In Figure 7.5, Stratum 3 is projected to have been about 40 cm thick, while in Figure 7.6 it is projected to have been about 60 cm thick.

Based on these observations, it is reasonable to conclude that considerable amounts of scoria bedrock and Stratum 3 sediments were removed, probably as a result of previous road construction. In Figure 7.5, an estimated 0.95 m was removed between the upper surface of Stratum 3 and the bar ditch; in Figure 7.6, an estimated 2.2 m was removed. Although artifacts were recovered from Stratum 3, both in the original sediments within the shelters and in the colluvium on the slope and in the bar ditch, the in situ artifact-bearing deposits—although disturbed by rodents, insects, worms, plants, and humans—were confined to the portions of the site in the shelters beneath the overhangs.

8 Archaeological Findings

The LA 139965, Coyote Creek Rockshelter, research design (Akins et al. 2014:47) estimated that about 151 grid units would be investigated at LA 139965. This projection was based on a brief initial visit to the site, the Trimble map of site boundaries, and a sketch map by Marshall and Marshall (2004:38); talus, shelter, and bar ditch sizes were estimated from an aerial photograph overlain by the Trimble map (App. 6.2). Once the data recovery phase began, however, actual on-the-ground mapping and a smaller than expected artifact distribution revealed the sizes of some of these areas (Fig. 8.1) varied considerably from our estimates. Ultimately, all or parts of 136 grid units were excavated in 463 levels. No cultural features were found.

Excavation approaches in the two shelters and intermediate areas varied due to differences in the size of the shelters, the amount of talus, and steepness of the slope. In all instances, methods were designed to provide east–west profiles of the shelter and slope, and to the extent possible, to avoid damage to downslope grid units during excavation of adjacent grid units. Excavation began in the larger South Talus and South Shelter, then moved to the North Talus and North Shelter; the Central Talus and cliff-side grids were the last to be investigated (Fig. 8.1). Findings are described in that sequence.

SOUTH TALUS AND SOUTH SHELTER

South Talus

The south area (Fig. 8.2) of the site was originally estimated to be about 380 sq m in size, with the South Talus comprising about 80 sq m of that total. The DRP proposed that at least 40 grid units would be excavated in the South Talus; a total of 49 grid units were investigated (Table 8.1). Following the approved change in the DRP, only one of the 70 sq m of bar ditch and highway-shoulder grid units was excavated. The area south of South Shelter, estimated at about 40 sq m, was a boulder-filled pit with enough recent soil accumulation to support a heavy growth of willows. None of the five grid units proposed for this area were investigated.

South Talus is the area between 237N and 253N that is not occupied by South Shelter or the bar ditch (Fig. 8.3). The South Talus boundary was defined by a tumble of boulders and heavy vegetation south of the 237N grid line, and to the north by a marked decline in artifact density in the talus area north of the 253N grid line. With these boundaries, the South Talus is about 65 sq m in size, with another 36 sq m within the bar ditch and road berm.

The first grid unit excavated was downslope from the northern extent of the South Shelter and was in the bar ditch extending into the road berm (250N/149E). Dense grass covered the surface and the fill graded from damp on the surface to thick mud at the base. Fill was removed in five levels of five cm each, ending when much of the base was occupied by boulders (Fig. 8.4). It was originally considered two strata (Strata 1 and 2), which were later recognized as variations of Stratum 3. Two bones (a deer tibia-shaft fragment and a large mammal long-bone shaft fragment) from Levels 3 and 4 were the only artifacts recovered from the grid unit. The profile (L–L'; Figs. 8.1, 8.2, 8.5, 8.6) exposed a thick mass of grass and grass roots in a sandy loam matrix overlying a layer of mostly flat-lying cobbles in a silty clay with mica flecks, then the boulders. Pea-sized gravel used to construct the roadbed was found throughout, but mainly in the upper stratum.

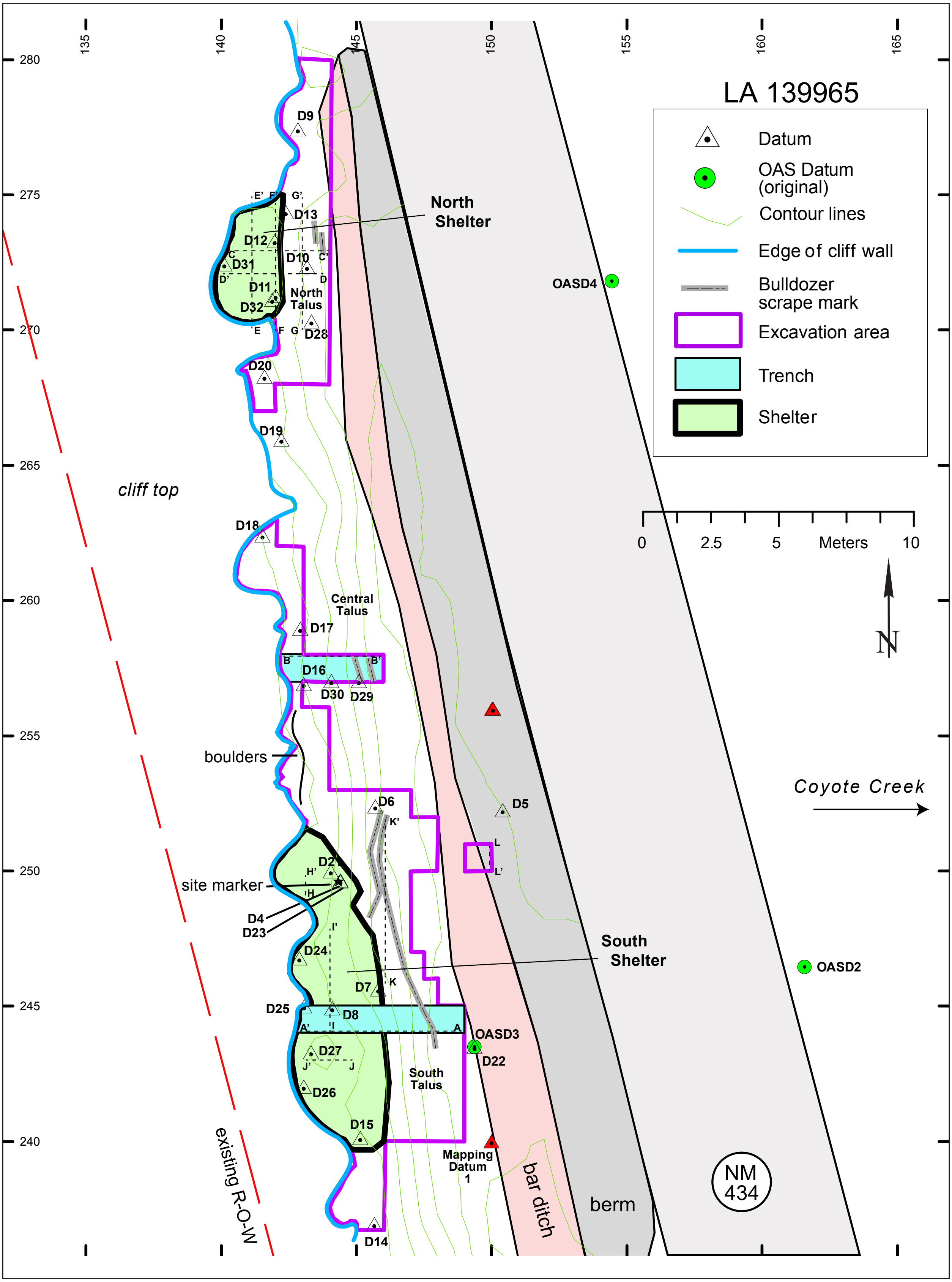

Figure 8.1. LA 139965, site map.

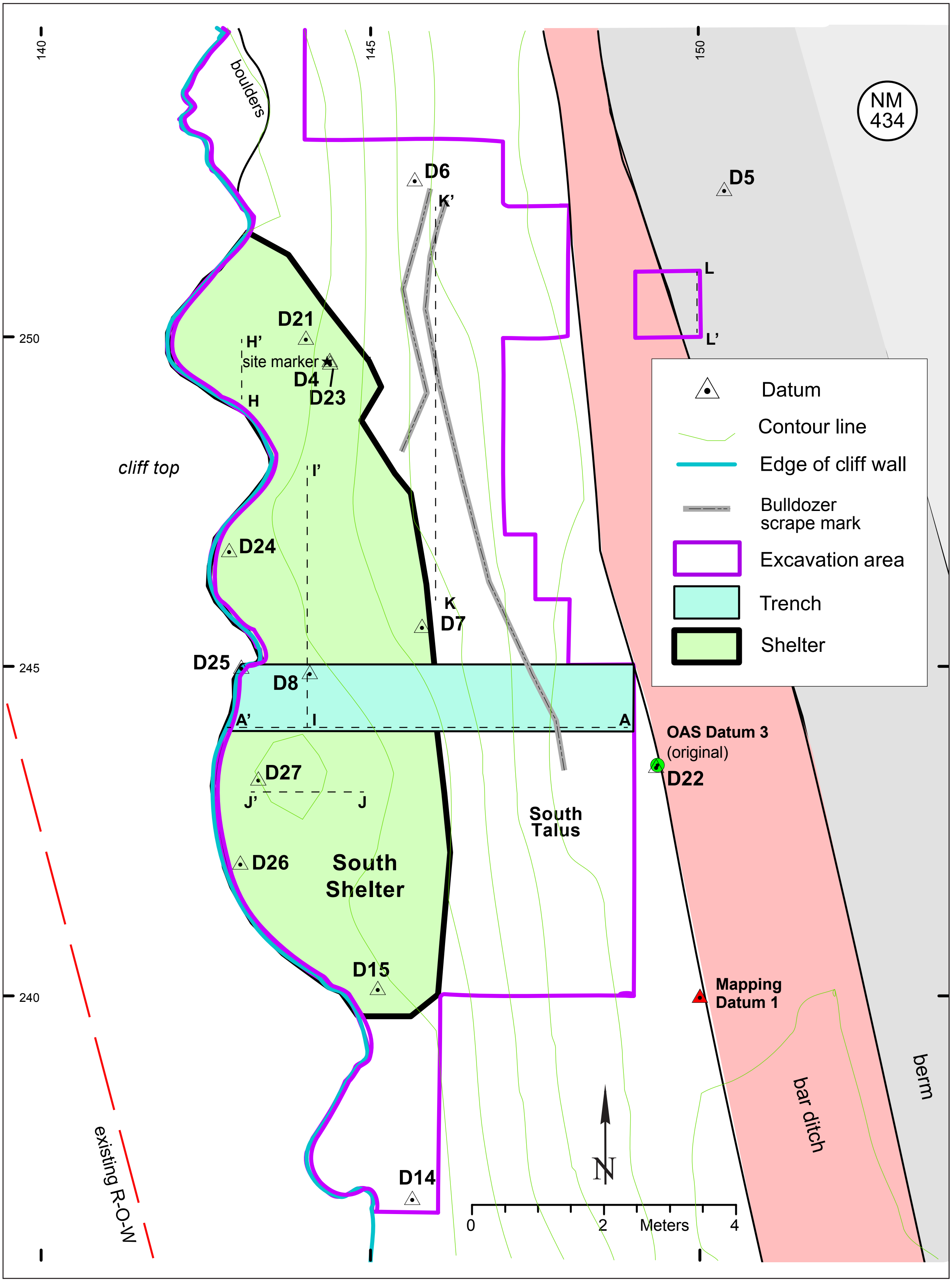

Figure 8.2. South Shelter and South Talus, plan map.

Table 8.1. South Talus grid units, excavated; highest beginning and lowest ending elevations, with artifact counts, disturbance types, and samples analyzed by level.

North	East	Levels	Beginning Elevations, in meters		Ending Elevations, in meters		Artifacts						Samples Analyzed	Disturbance (deepest level)	Comments
			West	East	West	East	Ceramics	Chipped Stone	Ground Stone	Bone	Historic	Other			
237	144	3	–	12.90	–	12.20	1	–	–	163	–	–	F	–	large boulder south
	145	2	12.82	12.54	12.20	12.01	–	–	–	34	–	–	–	–	boulder southwest
238	144/145	3	12.82	12.30	12.06	11.90	8	1	–	92	–	–	P	–	–
239	145	2	12.50	12.02	12.20	11.77	1	2	–	7	–	1	R	–	bedrock west portion
240	146	1	11.70	11.20	11.52	11.08	–	–	–	1	–	–	–	glass L.1	–
	147	2	11.05	10.58	10.90	10.32	2	2	–	1	–	1	–	–	–
	148	2	10.54	10.08	10.28	9.96	–	–	–	–	–	–	–	glass L. 2	no artifacts
241	146	2	11.65	11.10	11.45	10.80	1	3	–	11	–	–	–	glass L.1	–
	147	2	11.20	10.42	10.84	10.17	1	9	1	9	–	–	–	tree trunk and roots	–
	148	2	10.49	10.05	10.17	9.82	–	–	–	–	–	–	–	–	no artifacts
242	146	2	11.65	11.06	11.50	10.83	11	28	–	100	1	–	F	FT	–
	147	2	11.01	10.42	10.72	10.11	11	63	1	79	–	–	F	FT, plastic	–
	148	2	10.37	10.00	10.17	9.80	3	28	1	47	–	–	–	FT, glass	–
243	146	1	11.65	11.06	11.43	10.93	3	8	–	12	–	–	–	FT	–
	147	2	11.00	10.48	10.84	10.11	10	37	3	93	1	–	F	MS, FT, R, glass	–
	148	2	10.35	10.05	10.13	9.85	5	12	1	23	–	–	–	FT, gravel, glass	–
244	145	8	12.08	11.59	11.47	11.34	7	59	4	144	1	–	–	FT, glass L. 1	–
	146	2	11.55	10.96	11.32	10.75	–	25	–	24	1	–	–	FT	–
	147	4	10.90	10.45	10.71	10.02	6	59	1	71	7	2	F	MS, FT, glass L. 2	–
	148	8	10.30	10.01	9.90	9.66	–	10	–	24	1	–	F	FT, glass L. 2	SE test Levels 7 and 8
245	145	7	12.05	11.38	11.44	11.26	10	76	6	155	3	–	–	R, glass L. 2, L. 7	–
	146	2	11.37	10.83	11.23	10.65	1	16	–	44	–	–	–	MS, FT, glass L. 2	bedrock west side
	147	4	10.76	10.39	10.63	10.15	2	21	–	52	–	–	F	MS, plastic, glass L. 3	bedrock west side
246	145	8	12.06	11.36	11.50	11.26	2	62	1	117	4	–	–	FT, R, metal L. 2	bedrock east side
	146	1	11.33	10.79	11.22	10.63	3	39	1	46	1	–	F	FT. glass	–
	147	3	10.68	10.33	10.50	10.17	–	3	2	6	–	–	–	FT, glass L. 2, plastic	west half excavated
247	145	3	11.95	11.32	11.44	11.31	1	12	2	54	1	–	–	FT, R, metal L. 2	bedrock east side
	146	1	11.29	10.79	11.24	10.62	–	17	–	50	–	–	F	MS, FT, glass	–
248	144	2	12.40	11.95	12.00	11.71	2	12	–	135	1	–	–	R	–
	145	2	11.95	11.23	11.57	11.23	–	6	–	49	–	–	–	MS, FT	boulder SE
	146	1	11.23	10.82	11.16	10.70	–	13	–	33	–	–	–	MS, FT, glass, plastic	bedrock SW
249	144	3	12.58	11.87	12.10	11.76	2	23	–	91	–	–	–	FT, R	–
	145	2	11.90	11.24	11.68	11.14	1	12	–	43	1	–	–	MS, FT, ants	–
	146	2	11.27	10.76	11.12	10.50	–	3	–	35	1	–	–	MS, FT, ants, tree roots	–
250	144	1	12.56	11.78	12.15	11.76	–	2	–	32	–	–	F	FT	bedrock west side
	145	1	11.79	11.20	11.79	11.04	–	9	–	15	–	–	–	MS, FT, ant	bedrock west side

Table 8.1 (continued)

North	East	Levels	Beginning Elevations, in meters		Ending Elevations, in meters		Artifacts						Samples Analyzed	Disturbance (deepest level)	Comments
			West	East	West	East	Ceramics	Chipped Stone	Ground Stone	Bone	Historic	Other			
250	146	3	11.16	10.72	10.96	10.05	–	1	–	11	2	–	F	FT, glass and plastic L. 2	–
	147	3	10.61	10.25	10.46	9.89	–	31	1	5	1	–	–	FT	–
	149	5	10.19	10.25	9.95	9.95	–	–	–	2	–	–	–	plastic and glass L. 3	drainage ditch/ road berm
251	144	2	12.75	12.06	12.50	11.96	–	7	–	28	–	–	–	ant nest	–
	145	2	12.07	11.44	11.94	11.21	–	6	–	4	–	–	–	MS	–
	146	5	11.16	10.73	10.83	10.19	1	13	–	26	–	–	–	MS, R	–
	147	3	10.47	10.25	10.37	9.89	–	44	–	–	–	–	–	glass L. 1	–
252	142/143	4	12.69	12.27	12.35	12.10	–	18	1	407	–	–	P	–	–
	144	1	12.36	11.63	12.04	11.62	–	1	1	4	–	–	–	large root	–
	145	2	11.60	10.86	11.09	10.72	–	8	–	3	–	–	–	MS, FT, ant nest	bedrock SW
	146	4	11.00	10.54	10.62	10.26	–	16	–	5	–	–	–	FT, glass L. 4	–
Total		**131**					**95**	**817**	**27**	**2387**	**27**	**4**			

Samples: R = radiocarbon; F = flotation; P = pollen/starch/phytolith.
Disturbance: FT=foot traffic; L = level; MS = mechanical scrape mark; R = rodent.

The next set of grid units excavated were those that provided the South Shelter and South Talus stratigraphic profile (A–A'; Figs. 7.5, 8.1, 8.2); the combined units are sometimes referred to here as a "profile trench." These grid units were along the 244N grid line, starting at 148E and extending through 145E to where the shelter grids begin (Fig. 8.7). This location was chosen because it fell between two large boulders and allowed a continuous profile from the base to the back of the shelter. Fill was relatively deep in the first and last talus grid units, but the central grid units contained only 10 to 12 cm of loose disturbed fill. The last two levels of the 148E grid unit were examined by a test in the southeast corner, where the scoria slope left little room for excavation.

Early grid unit excavations were executed in 5 cm levels, conforming to the surface contour as much as possible given the slope and rock inclusions. However, excavations in the next series of grid units along the 250–251N grid lines led to the request to modify the DRP. These adjacent grid units provided enough perspective to begin to understand the site history. Like the initial test at 250N/149E, the 250–251N/147E grid units had a mass of tumbled boulders in the eastern (or downslope) half of the grid units (Fig. 8.8), and steeply sloping scoria in the western half. Fill tended to be shallow, except for the area of the boulders where excavation was continued down between the larger rocks. Clearing the 250–251N/145N grid units revealed what first appeared to be a trail excavated across the slope toward the shelter (Fig. 8.9). Additional South Talus excavations indicated that these were caused by mechanical equipment contouring the scoria during road construction and thus creating the talus slope. Mechanical disturbance is also suggested by the rock configuration in grid unit 250N/143E, where the edge of the blade left an alignment of rocks (Fig. 8.10).

By then, it had been established that the talus fill was a single, disturbed stratum and there was no need to excavate in 5 cm levels. After consulting with HPD, 10 cm levels were used. In most grid units, excavation stopped at bedrock. However, the easternmost grid unit excavation stopped at the level of the rock and boulder mass, as few artifacts were found and fill between the rocks tended to be wet and often contained masses of clay that had settled between the rocks. Grid units at the far south of the talus (237–239N) were occupied by a jumble

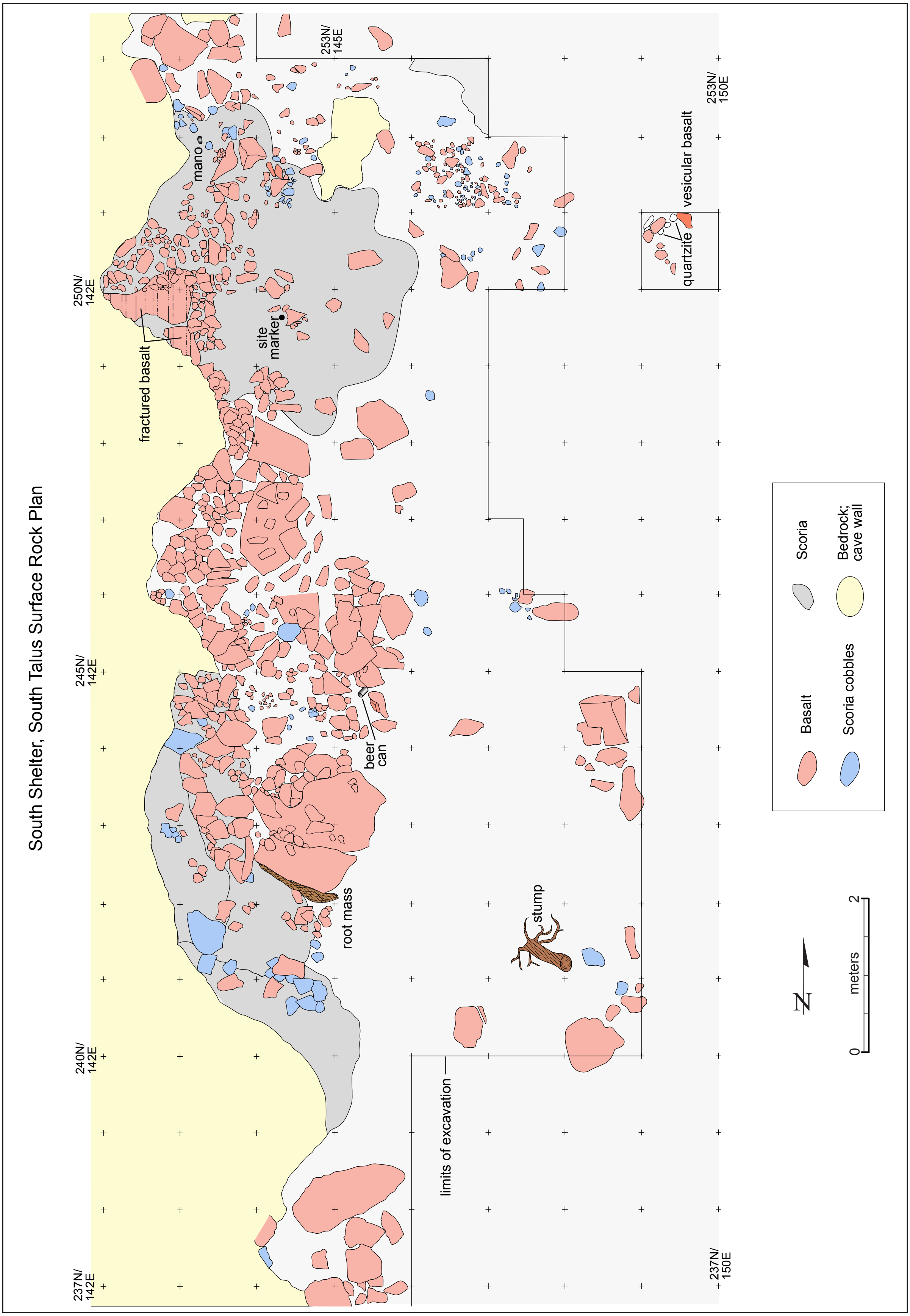

Figure 8.3. South Shelter and South Talus, plan map showing surface rock distribution.

Figure 8.4. Initial grid unit—250N/149E, in bar ditch at eastern extent of South Talus—after excavation.

Figure 8.5. Stratigraphy in east wall of grid unit 250N/149E, view east.

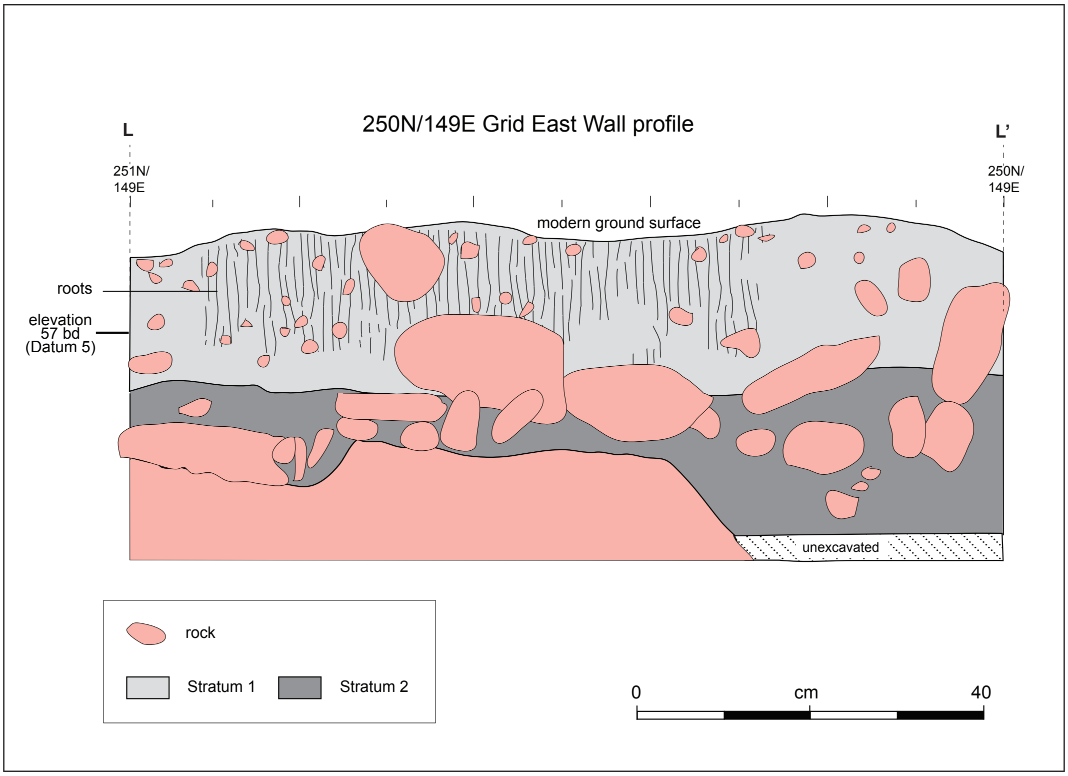

Figure 8.6. North–south profile (L–L′), grid unit 250N/149E; east wall.

Figure 8.7. South Talus, "profile trench" (A–A′) grid units along the 244N grid line, view west from to South Shelter. (See Fig. 7.5 for detailed stratigraphic A–A′ profile drawing.)

Figure 8.8. South Talus, boulders at base of grid units 250–251N/147E, view west.

Figure 8.9. South Talus, linear marks in grid unit 250N/145E, view south.

Figure 8.10. South Talus, rock alignment in grid unit 250N/143E, view southwest.

Figure 8.11. South Talus, rock at far south end (237N/145E) of excavation area.

of large rocks and vegetation (Fig. 8.11). No excavation took place in this area.

Fill in the South Talus area was Stratum 3 (Chapter 7)—generally a thin layer in the more central grid units with greater accumulations near the cliff edge, fronting the shelter, and at the base in the area of the large basalt boulders (Figs. 7.5). Along the 146E grid line (Fig. 8.12), Stratum 3 was thin, very dry, and gritty from sand and mica at the south end (246N). It was thicker to the north (248N) where it was the more typical clayey loam with fewer mica inclusions. Scoria bedrock elevations dip about 37 cm from the south end of the profile at 246N to the north end at 252N. Root and worm disturbance was found throughout.

East–west slopes were steep throughout with the west edge of the grid units generally between 50 and 70 cm higher than the east edge (Table 8.1). Clearing the talus revealed a number of long linear scrapes in the scoria bedrock (Fig. 8.13). These were diagonal to perpendicular to the slope angling up to the south and extending from at least 243N to 253N (Fig. 8.2), and were also visible in the Central Talus trench at 257N. These are probably the result of mechanical equipment cutting into portions of the bedrock.

South Talus Artifacts and Sample Results

The South Talus had the second largest number of excavated grid levels (n = 131) and the second largest counts for chipped stone, ground stone, bone, and historic artifacts recovered. It has fewer ceramics than all but the Central Talus area. For certain artifact categories, South Talus grid units were divided into section groups, and may be discussed as follows: south (237–242N), main (243–247N), and north (248–252N).

Ceramics

Except for the glaze wares, the South Talus ceramics are of the Taos tradition (91.5 percent). Most are Plain body sherds (57.9 percent) (Table 8.2) with leucocratic igneous temper (Table 8.3). Glaze ware sherds dating between AD 1325 and 1425 (Chapter 9) were found in three adjacent grids (242N/146E, 243N/147E, and 244N/145E) and were in the first two levels (10 cm) of fill. Pieces of a cloud blower were found a grid unit apart. One piece was found in Level 6 of 245N/145E and the other in the first level of 247N/145E. Except for the wide neckbanded (wiped or undulated) sherd that was found in 245N/145E, wide neckbanded sherds were all found south of the 244N grid line; they all probably date between AD 900 and 1100 (Chapter 9, this report).

Coiled neck sherds have a similar distribution, with all eight found south of the 243N grid line. Other wares were mainly found in the more northern grid units. Three of the four Taos Incised gray sherds were found north of the 245N grid line, and all but two of the 10 corrugated types were found north of the 244N grid line.

Chipped Stone

A good sample of chipped stone artifacts (Table 8.4) was recovered from the 131 levels of fill considered part of the South Talus (n = 817; 23.5 percent of the total chipped stone). Core flakes make up much of the assemblage (71.5 percent), with fewer pieces of angular debris (6.0 percent), biface flakes (7.3 percent), and a notching flake. Cores tended to be unidirectional (n = 18) with few bidirectional (n = 8). Tool types include a hammerstone, a core hammerstone, choppers (n = 8), strike-a-light flints (n = 5), and end and side scrapers (n = 10). Bifaces (n = 5), projectile point preforms (n = 20), and projectile points were relatively common (n = 32). The projectile points were complete (n = 9), proximal ends (n = 9), or distal ends (n = 9), with fewer medial or distal (n = 5) pieces. All of the site strike-a-light flints came from the South Talus. Two were from the first level of fill (246N/146E and 251N/147E), one was from the second level of fill (242N/147E), and one was from Level 3 (244N/145E).

Chert (29.3 percent) and rhyolite (which includes the local olivine basalt; 22.4 percent) are the most common material types, followed by obsidian (16.9 percent) and lesser amounts of silicified wood (7.2 percent), igneous (0.1 percent), basalt/andesite (9.8 percent), limestone (0.1 percent), metaquartzite (7.8 percent), and quartz (8.4 percent). Biface and notching flakes of chert, silicified wood, obsidian, basalt/andesite, metaquartzite, and quartz attest to manufacture or rejuvenation of tools made of those materials. Cores have a similar material type distribution. Scrapers were made of chert (n = 4), silicified wood (n = 1), and rhyolite (n = 5). Projectile point preforms tend to be made of chert (50.0 percent), obsidian (20.0 percent), and basalt/

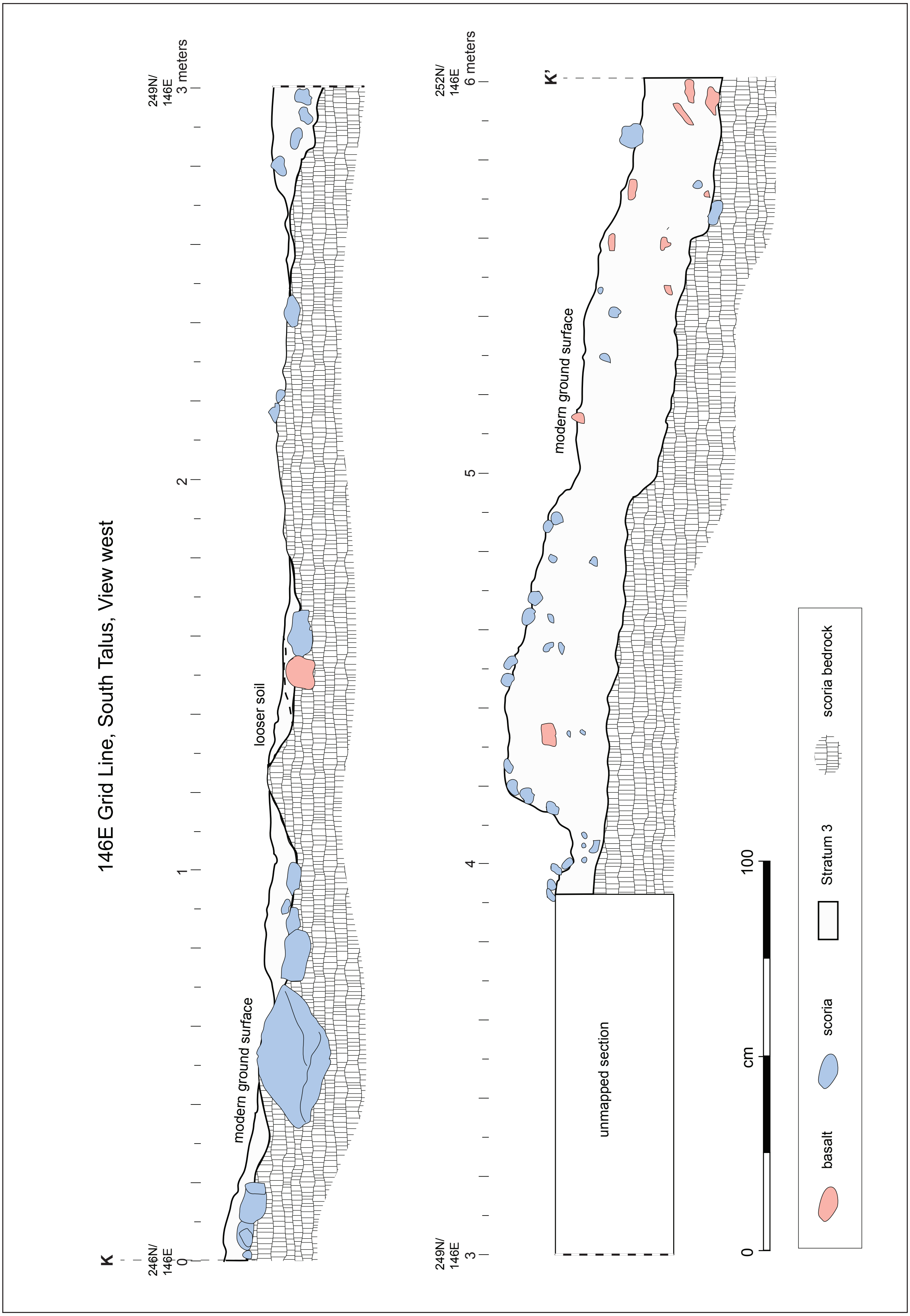

Figure 8.12. South Talus, north–south profile (K–K') along the 146E grid line, 246–252N; west wall.

Figure 8.13. South Talus and South Shelter, mostly excavated, view south.

Table 8.2. South Talus, temper by pottery type; counts and percents.

Tradition	Taos						Middle Rio Grande		Total	
Temper	**Leucocratic igneous w/ mica**		**Leucocratic igneous**		**Fine sand, silt, and mica**		**Latitite**			
	n =	**%**	**n =**	**%**	**n =**	**%**	**n =**	**%**	**n =**	**%**
Glaze yellow/cream slipped (unpainted)	–	–	–	–	–	–	4	100.0	**4**	**100.0**
Glaze-on-yellow cream	–	–	–	–	–	–	4	100.0	**4**	**100.0**
Plain rim	–	–	2	100.0	–	–	–	–	**2**	**100.0**
Plain body	12	21.8	41	74.5	2	3.6	–	–	**55**	**100.0**
Wide Neckbanded	1	12.5	7	87.5	–	–	–	–	**8**	**100.0**
Wide Neckbanded (wiped or undulated)	–	–	1	100.0	–	–	–	–	**1**	**100.0**
(Taos) Incised Gray	–	–	4	100.0	–	–	–	–	**4**	**100.0**
Coiled Necked	–	–	8	100.0	–	–	–		**8**	**100.0**
Indented Corrugated	1	50.0	1	50.0	–	–	–	–	**2**	**100.0**
Smeared Plain Corrugated	2	66.7	1	33.3	–	–	–	–	**3**	**100.0**
Smeared Indented Corrugated	2	50.0	2	50.0	–	–	–	–	**4**	**100.0**
Total	**18**	**18.9**	**67**	**70.5**	**2**	**2.1**	**8**	**8.4**	**95**	**100.0**

Table 8.3. South Talus, vessel form by pottery type; counts and percents.

	Indeterminate		Bowl Body		Jar Neck		Jar Rim		Jar Body		Cloudblower		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Glaze yellow/cream slipped (unpainted)	–	–	4	100.0	–	–	–	–	–	–	–	–	**4**	**100.0**
Glaze-on-yellow cream	–	–	4	100.0	–	–	–	–	–	–	–	–	**4**	**100.0**
Plain rim	–	–	–	–	–	–	2	100.0	–	–	–	–	**2**	**100.0**
Plain body	1	1.8	–	–	1	1.8	–	–	51	92.7	2	3.6	**55**	**100.0**
Wide Neckbanded	–	–	–	–	1	12.5	–	–	7	87.5	–	–	**8**	**100.0**
Wide Neckbanded (wiped or undulated)	–	–	–	–	1	100.0	–	–	–	–	–	–	**1**	**100.0**
(Taos) Incised Gray	–	–	–	–	4	100.0	–	–	–	–	–	–	**4**	**100.0**
Coiled Necked	–	–	–	–	4	50.0	–	–	4	50.0	–	–	**8**	**100.0**
Indented Corrugated	–	–	–	–	2	100.0	–	–	–	–	–	–	**2**	**100.0**
Smeared Plain Corrugated	–	–	–	–	–	–	–	–	3	100.0	–	–	**3**	**100.0**
Smeared Indented Corrugated	–	–	–	–	–	–	–	–	4	100.0	–	–	**4**	**100.0**
Total	**1**	**1.1**	**8**	**8.4**	**13**	**13.7**	**2**	**2.1**	**69**	**72.6**	**2**	**2.1**	**95**	**100.0**

andesite (20.0 percent). However, obsidian was favored for small projectile points (36.4 percent) followed by chert (27.3 percent) and basalt/andesite (18.2 percent). The same is true for the small corner-notched points, where half are obsidian and a quarter each are of chert and basalt/andesite. In contrast, the small side-notched points are mainly chert (45.5 percent) and obsidian (27.3 percent). Strike-a-light flints were made of chert (40 percent) and quartz (60 percent).

A wide diversity of activities is represented by the chipped stone and tool assemblage (Chapter 10) recovered from the talus deposits. The deposits include evidence of core reduction, projectile point manufacture, arrow-shaft refurbishing, hunting, and meat processing. There is also indication of leather working and general pounding, chopping, scraping, cutting, as well as historic-era fire-making.

Spatially, the far south end of the site—where the area adjacent to the cliff is considered part of South Talus (238N–241N)—had few chipped stone items (n = 3), one a basalt/andesite projectile point preform. Obsidian flakes comprise the rest of the assemblage. Within the southern part of the talus (between 240N–249N), chipped stone densities are highest in the grid units adjacent to South Shelter, which probably include shelter deposits in at least portions of those grid units. These are also the grid units with the thickest deposits (244N/145E, 245N/145E, and 246N/145E). The more central grid units had little fill and fewer artifacts, while some of those at the east edge—where the contours flatten out and soil accumulated between the boulders—also have larger sample sizes (242N/147E). Indeed, Pearson correlations of the number of levels in the grid unit and the total counts for chipped stone, debitage, cores, and projectile points in that grid unit are statistically significant (Table 8.5). Correlations between the amount of debitage and cores and projectile points are also significant, as are correlations for core tools and unifaces and cobble tools and cores. What this seems to suggest is that the number of artifacts is largely determined by the amount of fill excavated.

Ground Stone

Nearly half (n = 13; 48.1 percent) of the South Talus ground stone artifacts are manos (Table 8.6); only four of these are complete tools. All but one, which is indeterminable, were made from cobbles,

Table 8.4. South Talus, chipped stone, counts by type and grid unit.

North	East	Angular debris	Flake	Utilized debitage	Unutilized core	Utilized core	Core-hammerstone	Hammerstone	Chopper	Core-chopper	Strike-a-light flint	Scraper-graver	End scraper	Side scraper	End/ side scraper	Biface	Preform	Small point	Small corner-notched point	Small side-notched point	En Medio point	Eccentric point	Total
238	145	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	**1**
239	145	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**2**
240	147	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**2**
241	146	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	**3**
	147	–	7	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	**9**
242	146	6	21	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**28**
	147	3	52	1	1	–	–	–	–	–	1	–	–	–	–	1	3	–	1	–	–	–	**63**
	148	–	24	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1	1	–	–	**28**
243	146	–	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**8**
	147	3	31	–	2	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	**37**
	148	–	9	–	–	–	–	–	–	–	–	–	1	–	–	–	1	1	–	–	–	–	**12**
244	145	2	49	2	1	–	–	–	–	–	1	–	–	–	–	–	1	–	1	2	–	–	**59**
	146	–	20	4	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	**25**
	147	6	47	1	1	–	1	–	1	–	–	–	–	–	–	–	1	1	–	–	–	–	**59**
	148	–	8	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	**10**
245	145	5	60	–	3	–	–	1	–	–	–	–	–	–	–	1	3	1	1	1	–	–	**76**
	146	2	10	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1	–	–	–	**16**
	147	2	17	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	**21**
246	145	–	56	–	1	–	–	–	–	–	–	–	1	–	–	–	1	–	–	3	–	–	**62**
	146	4	29	4	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	**39**
	147	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**3**
247	145	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	**12**
	146	1	10	1	–	–	–	–	–	–	–	1	–	–	1	–	2	1	–	–	–	–	**17**
248	144	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	**12**
	145	1	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**6**
	146	2	9	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	**13**
249	144	–	22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	**23**
	145	–	10	1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	**12**
	146	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**3**
250	144	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**2**
	145	–	5	–	–	–	–	–	–	–	–	–	–	–	–	1	2	–	1	–	–	–	**9**
	146	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**
	147	4	19	1	1	–	1	–	3	–	–	–	1	–	–	–	–	–	–	–	1	–	**31**
251	144	–	6	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	**7**
	145	–	4	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	**6**

Table 8.4 (continued)

North	East	Angular debris	Flake	Utilized debitage	Unutilized core	Utilized core	Core-hammerstone	Hammerstone	Chopper	Core-chopper	Strike-a-light flint	Scraper-graver	End scraper	Side scraper	End/side scraper	Biface	Preform	Small point	Small corner-notched point	Small side-notched point	En Medio point	Eccentric point	Total
251	146	–	6	–	–	–	–	–	–	6	–	–	1	–	–	–	–	–	–	–	–	–	13
	147	2	35	–	1	–	–	–	1	–	1	–	–	2	–	–	–	–	–	1	–	1	44
252	143	–	13	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18
	144	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
	145	–	7	–	–	–	–	–	–	–	–	–	–	–	–	–		1	–	–	–	–	8
	146	–	9	1	2	–	–	–	2	–	–	–	–	1	–	–	1	–	–	–	–	–	16
Total		**43**	**644**	**21**	**18**	**1**	**2**	**1**	**8**	**6**	**5**	**1**	**4**	**5**	**1**	**5**	**20**	**11**	**8**	**11**	**1**	**1**	**817**

usually orthoquartzite (n = 7). Most had been exposed to heat (84.6 percent), suggesting use or discard in conjunction with a thermal feature.

A variety of other tool types were found. Neither of the metate fragments is complete enough to determine a type. Two smooth abraders were found, as were a hammerstone and a fire prod; some suggest a range of functions other than food preparation.

The ground stone objects ranged from surface finds to those located deep in the fill of grids adjacent to the shelter. The complete surface mano was cached in a crevice along the cliff edge (252N/143E).

Bone

South Talus has the second largest sample of fauna (n = 2387) found at the site. Due to the large quantity of certain artifacts, such as bone, South Talus was divided into three sections: south (237–242N), main (243–247N), and north (248–252N).

Slightly more faunal remains came from the 18 north South Talus grid units (n = 928) than from the 15 main section South Talus grid units (which had thicker deposits and fronted the main section of South Shelter; n = 915), or from the south section, which comprised 11 South Talus grid units (n = 544).

Most of the bone was found in the upper two levels of fill (Table 8.7), with relatively few from deeper levels of all grids, except those in the main section, fronting South Shelter. When considered by these three South Talus sections, the deeper levels always have more of the small mammals considered subsistence animals (large rodents, squirrels, rabbit, beaver) than the upper levels. Large artiodactyls (elk, bison, large artiodactyl) varies, with the largest proportion in the deeper levels of the more northern grid units. Medium artiodactyls—mainly deer but also pronghorn, bighorn sheep, and small to medium and medium artiodactyl—comprise between 65.7 and 92.9 percent of the area and level assemblages.

The few bones from domestic animals (sheep or goats; n = 5) were from grid unit 246N/146E (Levels 2 and 4) or from the northern part of the talus (250N/146E surface and Level 3; 252N/143E Level 1). Domestic animal bones from the surface were sun-bleached and those from the northernmost grid unit were burned.

More than in other levels, Level 1 bone is checked, corroded, or sun-bleached. None of the

Table 8.5. South Talus, correlation coefficients for chipped stone types.

		Levels	Total chipped stone	Debitage	Cores	Core tools	Cobble tools	Uniface	Projectile points
Levels	Pearson Correlation	1	0.492**	0.470**	0.417**	0.263	0.136	0.047	0.362*
	Sig. (2-tailed)	–	0.000	0.001	0.004	0.074	0.361	0.755	0.012
	N	47	47	47	47	47	47	47	47
Total chipped stone	Pearson Correlation	0.492**	1.000	0.995**	0.559**	0.026	0.301*	0.142	0.702**
	Sig. (2-tailed)	0.000	–	0.000	0.000	0.860	0.039	0.340	0.000
	N	47	47	47	47	47	47	47	47
Debitage	Pearson Correlation	0.470**	0.995**	1.000	0.524**	-0.019	0.254	0.103	0.667**
	Sig. (2-tailed)	0.001	0.000	–	0.000	0.897	0.084	0.489	0.000
	N	47	47	47	47	47	47	47	47
Cores	Pearson Correlation	0.417**	0.559**	0.524**	1.000**	-0.036	0.371*	0.066	0.318*
	Sig. (2-tailed)	0.004	0.000	0.000	–	0.811	0.010	0.661	0.029
	N	47	47	47	47	47	47	47	47
Core tools	Pearson Correlation	0.263	0.026	-0.019	-0.036	1.000	0.043	0.305*	-0.106
	Sig. (2-tailed)	0.074	0.860	0.897	0.811	–	0.775	0.037	0.478
	N	47	47	47	47	47	47	47	47
Cobble tools	Pearson Correlation	0.136	0.301*	0.254	0.371*	0.043	1.000	0.046	0.110
	Sig. (2-tailed)	0.361	0.039	0.084	0.010	0.775	–	0.757	0.463
	N	47	47	47	47	47	47	47	47
Uniface	Pearson Correlation	0.047	0.142	0.103	0.066	0.305*	0.046	1.000	0.097
	Sig. (2-tailed)	0.755	0.340	0.489	0.661	0.037	0.757	–	0.517
	N	47	47	47	47	47	47	47	47
Projectile points	Pearson Correlation	0.362*	0.702**	0.667**	0.318*	-0.106	0.110	0.097	1.000
	Sig. (2-tailed)	0.012	0.000	0.000	0.029	0.478	0.463	0.517	–
	N	47	47	47	47	47	47	47	47

**	= Correlation is significant at the 0.01 level (2-tailed).
*	= Correlation is significant at the 0.05 level (2-tailed).

Table 8.6. South Talus, ground stone summary, by type, material, and provenience.

Artifact Type	Condition	Material	North	East	Level
Polishing stone, nfs	Whole	Mudstone	241	147	1
Smooth abraders	Corner(s) only missing	Micaceous schist	242	147	1
Flaked abrader	Whole	Micaceous schist	242	148	1
Indeterminate, fragmentary	Surface flake	Basalt	243	147	1
Hammerstone	Whole	Metaquartzite	243	147	1
Metate, nfs	Internal fragment	Sandstone	243	147	2
Mano, nfs (fragmentary)	Surface flake	Micaceous schist	243	148	1
Smooth abraders	Edge fragment	Micaceous schist	244	145	2
One-hand mano	Corner(s) only missing	Sandstone	244	145	4
One-hand mano	Corner fragment	Orthoquartzite	244	145	6
Indeterminate, fragmentary	split lengthwise	Micaceous schist	244	145	8
Metate, nfs	Internal fragment	Sandstone	244	147	1
One-hand mano	Whole	Metaquartzite	245	145	1
Indeterminate, fragmentary	Surface flake	Orthoquartzite	245	145	3
One-hand mano	split lengthwise	Orthoquartzite	245	145	3
One-hand mano	End fragment	Orthoquartzite	245	145	5
One-hand mano	Edge fragment	Orthoquartzite	245	145	5
Two-hand mano, nfs	End fragment	Metaquartzite	245	145	6
One-hand mano	Corner fragment	Orthoquartzite	246	145	3
One-hand mano	Whole	Metaquartzite	246	146	1
Indeterminate, fragmentary	Surface flake	Basalt	246	147	1
Coarse abraders	End fragment	Basalt	246	147	2
One-hand mano	Whole	Orthoquartzite	247	145	2
Mano, nfs (fragmentary)	Surface flake	Orthoquartzite	247	145	3
Coarse abraders	Whole	Micaceous schist	250	147	1
Fire prod	Whole	Micaceous schist	252	144	1
One-hand mano	Whole	Micaceous schist	252.02	143.67	0

nfs = not further specified.

Table 8.7. South Talus, fauna summary, by subdivision and grid unit/level; counts and percents.

	Grid Units 237–242N						Grid Units 243–247N								Grid Units 248–253N								Total	
	Level 1		Level 2		Level 3		Level 1		Level 2		Level 3		Level 4+		Level 1		Level 2		Level 3		Level 4+			
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Subsistence Animal Size Group																								
Small mammal	8	41.0	11	4.3	9	14.5	13	4.6	8	3.9	5	6.0	45	15.1	20	7.2	24	7.8	13	5.3	7	20.0	**163**	**7.3**
Medium artiodactyl	171	87.2	233	90.3	53	85.5	260	92.6	186	91.6	75	90.4	245	82.2	250	90.3	267	86.7	216	88.2	23	65.7	**1980**	**88.2**
Large artiodactyl	17	8.7	14	5.4	–	–	7	2.4	9	4.4	3	3.6	8	2.7	7	2.5	17	5.5	16	6.5	5	14.3	**103**	**4.6**
Total	**196**	**100.0**	**258**	**100.0**	**62**	**100.0**	**280**	**100.0**	**203**	**100.0**	**83**	**100.0**	**298**	**100.0**	**277**	**100.0**	**308**	**100.0**	**245**	**100.0**	**35**	**100.0**	**2246**	**100.0**
Environmental Alteration																								
Egg shell	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.7	–	–	–	–	–	–	**2**	**0.1**
None	120	58.5	169	62.4	42	62.7	216	74.0	164	75.9	66	73.3	257	81.1	187	62.1	189	57.1	56	21.7	17	44.7	**1483**	**62.1**
Pitting/corrosion	24	11.7	13	4.8	4	6.0	9	3.1	8	3.7	2	2.2	8	2.5	21	7.0	94	28.4	181	70.2	13	34.2	**377**	**15.8**
Sun bleached	5	2.4	–	–	–	–	–	–	1	0.5	–	–	–	–	13	4.3	1	0.3	–	–	–	–	**20**	**0.8**
Checked/ exfoliated	56	27.3	87	32.1	21	31.3	64	0.2	40	18.5	19	21.1	45	14.2	75	24.9	44	13.3	20	7.8	8	21.1	**480**	**20.1**
Root etched	–	–	2	0.7	–	–	2	0.7	1	0.5	3	3.3	5	1.6	3	1.0	3	0.9	1	0.4	–	–	**20**	**0.8**
Rounded/ polished	–	–	–	–	–	–	1	0.3	2	0.9	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**0.1**
Precipate coating	–	–	–	–	–	–	–	–	–	–	–	–	2	0.6	–	–	–	–	–	–	–	–	**2**	**0.1**
Total	**205**	**100.0**	**271**	**100.0**	**67**	**100.0**	**292**	**100.0**	**216**	**100.0**	**90**	**100.0**	**317**	**100.0**	**301**	**100.0**	**331**	**100.0**	**258**	**100.0**	**38**	**100.0**	**2387**	**100.0**
Animal Alteration																								
Carnivore	–	–	1	0.4	2	3.0	–	–	1	0.5	1	1.1	1	0.3	–	–	1	0.3	–	–	–	–	**7**	**0.3**
Rodent	4	2.0	16	5.9	5	7.5	4	1.4	4	1.9	2	2.2	4	1.3	10	3.3	10	3.0	2	0.8	–	–	**61**	**2.6**
Carnivore, rodent	–	–	–	–	–	–	–	–	–	–	–	–	1	0.3	–	–	–	–	1	0.4	–	–	**2**	**0.1**
Scat	–	–	2	0.7	1	1.5	1	0.3	2	0.9	3	3.3	–	–	4	1.3	1	0.3	–	–	–	–	**14**	**0.6**
Total	**4**	**100.0**	**19**	**100.0**	**8**	**100.0**	**5**	**100.0**	**7**	**100.0**	**6**	**100.0**	**6**	**100.0**	**14**	**100.0**	**12**	**100.0**	**3**	**100.0**	**–**	**100.0**	**84**	**100.0**
Burning																								
Unburned	137	66.8	176	64.9	45	67.2	141	84.3	123	56.9	48	53.3	171	53.9	213	70.8	257	77.6	233	90.3	26	68.4	**1571**	**65.8**
Discard burn	67	32.7	91	33.6	21	31.3	149	51.0	88	40.7	39	43.3	130	41.0	85	28.2	73	22.1	24	9.3	10	26.3	**777**	**32.6**
Roasting or scorch	–	–	2	0.7	1	1.5	2	0.7	2	0.9	3	3.3	16	5.0	3	1.0	1	0.3	1	0.4	1	2.6	**32**	**1.3**
Boiled?	1	0.5	1	0.4	–	–	–	–	1	0.5	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**0.1**
Deliberate partial	–	–	1	0.4	–	–	–	–	2	0.9	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**0.1**
Partial	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2.6	**1**	**0.1**
Total	**205**	**100.0**	**271**	**100.0**	**67**	**100.0**	**292**	**100.0**	**216**	**100.0**	**90**	**100.0**	**317**	**100.0**	**301**	**100.0**	**331**	**100.0**	**258**	**100.0**	**38**	**100.0**	**2387**	**100.0**

Level 1 bone was carnivore-altered but nearly all of the levels had rodent gnawing. More of the bone from grid units fronting the main shelter deposits was burned; only the deepest levels of the more northern South Talus grid units had appreciable burning (Table 8.7).

Differences in the areas and levels are relatively minor. This is as expected given the disturbance in the deposits in general.

South Talus produced a small number of awls (n = 5), small tubular beads (n = 3), a pendant blank or gaming piece, an antler flaker, a flaked bone tool, and two pieces that were too fragmentary to determine a tool type (Chapter 12, this report). Nearly half are burned and only the potential gaming piece or pendant is complete. The burning and largely broken assemblage is consistent with refuse, but some of the breakage could also result from mechanical and natural movement of the deposits.

Microbotanical and Macrobotanical Remains

Carbonized macrobotanical remains were recovered in 23 South Talus flotation samples. These samples contained a wide range of charred plant parts from amaranth, goosefoot, corn, grass, aster, bean family, scorpion weed, sedge family, yucca, and dock. Burned needles of Douglas fir, possible piñon pine, and ponderosa, and an acorn were also found. Most of the wood was ponderosa pine. More of the identified specimens were goosefoot (n = 12) than any other plant.

Far more unburned taxa that are not represented in the charred remains were found. Mullein = (n = 18)—which grows on the site—was found in more samples than any other taxa, and was closely followed by purslane and hedgehog cactus (n = 16), then vervain (n = 12), stickleaf (n = 11), ground cherry (n = 9), wild lettuce (n = 8) brome (n = 7), spurge (n = 4), sunflower and mustard (n = 3), strawberry and sumac (n = 2), and raspberry, dandelion, and gumweed (n = 1). In addition to the pieces of burned acorn shell, six other samples had unburned acorn shell or cups.

Rodent pellets were found in 70 percent of the South Talus samples and were burned in six of the samples. The burned pellets were spread along the talus with one sample from the southern part in Level 1, three from the portion fronting the main section of the shelter (Levels 1–3), and two from the far north section, in Levels 1–2 (App. 4.1c).

Pollen was extracted from three South Talus sediment samples, a wash from a one-hand mano (Phillips, Chapter 14), and a wash from a second one-hand mano (Cummings and Varney, Chapter 14). The sediment samples were taken from the far south end (238N/145E Level 1), center (246N/145E Level 8), and far north end (252N/143E Level 1) of the South Talus. Grass pollen is the most abundant plant type in all three sediment samples. In addition, all three contained ponderosa pine, oak, fir, cattail, sunflower, cheno-am, aster, pea, spurge, mustard, pea, and sage pollen; some probably reflecting the local pollen rain. Two of the three also had piñon pine, juniper, alder, rose family, nightshade, and lily pollen. Two of the sediment samples contained corn pollen (the far south and far north samples), and one each had prickly pear, spruce, willow, maple, spiderling, and wild buckwheat pollen. The wash from the first mano (from Level 1 of 245N/145E) had no pollen. The second mano (from 244N/145E Level 3) had aggregates of amaranth, large amounts of sunflower and wild buckwheat, and small amounts of meadow rue and cattail pollen, suggesting a diverse array of seeds were ground with this mano.

Other Artifacts (Beads/Other Stone)

A few miscellaneous items were recovered from the South Talus, including the only travertine disc bead found—although most items this size would have passed through the larger screen size and even the smaller screen size. Others include a piece of olivine basalt that was naturally perforated, a piece of mica (1.0 by 0.4 cm), and piece of jet.

Historic Artifacts

Modern glass, plastic, and other obvious intrusive objects were not collected. These were noted in the grid unit forms and only those objects that could potentially provide information on dating the historic use of the shelter or how it was used during the historic period were collected. A total of 27 historic artifacts were collected from South Talus grid units (Table 8.8). Most are clear or amber bottle glass (33.3 percent—probably modern beer bottles) and cans or can fragments (18.5 percent). One cut common nail might predate 1900 but most found are probably later. A mean artifact date of 1890 is probably early for the South Talus historic assemblage.

Table 8.8. South Talus, historic artifact summary, by type, date, and provenience.

North	East	Level	Function	Fragment	Material	Color	Technique	Opening/ Closure	Begin Date	End Date	Count
242.00	146.00	1	Bottle, indeterminate	Body	Glass	Amber	Mold	–	1880	–	1
243.00	147.00	2	Bottle, indeterminate	Body	Glass	Green	Mold	–	1880	–	1
244.00	145.00	5	Scrap	Body	Iron	Brown	Flat, sheet machined	–	–	–	1
244.00	146.00	2	Bottle, indeterminate	Body	Glass	Amber	Mold	–	1880	–	1
244.00	147.00	1	Bottle, indeterminate	Body	Glass	Amber	Mold	–	1880	–	1
244.00	147.00	1	Bottle, indeterminate	Body	Glass	Brown	Mold	–	1880	–	2
244.00	147.00	2	Beer Bottle	Finish	Glass	Amber	Mold	–	1880	–	1
244.00	147.00	2	Bottle, liquor	Finish	Glass	Amber	Mold	–	1880	–	1
244.00	147.00	3	Bottle, indeterminate	Body	Glass	Clear	Mold	–	1880	–	1
244.00	147.00	2	Scrap	Body	Iron	Brown	Flat, sheet machined	–	–	–	1
244.00	148.00	1	Nail, common	Whole	Iron	Brown	Cut	–	1820	1900	1
245.00	145.00	3	Can, indeterminate	Can Top or Bottom	Tinned Steel	Brown	Flat, sheet machined	–	1888	–	3
246.00	145.00	2	Unidentifiable	Unidentifiable	Iron	Brown	Mold	–	–	–	2
246.00	145.00	2	Frog fastener	Whole	Copper	Brown	Cast	–	–	–	1
246.00	145.00	8	Bottle, indeterminate	Body	Glass	Amber	Mold	–	1880	–	1
246.00	146.00	1	Sardine can	Rim	Tinned Steel	Brown	Flat, sheet machined	–	1875	–	1
247.00	145.00	3	Centerfire cartridge	Cartridge	Brass	Brown	Extruded	–	1873	–	1
248.90	144.30	0	Vegetable or fruit can	Whole	Tinned Steel	Brown	Flat, sheet machined	Knife	1904	–	1
249.00	145.00	1	Bottle, indeterminate	Base	Glass	Green	Flat, sheet machined	–	1880	–	1
249.00	146.00	1	Flat glass	Whole	Glass	Green	Flat, sheet machined	–	1888	–	1
250.00	146.00	2	Bottle, indeterminate	Finish	Glass	Amber	Mold	–	1880	–	1
250.00	146.00	2	Bottle, indeterminate	Body	Glass	Amber	Mold	–	1880	–	1
250.00	147.00	2	Tail light	Body	Glass	Red	Mold	–	1920	–	1

Radiocarbon Dates

A single radiocarbon date was obtained for the South Talus. The sample was from the far south end of the site just outside of South Shelter and in a grid unit adjacent to the cliff. Ponderosa pine charcoal returned a most precise date of AD 967–1016 (Chapter 16). This is younger than most of the South Shelter dates and most comparable to a date at the north end of the shelter.

South Talus Summary

Sediments in the South Talus were the general site alluvial deposits with abundant cultural material. Deep gouges in the scoria, rock distributions at the top of the talus, and boulders placed within the shelter area—as well as the total lack of features or other indications of activity areas—indicate massive disturbance and elimination of the site area in front of South Shelter. Projections of the original bedrock contour (Fig. 7.5) indicate that up to a meter of scoria was removed to create the current slope. Because the talus slope was created by mechanical excavation associated with road construction, all of the deposits had to have originated elsewhere on the site. Some could have eroded out of South Shelter—especially the thicker layers adjacent to the shelter. Other sediments could have been pushed from elsewhere in the site during construction. Artifacts such as the strike-a-light flints are unique to South Talus and suggest that they represent parts of the site that are not otherwise represented in the more intact deposits within South Shelter. The presence of domestic animal bones in some of the deeper talus grid units also attests to recent movement of the sediment. Yet the ceramic distribution suggests some of the South Talus artifacts either eroded from South Shelter or were moved from adjacent areas once associated with South Shelter. Glaze ware sherds were found in the 243–244N grid units in both the shelter and talus; cloud blower pieces were found deep in two near-adjacent grid units; wide-necked sherds that were all south of the 244N line in the South Talus were mainly from the south in the shelter; and corrugated sherds were found in the more northern grid units in both. As a result, we cannot say that the South Talus artifacts form a cohesive group of artifacts for comparative purposes—but they do contribute to our knowledge of the site as it once was.

South Shelter

South Shelter was originally estimated to be relatively small, the 8 sq m along the cliff under a slight overhang (Fig. 8.14). It is was open at both ends and not as well defined as North Shelter. During excavation, grid units with relatively flat bottoms and intact fill (as opposed to scraped or redeposited fill) and mainly under the overhang were treated as South Shelter (approximately 31.8 sq m). Adjacent grids with little (north of the 248N grid line) and no overhang (at the 252N line) were also considered part of South Shelter even though the low shelter ceiling would not allow for activities other than sitting or crawling. Ceiling heights varied and were over 1.5 m from the basal scoria to the ceiling in some areas.

Grid units comprising South Shelter extended from 240 to 252N and 142 to 144E (Fig. 8.2; Table 8.9) and include all or parts of 31 grid units. In areas where the shelter extended into the 142E grid units, these were included with the adjacent 143E grid unit because they were either very small or had exposed bedrock with little or no fill to excavate (e.g., Fig. 7.5). All of the South Shelter grid units were completely excavated to bedrock in 5 cm levels, although this is not always evident in Table 8.9 due to intervening rocks and boulders and the constant switching of the grid unit corner used to measure the level.

Excavation within the shelter began as the western extension of the stratigraphic profile trench at 244N. As much as 71 cm of fill was removed (244N/142–143E) from within the shelter portion of the trench. While the trench grid units were being excavated, the talus grid units north of the trench to the north end of the shelter were started (245–251N), clearing the area downslope and into the shelter (Fig. 8.15).

The fill was documented by the main profile trench and a number of north–south and east–west profiles. Much of the South Shelter fill was Stratum 3 (Fig. 7.5); it was damp when excavated and had little evidence of internal stratification (Fig. 8.16). In addition, some of the rocks—ranging from basalt boulders to smaller basalt spalls—were moved within or placed in or at the edge of the shelter during road construction, but which ones was not always evident. Older, long-exposed olivine basalt faces have a buff or brown patina; fresher breaks are

Figure 8.14. South Shelter, prior to excavation and tree removal, view west.

gray. An area of gray cliff rock between 246N–248N (Fig. 8.17) probably represents a geologically recent spall but the lower section has fractures that could be even more recent and construction related (Fig. 8.18). This is particularly relevant because one such boulder (Fig. 8.19) had the dark Stratum 3 alluvial fill on top of, beneath, and behind it. Mainly gray in color, one face of the boulder was covered by the scoria interface layer and small amounts of patinated surface faced outward (east). Charcoal from the fill on top of the boulder (Figs. 8.20, 8.21) has an older radiocarbon date (AD 658–693 [most precise dates]; Chapter 16) than fill from lower levels around the boulder (AD 1222–1287 in Level 7, AD 1169–1270 in Level 10, AD 1039–1210 in Level 13, and AD 1020–1155 in Level 13 [most accurate dates]; Chapter 16). Further, the rockshelter ceiling above the boulder has no scars or unpatinated surfaces. The dating results combined with the lack of shelter scarring (which, if present, would suggest the boulder had fallen from directly above), indicate that the boulder was not in its original location and had likely been placed there by mechanical equipment. The older fill could have been pushed to the back of the shelter and eventually covered the top of the boulder. Yet this is not at all clear from the profile exposed by excavation (Figs. 8.20, 8.21). Other boulders within the shelter were more obviously dumped, or at least rolled into position, during road construction. One large boulder was upside down so that the surface that was facing down before it fell was now facing up, suggesting it had been moved by mechanical equipment (Fig. 8.18).

A slight variation of Stratum 3 (Stratum 3A) and lenses of clean buff-colored fill (Stratum 4) were found in some grid units. Stratum 4 occurred in a restricted area beneath a crack in the ceiling rock and appears to have been fill that filtered down from above (Figs. 7.5, 8.22). Textural differences in Stratum 3 were present in some of the less disturbed grids near the back of the shelter. Figures 8.23 and 8.24 show remnants of Stratum 3a, a pocket of ash, and three distinct fill textures—the central layer is probably due to the rodent disturbance. Textural differences are also

Table 8.9. South Shelter grid units, excavated; highest beginning and lowest ending elevations, with artifact counts, disturbance types, and samples analyzed by level.

North	East	Levels	Beginning Elevations, in meters		Ending Elevations, in meters		Artifacts						Samples Analyzed	Disturbance (lowest level)	Comments
			West	East	West	East	Ceramics	Chipped Stone	Ground Stone	Bone	Historic	Other			
240	143/144	8	12.65	12.42	12.19	11.89	–	8	–	36	–	–	–	R nest, plastic L. 7-R	bedrock SW
	145	4	12.16	11.71	11.76	11.65	–	15	–	22	–	–	F	–	scoria west edge
241	143/144	12	12.53	12.37	12.26	11.71	26	42	3	218	3	1	P, F	R nest, R, sawn wood L. 3	beneath duff
	145	8	12.39	11.76	11.81	11.56	26	45	1	141	–	–	R, F	R nest, glass L. 7	–
242	142/143	4	12.76	12.47	12.55	12.29	–	–	–	4	–	–	–	–	bedrock west portion
	144	16	12.51	12.71	11.77	11.68	23	72	5	290	1	1	R P, F	R nest, R, glass L. 2	fill on top of boulder probably highway dump
	145	9	12.77	11.94	11.68	11.52	23	88	4	219	1	–	P, F	R nest, R, glass L. 2	some fill on top of boulder-probably highway dump
243	142/143	9	12.79	12.42	12.33	11.65	6	17	–	95	4	–	R, F	R, metal L. 4	–
	144	13	12.55	12.54	11.72	11.60	12	92	–	335	2	1	R, F	R nest, glass L. 5; plastic-R L. 12	–
	145	8	12.51	11.69	11.56	11.53	17	84	4	232	1	–	P, F	FT, R, metal, glass L. 4	fill on top of boulder-probably highway dump
244	142/143	8	12.48	12.27	11.84	11.79	11	58	1	243	27	3	F	R, metal L. 4	–
	144	10	12.24	12.14	11.71	11.47	8	176	5	403	10	6	P, F	FT, R, metal, glass L. 4	–
245	143	10	12.29	12.22	11.70	11.65	8	89	3	353	1	–	F	R, glass L. 2	–
	144	10	12.21	12.14	11.60	11.51	24	194	2	510	4	–	F	R, glass, metal L. 2	modern trash in rodent L.9 & 10
246	142/143	9	12.49	12.21	11.80	11.58	2	84	3	224	1	–	F	R nest, R, glass L. 3	–
	144	13	12.22	12.12	11.59	11.46	12	217	2	552	3	1	F	R nest, R, modern trash in L. 7–9	upper disturbed by boulder removal
247	142/143	6	12.41	12.20	12.41	11.94	–	30	–	52	–	–	F	R nest, R	bedrock west side; recent fire on surface
	144	8	12.45	12.06	11.85	11.49	5	55	2	275	1	–	R, F	R	upper disturbed by boulder removal
248	143	1	–	12.43	–	12.02	–	2	1	6	–	–	–	R	bedrock west side
249	143	4	–	12.60	–	12.01	–	9	–	150	2	–	F	R	bedrock west half
250	142	1	12.85	12.83	12.46	12.63	–	1	–	1	–	–	–	–	bedrock west side
	143	4	12.82	12.56	12.24	12.26	–	6	–	146	2	–	RP	R	–
251	142/143	3	12.82	12.45	12.65	12.33	1	21	–	148	–	–	F	R	–
Total		**178**	–	–	–	–	**204**	**1405**	**36**	**4655**	**64**	**13**			

Samples: R = radiocarbon; F = flotation; P = pollen/starch/phytolith.
Disturbance: FT = foot traffic; L = level; MS = mechanical scrape mark; R = rodent.

Figure 8.15. South Shelter, north of 244N after excavation, view west.

Figure 8.16. South Shelter, close-up of fill along the 144E grid line at 245N, view west.

Figure 8.17. South Shelter, light-colored rock between 246N and 248N, view west.

Figure 8.18. South Shelter, detail of light-colored rock showing possible recent impacts and spalling.

Figure 8.19. South Shelter, boulder at 242N, with fill on top, before excavation and showing shelter ceiling above.

Figure 8.20. South Shelter, boulder with Stratum 3 fill on top; grid units 242–243N/145E.

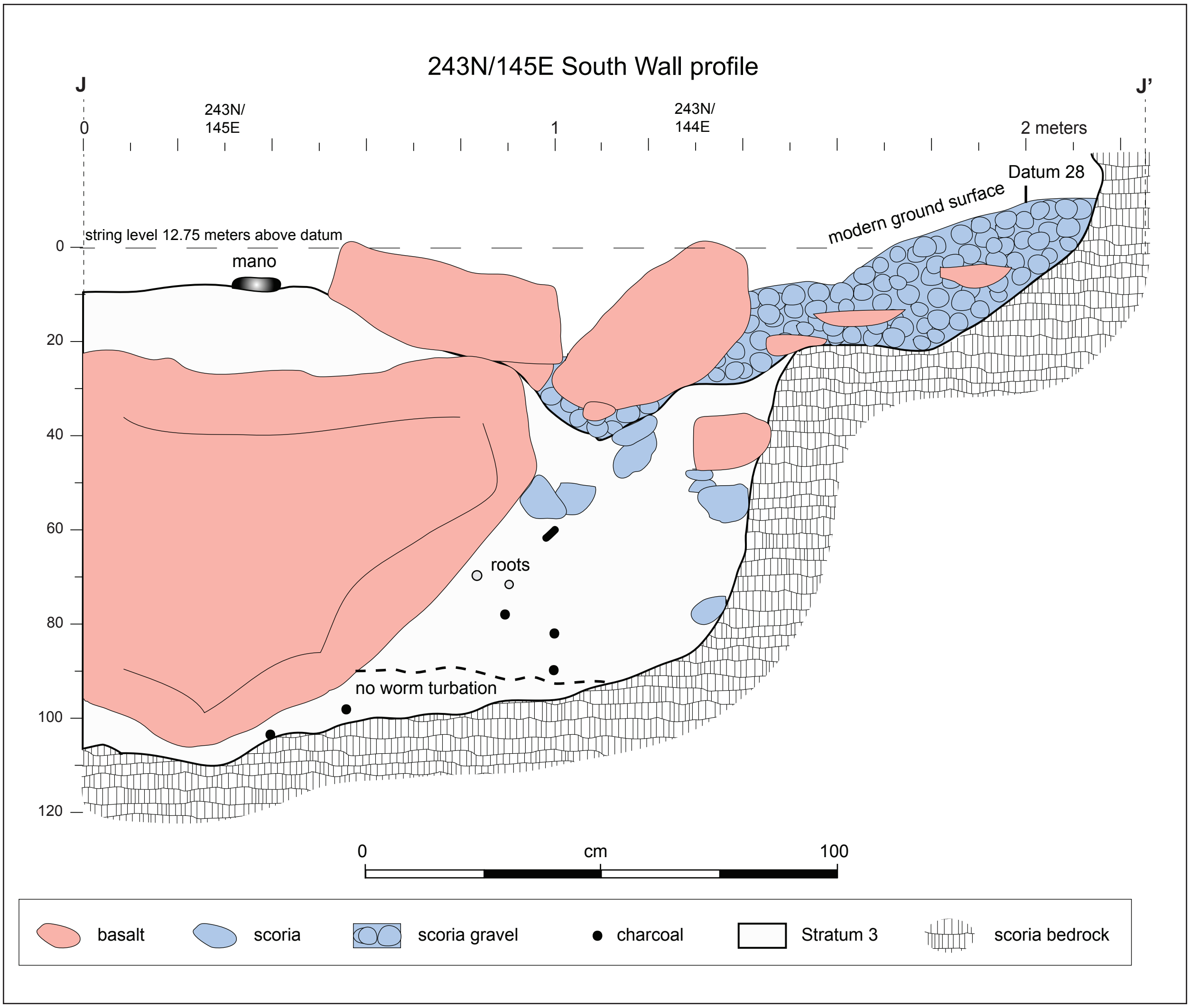

Figure 8.21. South Shelter, east–west profile (J–J') along the 243N grid line, 143–146E, south wall.

evident along the 143E line at 249N to 250E (Figs. 8.25, 8.26). Rodent burrows were common and contributed to the mixing of the sediment.

No features were found, but a group of rocks interrupting Stratum 4 in grid unit 243N/144–145E, Levels 10–13, was treated as a feature until it was determined to be a natural occurrence (Fig. 8.27). Rodent burrowing interrupted the Stratum 4 deposit and the rocks appear to have settled in the depression.

While there is considerable evidence of disturbance within South Shelter, a number of charcoal stains and charcoal and ash stains or pockets were also noted (Table 8.10). These and two packed areas that could represent use surfaces suggest that deposits in some areas retained their integrity in spite of the intermittent alluvial events and worm and rodent activity.

South Shelter Artifacts and Sample Results

Artifacts were common in South Shelter, where 178 levels were excavated (Table 8.9). Because so many of the site grid units and excavated levels were in the South Shelter, it has the highest counts for all artifact types and the most radiocarbon dates and samples analyzed. For certain artifact categories, South Shelter grid units were divided into section groups, and may be discussed as follows: south (240–243N), main (244–246N), and north (247–251N).

Figure 8.22. South Shelter, stratum 4 in the south wall of the A–A′ profile trench (244N/143E), view to south.

Figure 8.23. South Shelter, stratigraphy in west wall of grid units 246–248N/144E, view west.

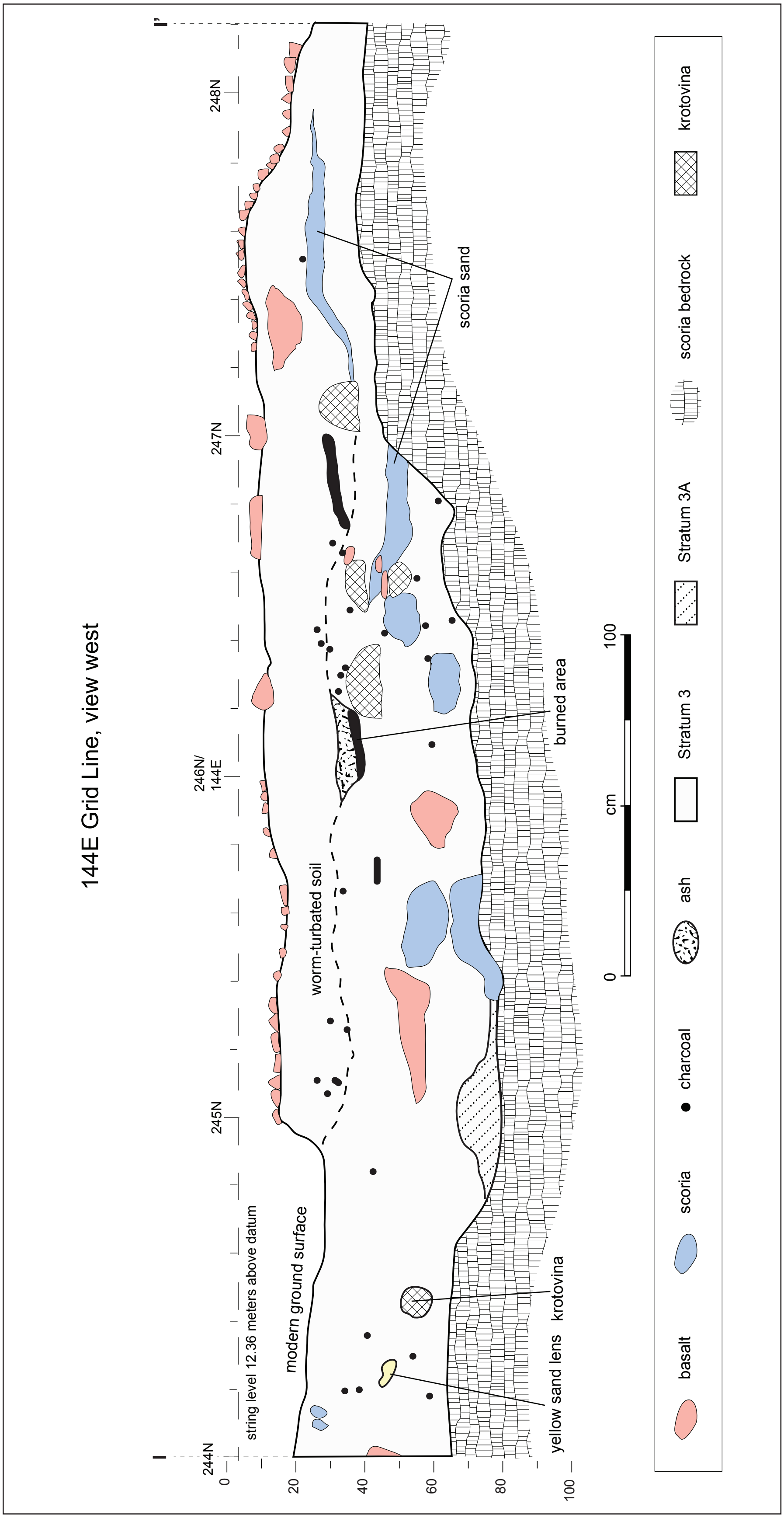

Figure 8.24. South Shelter, north–south profile (I–I') along the 144E grid line, 245–248N; west wall.

Figure 8.25. South Shelter, stratigraphy in west wall of southern half of grid unit 249N/143E, view west.

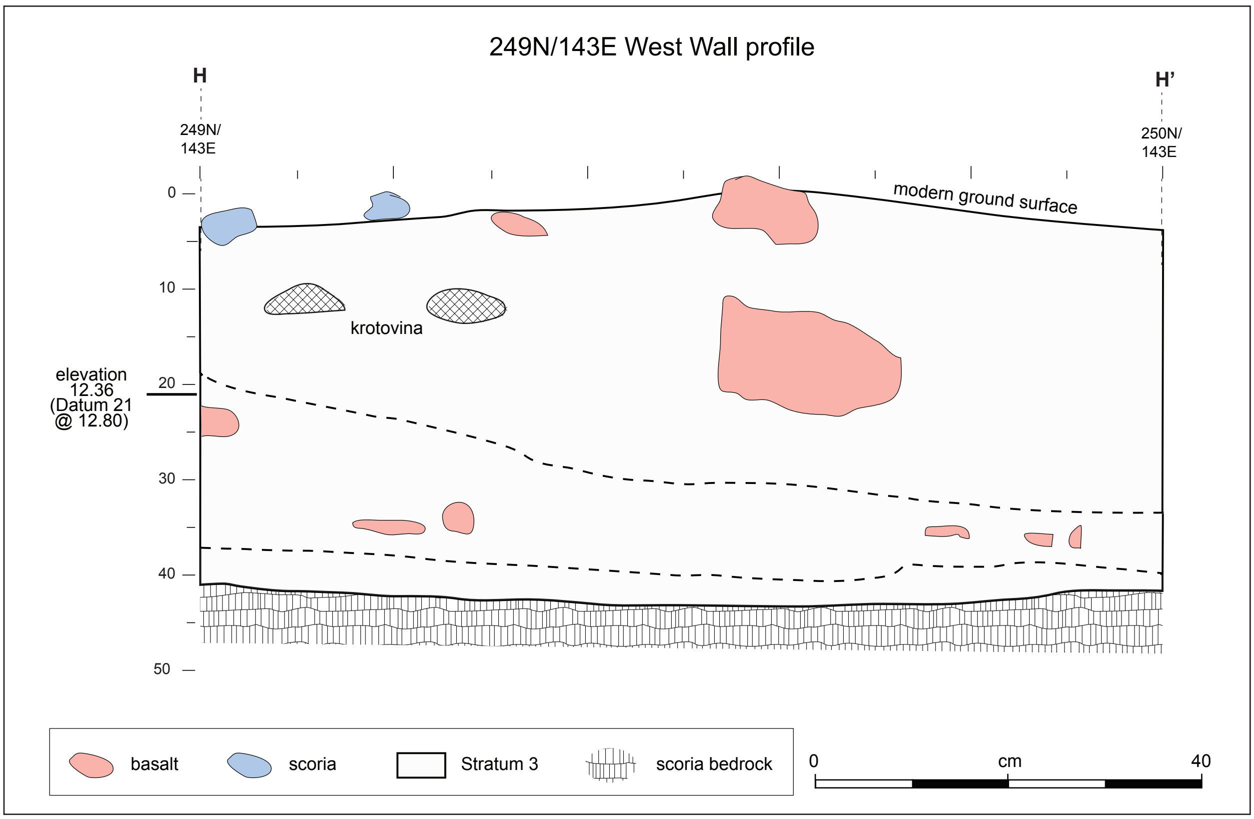

Figure 8.26. South Shelter, north–south profile (H–H'), grid unit 249N/143E; west wall.

Figure 8.27. South Shelter, cluster of rocks in grid units 243N/144–145E.

Table 8.10. South Shelter, charcoal and ash stains, possible use surfaces (summary by provenience).

North	East	Level	Elevation	Description
Charcoal and Ash Stains				
241	144	9	11.97–11.88	eastern half of grid; ash and charcoal stain
241	145	7	11.85	charcoal stain, center of grid, 20 x 50 cm
242	144	7	12.20–12.10	charcoal stain, 60 x 40 cm
242	144	15	11.76	charcoal stain, 10 x 20 cm
243	145	5	11.88–11.33	small pockets between boulders, 3 10 x 10 cm
244	143	2	12.21–12.09	2 stains, 50 x 50 & 50 x 30+ cm
244	143	4	11.99	stain, 20 x 40 cm
244	143	7	11.88–11.84	2 stains, 60+ x 50+, 40+ x 12+ cm
245	143	4	12.06	charcoal concentration, 40 x 50 cm
245	143	6	11.97–11.94	charcoal concentration, 50 x 50 cm
246	143	4	12.11–12.09	charcoal stain, 20 x 20 cm
246	143	6	12.03–11.98	charcoal and ash, 90 x 40 cm
246	144	5	11.96–11.91	ash, 40 x 20 cm
247	144	6	11.90	stain, 25 x 8+ cm
250	143	3–4	12.50–12.36	charcoal and burned bone in SE corner
Possible Use Surfaces				
244	144	5	11.89-11.91	northern thrid of grid
245	144	4	11.95	southwest portion of grid

Ceramics

South Shelter has the largest sample of ceramic artifacts but only three unique types or traditions (Glaze Unpainted Yellow and Red Slip, Cieneguilla Glaze-on-yellow, and polished smudged), the rest were found in at least one other area. It has the lowest proportion of plain body sherds (54.1 percent). Except for the glaze wares, all of the pottery types can be placed in the Taos tradition, where most of the temper is leucocratic igneous or leucocratic igneous with mica (Table 8.11). More of the South Shelter sherds are from bowls but jars remain the most common vessel type (Table 8.12). The cloud blower sherds were found in grids 244N/144E Level 7 and 245N/145E Level 5, near those found in the South Talus.

Glaze ware sherds were mainly found in 244–246N/143–144E with the exception of a single sherd in 243N/143E. All are from upper to middle levels of fill. Corrugated types are slightly more common in the more northerly grid units (12 were south of the 245N grid line and 16 were north). Wide neckbanded, Taos Incised, and coiled necked types were more common to the south (33 versus 5) with none found in the 244N through 246N grid units. Polished smudged sherds were found in Level 6 of 243N/144E and Level 3 of 244N/144E.

Chipped Stone

The South Shelter produced the largest sample of chipped stone items (n = 1405, or 40.4 percent of the total chipped stone) recovered from 178 levels of fill (Table 8.13). Compared to the other areas, relative proportions of debitage, cores, core tools, cobble tools, unifaces, and bifaces are similar. Most of the South Shelter assemblage is core flakes (72.9 percent) with a larger proportion of biface flakes (11.5 percent) than any other area. Other debitage types include angular debris (3.6 percent), notching flakes (2.2 percent), hammerstone flakes (0.8 percent), and potlids (0.4 percent). Cores are relatively rare and most are unidirectional (n = 16), with single examples of bidirectional and multidirectional. Single choppers, drills, gravers, and a scraper-graver were found along with end (n = 5), side (n = 2), and end/side (n = 4) scrapers. Bifaces (n = 11), projectile point preforms (n = 34), stemmed projectile points (n = 1), small side-notched projectile points (n = 22), and eccentric points (n = 4) were more common than expected given that 40.5 percent of the chipped stone came from South Shelter. Small projectile points (n = 9), small-stemmed projectile points (n = 1), small corner-notched projectile points (n = 11), and En Medio points (n = 1) are less frequent than expected.

Fewer activities are indicated for the South Shelter assemblage than for the smaller samples from South Talus and North Talus. Core reduction, projectile point manufacture, arrow-shaft refurbishing, hunting, and meat processing are all indicated. Other activities include woodworking, general scraping, and general cutting (Chapter 10).

The most common material type is chert (41.0 percent), followed by silicified wood (16.4 percent), obsidian (11.7 percent), and basalt/andesite (10.6 percent). Less abundant materials include metaquartzite (7.5 percent), rhyolite (6.9 percent), quartz (5.3 percent), and rare occurrences of limestone (0.4 percent) and orthoquartzite (0.1 percent). Most of the cores are chert (33.3 percent) or silicified wood (38.9 percent), with single cores of obsidian, basalt/andesite, and metaquartzite, and two of quartz. Cobble tools (n = 1 each) were of chert and rhyolite. Other tools were mainly chert (61.5 percent) or silicified wood (23.1 percent), with single examples of obsidian and basalt/andesite (7.7 percent). Bifaces and projectile points were mainly made of chert (35.4 percent), obsidian (31.3 percent), or basalt/andesite (19.8 percent), with fewer of silicified wood (4.2 percent), rhyolite (10 percent), metaquartzite (5.2 percent), orthoquartzite (2.1 percent), or quartz (1.0 percent).

Spatially, grid units with the most bifaces and projectile points were 245N/144E (n = 13 in 10 levels), 246N/143E (n = 10 in 9 levels), and 246N/144E (n = 18 in 13 levels). Cores are most common in grid units 244N/144E (n = 5 in 10 levels) and 245N/143E (n = 3 in 10 levels) and unifaces in 245N/144E (n = 3 in 10 levels) and 246N/144E (n = 4 in 13 levels). As with South Talus, the amount of chipped stone, debitage, cores, unifaces, and projectile points is highly correlated with the number of excavated levels (Table 8.14). Again, the distribution suggests a fairly random distribution. The only grid unit with what might be a related set of artifacts is Level 9 in 244N/144E with three cores and a uniface; however, no stains or possible activity areas were noted at this level in this grid unit (Table 8.10).

Table 8.11. South Shelter, temper by pottery type; counts and percents.

Tradition	Taos														Middle Rio Grande		Total	
Temper	Indeterminate		Leuococratic igneous w/ mica		Leuococratic igneous		Fine tuff and sand		Fine sand, silt, and mica		Self tempered		Fine sand or silt		Latitite			
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Glaze yellow/ cream slipped (unpainted)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	100.0	**8**	**100.0**
Glaze-on-yellow cream	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	100.0	**5**	**100.0**
Glaze Unpainted Yellow and Red Slip	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Cienequilla Glaze-on-yellow	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Plain rim	–	–	2	100.0	–	–	–	–	–	–	–	–	–	–	–	–	**2**	**100.0**
Unknown rim	–	–	–	–	–	–	–	–	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Plain body	1	0.9	34	30.6	75	67.6	–	–	1	0.9	–	–	–	–	–	–	**111**	**100.0**
Wide Neckbanded	–	–	1	10.0	9	90.0	–	–	–	–	–	–	–	–	–	–	**10**	**100.0**
Wide Neckbanded (wiped or undulated)	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
(Taos) Incised Gray	–	–	5	45.5	6	54.5	–	–	–	–	–	–	–	–	–	–	**11**	**100.0**
Coiled Necked	–	–	–	–	16	100.0	–	–	–	–	–	–	–	–	–	–	**16**	**100.0**
Indented Corrugated	–	–	–	–	5	100.0	–	–	–	–	–	–	–	–	–	–	**5**	**100.0**
Smeared Plain Corrugated	–	–	13	65.0	7	35.0	–	–	–	–	–	–	–	–	–	–	**20**	**100.0**
Smeared Indented Corrugated	–	–	1	33.3	2	66.7	–	–	–	–	–	–	–	–	–	–	**3**	**100.0**
Polished gray	–	–	1	25.0	3	75.0	–	–	–	–	–	–	–	–	–	–	**4**	**100.0**
Polished Smudged	–	–	–	–	3	100.0	–	–	–	–	–	–	–	–	–	–	**3**	**100.0**
Unpainted undifferentiated	–	–	–	–	–	–	2	66.6	–	–	–	–	1	33.3	–	–	**3**	**100.0**
Total	**1**	**0.5**	**57**	**27.8**	**127**	**62.0**	**2**	**1.0**	**1**	**0.5**	**1**	**0.5**	**1**	**0.5**	**15**	**7.3**	**205**	**100.0**

Table 8.12. South Shelter, vessel form by pottery type; counts and percents.

Pottery Type	Bowl Rim		Bowl Body		Jar Neck		Jar Rim		Jar Body		Indeterminate Coil Handle		Cloudblower		Body Sherd, Polished Interior/Exterior		Jar Rim with Coil Handle		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Glaze yellow/cream slipped (unpainted)	–	–	8	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**8**	**100.0**
Glaze-on-yellow cream	–	–	5	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**5**	**100.0**
Glaze Unpainted Yelow and Red Slip	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Cienequilla Glaze-on-yellow	1	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Plain rim	–	–	–	–	–	–	1	50.0	–	–	–	–	–	–	–	–	1	25.0	**2**	**100.0**
Unknown rim	–	–	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Plain body	–	–	–	–	5	4.5	2	1.8	102	91.9	1	0.9	1	0.9	–	–	–	–	**111**	**100.0**
Wide Neckbanded	–	–	–	–	4	40.0	1	10.0	5	50.0	–	–	–	–	–	–	–	–	**10**	**100.0**
Wide Neckbanded (wiped or undulated)	–	–	–	–	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	**1**	**100.0**
(Taos) Incised Gray	–	–	–	–	9	81.8	–	–	2	18.2	–	–	–	–	–	–	–	–	**11**	**100.0**
Coiled Necked	–	–	–	–	1	6.3	–	–	15	93.8	–	–	–	–	–	–	–	–	**16**	**100.0**
Indented Corrugated	–	–	–	–	4	80.0	–	–	1	20.0	–	–	–	–	–	–	–	–	**5**	**100.0**
Smeared Plain Corrugated	–	–	–	–	3	15.0	1	5.0	16	80.0	–	–	–	–	–	–	–	–	**20**	**100.0**
Smeared Indented Corrugated	–	–	–	–	1	33.3	–	–	2	66.7	–	–	–	–	–	–	–	–	**3**	**100.0**
Polished gray	–	–	2	50.0	–	–	–	–	–	–	–	–	1	25.0	1	25.0	–	–	**4**	**100.0**
Polished Smudged	1	33.3	2	66.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**100.0**
Unpainted undifferentiated	2	66.7	1	33.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**100.0**
Total	**4**	**2.0**	**19**	**9.3**	**27**	**13.2**	**6**	**2.9**	**144**	**70.2**	**1**	**0.5**	**2**	**1.0**	**1**	**0.5**	**1**	**0.5**	**205**	**100.0**

Table 8.13. South Shelter, chipped stone, counts by type and grid unit.

North	East	Angular debris	Flake	Utilized debitage	Chopper	Drill	Graver	Unutilized core	Scraper-graver	Uniface	End scraper	Side scraper	End/ side scraper	Biface	Projectile point preform	Small point	Small stemmed point	Small corner-notched point	Small side-notched point	En Medio point	Eccentric point	Total
240	144	1	6	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	**8**
	145	–	15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**15**
241	144	4	30	–	–	–	–	1	–	–	–	–	–	1	5	–	–	–	1	–	–	**42**
	145	3	38	–	–	–	–	1	–	–	–	–	–	–	–	–	–	2	–	–	1	**45**
242	144	1	67	1	–	–	–	1	–	–	–	–	–	–	1	–	–	–	–	–	1	**72**
	145	4	80	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	2	–	–	**88**
243	143	2	12	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	–	–	**17**
	144	4	78	–	–	–	–	2	–	–	–	–	–	1	4	1	–	–	2	–	–	**92**
	145	2	73	1	–	–	–	–	–	–	–	–	–	–	4	–	–	2	2	–	–	**84**
244	143	2	51	–	–	–	1	1	–	–	–	–	–	–	1	–	–	–	2	–	–	**58**
	144	4	158	–	–	–	–	5	–	–	1	1	–	3	–	1	–	1	–	1	1	**176**
245	143	5	76	–	–	–	–	3	–	–	–	–	–	–	3	–	–	1	1	–	–	**89**
	144	3	174	1	–	–	–	–	–	–	2	–	1	–	6	–	1	1	4	–	1	**194**
246	143	2	69	1	–	–	–	1	–	1	–	–	–	2	3	1	–	–	4	–	–	**84**
	144	6	187	–	–	1	–	1	1	–	2	–	2	3	3	4	1	3	3	–	–	**217**
247	143	–	28	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	**30**
	144	–	49	2	–	–	–	–	–	–	–	1	–	1	2	–	–	–	–	–	–	**55**
248	143	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**2**
249	143	–	8	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	**9**
250	142	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**
	143	2	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**6**
251	143	–	20	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**21**
Total		**46**	**1225**	**6**	**1**	**1**	**1**	**18**	**1**	**1**	**5**	**2**	**4**	**11**	**34**	**9**	**1**	**11**	**22**	**1**	**4**	**1405**

Table 8.14. South Shelter correlation coefficients for chipped stone types.

		Levels	Total chipped stone	Debitage	Cores	Cobble tools	Uniface	Projectile points
Levels	Pearson Correlation	1.000	0.646**	0.642**	0.481*	0.021	0.328	0.639**
	Sig. (2-tailed)	–	0.001	0.001	0.020	0.924	0.126	0.001
	N	23	23	23	23	23	23	23
Total chipped stone	Pearson Correlation	0.646**	1.000	0.999**	0.512*	0.293	0.820**	0.890**
	Sig. (2-tailed)	0.001	–	0.000	0.013	0.175	0.000	0.000
	N	23	23	23	23	23	23	23
Debitage	Pearson Correlation	0.642**	0.999**	1.000	0.513*	0.285	0.814**	0.874**
	Sig. (2-tailed)	0.001	0.000	–	0.012	0.188	0.000	0.000
	N	23	23	23	23	23	23	23
Cores	Pearson Correlation	0.481*	0.512*	0.5130*	1.000	-0.074	0.204	0.313
	Sig. (2-tailed)	0.020	0.013	0.012	–	0.737	0.351	0.145
	N	23	23	23	23	23	23	23
Cobble tools	Pearson Correlation	0.021	0.293	0.285	-0.074	1.000	0.419*	0.317
	Sig. (2-tailed)	0.924	0.175	0.188	0.737	–	0.046	0.140
	N	23	23	23	23	23	23	23
Uniface	Pearson Correlation	0.328	0.820**	0.814**	0.204	0.419*	1.000	0.760**
	Sig. (2-tailed)	0.126	0.000	0.000	0.351	0.046	–	0.000
	N	23	23	23	23	23	23	23
Projectile points	Pearson Correlation	0.639**	0.890**	0.874**	0.313	0.317	0.760**	1.000
	Sig. (2-tailed)	0.001	0.000	0.000	0.145	0.140	0.000	–
	N	23	23	23	23	23	23	23

**	= Correlation is significant at the 0.01 level (2-tailed).
*	= Correlation is significant at the 0.05 level (2-tailed).

Ground Stone

More ground stone tools were recovered from South Shelter than any other area (n = 36; Table 8.15). Manos comprise less than a third of the fragments (n = 11; 30.6 percent) with nearly as many abraders (25.0 percent) and more metates and metate fragments (16.7 percent) than the South Talus. Manos were again mainly orthoquartzite (54.5 percent) and micaceous schist (36.4 percent). More were made from cobbles (63.7 percent) than slabs (9.1 percent) with the rest indeterminate (27.3 percent). Few were complete (27.3 percent) and just over half had been exposed to heat (54.5 percent).

Both basin and slab metates were found along with a preform and indeterminate fragments. The preform was flaked along much of the edge and the bottom is ground but does not show grinding wear. It is the only complete metate. Materials include the local olivine basalt, vesicular basalt, sandstone, and schist. Only two have evidence of exposure to heat.

Abraders are the second most common ground stone artifact category (n = 9; 25.0 percent). Most are smooth abraders (n = 6), with fewer that are coarse (n = 2), and one a flaked abrader. All of the abraders were made from cobbles of a variety of materials, none with more than one or two examples. Fewer than half (44.4 percent) have evidence of heat exposure.

Other types include a polishing stone, a hammerstone, and two manuports. All were made from cobbles and none have evidence of heat exposure.

Ground stone tools occurred throughout the shelter area from the surface to the lowest levels. Rarely were more than one object found in a grid unit at the same level (Table 8.9) and these were either fragments, or in one case, a mano and a mano fragment. In general, the distribution does not suggest discrete activity areas but rather an area primarily used for trash disposal and perhaps for caching objects between visits to the site area.

Table 8.15. South Shelter, ground stone summary, by type, material, and provenience.

Artifact type	Condition	Material	North	East	Level
Smooth abraders	Whole	Metaquartzite	241	144	3
Flaked abrader	Whole	Micaceous schist	241	144	11
Coarse abraders	Corner(s) only missing	Orthoquartzite	241	145	3
Metate, basin	End chipped	Basalt	241.8	144.65	3
Smooth abraders	Corner fragment	Micaceous schist	242	144	4
Stone ball	Whole	Metaquartzite	242	144	6
Indeterminate, fragmentary	Surface flake	Basalt	242	144	14
Indeterminate, fragmentary	Edge fragment	Orthoquartzite	242	145	4
Metate, nfs	Internal fragment	Sandstone	242	145	5
Metate, nfs	Internal fragment	Sandstone	242	145	7
Indeterminate, fragmentary	Surface flake	Orthoquartzite	242	145	9
Metate preform	Whole	Basalt	242.54	144.42	4
Mano, nfs (fragmentary)	Corner fragment	Orthoquartzite	242.75	144.85	0
One-hand mano	Edge fragment	Micaceous schist	243	145	3
Mano, nfs (fragmentary)	Medial fragment	Orthoquartzite	243	145	7
Smooth abraders	End fragment	Metaquartzite	243	145	8
Metate, slab	Corner fragment	Micaceous schist	243.9	145.1	13
Coarse abraders	End fragment	Sandstone	244	143	2
Polishing stone, nfs	End fragment	Basalt	244	144	1
Smooth abraders	Whole	Metaquartzite	244	144	1
Two-hand mano, slab	End fragment	Micaceous schist	244	144	6
Indeterminate, fragmentary	End fragment	Orthoquartzite	244	144	8
Metate, nfs	Internal fragment	Sandstone	244	144	8
One-hand mano	Whole	Orthoquartzite	245	143	6
Indeterminate, fragmentary	Surface flake	Micaceous schist	245	143	7
Mano, nfs (fragmentary)	Surface flake	Orthoquartzite	245	143	10
One-hand mano	Corner fragment	Orthoquartzite	245	144	7
Smooth abraders	Edge fragment	Orthoquartzite	245	144	9
Smooth abraders	Whole	Metaquartzite	246	143	3
Mano, nfs (fragmentary)	End fragment	Sandstone	246	143	6
One-hand mano	Whole	Micaceous schist	246	143	6
Indeterminate, fragmentary	Internal fragment	Metaquartzite	246	144	4
One hand mano preform	Whole	Micaceous schist	246	144	10
Manuport	End fragment	Micaceous schist	247	144	3
Mano, nfs (fragmentary)	Internal fragment	Orthoquartzite	247	144	8
Hammerstone	Whole	Quartz	248	143	1

nfs = not further specified.

Bone

More bone was found in South Shelter grid units (n = 4655) than any other site area. Dividing South Shelter into three sections (south: 240–243N, main: 244–246N, and north: 247–251N) and into three groups of fill levels (Levels 1–3; Levels 4–9; and Levels 10–16), Table 8.16 shows some differences between these grid and level groups. The south section has little variation in the proportions of the animal groups but the main section of the shelter (244–246N) shows an increase in the proportion of small mammals with depth. The north section has more small mammal bone in the upper fill levels but relatively little in the lower fill levels. Proportions of large artiodactyl bone are consistently higher in the upper levels of fill for all divisions.

Domestic animal bones (n = 22)—their presence might indicate disturbance—were found in all three sections of the shelter. The single cattle specimen from South Shelter was found in Level 2 of a south section grid unit, as were seven sheep or goat specimens. Most came from Levels 2 and 3, with one from Level 4. Fewer (n = 7) were from the main section. Again, these were mainly in Levels 2 and 3, with a single specimen from Level 5. The more northern grid units contained six specimens, one each from the surface to Level 5.

Table 8.16. South Shelter, fauna summary, by subdivision and grid unit/level; counts and percents.

Levels	Small Mammal		Medium Artiodactyl		Large Artiodactyl		Total	
	n =	%	n =	%	n =	%	n =	%
Grid Units 240-243N								
1–3	29	12.4	191	82.0	13	5.6	**233**	**100.0**
4–9	119	14.7	652	80.5	39	4.8	**810**	**100.0**
10–16	52	12.5	347	83.4	17	4.1	**416**	**100.0**
Group Total	200	13.7	1190	81.6	69	4.7	**1459**	**100.0**
Grid Units 244-246N								
1–3	17	6.0	259	90.9	9	3.2	**285**	**100.0**
4–9	177	10.9	1400	85.8	54	3.3	**1631**	**100.0**
10–13	23	12.4	159	85.5	4	2.2	**186**	**100.0**
Group Total	217	10.3	1818	86.5	67	3.2	**2102**	**100.0**
Grid Units 247-251N								
1–3	72	20.9	255	74.1	17	4.9	**344**	**100.0**
4–8	28	9.2	270	88.2	8	2.6	**306**	**100.0**
Group Total	100	15.4	525	80.8	25	3.8	**650**	**100.0**
Total								
	517	**12.3**	**3534**	**83.9**	**162**	**3.8**	**4213**	**100.0**

Even though South Shelter is somewhat protected, small amounts of bone are sun-bleached or weathered and the degree decreases with depth. In the south section, the proportion of weathering decreases from 18.3 to 15.4 then 14.5 percent; in the main section from 12.6 to 11.2 to 9.5 percent; and in the north section from 16.4 to 9.1 percent. Small amounts of carnivore and rodent gnawing are found throughout. Carnivore gnawing is always less than 2.0 percent (ranging from 0.4 to 1.6 percent), while rodent gnawing is slightly more common (ranging from 0.7 to 2.4 percent). Possible scat is most common in the north section (3.4 percent), with less in the other two divisions (0.9 percent of the south section and 0.6 percent in the main section). Decidedly more of the main-section bone is burned (Table 8.17) in all level groups. This is true for both the discarded or heavily burned bone and the scorched and possibly roasted bone. The greater extent of burning in the main section probably indicates more intense use and discard in the central part of the shelter.

South Shelter had the largest number of worked bone objects (n = 24). Awls were the most common artifact type (n = 10); half are essentially complete. Grid unit 242N/145E had three of the awls (two complete) but these were found in Levels 2, 4, and 7 and cannot be considered part of an activity area. Other worked bone types include manufacturing debris (n = 1), small fragments (n = 1), a long bone with use wear and polish, small tubular beads (n = 3), a possible pendant blank or gaming piece, antler flakers (n = 2), and a spatulate-like object with a large flake or notch in the working surface. Few of these objects are burned. This combined with the relatively large proportion of complete objects may indicate that deposits within the shelter included more than refuse.

Microbotanical and Macrobotanical Remains

Samples analyzed from South Shelter include flotation (n = 76), sediment pollen (n = 3), pollen and starch (n = 6), and phytolith and starch (n = 2). Except for probable aster family, all of the plants represented by charred plant parts other than wood from the site were found in this shelter. Those found in a significant number of samples include amaranth (n = 26 samples), cheno-am (n = 61 samples), goosefoot (n = 65 samples), corn (n = 33 samples), grass (n = 33 samples), sedge (n = 11 samples), Douglas fir (n = 51 samples), and ponderosa pine (n = 51 samples). Also present was a single tobacco seed, a piece of buffalo gourd or squash rind, yucca seed, hedgehog cactus seeds, and a range of other plants (Chapter 13, this report). Ponderosa pine was

Table 8.17. South Shelter, burned bone summary, by subdivision and grid unit/level; counts and percents.

Levels	Unburned		Discard burn		Roasting burn/scorch		Boiled?		Deliberate partial burn		Partial		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Grid Units 240-243N														
1–3	165	65.7	83	33.1	3	1.2	–	–	–	–	–	–	**251**	**100.0**
4–9	537	60.1	336	37.6	15	1.7	3	0.3	2	0.2	–	–	**893**	**100.0**
10–16	291	65.0	146	32.6	9	2.0	–	–	–	–	2	0.4	**448**	**100.0**
Group Total	993	62.4	565	35.5	27	1.7	3	0.2	2	0.1	2	0.1	**1592**	**100.0**
Grid Units 244-246N														
1–3	144	46.5	158	51.0	8	2.6	–	–	–	–	–	–	**310**	**100.0**
4–9	746	42.3	927	52.6	83	4.7	1	0.1	1	0.1	4	0.2	**1762**	**100.0**
10–13	104	49.3	98	46.4	9	4.3	–	–	–	–	–	–	**211**	**100.0**
Group Total	994	43.5	1183	51.8	100	4.4	1	0.0	1	0.0	4	0.2	**2283**	**100.0**
Grid Units 247-251N														
1–3	307	66.9	133	29.0	17	3.7	1	0.2	–	–	1	0.2	**459**	**100.0**
4–8	206	64.6	108	33.9	5	1.6	–	–	–	–	–	–	**319**	**100.0**
Group Total	513	65.9	241	31.0	22	2.8	1	0.1	–	–	1	0.1	**778**	**100.0**
Total														
	2502	**53.7**	**1989**	**42.7**	**149**	**3.2**	**5**	**0.1**	**3**	**0.1**	**7**	**0.2**	**4655**	**100.0**

the most common wood taxa, found in 95.0 percent of the flotation, macrobotanical, and wood samples. Oak was also common (77.0 percent), as was c.f. alder (53.0 percent) (Chapter 13, this report).

In addition to the charred plant remains, charred rodent pellets (App. 4.1) were found in 28 (36.8 percent) of the flotation samples and rodent pellets in general were absent in 23 (30.3 percent). Charred rodent pellets are most common in the north section of the South Shelter grid units (247–251N), where all but one sample had charred rodent pellets (87.6 percent) and these were found from Level 1 to the base at Level 7. Charred pellets were not as common in the south (240–243N) or main (244–246N) sections of South Shelter. At the south end, none were found in the upper fill levels (Levels 1–3) and the proportion of samples with burned pellets increased with depth (27.3 percent of the 11 samples from Levels 4–9; 50.0 percent of the 6 samples from Levels 10–16). The same is true for the main section of the shelter (10.0 percent of the 10 samples from Levels 1–3; 36.4 percent of the 33 samples in Levels 4–9; 40.0 percent of the 5 samples from Levels 10–13). It is hard to speculate how the burned rodent pellets became incorporated in the shelter fill unless the accumulated rodent debris was routinely burned when groups returned to the shelter or that proximity to features or hot coals caused the burning. Furthermore, the proportion of South Talus samples with burned rodent pellets (31.6 percent) and that for North Shelter is essentially the same (30.2 percent).

Uncharred plant remains were commonly found in the South Shelter flotation samples (App. 4.2) and include many of the same taxa as were found charred. Plants found only as uncharred remains include spurge (n = 11 samples), stickleaf (n = 8 samples), wild lettuce (n = 3 samples), and single occurrences of tumbleweed, nightshade family, brome, strawberry, and spiderling. No burned acorn shells were found in the South Shelter Levels 5–15 samples but unburned specimens were present in six of the 20 samples from the south section (30.0 percent), in fewer of the shelter's main-section samples (11 of 47 or 23.4 percent, all but one from deeper levels of fill), and two of nine (22.2 percent, all from Levels 4 and 6) of those from the north section. Acorn caps and shell were also collected as macrobotanical samples from the upper two levels of three of the north-section grid units. While many of the acorn pieces may have been introduced by rodents, some may have been food debris left by humans.

South Shelter sediment pollen samples were taken from Levels 1, 3, and 7 of the same grid unit (243N/145E). Ponderosa pine, grass, cheno-am, aster, pea, and nightshade pollen are common to all three samples. Cattail, piñon pine, alder, mustard, spurge, rose, and Mormon tea pollen were found in two, and lily, spruce, sagebrush, and willow pollen in one. The greatest concentration of corn pollen was from the Level 1 sample. Pollen washes of ground stone objects (two manos and a metate fragment) did not contain pollen (Phillips, Chapter 14).

Washes from a smooth abrader, a basin metate, a slab metate fragment, and a one-hand mano were examined for pollen and starch grains. All four samples had pollen that reflects the local environment—pine, sage, high-spine aster, and grass. The amount of Mormon tea pollen in the basin metate sample suggests grinding for medicinal use. Aggregates of sage and grass in that same sample suggest it was also used for grinding these plants. The smooth abrader sample also had aggregates of grass pollen suggesting it was used for processing grass. More interesting is the presence of muscle fiber in that sample indicating it was also used for processing meat. The slab metate fragment sample had large amounts but no aggregates of grass pollen and was probably used for grinding grass and possibly mustard. The mano sample had aggregates of grass pollen. Only the basin metate had lenticular starch grains indicative of cool season grasses. The smooth abrader and basin metate had spores from ferns—probably due to the shady protected area of the shelter. Washes from a mano fragment and a flaked abrader were examined for starch and phytoliths. Both had forms typical of cool and warm season grasses (Cummings and Varney, Chapter 14).

Other Artifacts (Shell)

The South Shelter has the largest number of other artifacts but the majority are small pieces of unworked shell that could be fragments of shell ornaments or raw material. It is also possible that species of bivalves once lived in Coyote Creek and were either used as food items or fragmented shells were carried into the shelter in the alluvium. The pondhorn mussel (*Uniomerus tetralasmus*), paper pondshell (*Utterbackia imbecillis*), and giant floater mussel (*Pyganodon grandis*) are noted for San Miguel county or the Canadian River drainage (Bison-M, accessed January 29, 2016). Also found were a crinoid and two pieces of limonite.

Historic Artifacts

Modern glass, plastic, and other obvious intrusive objects were not collected. These were noted in the grid unit forms and only those objects that could potentially provide information on dating the historic use of the shelter or how it was used during the historic period were collected (Table 8.18). As fitting for the largest excavation area, more historic artifacts were recovered from South Shelter than any other area (n = 64). Most are pieces of green or amber bottle glass (17.2 percent) or cans or can fragments (56.3 percent). Fencing material (wire, stables) comprises much of the rest. Bottle glass is the most common historic item found at both ends of the shelter while cans and can fragments are common in the more central grid units. Most of the historic items have beginning dates in the late 1800s into the early 1900s; only one has an end date (1920). Again, a mean artifact date of 1881 seems early for the assemblage.

Radiocarbon Dates

South Shelter radiocarbon dates include three on sediment, two on charcoal from the north end of the shelter, and a series of five on charcoal from different levels of the same grid unit in the main section of the shelter. The sediment date from near the south end of the shelter (241N/145E) was most accurately dated at AD 1311–1359 or 1387–1434, the latest date for the shelter and the site (Chapter 16). The other two sediment samples taken from the main South Shelter profile (Fig. 7.5) returned dates of AD 771–903 for the sample farther back in the shelter, and AD 1246–1302 for one about a meter to the east (most accurate dates, Chapter 16).

Two dates were obtained for the north end of the shelter. A sample from Level 4 in grid unit 250N/143 has a most precise date of AD 901–921 or 950–996; one south of that, in Level 3 of 247N/144E, dated considerably later, with a most precise date of AD 1268–1294 (Chapter 16).

Grid unit 242N/144E was chosen for a series of dates because it included fill on top of a boulder as well as fill beside and beneath it. Fill on top of the boulder was most precisely dated at AD 658–693; fill in Level 7 was most precisely dated at AD 1252–1283; Level 10 most precisely dated at AD 1215–1260; Level 13 most accurately at AD 1039–1210; and Level 16 most accurately dated at AD 1020–

Table 8.18. South Shelter, historic artifact summary, by type, date, and provenience.

North	East	Level	Function	Fragment	Material	Color	Technique	Seams	Opening/ Closure	Begin Date	End Date	Total
241	144	3	Bottle, indeterminate	Body	Glass	Green	Mold	–	–	1880	–	**2**
241	144	7	Bottle, indeterminate	Body	Glass	Clear	Mold	–	–	1880	–	**1**
242	144	4	Bottle, indeterminate	Body	Glass	Green	Mold	–	–	1880	–	**1**
242	145	2	Bottle, indeterminate	Base	Glass	Amber	Mold	–	–	1880	–	**1**
243	143	4	Sheet/flat metal	Body	Iron	Brown	Flat, sheet machined	–	–	1888	–	**4**
243	144	4	Wire	Section	Iron	Brown	Drawn	–	–	1867	–	**1**
243	144	4	Can	Lid	Tinned steel	Brown	Flat, sheet machined	–	–	1904	–	**1**
243	145	3	Strap/band/strip	Body	Iron	Brown	Flat, sheet machined	–	–	1888	–	**1**
244	143	0	Vegetable or fruit can	Whole	Tinned steel	Brown	Flat, sheet machined	Locked and lapped	–	1904	–	**1**
244	143	1	Sardine can	Base and body	Tinned steel	Brown	Flat, sheet machined	–	Knife	1875	–	**1**
244	143	1	Can	Body	Tinned steel	Brown	Flat, sheet machined	–	–	1904	–	**15**
244	143	1	Vegetable or fruit can	Rim and body	Tinned steel	Brown	Flat, sheet machined	–	–	1904	–	**2**
244	143	1	Vegetable or fruit can	Can top or bottom	Tinned steel	Brown	Flat, sheet machined	–	–	1904	–	**3**
244	143	1	Vegetable or fruit can	Rim and body	Tinned steel	Brown	Flat, sheet machined	Locked and lapped	–	1904	–	**4**
244	143	2	Strap/band/strip	Body	Iron	Brown	Cut and punched	–	–	–	–	**1**
244	143	4	Rivet-burr	Whole	Iron	Brown	Cast	–	–	1900	–	**1**
244	144	1	Vegetable or fruit can	Can top or bottom	Tinned steel	Brown	Flat, sheet machined	–	Knife	1904	–	**1**
244	144	1	Vegetable or fruit can	Can top or bottom	Tinned steel	Brown	Flat, sheet machined	–	–	1904	–	**2**
244	144	1	Can	Body	Tinned steel	Brown	Flat, sheet machined	–	–	1904	–	**5**
244	144	2	Wire	Section	Iron	Brown	Drawn	–	–	1867	–	**1**
244	144	7	Bottle, indeterminate	Body	Glass	Amber	Mold	–	–	1880	–	**1**
245	143	3	Disc	Whole	Copper	Brown	Flat, sheet machined	–	–	–	–	**1**
245	144	2	Wire weight	Section	Iron	Brown	Drawn	–	–	–	–	**1**
245	144	2	Fence staple	Whole	Iron	Brown	Cast	–	–	1868	–	**1**
245	144	4	Bottle, indeterminate	Body	Glass	Amber	Mold	–	–	1880	–	**1**
245	144	5	Scrap	Body	Brass	Brown	Flat, sheet machined	–	–	–	–	**1**
246	143	1	Sauce can	Can top or bottom	Tinned steel	Brown	Flat, sheet machined	Locked and lapped	Knife	1904	–	**1**
246	144	3	Bottle, indeterminate	Body	Glass	Amber	Mold	–	–	1880	–	**1**
246	144	3	Bottle, indeterminate	Body	Glass	Green	Mold	–	–	1880	–	**1**
246	144	4	Bottle, indeterminate	Body	Glass	Green	Mold	–	–	1880	–	**1**
247	144	1	Bottle, indeterminate	Body	Glass	Green	Mold	–	–	1880	–	**1**
249	143	1	Bottle, indeterminate	Body	Glass	Blue/green	Mold	–	–	1880	–	**1**
249	143	3	Bottle, indeterminate	Body	Glass	Green	Mold	–	–	1880	–	**1**
250	143	1	Bottle, indeterminate	Body	Glass	Clear	Mold	–	–	1880	–	**1**
250	143	1	Flat glass	Body	Glass	Green	Flat, sheet machined	–	–	1880	–	**1**

1155 (Chapter 16). With the exception of the boulder-top fill, the sequence is as would be expected of more-or-less intact deposits. The earlier date on top is further evidence of modern construction-related displacement of rocks and soil.

In addition to the traditional radiocarbon samples, burned corn and burned and unburned bones were dated using low-energy plasma radiocarbon methods (Chapter 16). Corn from the north end of the shelter (251N/143E, Level 2) returned a calibrated date of AD 1019, while a sample from 246N/144E, Level 8, was considerably later (cal AD 1266). Fill in that level had considerable rodent disturbance (Fig. 8.24) that could have moved the later corn to a deeper level. The earlier corn date falls just outside the range of a traditional date from Level 3 of the grid unit to the south (AD 894–1018). Two bones from 244N/144E, Level 7, have vastly different dates. A piece of unburned deer metacarpal most likely dates to cal AD 1890 (46.9 percent probability), while a burned bison molar dated much earlier (cal AD 656, 82.6 percent probability). Again, Figure 7.5 indicates considerable rodent disturbance at about this level, which may have displaced one or both of the bones sampled, and the sediment sample from the south profile of the grid returned a date of AD 1256–1302.

South Shelter Summary

Artifacts recovered from South Shelter suggest a lengthy use. The evidence regarding how intact the deposits were is mixed; road construction had caused considerable disturbance in the 242–243N grid units. Such disturbance is indicated by the early dates for deposits found on top of a boulder; the deposits were probably placed in the shelter along with the boulder during the road construction. Glass and other historic artifacts were both collected and noted but not collected; these items also document disturbance. In the far south area (240–243N) of South Shelter, glass was found as deep as Level 7 and was relatively common in Levels 3 and 4, suggesting considerable disturbance in that part of the shelter. In the central or main section of the shelter (244–246N) bottle glass was mainly found in the first two levels of fill with a single piece in Level 7. Metal objects were found in Levels 4 and 5. Almost all of the glass in the more northern grid units (247–251N) was in Level 1, with a single piece in Level 3. Domestic animal bones were found as deep as Level 5 in the main and south sections and Level 4 in the north section.

Evidence that at least some of the deposits maintained some integrity was found in charcoal and ash stains and patches of compacted clay found throughout (Table 8.10). Radiocarbon dates from 242N/144E—except for the boulder top sample—are in the correct sequence. Distinct occupational episodes could not be defined but some of the trends noted in the artifacts (e.g., more small mammal bones in lower levels) could reflect temporal trends. However, for the most part, there were few differences within the artifact assemblages. Most seem to indicate trash disposal was the main activity represented in the shelter and that the use of the shelter remained the same, regardless of the time period.

NORTH TALUS AND NORTH SHELTER

North Talus

The North Talus area was originally estimated to be 18 sq m plus 4 sq m of bar ditch. The DRP proposed excavating 11 talus grid units and 1 bar-ditch grid unit. Ultimately, 26 full or partial grid units were excavated. These included a small part of the bar ditch and an elevated area about 2 m south of North Shelter (266–280N/140–143E; Figs. 8.28, 8.29). The elevated area, which does not have a rock overhang, is at about the same elevation as the base of North Shelter. Because the North Shelter was fairly small, the excavation strategy in the northern site area was to leave a block of grid units intact and excavate the fill on either side (Fig. 8.30) rather than excavating a profile trench through the center of the area.. Excavation was complicated by a mass of boulders and brush that was deposited at the mouth of the shelter (Fig. 8.31), many of these rocks extended well beyond the block of grid units and had to be removed before the profiles were drawn so they are not represented in the profiles.

The North Talus is the area from 266N to the north end of the site at 280N where the drainage ditch and cliff wall intersect (Fig. 8.28). No artifacts were recovered from north of the 278N grid line and the 277N grid units contained few artifacts (a quartz unidirectional core, core flakes of chert [n = 2] and

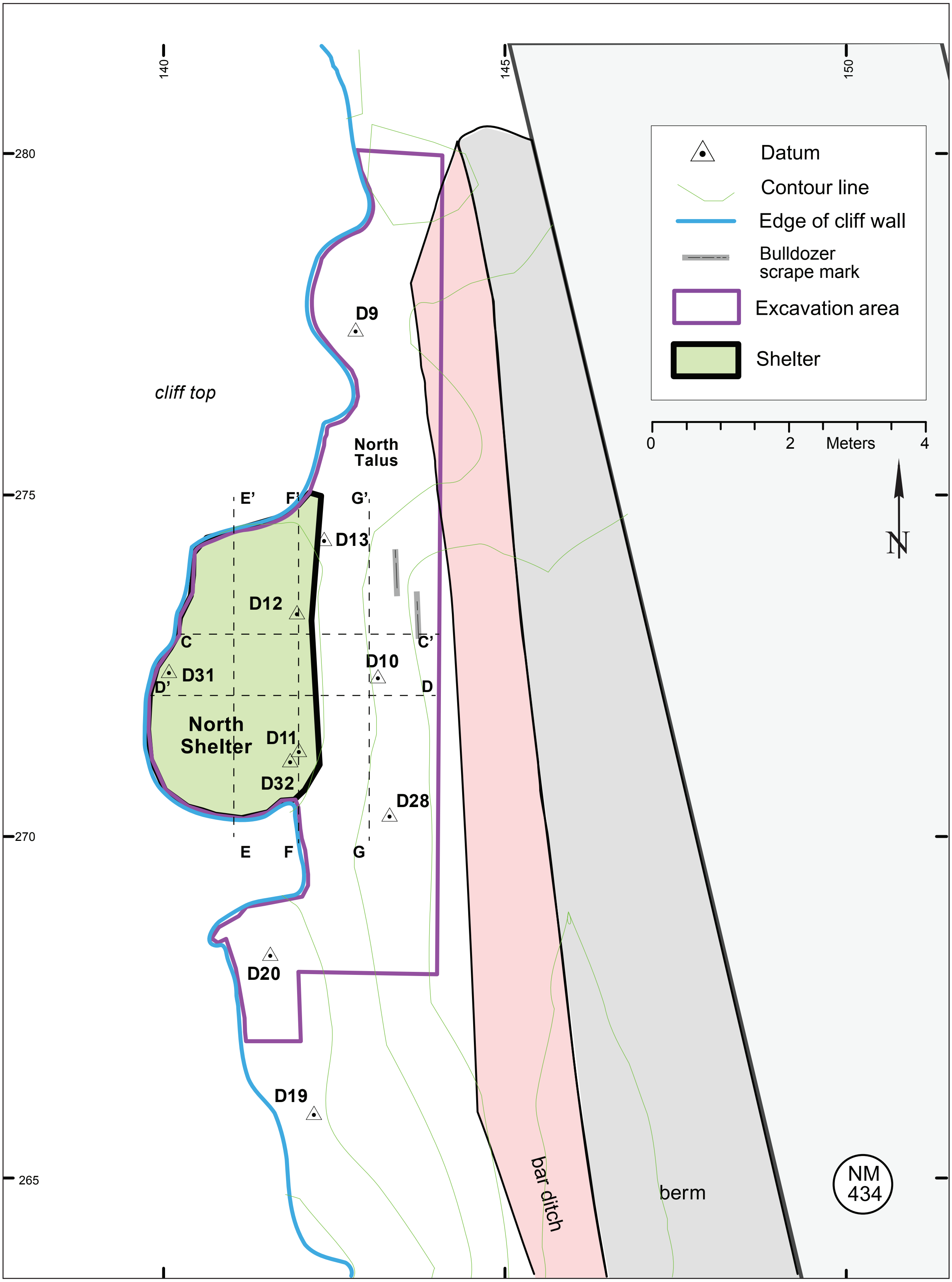

Figure 8.28. North Shelter and North Talus, plan map.

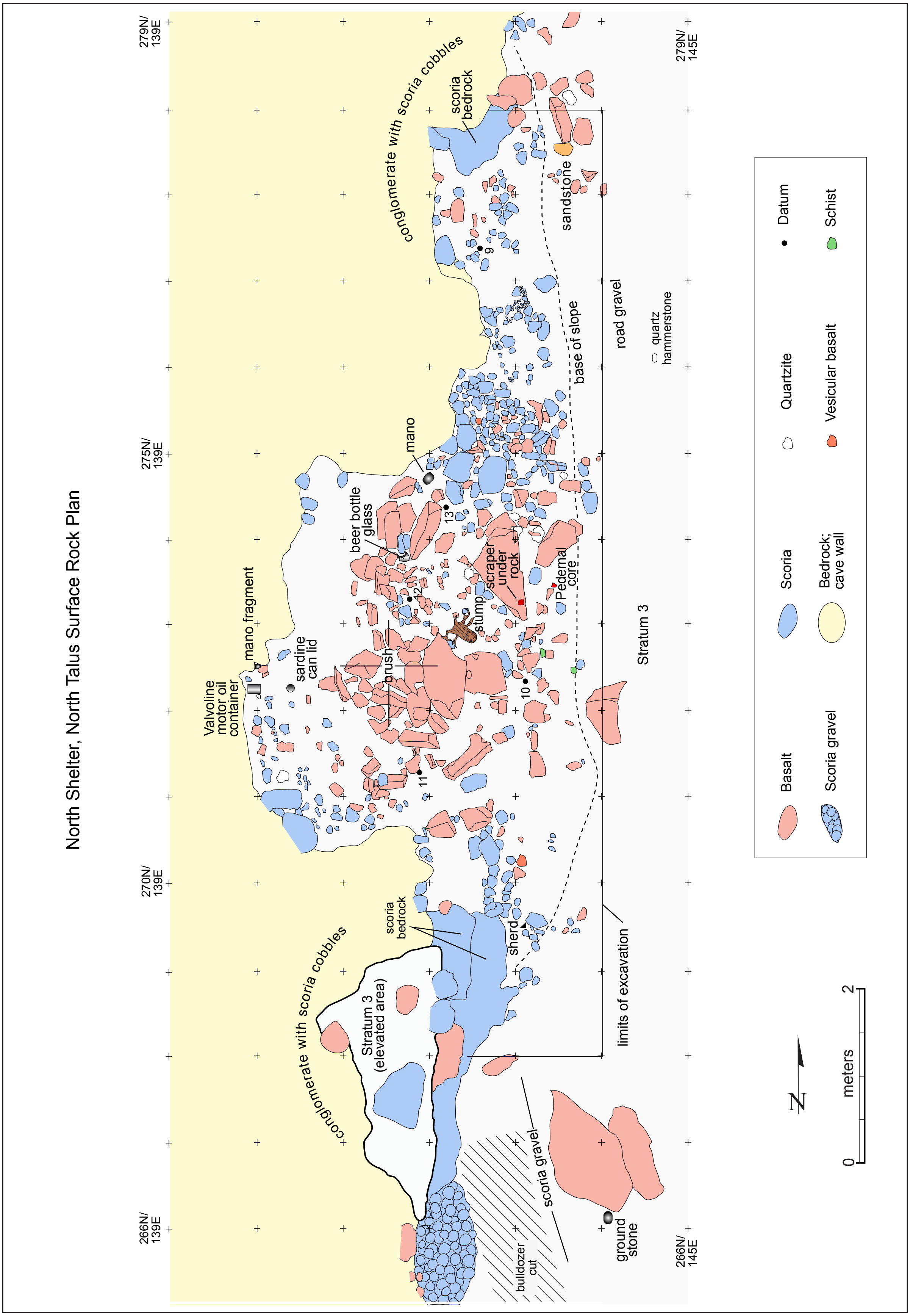

Figure 8.29. North Shelter and North Talus, plan map showing surface rock distribution.


Figure 8.30. North Talus and North Shelter during excavation, view west.


Figure 8.31. North Shelter, rock and brush at entrance.

quartz [n = 1], a chert drill, and a single bone). The elevated area at the south end produced few artifacts other than bone (48 pieces, plus a chert projectile point preform fragment, a complete olivine basalt hammerstone, and a complete metaquartzite flaked abrader). At the base of the talus, grid unit 268N/143E had few artifacts (1 plain body sherd, a quartz core, and 10 bones) compared to North Talus grid units to the north. The grid unit just to the south (267N/143E) was not excavated as it was largely occupied by a basalt boulder and scoria rubble.

Grid units at 143E were adjacent to a shallow bar ditch and were relatively flat with elevation differences of about 10 to 40 cm between the west and east borders of the grid unit (Table 8.19). The 142E grid units just outside of the shelter had steeper slopes in front of the shelter, some with east–west elevation differences of up to about 75 cm where mechanical equipment had scraped a near vertical face. Excavation was in 5 to 10 cm levels that generally followed the surface contour as much as was possible given the amount of rock and bedrock contours. Fill was mainly Stratum 3 with areas of Stratum 5 where road construction activities introduced a different soil. Stratum 5 was variable and much of that excavated from grid units 270–271N/143E differs from that described in Chapter 7 for the profile in 272N/143E. In these grid units it was more brown (10YR 4/2) and a sandy silt that ranged from clean and smooth to more gritty where it was mixed with deteriorated scoria. A north–south profile along the 143E grid line (G–G'; Figs. 8.28, 8.32) indicates that the mechanical alteration followed the cliff edge above the shelter encountering scoria bedrock in the northern grid units, while leaving more soil exposed in southern grid units (contrast the east–west profiles at 272N [D–D'; Figs. 8.28, 8.33] and 273N [C–C'; Figs. 7.6, 8.28]). Much of the fill in the 143E profile is a mix of Stratum 3 and Stratum 5 (the brown sandy clay introduced by mechanical modification of the slope). Small pea-sized road gravel was common in the 143E grid units and small pieces of asphalt were found throughout. Plastic and clear and brown beer-bottle glass were also common. Evidence of road construction was also seen in the scrape marks in the base scoria of grid units 273–274N/143E and the slope in the 143E grid units (Fig. 8.34).

The north–south profile along the 142N grid line was at the shelter opening (F–F'; Figs. 8.28, 8.35) and most of the profile consisted of exposed and scraped scoria. Stratum 5 was even more evident in the lower portion of this profile, mainly in grid units 270–272N/142E). Like within the shelter, the upper fill has fewer rocks, except for the material dumped by the bulldozer at the center of the profile.

North Talus Artifacts and Sample Results

North Talus grid units contained considerable quantities of artifacts. These were obtained from 83 levels of fill (Table 8.19) and were concentrated in the grid units fronting the opening of the shelter.

Ceramics

North Talus has the second largest sample of ceramics. Proportionately, more are Plain body sherds (66.4 percent) than any other type. All belong to the Taos tradition and most have leucocratic igneous temper (Table 8.20). Exceptions are an unpainted sherd, a mineral painted sherd, and the Taos Black-on-white sherds. “Jar” is the only form recognized (Table 8.21). The pottery types are spread throughout the grid units with no spatial clustering.

Chipped Stone

The 83 levels of fill removed from the North Talus recovered 634 pieces of chipped stone, 18.2 percent of the total amount from the site. Core flakes (n = 480; 75.7 percent) are by far the most common type with fewer biface flakes (n = 32; 5.0 percent), angular debris (n = 27; 4.3 percent), notching flakes (n = 8), hammerstone flakes (n = 1), and potlids (n = 2). Proportionately, more cores were found than in any other area. Most are unidirectional (n = 24), but the assemblage also includes a tested cobble and bidirectional cores (n = 5). Tool types include choppers, drills, scrapers, and a knife (Table 8.22). Most of the projectile points are small but also include large corner-notched, an En Medio point, and a Spanish corner-notched point.

North Talus has the second-largest number of activities represented by the chipped stone. Core reduction, projectile point manufacture, hunting, meat processing, and leather-working are all indicated. General pounding, scraping, and cutting activities are also represented.

For debitage (n = 549), chert is slightly more common (30.6 percent) than silicified wood (22.2 percent), followed by obsidian (13.1 percent), quartz (10.6 percent), rhyolite (9.5 percent), basalt/

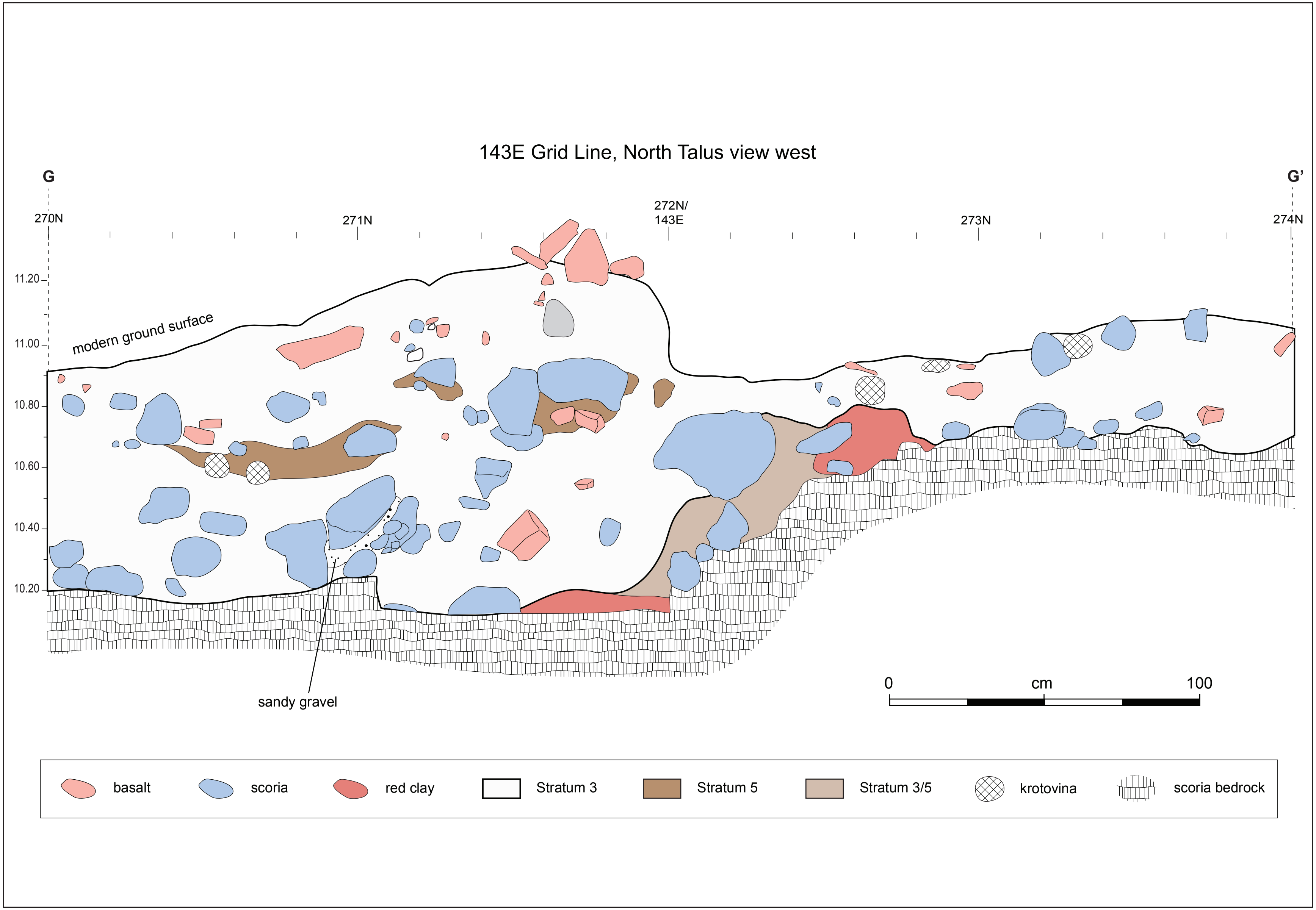

Figure 8.32. North Talus, north–south profile (G–G') along the 143E grid line, 270–275N; west wall.

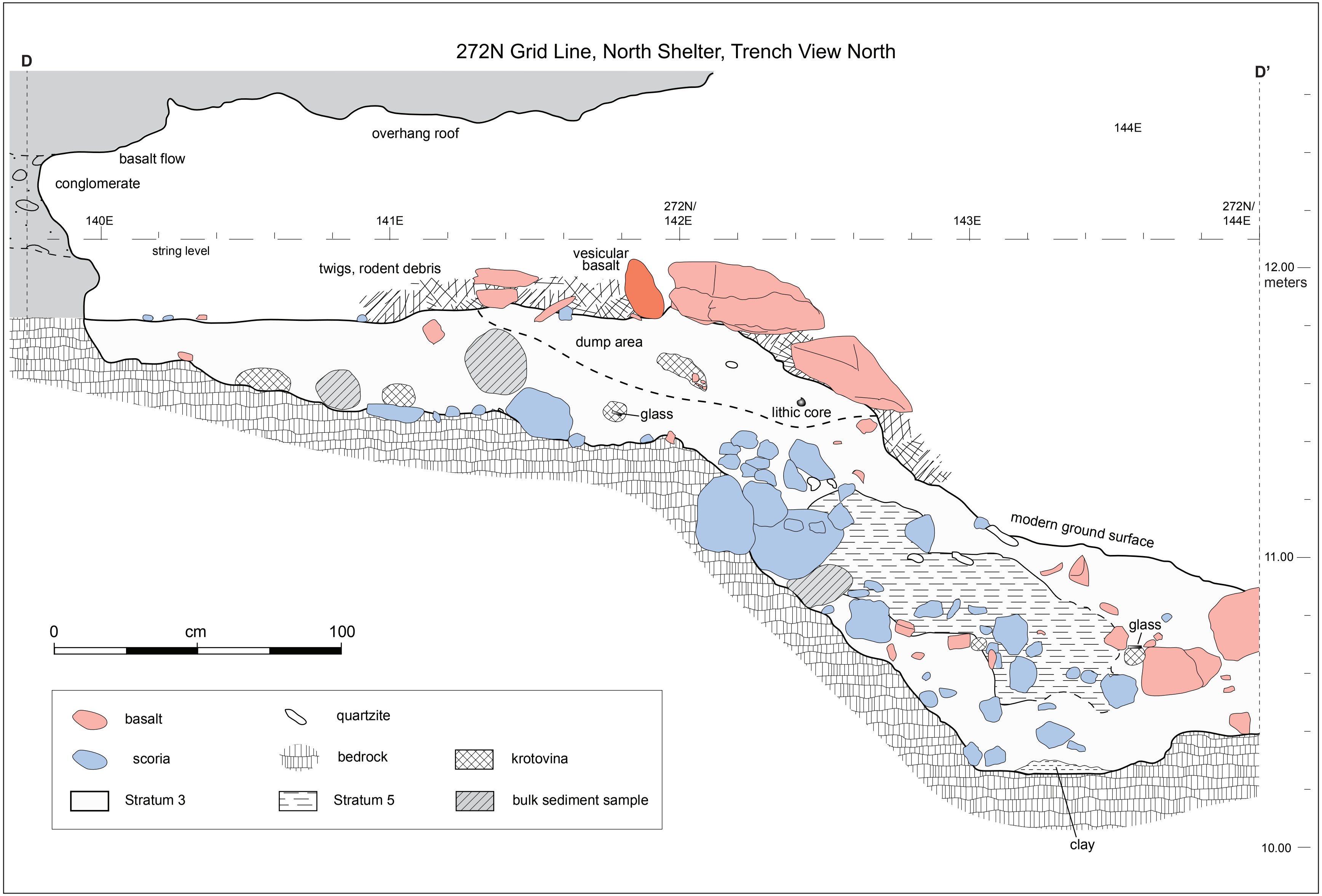

Figure 8.33. North Shelter and North Talus, east–west profile (D–D') along the 272N grid line, 140–144E; north wall. (See Fig. 7.6 for east–west profile C–C', along the 273N grid line.)

Figure 8.34. North Talus, bulldozer scrapes in scoria (273–274N/143E).

andesite (8.4 percent), metaquartzite (4.6 percent), limestone (0.9 percent), and orthoquartzite (0.2 percent). Cores (n = 28) are most often silicified wood (46.4 percent) and quartz (32.1 percent), plus chert (10.7 percent), metaquartzite (7.1 percent), and rhyolite (3.6 percent). Core tools were made of metaquartzite and quartz (1 each) and cobble tools are of rhyolite (n = 2) and metaquartzite (n = 1). All but one of the scrapers were made of chert, the other was metaquartzite. Chert (34.9 percent) and basalt/andesite (34.9 percent) were favored for bifaces and projectile points. Obsidian was also fairly common (18.6 percent), with token amounts of these tools being made of silicified wood (2.3 percent), rhyolite (4.7 per cent), and quartz (4.7 percent).

Chipped stone densities were greatest in the 271N and 272N grid units. The chipped stone counts, amount of debitage, and number of projectile points are highly correlated with number of levels and every other chipped stone artifact category (Table 8.23). Again, the distribution is consistent with discards rather than caches or activity areas. The sole exception could be the cluster of sheep or goat bones and the possible Spanish side-notched projectile point found in the elevated area at the north end of North Talus.

Ground Stone

A total of 29 pieces of ground stone were recovered from the North Talus (Table 8.24). This includes equal numbers of one-hand manos and abraders with more hammerstones than any other area. Although this is the second-largest sample of ground stone, there is less variety than the South Talus. Complete artifacts are more common than the other areas (41.4 percent, followed by 33.3 percent for North Shelter and South Talus).

All but two of the North Talus manos are one-hand manos and the others are indeterminate and a one-hand mano preform. Four of the one-hand manos and the preform are complete artifacts. The favored material was again orthoquartzite (57.1 percent of the one-hand manos). Micaceous schist was used to make two and olivine basalt one. The

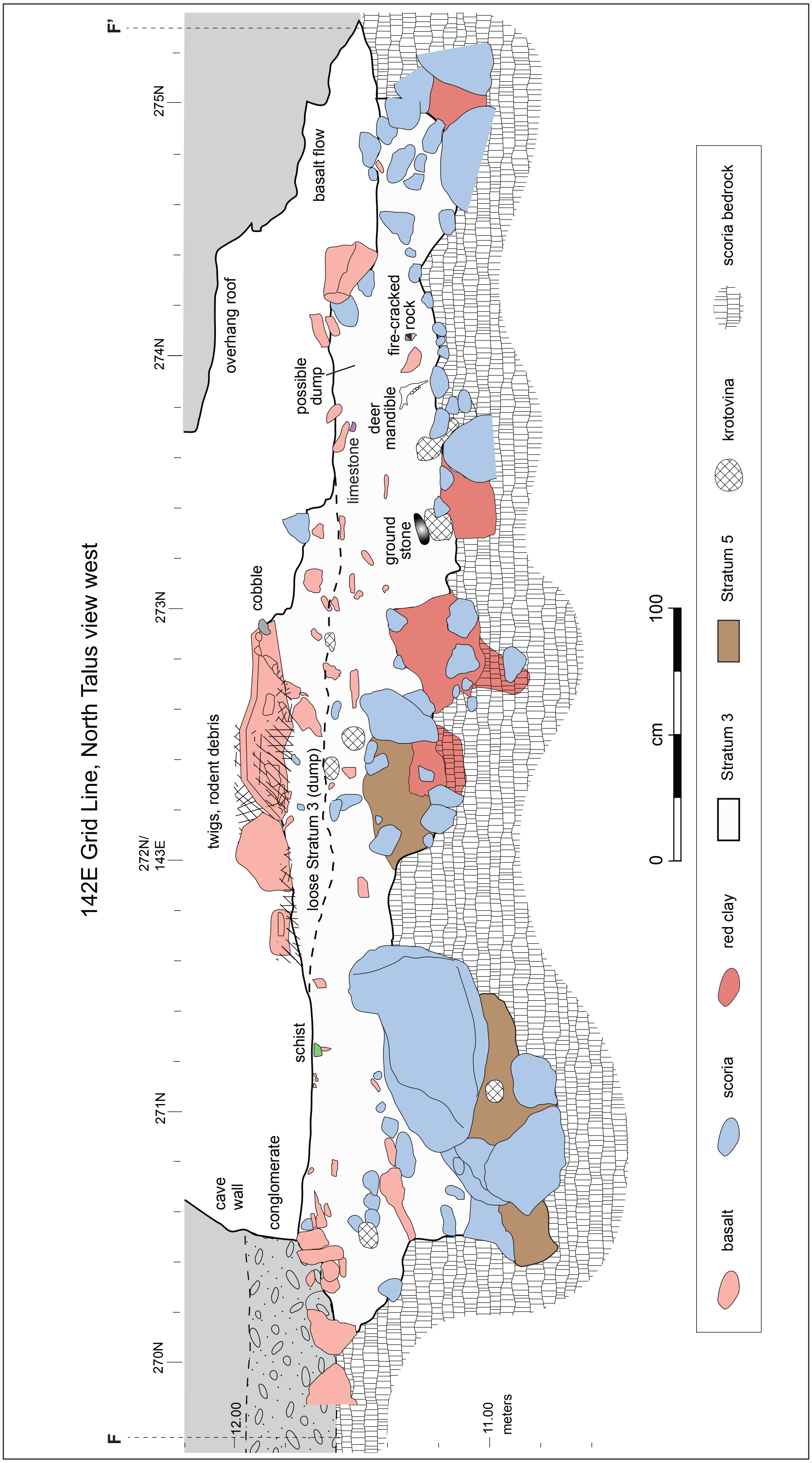

Figure 8.35. North Talus at North Shelter opening, north–south profile (F–F') along the 142E grid line, 270–275N; west wall.

Table 8.19. North Talus grid units, excavated; highest beginning and lowest ending elevations, with artifact counts, disturbance types, and samples analyzed by level.

North	East	Levels	Beginning Elevations, in meters		Ending Elevations, in meters		Artifacts						Samples Analyzed	Disturbance	Comments
			West	East	West	East	Ceramics	Chipped Stone	Ground Stone	Bone	Historic	Other			
266 -269	141	2	12.20	11.90	12.06	11.70	–	1	2	48	–	–	P	–	elevated area; little fill
268	142/ 143	2	10.80	10.50	10.35	10.30	1	1	–	10	–	–	F	glass; L2	–
269	142	3	11.60	10.74	11.60	10.44	5	31	–	57	–	–	–	MS, glass, plastic; L2	SW half bedrock
	143	4	10.77	10.55	10.12	10.15	6	45	1	94	2	1	–	FT, plastic, glass; L2	–
270	142	8	11.71	11.15	10.75	10.52	17	77	3	218	–	1	P, F	FT, R, plastic, glassp; L7	SW bedrock
	143	9	11.10	10.64	10.22	10.18	24	92	–	177	2	2	F	R, glass, plastic; L9	road gravel; L9
271	142	11	11.54	11.08	10.38	10.23	16	88	8	229	3	–	F	FT, R, plastic, glass; L10	–
	143	10	11.09	10.79	10.14	10.11	23	112	4	191	1	–	P, F	FT, R, glass, plastic; L8	road gravel; L9
272	142	3	11.89	11.12	10.79	10.47	16	27	–	133	–	1	F	R, glass, plastic; L2	mechanical dump
	143	5	11.05	10.83	10.29	10.29	7	51	6	110	3	1	F	MS, R, plastic, glass; L4	–
273	142	5	11.86	11.18	11.32	10.85	16	40	2	170	–	–	P	R, glass, plastic; L4	–
	143	3	11.18	10.75	10.84	10.25	3	23	–	41	1	–	–	R, glass, plastic; L2	–
274	142	3	11.70	11.10	11.18	10.74	9	11	1	61	–	–	P, F	R, glass; L1	–
	143	4	11.09	10.87	10.74	10.54	2	19	1	53	–	–	F	MS, R, plastic; L3	–
275	142/ 143	2	11.10	10.90	10.65	10.45	3	10	–	7	1	–	–	MS, surface glass	–
276	142/ 143	2	11.24	11.01	10.80	10.40	1	–	1*	1	–	–	–	road gravel	–
277	142	1	11.70	11.40	11.48	11.08	–	–	–	–	–	–	–	–	bedrock SW corner; no artifacts
	143	4	11.39	11.12	11.09	10.35	–	5	–	1	–	–	–	road gravel and glass; L4	SE test to bedrock
278	142	1	11.60	11.40	11.60	11.32	–	–	–	–	–	–	–	road gravel, glass surface	bedrock west side; one surface artifact
	143	1	11.38	11.43	11.10	10.95	–	–	–	–	–	–	–	road gravel, glass and metal	bedrock NW corner; no artifacts
Total		**83**					**149**	**633**	**28**	**1601**	**13**	**6**			

Ground Stone Artifacts: * = 144E.
Samples: R = radiocarbon; F = flotation; P = pollen/starch/phytolith.
Disturbance: FT=foot traffic; L = level; MS = mechanical scrape mark; R = rodent.

Table 8.20. North Talus, temper by pottery type; counts and percents.

Temper	Leucocratic igneous w/ mica		Leucocratic igneous		Sherd and sand		Fine tuff and sand		Fine sand or silt		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Plain Rim	–	–	2	100.0	–	–	–	–	–	–	**2**	**100.0**
Plain Body	30	30.3	69	69.7	–	–	–	–	–	–	**99**	**100.0**
Wide Neckbanded	–	–	6	100.0	–	–	–	–	–	–	**6**	**100.0**
(Taos) Incised Gray	3	25.0	9	75.0	–	–	–	–	–	–	**12**	**100.0**
Coiled Necked	2	66.7	1	33.3	–	–	–	–	–	–	**3**	**100.0**
Wiped Scored	–	–	1	100.0	–	–	–	–	–	–	**1**	**100.0**
Indented Corrugated	–	–	2	100.0	–	–	–	–	–	–	**2**	**100.0**
Smeared Corrugated	4	28.6	10	71.4	–	–	–	–	–	–	**14**	**100.0**
Polished Utility	–	–	1	100.0	–	–	–	–	–	–	**1**	**100.0**
Unpainted Undifferentiated	–	–	–	–	–	–	–	–	2	100.0	**2**	**100.0**
Mineral paint Undifferentiated	–	–	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Taos Black-on-white	–	–	–	–	–	–	1	16.7	5	83.3	**6**	**100.0**
Total	**39**	**26.2**	**101**	**67.8**	**1**	**0.7**	**1**	**0.7**	**7**	**4.7**	**149**	**100.0**

Table 8.21. North Talus, vessel form by pottery type; counts and percents.

	Indeterminate		Jar Neck		Jar Rim		Jar Body		Jar Body w/ Lug Handle		Total	
	n =	%	n =	Col. %	n =	Col. %	n =	Col. %	n =	Col. %	n =	Col. %
Plain rim	–	–	–	–	2	100.0	–	–	–	–	**2**	**100.0**
Plain body	–	–	13	13.1	–	–	86	86.9	–	–	**99**	**100.0**
Wide Neckbanded	–	–	2	33.3	–	–	4	66.7	–	–	**6**	**100.0**
(Taos) Incised Gray	1	8.3	7	58.3	–	–	3	25.0	1	8.3	**12**	**100.0**
Coiled Necked	–	–	1	33.3	–	–	2	66.7	–	–	**3**	**100.0**
Wiped Scored gray	–	–	–	–	–	–	1	100.0	–	–	**1**	**100.0**
Indented Corrugated	–	–	2	100.0	–	–	–	–	–	–	**2**	**100.0**
Smeared Plain Corrugated	–	–	14	100.0	–	–	–	–	–	–	**14**	**100.0**
Polished gray	–	–	–	–	–	–	1	100.0	–	–	**1**	**100.0**
Unpainted undifferentiated	–	–	–	–	–	–	2	100.0	–	–	**2**	**100.0**
Mineral paint (undifferentiated)	–	–	–	–	–	–	1	100.0	–	–	**1**	**100.0**
Taos B/w	–	–	1	16.7	–	–	5	83.3	–	–	**6**	**100.0**
Total	**1**	**0.7**	**40**	**26.8**	**2**	**1.3**	**105**	**70.5**	**1**	**0.7**	**149**	**100.0**

indeterminate fragment was also olivine basalt and the preform was schist. Less than half of the one-hand manos were made from cobbles (42.9 percent), as was the preform. The rest were indeterminate. All but four of the one-hand manos were exposed to heat, as were the indeterminate fragment and the preform.

Abraders were a mix of coarse (n = 3), smooth (n = 4), and flaked (n = 2) types. One of the smooth and both flaked abraders are complete, the rest are fragmentary. Coarse abraders were made of olivine basalt (n = 2) and schist (n = 1), smooth abraders are sandstone (n = 3) and schist, and the flaked abraders are metaquartzite (n = 1) and schist (n = 1). All were made from cobbles. About half of each group had been exposed to heat.

Two of the three metate fragments were from basin metates. Two were made from sandstone and one from schist. All had been exposed to heat.

Hammerstones were all complete and made of a variety of materials, all cobbles. Only one had been exposed to heat.

In the fairly restricted area comprising the North Talus, it was common for grids and levels to contain more than one piece of ground stone (Table 8.24). Only one artifact was found in a lower level of fill, most were from Level 1 (55.2 percent). Grid unit 271N/142E had the most (n = 8); all but one

Table 8.22. North Talus, chipped stone, counts by type and grid unit.

North	East	Utilized debitage	Unutilized angular debris	Unutilized flake	Hammerstone	Chopper	Drill	Core hammerstone	Scraper/graver	Unutilized core	End scraper	Side scraper	End/side scraper	Biface	Knife	Projectile point preform	Small point	Stemmed point	Small stemmed point	Large corner-notched point	Small corner-notched point	Small side-notched point	En Medio point	Spanish side-notched point	Total
267	141	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	**2**
268	143	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**
269	142	–	1	27	–	–	–	–	–	1	1	–	–	–	–	–	1	–	–	–	–	–	–	–	**31**
269	143	1	2	39	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**45**
270	142	–	2	64	–	–	–	–	1	2	–	1	–	1	–	1	3	–	1	–	–	1	–	–	**77**
270	143	2	7	69	1	1	–	1	–	5	–	–	–	2	–	2	–	1	–	–	–	1	–	–	**92**
271	142	1	3	72	–	–	–	–	–	6	–	–	1	–	–	2	1	–	–	2	–	–	–	–	**88**
271	143	1	6	86	–	1	–	1	–	3	1	1	1	1	–	1	2	–	1	–	2	3	1	–	**112**
272	142	–	1	26	–	–	–	–	–	2	1	–	–	–	–	–	1	–	–	–	–	–	–	–	**31**
272	143	–	3	44	–	–	–	–	–	1	–	–	–	–	–	1	1	–	1	–	–	–	–	–	**51**
273	142	1	–	32	–	–	–	–	–	2	–	–	–	–	1	–	–	–	–	–	–	–	–	–	**36**
273	143	–	1	19	–	–	–	–	–	1	–	1	–	–	–	1	–	–	–	–	–	–	–	–	**23**
274	142	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	**11**
274	143	–	–	16	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	1	–	–	–	**19**
275	143	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**10**
277	143	–	–	3	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**5**
Total		**6**	**26**	**517**	**1**	**2**	**1**	**2**	**1**	**28**	**3**	**3**	**2**	**5**	**1**	**9**	**10**	**1**	**3**	**2**	**4**	**5**	**1**	**1**	**634**

Table 8.23. North Talus correlation coefficients for chipped stone types.

		Levels	Total chipped stone	Debitage	Cores	Core tools	Cobble tools	Uniface	Projectile points
Levels	Pearson Correlation	1.000	0.949**	0.944**	0.862**	0.604**	0.552*	0.603**	0.871**
	Sig. (2-tailed)	–	0.000	0.000	0.000	0.005	0.012	0.005	0.000
	N	20	20	20	20	20	20	20	20
Total chipped stone	Pearson Correlation	0.949**	1.000	0.999**	0.839**	0.682**	0.613**	0.684**	0.883**
	Sig. (2-tailed)	0.000	–	0.000	0.000	0.001	0.004	0.001	0.000
	N	20	20	20	20	20	20	20	20
Debitage	Pearson Correlation	0.944**	0.999**	1.000	0.841**	0.659**	0.595**	0.667**	0.863**
	Sig. (2-tailed)	0.000	0.000	–	0.000	0.002	0.006	0.001	0.000
	N	20	20	20	20	20	20	20	20
Cores	Pearson Correlation	0.862**	0.839**	0.841**	1.000	0.514*	0.547*	0.383	0.584**
	Sig. (2-tailed)	0.000	0.000	0.000	–	0.020	0.012	0.095	0.007
	N	20	20	20	20	20	20	20	20
Core tools	Pearson Correlation	0.604**	0.682**	0.659**	0.514*	1.000	0.943**	0.435	0.733**
	Sig. (2-tailed)	0.005	0.001	0.002	0.020	–	0.000	0.055	0.000
	N	20	20	20	20	20	20	20	20
Cobble tools	Pearson Correlation	0.552*	0.613**	0.595**	0.547*	0.943**	1.000	0.215	0.601**
	Sig. (2-tailed)	0.012	0.004	0.006	0.012	0.000	–	0.363	0.005
	N	20	20	20	20	20	20	20	20
Uniface	Pearson Correlation	0.60**	0.684**	0.667**	0.383	0.435	0.215	1.000	0.768**
	Sig. (2-tailed)	0.005	0.001	0.001	0.095	0.055	0.363	–	0.000
	N	20	20	20	20	20	20	20	20
Projectile points	Pearson Correlation	0.871**	0.883**	0.863**	0.584**	0.733**	0.601**	0.768**	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.007	0.000	0.005	0.000	–
	N	20	20	20	20	20	20	20	20

**	= Correlation is significant at the 0.01 level (2-tailed).
*	= Correlation is significant at the 0.05 level (2-tailed).

ground stone artifact was recovered from the first level of fill.

Bone

A good sample of bone was recovered from the North Talus (n = 1601). Most specimens were from the south end of the area in front of the North Shelter. Dividing the area into three divisions (south of the shelter 267–269N, the south portion of the shelter 270–271N, and the remaining shelter and north 272–-277N—including those from the far north grid units [n = 9]) and by level groups (Table 8.25) finds more small mammal remains in the grid units at the south end of the North Shelter, regardless of level. Since virtually all of the fill in the North Talus was disturbed—except for the southernmost grid units that comprise the elevated area, this may be more of a preservation issue than anything else, or could indicate that these deposits tend to be relatively early. The elevated platform had numerous sheep or goat specimens (n = 11 in Level 1; n = 2 in Level 2) and another five were found in the grid units just below the elevated platform indicating historic use of that area. The only other North Talus domestic animal bone was found in the first level of fill in grid unit 274N/143E.

Weathered bone is more common in the southerly shelter-fronting grid units (22.2 percent compared to 16.7 percent to the south and 16.1 percent to the north). Carnivore and rodent gnawing are negligible for all but the far south North Talus area, where even then only 1.0 percent were carnivore gnawed and another 1.9 percent were rodent gnawed. Large proportions of all are burned (45.5 percent, 43.2 percent, and 53.2 percent south to north).

Unlike other areas of the site, the North Talus had more ornaments than awls. Most are bead or tube fragments (n = 4) but also included is a partially drilled pendant (or large flat bead) and an ovoid pendant blank or gaming piece. One of the three awls is complete. Other worked bone types include small fragments that could not be identified as a specific tool type (n = 3), a nicely made bone scraper, and a tool with small step fractures along a curved distal end (Chapter 12). Few are burned (n = 3). For the small number of grid units and levels

Table 8.24. North Talus, ground stone summary, by type, material, and provenience.

Artifact type	Condition	Material	North	East	Level
Hammerstone	Whole	Basalt	267	141	1
Flaked abrader	Whole	Metaquartzite	267.15	141.80	1
Polishing stone, nfs	End fragment	Basalt	269	143	1
Hammerstone	Whole	Micaceous schist	270	142	1
Hammerstone	Whole	Quartz	270	142	1
Metate, basin	Edge fragment	Sandstone	270	142	3
Indeterminate, fragmentary	Surface flake	Micaceous schist	271	142	1
Indeterminate, fragmentary	Surface flake	Metaquartzite	271	142	1
Polishing stone, nfs	Surface flake	Metaquartzite	271	142	1
Mano, nfs (fragmentary)	End fragment	Basalt	271	142	1
One-hand mano	Whole	Orthoquartzite	271	142	1
One-hand mano	Medial fragment	Orthoquartzite	271	142	1
One-hand mano	Edge fragment	Micaceous schist	271	142	1
Metate, nfs	Internal fragment	Orthoquartzite	271	142	2
Smooth abraders	Edge fragment	Orthoquartzite	271	143	1
Coarse abraders	Split lengthwise	Basalt	271	143	2
One-hand mano	Whole	Micaceous schist	271	143	3
One-hand mano	End fragment	Basalt	271	143	8
Smooth abraders	Whole	Orthoquartzite	272	143	1
Flaked abrader	Whole	Micaceous schist	272	143	1
Coarse abraders	End fragment	Micaceous schist	272	143	2
Coarse abraders	End fragment	Basalt	272	143	2
Smooth abraders	End fragment	Orthoquartzite	272	143	2
Smooth abraders	Corner(s) only missing	Micaceous schist	272	143	4
One hand mano preform	Whole	Micaceous schist	273	142	4
Metate, basin	Lateral fragment	Micaceous schist	273.70	142.40	2
One-hand mano	Whole	Orthoquartzite	274	143	1
One-hand mano	Whole	Orthoquartzite	274.80	142.08	0
Hammerstone	Whole	Quartz	276.15	144.60	0

nfs = not further specified.

Table 8.25. North Talus, fauna summary, by subdivision and grid unit/level; counts and percents.

Levels	**Small Mammal**		**Medium Artiodactyl**		**Large Artiodactyl**		**Total**	
	n =	**%**	**n =**	**%**	**n =**	**%**	**n =**	**%**
Grid Units 267-269N								
1	9	7.7	103	8.0	5	4.3	**117**	**100.0**
2–3	5	9.1	50	90.9	–	–	**55**	**100.0**
4–6	1	20.0	3	60.0	1	20.0	**5**	**100.0**
Group Total	15	8.5	156	88.1	6	3.4	**177**	**100.0**
Grid Units 270-271N								
1	27	13.4	165	81.7	10	5.0	**202**	**100.0**
2–3	33	11.7	243	86.2	6	2.1	**282**	**100.0**
4–6	32	17.6	141	77.5	9	4.9	**182**	**100.0**
7–11	11	12.6	72	82.8	4	4.6	**87**	**100.0**
Group Total	103	13.7	621	82.5	29	3.9	**753**	**100.0**
Grid Units 272-277N								
1	30	10.9	235	85.8	9	3.3	**274**	**100.0**
2–3	20	8.5	209	88.9	6	2.6	**235**	**100.0**
4–5	3	7.9	34	89.5	1	2.6	**38**	**100.0**
Group Total	53	9.7	478	87.4	16	2.9	**547**	**100.0**
Total								
	171	**11.6**	**1255**	**85.0**	**51**	**3.4**	**1477**	**100.0**

excavated, the North Talus has a diverse array of worked bone types; it is not centered on manufacturing activities.

Microbotanical and Macrobotanical

Samples analyzed from the North Talus include 13 flotation samples, pollen washes from a mano preform and a one-hand mano, and pollen and starch washes from two one-hand manos, a basin metate fragment, and a metate. Flotation samples produced little charred material. Goosefoot (n = 9 samples) and cheno-am (n = 5 samples) were the most ubiquitous burned seeds. Other cultural plant remains include a corn cupule, a grass caryopsis, a mint family seed, hedgehog cactus seed, and needles from Douglas fir (n = 2) and ponderosa pine (n = 1). Flotation wood was mainly ponderosa and oak with small amounts of alder, chokecherry, cottontail/willow, and juniper (App. 4.5d-4.5f).

Uncharred taxa not represented in the charred flotation plant remains are numerous. Purslane was found in all 13 samples, aster in 11, brome and alder in eight each, groundcherry and mullein in six each, wild lettuce in five, vervain in four, spurge and dock in three each, sumac in two, and primrose, sedge, and strawberry in one each (App. 4.5a–4.5c).

Rodent pellets were found in just under half of the flotation samples and half of those contained burned rodent pellets. Burned pellets were found in single samples from Level 1, Level 3, and Level 7.

A wash from a one-hand mano preform found in Level 4 of 273N/142E had no pollen, but a mano from deep in the talus (271N/143E Level 8) produced 13 types of pollen. Grass pollen was the most abundant with smaller amounts of ponderosa pine, piñon pine, oak, fir, spruce, cattail, high and low-spine aster, mustard, pea, sedge, and a Linguliflorae (Phillips, Chapter 14). Since this sample was deep in the mechanically disturbed fill, it is possible that it represents no more than the local pollen rain. The large amount of grass pollen (30 percent of the pollen in the sample) could reflect where the soil was moved from or could indicate that grass was ground with this tool.

The pollen and starch wash samples on a metate fragment, a basin metate, and two one-hand manos were more productive while a flaked abrader was less so. Pollen common to all four samples includes that from pine, oak, cheno-ams, sage, high spine asters, and grass. Alder, Mormon tea, and wild buckwheat were found in three of the samples and juniper and meadowrue in two. The metate fragment had aggregates of grass pollen indicating that grass was ground on this metate. The basin metate had aggregates of cheno-ams and sage and enough cattail pollen to suggest these were all processed with this metate. One of the one-hand manos also had aggregates of sage and a good amount of grass pollen. The other one-hand mano had no aggregates and fairly low counts for grass. Phytolith and starch wash samples from the mano and abrader indicate the grasses were both cool and warm season species (Cummings and Varney, Chapter 14).

Other Artifacts

The only ornament other than the bone ornaments noted above was a sandstone pendant blank. Also found were a variety of materials—some of which are probably natural inclusions in the soil but others could have been brought to the site. These include a piece of horn coral or sharks tooth, a crinoid, two pieces of limonite, and one of red ochre. All but the piece of coral or sharks tooth came from grid units fronting the shelter.

Historic Artifacts

Modern glass, plastic, and other obviously intrusive objects were not collected. These were noted in the grid unit forms and only those objects that could potentially provide information on dating the historic use of the shelter or how it was used during the historic period were collected. Glass was noted for the second level of fill in the elevated platform, and plastic, glass, and even road gravel occurred as deep as Level 9 in the grids fronting the shelter (Table 8.19).

Fourteen historic objects were collected (Table 8.26). A variety of types are represented with beginning dates ranging from 1800 to 1944. Only one has an end date (1935). Included is an array of cans, bottles, and cartridges, much of which could be attributed to roadside discard or short-term visits to the site area. A mean date of 1931 may be early for the objects collected.

North Talus Summary

Deposits forming the North Talus are largely disturbed by road construction that scraped away the scoria and cultural deposits in front of the North

Table 8.26. North Talus, historic artifact summary, by type, date, and provenience.

North	East	Level	Function	Fragment	Material	Color	Technique	Seams	Total
269	143	1	Crown cap	Body	Metal, plastic	Brown	Stamped	–	**2**
270	143	1	Centerfire cartridge	Cartridge	Brass	Brass	Extruded	–	**1**
270	143	3	Liquor flask	Base, body	Glass	Clear	Machined	Body	**1**
271	142	1	Decorative object	Body	Glass	Clear	Mold	–	**1**
271	142	1	Sauce can	Can top, bottom	Tinned steel	Brown	Machined	Locked, lapped	**1**
271	142	3	Bottled goods	Body	Ceramic	White	Wheel	–	**1**
271	143	6	Unidentifiable	Body	Ceramic	White	Mold	–	**1**
272	143	1	Indeterminate	Body	Ceramic	White	Wheel	–	**1**
272	143	1	Indeterminate	Body	Ceramic	Cream	Wheel	–	**1**
272	143	2	Bottled goods	Body	Ceramic	White, yellow	Wheel	–	**1**
273	143	1	Bottled goods	Body	Ceramic	Multiple	Wheel	–	**1**
275	143	1	Bottled goods	Body	Ceramic	Multiple	Wheel	–	**1**

Shelter and along the cliff. The only exception appears to be the elevated platform between 266–269.16N in 141E. The platform area contained not only sheep and goat bones but also a Spanish side-notched projectile point, attesting to the historic use of that area. A single sheep or goat bone was found in a grid unit fronting the north half of the shelter and others were downslope from the elevated platform. Talus fill not only had indications of disturbance in the form of glass, plastic, and road gravel at deep levels, but it had a unique soil (Stratum 5) that was introduced to the area (Figs. 8.33, 8.35).

Both the ceramic and chipped stone assemblages hint that the North Talus and North Shelter area may be slightly earlier than the South Talus and South Shelter areas. Cores and hammerstones are especially common and the worked bone assemblage had fewer awls and more beads than other areas. Otherwise, there is little to suggest any differences in how the area represented by the North Talus deposits and the rest of the site were used. That it is more like the North Shelter is an indication that some of the talus deposits probably eroded out from the shelter or came from nearby.

North Shelter

The smaller of the two rockshelters (Fig. 8.1) at LA 139965, North Shelter was estimated to be about 8 sq m in size with at least 40 cm of fill in some places and was to be completely excavated (Figs. 8.36, 8.37). When defined as the area west of the 142E line, the sheltered area was approximately 8.9 sq m but occupied parts of 12 grid units (Fig. 8.28) and had a maximum ceiling height of about 1.5 m from ceiling to bedrock. To preserve an east–west profile of the shelter and adjoining talus area, excavation commenced in the talus on either side of the central line of grid units (272N) and proceeded toward and into the shelter (Fig. 8.30). Once the shelter grid units were cleared to bedrock and profiles drawn on either side of the central line of grid units, the remaining units were excavated (Fig. 8.38). A north–south profile of the fill and shelter walls and ceiling along 141E was drawn (E–E'; Fig. 8.39).

Within the North Shelter, the central area was covered with a mass of brush and large rocks that had been dumped in the shelter opening (Figs. 8.36, 8.37). Most had to be removed before the profiles were drawn and do not appear in the profiles. Many of the substantial rocks had fresh breaks indicating they were fractured and dumped by mechanical equipment (Fig. 8.40). Some also had ash adhering to their surfaces indicting they were part of or near thermal features. Rodents utilized the rock pile, adding smaller pieces of vegetation for nesting and numerous acorn hulls. The loose vegetation was removed and the remaining rocks photographed and sketched.

Shelter fill was removed by grid unit, in 5 cm levels (Table 8.27). Fill depths ranged from a few centimeters along the shelter walls to about 40 cm near the front of the shelter. The fill was uniformly damp, worm-worked soil from just below the surface with little indication of stratification (Fig. 8.41). Areas of slightly more compact soil were observed, some of which were probably the bases of rodent burrows. Other compacted areas may have resulted from human activities. Figure 8.39 shows

Figure 8.36. North Shelter, before excavation.

Figure 8.37. North Shelter and North Talus, with vegetation removed.

Figure 8.38. North Shelter, excavated.

several discontinuous lenses of clean clay around the 11.65–11.75 elevation in two of the three grid units with rodent disturbance at that level in the center grid unit. None of the compacted areas were large—most were no more than small patches—but others, and a 10 cm diameter pocket of ash, were observed near the same level in 272N/141E. Just below these in the same grid unit, was a larger (60 by 15 cm) packed area that may have been burned (Fig. 8.42). No formal features were found, nor were there concentrations of artifacts that could indicate activity areas. Modern glass (usually from brown or clear, but occasionally dark-green beer bottles), foil, and plastic were found in the lowest levels of three grid units and the next-lowest level in one. All grid units had modern material throughout, indicating considerable mixing of deposits by burrowing rodents.

North Shelter Artifacts and Sample Results

A total of 51 levels were excavated within North Shelter. These resulted in relatively large artifact counts given the restricted area and number of excavated grid units (Table 8.27).

Ceramics

The small number of excavated levels in North Shelter produced the only Cibola tradition sherd in the site assemblage (Table 8.28). Otherwise, North Shelter has the largest proportion of Plain body sherds (72.7 percent) of the four areas with ceramics. Except for the Cibola sherd, temper is leucocratic igneous, mainly non-micaceous. All are from jars except for one indeterminate Taos Incised. Plain, neckbanded, clapboard, and corrugated rims or necks were all found (Table 8.29). Again, because of the restricted space involved, there does not appear to be any spatial clustering of the various wares.

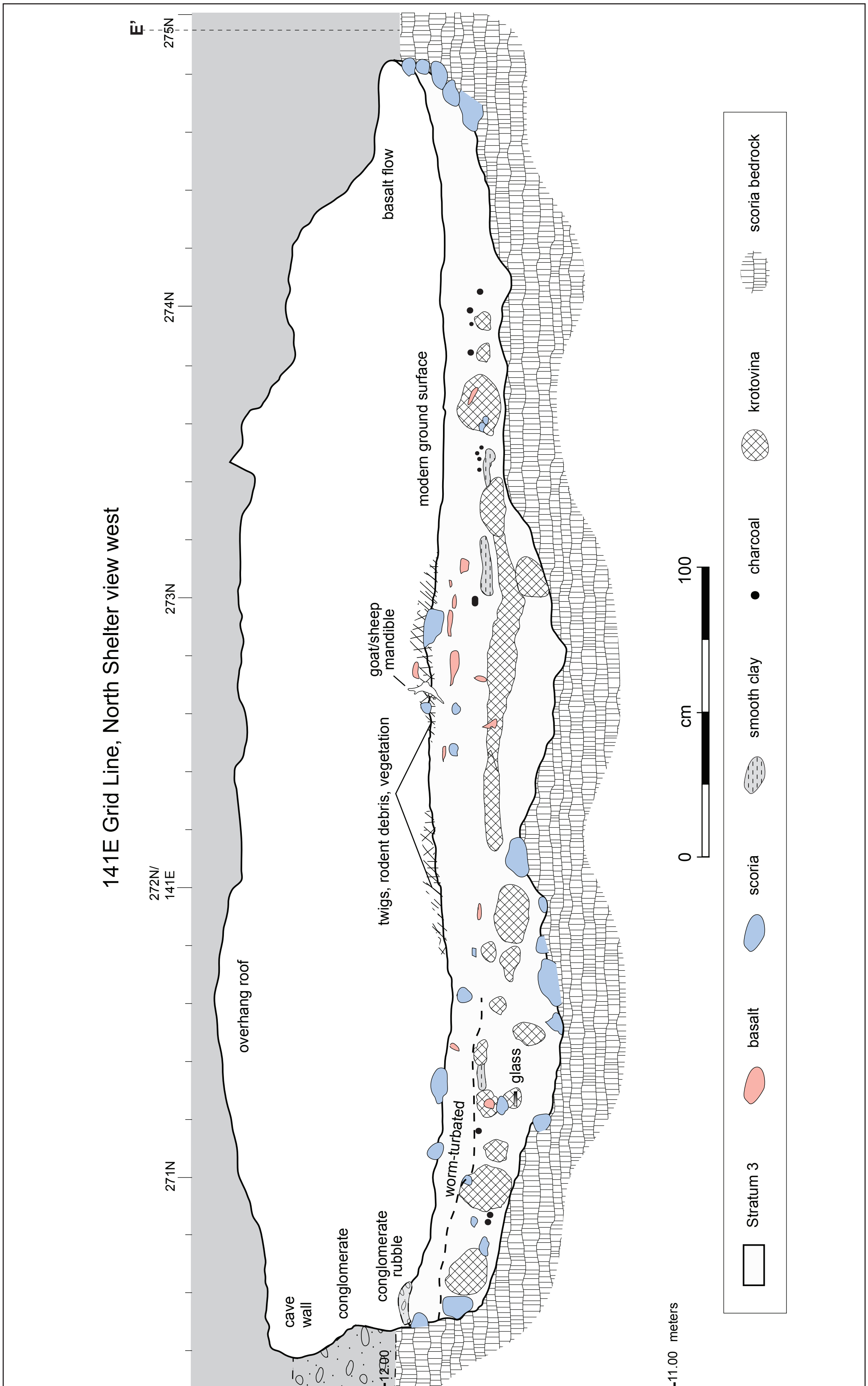

Figure 8.39. North Shelter, north–south profile (E–E') along the 141E grid line, 270–275N; west wall.

Figure 8.40. North Shelter, rock and vegetation on surface of grid unit 272N/141E.

Chipped Stone

Chipped stone was recovered from all 51 levels excavated from within North Shelter (n = 617). The density per level (12.1) is greater than any other area (South Shelter 7.9, North Talus 7.6, South Talus 6.2, and Central Talus 0.2). Core flakes are the most common chipped stone type (75.7 percent) with fewer biface flakes (8.4 percent), pieces of angular debris (4.2 percent), and notching flakes (2.4 percent). Cores are all unidirectional (n = 18, 2.9 percent). Scrapers are rare (n = 2) and most projectile points are small, and most often corner-notched (Table 8.30). Fewer activities are indicated by the chipped stone assemblage than for any other area. Core reduction, projectile point manufacture, arrow-shaft refurbishing, hunting, and meat processing are all represented. Also indicated are leather-working, general pounding, and general scraping with no evidence for woodworking, general chopping, or general cutting (Chapter 10).

Chert (33.0 percent) and silicified wood (24.8 percent) were favored material for debitage with lesser amounts of obsidian (14.5 percent), basalt/andesite (10.4 percent), quartz (6.4 percent), metaquartzite (5.7 percent), and limestone (0.2 percent). Cores are chert (n = 6), silicified wood (n = 4), rhyolite (n = 3), quartz (n = 2), obsidian (n = 1), and metaquartzite (n = 1). Bifaces and projectile points are mainly chert (48.6 percent) and obsidian (21.6 percent), plus basalt/andesite (16.2 percent), metaquartzite (8.1 percent), silicified wood (2.7 percent), and rhyolite (2.7 percent).

Most of the chipped stone artifacts found in the North Shelter came from the more central grid units (271N and 272N, 140E and 141E) there, but no particular level of any grid unit had enough tools to suggest an activity area. Unlike all of the previous site areas, the number of levels in a grid unit does not correlate with anything but the number of bifaces and projectile points (Table 8.31). As would be expected, the amount of debitage is correlated with the overall chipped stone counts and with projectile point counts. Other significant correlations may be due to low counts more than anything else (e.g., core tools with unifaces).

Table 8.27.North Shelter grid units, excavated; highest beginning and lowest ending elevations, with artifact counts, disturbance types, and samples analyzed by level.

North	East	Levels	Beginning Elevations, in meters		Ending Elevations, in meters		Artifacts						Samples Analyzed	Disturbance	Comments
			West	East	West	East	Ceramics	Chipped Stone	Ground Stone	Bone	Historic	Other			
270	140	4	11.96	11.90	11.67	11.59	1	41	–	117	–	–	P	R, glass; L4	bedrock, all but NE corner
	141	5	11.94	11.76	11.52	11.44	13	48	–	168	–	–	R	R, plastic, glass; L3	bedrock, south half
271	139/ 140	6	11.91	11.83	11.68	11.47	26	106	1	381	3	1	–	R, scat, glass; L6	modern trash throughout
	141	6	11.84	11.68	11.42	11.37	22	129	–	352	–	–	RP	R, glass, plastic; L4	mechanical dump and rodent nest
272	139/ 140	7	11.85	11.83	11.49	11.47	20	88	1	371	–	1	R	R, glass; L5	–
	141	8	11.89	11.92	11.43	11.14	20	84	3	375	2	–	RP	R, plastic, glass; L8	mechanical dump and rodent nest
273	140	3	11.78	11.78	11.59	11.47	3	31	–	108	–	–	P	R, glass; L1	–
	141	8	11.87	11.86	11.48	11.26	15	50	2	249	2	–	P	R, glass, plastic; L7	mechanical dump and rodent nest
274	140/ 141	4	11.82	11.90	11.62	11.48	13	40	2	261	–	–	–	R, glass, plastic; L4	–
Totals		**51**					**133**	**617**	**9**	**2382**	**6**	**2**			

Samples: R = radiocarbon; F = flotation; P = pollen/starch/phytolith.
Disturbance: R = rodent; L = level.

Figure 8.41. North Shelter, fill in south face of grid unit 273N/143E.

Figure 8.42. North Shelter, possible burned area in 272N/141E.

Table 8.28. North Shelter, temper by pottery type; counts and percents.

Tradition	Taos										Cibola		Total	
Temper	Indeterminate		Leucocratic igneous w/ mica		Leucocratic igneous		Fine tuff and sand		Fine sand or silt		Sherd and sand			
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Mineral Paint undifferentiated	–	–	–	–	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Plain rim	–	–	–	–	1	100.0	–	–	–	–	–	–	**1**	**100.0**
Plain body	1	1.0	14	14.6	81	84.4	–	–	–	–	–	–	**96**	**100.0**
Wide Neckbanded	–	–	2	28.6	5	71.4	–	–	–	–	–	–	**7**	**100.0**
(Taos) Incised Gray	–	–	2	16.7	10	83.3	–	–	–	–	–	–	**12**	**100.0**
Clapboard Neck	–	–	–	–	1	100.0	–	–	–	–	–	–	**1**	**100.0**
Smeared Plain Corrugated	–	–	–	–	9	100.0	–	–	–	–	–	–	**9**	**100.0**
Unpainted undifferentiated	–	–	–	–	–	–	–	–	3	100.0	–	–	**3**	**100.0**
Taos B/w	–	–	–	–	–	–	1	50.0	1	50.0	–	–	**2**	**100.0**
Total	**1**	**0.8**	**18**	**13.6**	**107**	**81.1**	**1**	**0.8**	**4**	**3.0**	**1**	**0.7**	**132**	**100.0**

Table 8.29. North Shelter, vessel form by pottery type; counts and percents.

Pottery Type	Indeterminate		Jar Neck		Jar Rim		Jar Body		Jar Body w/ Strap or Coil Handle		Jar Body w/ Lug Handle		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Mineral Paint undifferentiated	–	–	–	–	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Plain rim	–	–	–	1.0	1	100.0	–	–	–	–	–	–	**1**	**100.0**
Plain body	–	–	9	9.4	–	–	85	88.5	1	1.0	1	1.0	**96**	**100.0**
Wide Neckbanded	–	–	5	71.4	–	–	2	28.6	–	–	–	–	**7**	**100.0**
(Taos) Incised Gray	1	8.3	5	41.7	–	–	6	50.0	–	–	–	–	**12**	**100.0**
Clapboard Neck	–	–	–	–	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Smeared Plain Corrugated	–	–	–	–	1	11.1	8	88.9	–	–	–	–	**9**	**100.0**
Unpainted undifferentiated	–	–	–	–	–	–	3	100.0	–	–	–	–	**3**	**100.0**
Taos Black-on-white	–	–	–	–	–	–	2	100.0	–	–	–	–	**2**	**100.0**
Total	**1**	**0.8**	**19**	**14.4**	**2**	**1.5**	**108**	**81.8**	**1**	**0.8**	**1**	**0.8**	**132**	**100.0**

Table 8.30. North Shelter, chipped stone, counts by type and grid unit.

North	East	Utilized debitage	Unutilized angular debris	Unutilized flake	Hammerstone	Core hammerstone	Unutilized core	Side scraper	End/ side scraper	Biface	Projectile point preform	Small point	Small stemmed point	Small corner-notched point	Small side-notched point	En Medio point	Small point, fluted?	Total
270	140	–	–	40	–	–	–	–	–	–	–	1	–	–	–	–	–	**41**
	141	–	3	44	–	–	–	–	–	–	–	–	–	1	–	–	–	**48**
271	140	–	1	97	–	1	3	1	1	–	–	1	–	–	1	–	–	**106**
	141	1	3	112	–	–	6	–	–	–	–	2	1	2	1	–	1	**129**
272	140	–	10	69	–	–	1	–	–	2	1	1	–	2	2	–	–	**88**
	141	–	1	74	1	–	–	–	–	–	2	2	1	1	1	1	–	**84**
273	140	–	3	25	–	–	1	–	–	–	1	–	–	1	–	–	–	**31**
	141	–	2	39	–	–	5	–	–	1	2	–	–	1	–	–	–	**50**
274	141	1	1	34	–	–	1	–	–	1	1	1	–	–	–	–	–	**40**
Total		**2**	**24**	**534**	**1**	**1**	**17**	**1**	**1**	**4**	**7**	**8**	**2**	**8**	**5**	**1**	**1**	**617**

Table 8.31. North Shelter, correlation coefficients for chipped stone types.

		Levels	Total chipped stone	Debitage	Cores	Core tools	Cobble tools	Uniface	Projectile points
Levels	Pearson Correlation	1.000	0.523	0.481	0.358	0.069	0.485	0.069	0.714**
	Sig. (2-tailed)	–	0.149	0.190	0.344	0.859	0.185	0.859	0.031
	N	9	9	9	9	9	9	9	9
Total chipped stone	Pearson Correlation	0.523	1.000	0.997*	0.541	0.409	0.169	0.409	0.680**
	Sig. (2-tailed)	0.149	–	0.000	0.133	0.274	0.664	0.274	0.044
	N	9	9	9	9	9	9	9	9
Debitage	Pearson Correlation	0.481	0.997*	1.000	0.501	0.434	0.155	0.434	0.640
	Sig. (2-tailed)	0.190	0.000	–	0.169	0.243	0.691	0.243	0.064
	N	9	9	9	9	9	9	9	9
Cores	Pearson Correlation	0.358	0.541	0.501	1.000	0.184	-0.313	0.184	0.274
	Sig. (2-tailed)	0.344	0.133	0.169	–	0.635	0.412	0.635	0.476
	N	9	9	9	9	9	9	9	9
Core tools	Pearson Correlation	0.069	0.409	0.434	0.184	1.000	-0.125	1.000*	-0.146
	Sig. (2-tailed)	0.859	0.274	0.243	0.635	–	0.749	–	0.707
	N	9	9	9	9	9	9	9	9
Cobble tools	Pearson Correlation	0.485	0.169	0.155	-0.313	-0.125	1.000	-0.125	0.512
	Sig. (2-tailed)	0.185	0.664	0.691	0.412	0.749	–	0.749	0.159
	N	9	9	9	9	9	9	9	9
Uniface	Pearson Correlation	0.069	0.409	0.434	0.184	1.000*	-0.125	1.000	-0.146
	Sig. (2-tailed)	0.859	0.274	0.243	0.635	–	0.749	–	0.707
	N	9	9	9	9	9	9	9	9
Projectile points	Pearson Correlation	0.714**	0.680**	0.640	0.274	-0.146	0.512	-0.146	1.000
	Sig. (2-tailed)	0.031	0.044	0.064	0.476	0.707	0.159	0.707	–
	N	9	9	9	9	9	9	9	9

** = Correlation is significant at the 0.05 level (2-tailed).
* = Correlation is significant at the 0.01 level (2-tailed).

Table 8.32. North Shelter, ground stone summary, by type, material, and provenience.

Artifact type	Condition	Material	North	East	Level
Hammerstone	Whole	Quartz	271	140	1
Polisher	Whole	Basalt	272	140	1
Mano, nfs (fragmentary)	Internal fragment	Sandstone	272	141	1
Mano, nfs (fragmentary)	Internal fragment	Orthoquartzite	272	141	8
One-hand mano	Corner(s) only missing	Orthoquartzite	272.78	141.24	8
Polishing stone, nfs	Whole	Metaquartzite	273	141	3
One-hand mano	Corner(s) only missing	Orthoquartzite	273	141	8
Indeterminate, fragmentary	Surface flake	Basalt	274	141	1
Hammerstone	End fragment	Quartz	274	141	2

nfs = not further specified.

Ground Stone

Few pieces of ground stone were recovered from the North Shelter (Table 8.32). Nearly half are one-hand manos (44.4 percent) with polishing and hammerstones the only other types. None of the manos are complete. All but one was made from orthoquartzite. Both one-hand manos were made from cobbles while the fragments were indeterminate or slabs. Three had been exposed to heat. Polishers were complete and of olivine basalt and metaquartzite cobbles. One had been exposed to heat. Both hammerstones were made of quartz, one was also a core. Neither have signs of heat alteration.

Complete artifacts tended to be in the upper levels of fill, although a slightly damaged one-hand mano was in Level 8 (Table 8.32). Again, nothing suggests in situ activity areas—the fill is more likely random trash, with the possibility of some items abandoned or cached for future visits to the site.

Bone

For a small space, the North Shelter had considerable bone (n = 2282). It has the third largest sample size but the greatest density of bone per level (Chapter 12). Dividing the grid units into the shelter back (140E) and front (141E), combining levels of fill to form four groups (Table 8.33), and eliminating those specimens that came from multiple levels finds a consistent increase in small mammal forms with depth except for the lowest levels in the front grid units. The back grid units consistently have larger small-mammal proportions. Proportions of large artiodactyl remains are generally low.

Bones from domestic animals were found in seven grid units. Most were sheep or goat (n = 6) or c.f. sheep or goat (n = 13) but a single cattle rib came from Level 2 of a back grid and is the only sawn bone from the site. Those found in the back (140E) grid units are from Levels 1–3, while those from the front grid units (141E) are from Levels 2–4 and 7. Only the Level 7 specimen, a c.f. sheep or goat mandibular condyle fragment, is burned. Two are sun-bleached and six are weathered.

Relatively little of the bone is weathered and the amount of weathered and sun-bleached bone generally decreases with depth in both the front and back grid units—25.8, 14.6, 9.7, and 7.1 percent in the back grid unit level groups and 16.3, 14.6, 15.9, 11.5 percent in the front grid unit level groups. Slightly more of the front shelter bone is carnivore gnawed (2.3 percent) than the rear (1.8 percent). Levels 3–4 in the back (3.8 percent) and Levels 5–6 in the front (3.5 percent) have the most. Few are rodent gnawed (0.5 percent overall).

More of the bone toward the front of the shelter is burned (Table 8.34). Discard burns are more common in Levels 5–6 in the back of the shelter and in the lowest levels (Levels 7–8) of the front shelter grid units.

Over half of the North Shelter worked bone objects are awls, mainly fine-pointed. However, only one is complete. All are expedient tools that could have been broken in use and discarded in the shelter. Others are small fragments of objects that could not be identified (n = 4) along with two small tubular bead fragments.

Microbotanical and Macrobotanical

A total of 42 flotation, two sediment pollen samples, and two phytolith and starch samples were analyzed from North Shelter. Having fewer samples than South Shelter is probably a major factor in finding less diversity in charred plant remains recovered in the North Shelter flotation samples. The most common burned taxa are goosefoot (n = 35 samples), cheno-am (n = 23 samples), ponderosa

Table 8.33. North Shelter, fauna summary, by subdivision and grid unit/level; counts and percents.

Levels	Small Mammal		Medium Artiodactyl		Large Artiodactyl		Total	
	n =	%	n =	%	n =	%	n =	%
Grid Units 140E								
1–2	47	13.0	309	85.6	5	1.4	**361**	**100.0**
3–4	70	21.1	255	73.6	9	2.7	**334**	**100.0**
5–6	42	25.6	122	74.4	–	–	**164**	**100.0**
7–8	4	90.8	9	69.2	–	–	**13**	**100.0**
Group Total	163	18.7	695	79.7	14	1.6	**872**	**100.0**
Grid Units 141E								
1–2	49	12.9	311	82.1	19	5.0	**379**	**100.0**
3–4	69	15.9	357	82.1	9	2.1	**435**	**100.0**
5–6	53	19.5	213	78.3	6	2.2	**272**	**100.0**
7–8	13	11.7	96	86.5	2	1.8	**111**	**100.0**
Group Total	184	15.4	977	81.6	36	3.0	**1197**	**100.0**
Total								
	347	**16.8**	**1672**	**80.8**	**50**	**2.4**	**2069**	**100.0**

Table 8.34. North Shelter, burned bone summary, by subdivision and grid unit/level; counts and percents.

Levels	Unburned		Discard burn		Roasting burn or scorch		Boiled?		Partial		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
						Grid Unit 140E						
1–2	258	65.2	135	34.1	1	0.3	2	0.5	–	–	**396**	**100.0**
3–4	249	67.3	114	30.8	2	0.5	4	1.1	1	0.3	**370**	**100.0**
5–6	94	53.4	80	45.5	1	0.6	1	0.6	–	–	**176**	**100.0**
7–8	10	71.4	4	28.6	–	–	–	–	–	–	**14**	**100.0**
Group Total	611	63.9	333	34.8	4	0.4	7	0.7	1	0.1	**956**	**100.0**
						Grid Unit 141E						
1–2	238	58.2	166	40.6	2	0.5	2	0.5	1	0.2	**409**	**100.0**
3–4	278	58.0	191	39.9	3	0.6	7	1.5	–	–	**479**	**100.0**
5–6	157	54.3	125	43.3	5	1.7	2	0.7	–	–	**289**	**100.0**
7–8	52	46.0	61	54.0	–	–	–	–	–	–	**113**	**100.0**
Group Total	725	56.2	543	42.1	10	0.8	11	0.9	1	0.1	**1290**	**100.0**
						Total						
	1336	**59.2**	**876**	**39.3**	**14**	**0.6**	**18**	**0.8**	**2**	**0.1**	**2246**	**100.0**

pine needles (n = 20 samples), amaranth (n = 10 samples), corn (n = 10 samples), and grass (n = 8 samples). Also found are single or small numbers of aster (n = 1 sample), sedge (n = 3 samples), vervain (n = 1 sample), chokecherry (n = 3 samples), pine bark (n = 1 sample), piñon nut shell (n = 1 sample), Douglas fir needles (n = 14 samples), and hedgehog cactus seeds (n = 2 samples). By weight, ponderosa pine was the most common wood in the flotation samples (56 percent) followed by oak (31 percent). Alder (7 percent), and cottonwood/willow (4 percent) were present along with trace (1.0 percent or less) amounts of cf. Douglas fir, pine, and chokecherry. Wood in charcoal samples has a similar distribution but c.f. mountain mahogany was found in one sample.

Uncharred plant parts from taxa not represented in the charred assemblage are numerous and include plants unique to the site samples. Purslane was found in all but two of the flotation samples, groundcherry in 31 samples, spurge in 16 samples, dock in 12 samples, wild lettuce in 11 samples, sunflower, mullein, and strawberry in seven each, mint family and cf. alder in four each, brome in three samples, borage family and raspberry in two each, and stickleaf, scorpion weed, bulrush, tumbleweed, Russian olive, c.f. skullcap, and globe mallow all in one each. Unburned acorn shells were found in 21 of the samples.

Burned rodent pellets were found in all but nine of the flotation samples and 13 samples (31.0 percent) had unburned pellets (App. 4.1b). Samples from grid units at the back of the shelter (n = 17) were less likely to have rodent pellets and the only burned pellets were found in Level 2 of one grid unit. In the front grid unit samples (n = 25) pellets were found in most grid units (n = 23) and 44 percent (n = 11) had burned pellets. These were found in samples from every level. Again, we can only speculate that the brush and other debris left by the rodents was routinely burned to clean out the shelter or that proximity to features or hot coals caused the burning.

Pollen samples from the North Shelter were from near the base and at opposite ends of the shelter: 270N/140E Level 3 and 273N/140E Level 2. The more southerly sample had large amounts of grass and ponderosa pine pollen along with pine, oak, juniper, spruce, fir, willow, and alder. These may reflect the local pollen rain, but the cattail, at least some of the grass, cheno-ams, high and low-spine aster, mustard, pea, globemallow, and Mormon tea could be economic taxa. The more northern sample is dominated by grass and cheno-am pollen with a good amount from ponderosa pine. Other types are a combination of pollen rain and possible economic use—piñon pine, alder, low and high-spine aster, mustard, pea, nightshade family, lily, and sagebrush (Phillips, Chapter 14). The one-hand manos examined for phytoliths had both cool and warm season grasses. One had indications of grinding cool-season grass (Cummings and Varney, Chapter 14).

Other Artifacts

A piece of unworked mica (2 by 3 cm) was found in Level 3 of grid unit 271N 140E. An olivella shell bead was found at the back of the shelter in grid unit 272N/140E in sweepings from Levels 1 to 4.

Historic Artifacts

Modern glass, plastic, and other obviously intrusive objects were not collected. These were noted in the grid unit forms and only those objects that could potentially provide information on dating the historic use of the shelter or how it was used during the historic period were collected. Glass and plastic were noted in most grid units and levels, often in the deeper levels (Table 8.27). A Texaco Valvoline motor-oil can on the surface at the rear of the shelter was not collected.

Only seven historic artifacts were collected from the North Shelter (Table 8.35): two sardine cans, a piece of amber-colored glass, two metal buttons, a cartridge, and a safety pin. All but one was from the upper two levels of fill. Both of the buttons were manufactured between 1800 and 1870 and the cartridge dates between 1867 and 1912. The date range suggests multiple historic uses of this shelter, the earlier one leaving the safety pin and buttons and the later one by hunters or sheepherders who ate a meal of sardines and may have left the cartridge.

Radiocarbon Dates

Two sediment and six charcoal dates were obtained from North Shelter. The two sediment dates were taken from along the 273N grid line (Figs. 7.6, 16.8). The sample from further back in the shelter was slightly higher due to the bedrock contours. It has a most accurate date of AD 1256–1306 while the sediment sample from further out and slightly lower dated at AD 1152–1260 (most accurate, Chapter 16). A charcoal sample taken from the far southwestern corner of the shelter produced an early date, AD 681–721 (most precise, Chapter 16) and is the only sample to be a combination of ponderosa pine and oak charcoal. The other samples are on ponderosa pine charcoal. Two samples from grid unit 271N/141E have most precise dates of AD 1296–1319 or AD 1351–1391 for the central fill (Level 3) and the earliest North Shelter date of AD 567–630. Three of the charcoal samples were taken from the grid unit just to the north—272N/141E. Levels do not directly correspond between the two because the 272N/141E grid had much more rock and brush piled on top and the bedrock sloped down from the back to the front of the shelter. Most precise dates from this grid unit start at AD 1163–1221 in Level 3, which is about 10 cm deeper than Level 3 in 271N/141E. The middle date of AD 1246–1279 in Level 6 is younger than that from Level 3, which may be due to the considerable rodent disturbance at this level (Fig. 8.39). The final sample from the base of the grid unit in Level 8 has a most precise date of AD 901–921 or AD 950–996. The bedrock in this grid unit is irregular and has fill that is both higher and lower in elevation than the base of the adjacent grid unit.

In addition to the more traditional radiocarbon dates, four plasma dates were obtained from a corn kernel and three bones. The corn kernel was from Level 2 of grid unit 270/141 and dated cal 1017 (95.4 percent probability). The traditional AMS date from the same grid unit and level is considerably earlier (AD 681–721). A deeply buried and burned

Table 8.35. North Shelter, historic artifact summary, by type, date, and provenience.

North	East	Level	Function	Fragment	Material	Color	Technique	Opening/ Closure	Begin Date	End Date
271	140	1	Safety pin	Whole	Metal alloy	Brown	Drawn, shaped	–	1849	–
271	140	1	Rimfire cartridge	Cartridge	Copper	Green	Extruded	–	1867	1912
271	140	2	Sardine can	Base, body	Tinned steel	Brown	Machined	Knife	1875	–
272	141	1	Sardine can	Whole	Tinned steel	Brown	Machined	Knife	1875	–
272	141	6	Button, four-hole	Whole	Iron	Brown	Stamped, drilled	–	1800	1870
273	141	1	Bottle, indeterminate	Finish	Glass	Amber	Mold	–	1872	–
273	141	2	Button, four-hole	Whole	Iron	Brown	Stamped, drilled	–	1800	1870

mandibular condyle identified as sheep or goat that was found in Level 7 of grid unit 273N/141E dated at AD 341 (cal. 95.4 percent probability). This suggests that if the date is correct the specimen is from a mountain sheep rather than a domestic sheep or goat. The cattle rib with modern saw cuts from Level 2 of grid unit 271N/140E dated at cal AD 1904 (95.4 percent probability). The final plasma date is problematic. An unburned tooth fragment from Level 3 of grid unit 274N/141E was dated cal AD 1286 (85.2 percent probability). Originally identified as c.f. sheep or goat, the prehistoric date indicates that either the tooth is from a closely related species (pronghorn or bighorn sheep) or the date is erroneous. Since several of the traditional radiocarbon dates are consistent with this one, the plasma date is probably correct.

North Shelter Summary

North Shelter is a small, bounded area with little ceiling room, which would limit the types of activities possible for most of its use. In spite of considerable rodent burrowing, the presence of several compacted areas and a possible burned area indicate the deposits retain some integrity, especially in the lower levels of fill. Two of the earliest radiocarbon dates are at the base of the shelter. The third early date is from along the south wall in 270N/141E in a level just above where scoria bedrock occupied the south half of the grid unit. Fill at this level was described as dry powdery soil with decomposed scoria and many large pieces of charcoal. The latest date (most accurate AD 1287–1399) was from the grid unit to the north (271N/141E) in the second level of fill that was similarly described as very loose, powdery, and dry with considerable charcoal. Rodent disturbance, glass, and plastic were noted above and below but were absent in the lowest level of fill from where the earliest shelter date was recovered (most accurate AD 545–645). Dates from the central grid unit (272N/141E) are not in chronological order—although the ranges of the upper two dates overlap slightly. The Level 3 date (most precise AD 1163–1221) came from fill described as including some mechanical fill, rodent disturbed, and containing plastic and glass. Level 6, with a most accurate date of AD 1219–1284, had patches of clay, ash, and charcoal, as well as intrusive plastic, glass, and one of the metal buttons. The lowest level date (most accurate AD 894–1018) was just under the possible burned area in fill that had patches of clay, few rocks, little charcoal, and rodent disturbance.

These dates suggest that as much as 850 years are represented in up to 40 cm of fill, not including the historic period use. However, considerable disturbance was caused by rodent burrowing and the rock and fill placed just within the shelter. The density of artifacts of all types indicates it was primarily used for trash disposal but the compacted and burned areas also indicate other uses. As fill accumulated in the shelter, it was probably like it is today—very loose and dry, so that any activity caused movement of artifacts downward and toward the shelter walls. As a result, with the exception of the lowest levels, much of the fill is too disturbed to distinguish separate occupations.

CENTRAL TALUS & Cliff-Edge Grid Units

The area between the North Talus and South Talus was considered the Central Talus (Figs. 8.43, 8.44). It was originally estimated to be about 24 m north to south and 124 sq m in size. Based on refined definitions of the North and South Talus areas, the Central Talus area became the area extending from 253N to 266N. In this area, the cliff has little or no overhang, and in some areas the talus soil had been scraped away leaving only bedrock and decomposing bedrock. Grid units (263–265N/142E), adjacent to the cliff in the scraped area were not excavated (Fig. 8.45). Of the approximately 54 grid units that were not part of the bar ditch or highway berm in this area, 18 (33.3 percent) were excavated.

Excavation in the Central Talus began with a stratigraphic trench comprised of a line of four grid units between 257N and 258N at 142E to 145E (Fig. 8.46). Except for the grid unit at the base of the talus, the fill was shallow and excavated as a single level (Fig. 8.47). Fill was all Stratum 3 with scoria and olivine basalt inclusions and large olivine basalt boulders at the base. Excavation included units largely occupied by boulders (Figs. 8.48, 8.49) as well as those with rock rubble (Fig. 8.50), and an elevated area in grid units 260–262N/140–141E (Fig. 8.51). Most of the cliff-edge and Central Talus grid units had little fill,

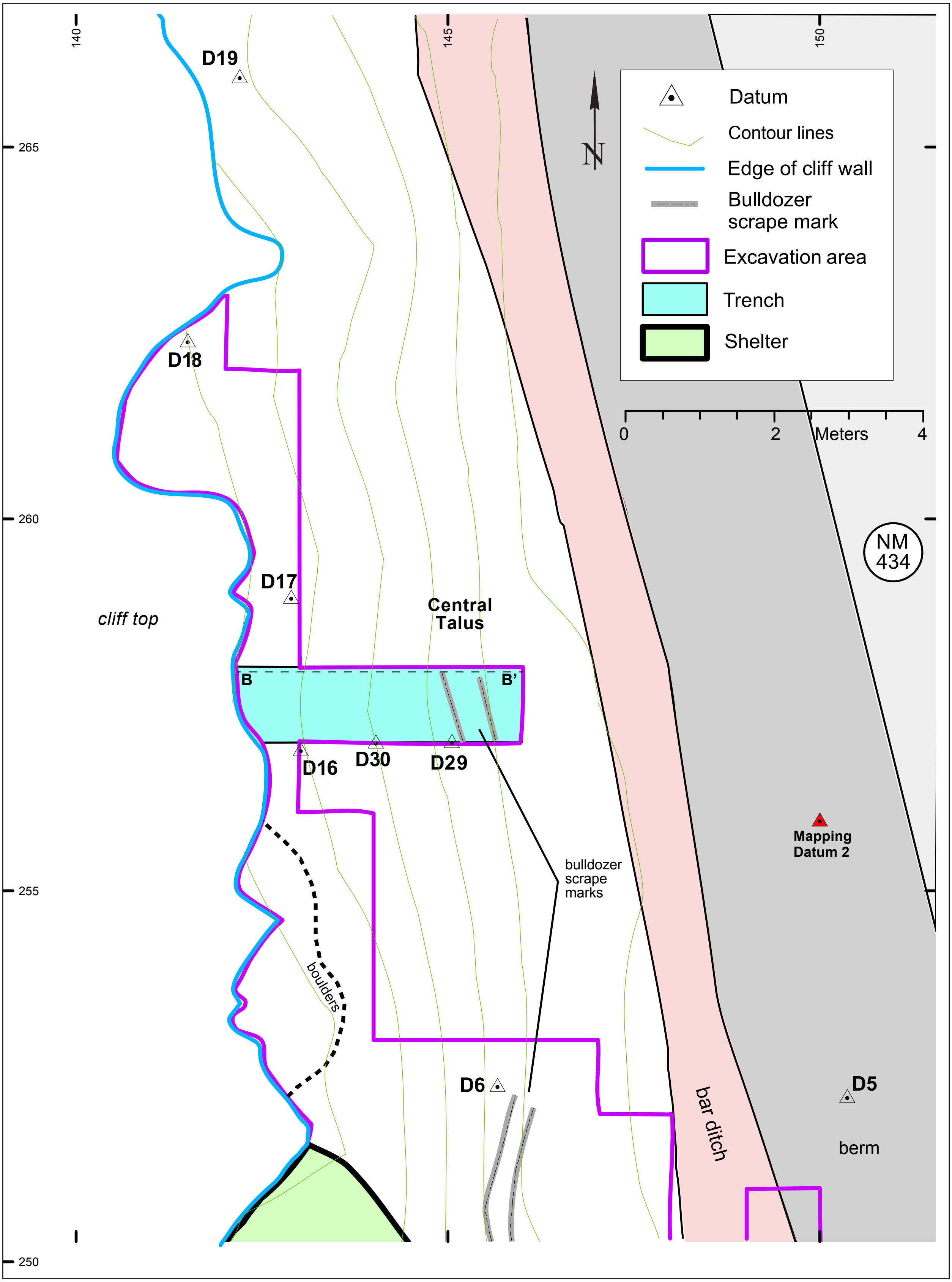

Figure 8.43. Central Talus, plan map.

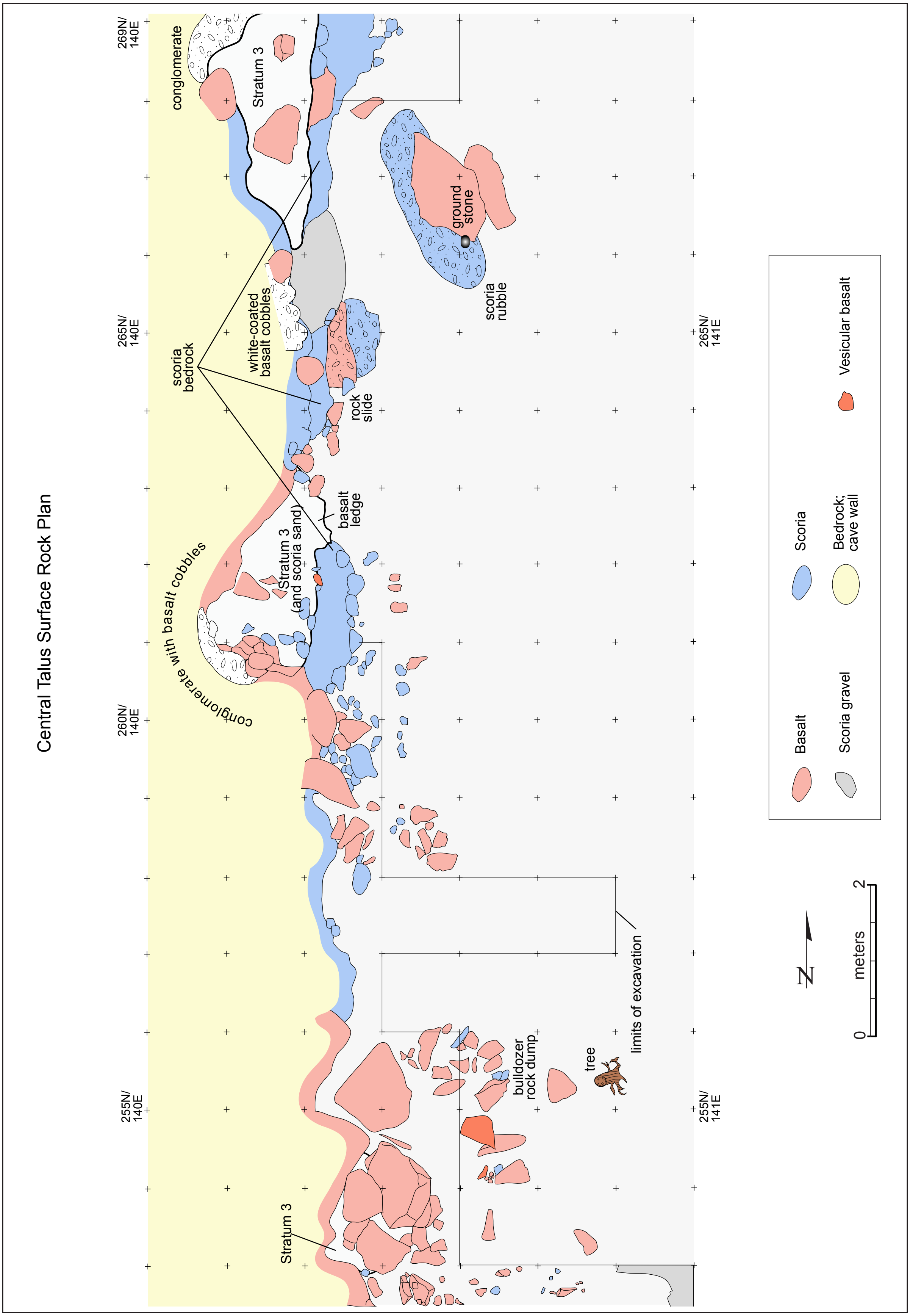

Figure 8.44. Central Talus, plan map showing surface rock distribution.

Figure 8.45. Central Talus, portion that was not excavated.

or the fill was in cracks between boulders and the cliff face. Most were excavated as single levels (Table 8.36) and few artifacts were recovered.

Central Talus and Cliff-Edge Artifacts and Sample Results

Few artifacts were found in the 20 levels of fill excavated in the Central Talus area. Seven of the excavation units in Table 8.36 had no artifacts other than modern glass, which was not collected for analysis. No ceramics, four pieces of chipped stone, 58 bones, two ground stone objects, and no historic artifacts were recovered from the Central Talus. Two flotation samples, one sediment pollen sample, and a radiocarbon sample on sediment were analyzed. The chipped stone artifacts were all from the two southernmost grid units (253N/142–143E) and most of the fauna came from the same two grid units. A single bone was the only artifact found in the stratigraphic trench.

Chipped Stone

Only four pieces of chipped stone were recovered from the 20 excavated levels. All are from two grid units and the first level of fill. These include the base of a small, stemmed projectile point made of chert, two silicified wood core flakes, and a chert biface flake.

Ground Stone

Two pieces of ground stone were collected

Figure 8.46. Central Talus trench, at 257N.

from the surface of the Central Talus. These include a burned medial fragment of a smooth abrader made from an orthoquartzite cobble from grid unit 255N/143E. A near complete two-handed mano was found in grid unit 253N/144E; it was made from a micaceous schist cobble and was fire-fractured.

Bone

Nearly all of the bone from the Central Talus came from between and around boulders (Fig. 8.48) in two grid units (253N/142E and 253N/143E), and all are from the first level of fill. Like other areas of the site, small mammals (14.4 percent) and large artiodactyls (5.8 percent) made up small portions of the assemblage, with medium artiodactyls comprising most (78.8 percent). Few bones were burned (n = 7; 12.0 percent).

Microbotanical and Macrobotanical

Two Central Talus flotation samples and one sediment pollen sample were analyzed. The only charred plant parts found in the flotation samples were two ponderosa pine needles, pine bark, and an unidentifiable seed (Chapter 13). No charred rodent pellets were found in this relatively disturbed area of the site.

The pollen sample was taken from a grid unit adjacent to the cliff (256N/142E) to provide a sample for an area less impacted by human activities. Pollen from at least 17 taxa was identified. Grass and ponderosa pine were almost equally abundant with far less of any other taxon. Most of the other taxa could be part of the local pollen rain (piñon pine, juniper, oak, alder, fir, spruce, sage brush), but others—e.g., cattail, asters, mustard, pea family, and sedges (Phillips, Chapter 14)—could be economic, or could have arrived in the overbank deposit soils comprising the site.

Radiocarbon Dates

A date on the organic material in sediment from grid unit 239N/145E was most precisely dated at AD 967–1016. This location was chosen because there was no apparent cultural material that could influence the

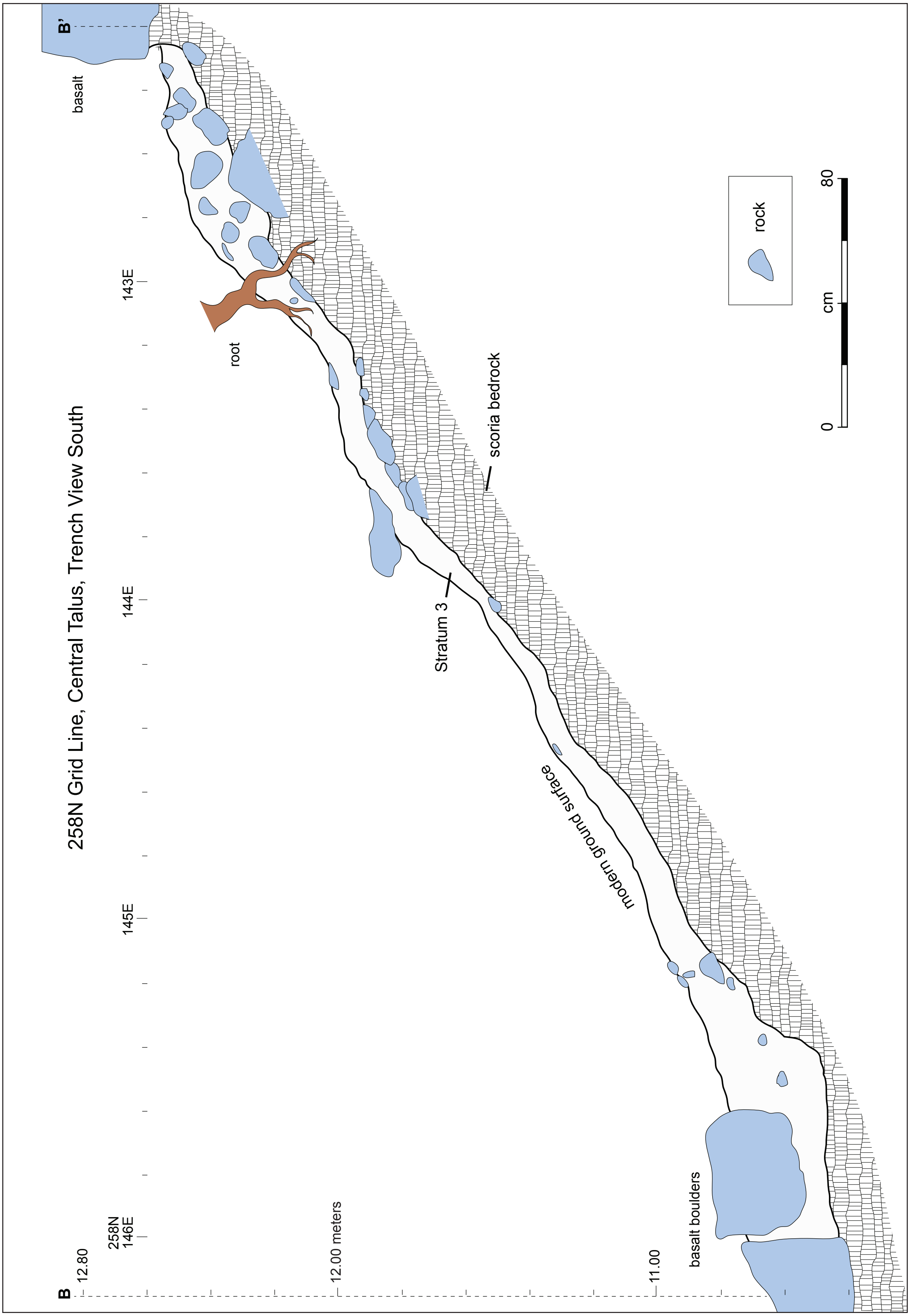

Figure 8.47. Central Talus trench, east–west profile (B–B') along the 258N grid line, view south.

Figure 8.48. Central Talus, boulders in grid units 253–255N/142–143E.

date. The only artifact from that particular grid was a cottontail lumbar vertebra fragment that could be a natural rather than a cultural object.

Central Talus Summary

The area between the two shelters had little indication of use. This is mainly because there was no overhang that could provide shelter and virtually no space for activities (e.g., Fig. 8.46). Even the elevated area had no artifacts other than a piece of glass, suggesting the area was used very little if at all.

ROCK ART

All of the potential rock art and graffiti found was in the area around North Shelter. Most are scratches in the rock surface while others are pigment stains, only one of which has a discernible form. Except for two of the modern scratched-graffiti panels, all are difficult to see and visible only when the light angle is right. Since none of these should be impacted by construction, they were photographed and located without detailed recording. Those that appear to be older are more difficult to access. Table 8.37 gives the general location and a brief description of each, going from north to south. In general, the modern graffiti is in areas easily accessed from the modern ground surface and are scratched into the darkly stained and unstained areas of the cliff face. The possible older images tend to be in natural-colored rock higher up on the cliff face. A pecked zigzag motif is more substantial than the graffiti and could be prehistoric to early historic in date.

The northernmost panel is just outside the site boundaries, where the cliff steps back to the west. It consists of fairly shallow scratches in an area with a black patina (Fig. 8.52). In addition to "Justin + Mega[n]," there is a larger "M" and a small "x." Other scratches do not seem to form patterns.

The second-most northern cluster of images consists of a possibly painted image with two areas

Figure 8.49. Central Talus, crevice excavation in 255N/142E.

of scratches above and to the north of the painted image (Fig. 8.53). The possibly painted symbol is a slightly left-leaning triangle with tassels or sticks at the top and a more irregular line at the base (Fig. 8.54). Other possible lines extend from the top of the triangle to the left; there is also a vertical line to the left of the image. Just above and to the right of the painted image is a series of curved lines with no obvious form (Fig. 8.55). Also to the right are a cluster of straight and curved lines, again with no obvious form (Fig. 8.56).

A few meters to the south is another graffiti cluster (Fig. 8.57). Again, it is scratched into the black patina on a south-facing area at the north end of North Shelter. Although the scratches form letters, no names or dates are evident. Just to the west (Fig. 8.58), is a series of seemingly random lines around and over an area of gold-colored patination.

Two meters to the south, above North Shelter and facing west to west–northwest is a natural-colored rock area marked with what is possibly red and white pigment (Fig. 8.59). No forms or patterns are evident.

The final example is above the south end of North Shelter, on a natural-colored rock that faces west (Fig. 8.60). The rock art there consists of a short, vertical zigzag with a curved tail at the base and, just above and north of the zigzag, a possible arrow pointing downward. This one is pecked and more substantial than the scratches considered modern graffiti.

Figure 8.50. Central Talus, rubble-filled grid unit 255N/142E.


Figure 8.51. Elevated area at 261N/141E.

Table 8.36. Central talus and cliff-side grid units, excavated; highest beginning and lowest ending elevations, with artifact counts, disturbance types, and samples analyzed by level.

North	East	Levels	Beginning Elevations, in meters		Ending Elevation, in meters		Artifacts						Samples Analyzed	Disturbance	Comments
			West	East	West	East	Ceramics	Chipped Stone	Ground Stone	Bone	Historic	Other			
253	142	1	13.25	–	13.00	–	–	2	–	30	–	–	F	Bird nest debris	Small area between boulders.
	143	1	12.60	12.25	12.40	12.06	–	2	1*	17	–	–	F	–	Boulders, west portion.
254	142	1	–	13.05	–	12.95	–	–	–	4	–	–	–	–	Most of the grid is boulders.
	143	1	12.30	12.20	12.22	12.00	–	–	–	–	–	–	F	–	Boulders, west portion.
255	142	4	13.05	–	12.48	–	–	–	–	–	–	–	–	–	Soil behind boulder.
	143	1	12.40	12.02	12.20	10.92	–	–	1	1	–	–	–	–	Boulder, SW corner; one surface artifact.
256	142	1	12.60	12.37	12.36	12.30	–	–	–	1	–	–	RP	–	Bedrock, west half.
257	142	1	12.64	12.41	12.44	12.26	–	–	–	1	–	–	–	–	Bedrock west portion.
	143	1	12.46	11.75	12.24	11.68	–	–	–	–	–	–	–	–	No artifacts.
	144	1	11.69	11.13	11.62	10.96	–	–	–	–	–	–	–	Road, gravel	No artifacts.
	145	3	11.05	10.62	10.90	10.34	–	–	–	–	–	–	–	Glass, Level 1	Test SE corner; no artifacts.
258	142	1	12.67	12.52	12.48	12.23	–	–	–	3	–	–	–	–	Bedrock, west third.
259	142	1	12.60	12.38	12.25	12.12	–	–	–	1	–	–	–	–	No artifacts.
260	142	1	12.64	12.15	12.20	11.93	–	–	–	–	–	–	–	–	Bedrock, west half; no artifacts.
261/ 262	140/ 141	1	13.26	12.99	12.95	12.97	–	–	–	–	–	–	–	Rodent nest, glass	Shelf in bedrock; no artifacts.
Total		**20**					**–**	**4**	**2**	**58**	**–**	**–**			

Samples: R = radiocarbon; F = flotation; P = pollen/starch/phytolith.
* = 144E.

Table 8.37. Rock art and graffiti panels, type and description by provenience.

Grid Unit	Facing	Type	Description
282N/142E	west	scratches	Justin + Megan; M, X, and other lines
277-278N/142E	west	red pigment?	tipi?
	west	scratches	just above tipi, curved and straight lines
	northwest	scratches	just right of tipi; straight and curved lines
275N/141–142E	northwest	scratches	letters and lines in dark patina
	north	scratches	around gold-colored spot
273-274N/141E	west	pigment	red and white
272N/141E	west	pecks	zig-zag with tail
	west	scratches	graffiti

Figure 8.52. Modern graffiti at 282N/142E.

Figure 8.53. Overview of panel with tipi and scratched designs in 277–278N/142E.

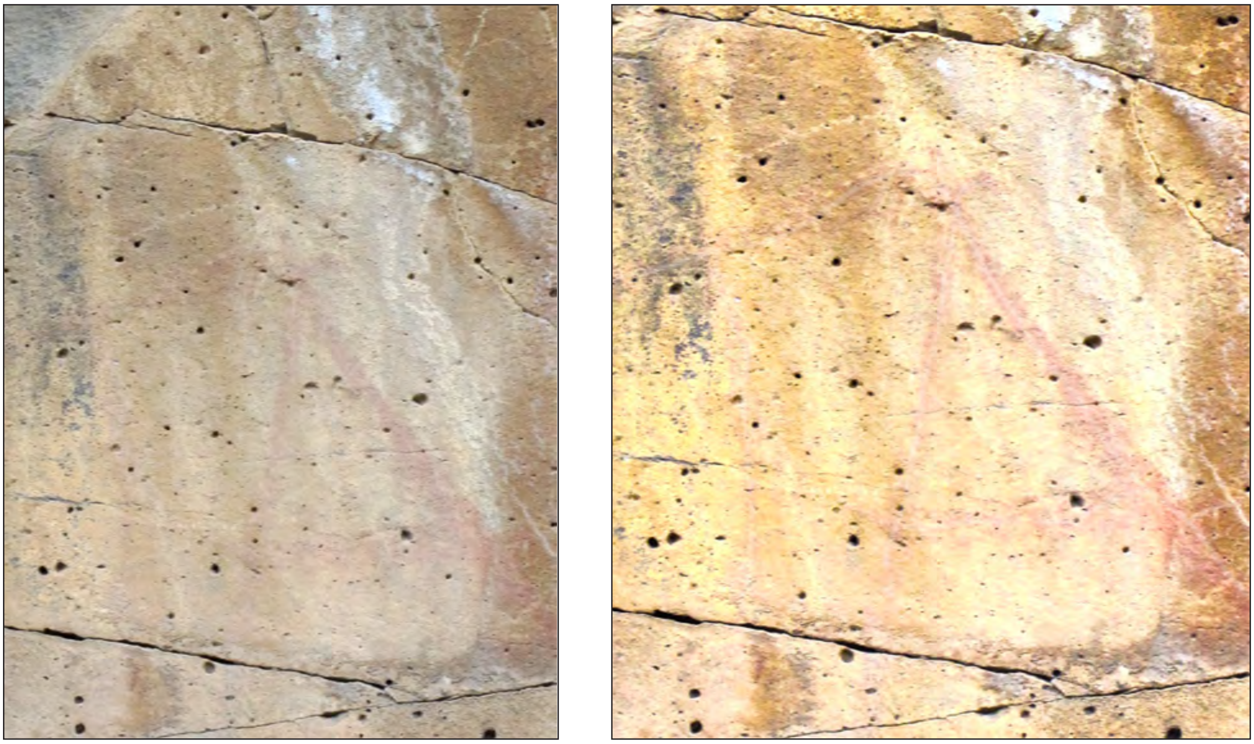

Figure 8.54 [a,b]. Detail of possible red paint image; (left) actual, (right) enhanced.

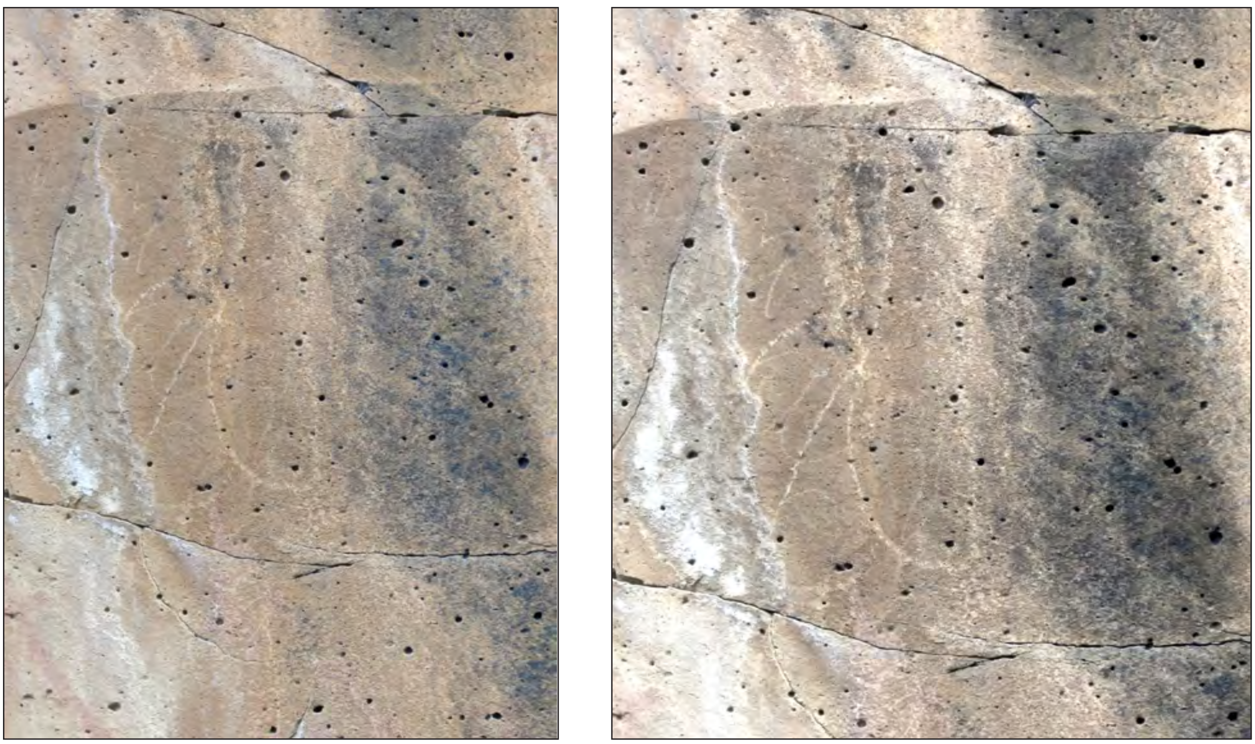

Figure 8.55 [a,b]. Scratched lines above painted image; (left) actual, (right) enhanced.

Figure 8.56 [a,b]. Scratched lines to the right of the painted image; (top) actual, (bottom) enhanced.

Figure 8.57. Letters and lines in patina at 275N/142E

Figure 8.58. Scratches on unpatinated rock at 275N/141E.

Figure 8.59. Red pigment (upper at center) and white pigment (center and left) at 273–274N/141E.

Figure 8.60. Pecked zigzag form at 272N/141E.

9 Ceramic Analysis

C. Dean Wilson

A total of 581 sherds associated with the two rockshelters at LA 139965 were analyzed. These include 132 sherds from the North Shelter, 149 sherds from the North Talus, 205 sherds from the South Shelter, and 95 sherds from the South Talus (Tables 9.1, 9.2).

Analysis Strategy

Analysis of the pottery recovered during this investigation involved the consistent recording of descriptive attributes, typological categories, and quantitative (count and weight) variables that form the basis for examining issues presented in the project research design (Akins et al. 2014). The resulting data allows for characterization and comparison of the LA 139965 ceramic assemblages and the assignment of dates; it also provides a foundation for the examination of issues relating to cultural affiliation or tradition, area of origin, exchange, form, and use of pottery vessels.

Descriptive Attributes

In order to examine various issues and trends, a number of descriptive attribute categories were recorded. Ceramic attributes that were recorded include temper type, surface manipulation, vessel form, paste color, refired paste color, and post-firing modification.

Temper Categories. Temper categories were assigned to each sherd based on observations made on a freshly broken surface through a binocular microscope. Criteria included the color, size, shape, and crystalline structure of the associated particles.

Most of the pottery at LA 139965 has temper comprising angular to sub-angular white to gray fragments and smaller amounts of associated material that seem to reflect the use of granite (leucocratic rock) derived from nearby sources in the Sangre de Cristo Mountains. While some variability in size, shape, and color was noted in these fragments, it was often difficult to distinguish temper sources—particularly in the dark paste found in the majority of the utility ware—through visual examination alone. The great majority of temper is characterized by the dominance of white to gray angular fragments along with the occasional occurrence of varying amounts of quartz sand and fine sandstone fragments. There also appears to be considerable variation in the size and inclusion of other mineral and rock types within these fragments. Most of

Table 9.1. Ware types, distribution by site area; counts and percents.

Ware Type	North Shelter		North Talus		South Shelter		South Talus		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%
Taos Utility	126	95.5	140	94	187	91.2	87	91.6	**540**	**92.9**
Taos White	5	3.8	9	6	3	1.5	–	–	**17**	**2.9**
Middle Rio Grande Glaze	–	–	–	–	15	7.3	8	8.4	**23**	**4**
Cibola White	1	0.8	–	–	–	–	–	–	**1**	**0.2**
Total	**132**	**100**	**149**	**100**	**205**	**100**	**95**	**100**	**581**	**100**

Table 9.2. Pottery types, distribution by ware group and site area; counts and percents.

Pottery Type	North Shelter		North Talus		South Shelter		South Talus		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%
Cibola White Ware										
Mineral Paint Undifferentiated	1	0.8	–	–	–	–	–	–	**1**	**0.2**
Middle Rio Grande Glaze Ware										
Glaze Yellow Unpainted	–	–	–	–	8	3.9	4	4.2	**12**	**2.1**
Glaze-on-yellow Indeterminate	–	–	–	–	6	2.9	4	4.2	**10**	**1.7**
Cienequilla Glaze-on-yellow	–	–	–	–	1	0.5	–	–	**1**	**0.2**
"Taos" Utility Ware										
Plain Rim	1	0.8	2	1.3	2	1.0	2	2.1	**7**	**1.2**
Indeterminate Rim	–	–	–	–	1	0.5	–	–	**1**	**0.2**
Plain Body	96	72.7	99	66.4	111	54.1	55	57.9	**361**	**62.1**
Wide Neckbanded	7	5.3	6	4.0	10	4.9	8	8.4	**31**	**5.3**
Wide Neckbanded (Wiped)	–	–	–	–	1	0.5	1	1.1	**2**	**0.3**
Incised Gray	12	9.1	12	8.1	11	5.4	4	4.2	**39**	**6.7**
Coiled Necked	–	–	3	2.0	16	7.8	8	8.4	**27**	**4.6**
Clapboard Neck	1	0.8	–	–	–	–	–	–	**1**	**0.2**
Brushed Scored	–	–	1	0.7	–	–	–	–	**1**	**0.2**
Indented Corrugated	–	–	2	1.3	5	2.4	2	2.1	**9**	**1.5**
Smeared Corrugated	9	6.8	14	9.4	23	11.2	7	7.4	**53**	**9.1**
Polished Utility	–	–	1	0.7	4	2.0	–	–	**5**	**0.9**
Polished Smudged	–	–	–	–	3	1.5	–	–	**3**	**0.5**
Taos White Ware										
Unpainted Undifferentiated	3	2.3	2	1.3	3	1.5	–	–	**8**	**1.4**
Mineral paint Undifferentiated	–	–	1	0.7	–	–	–	–	**1**	**0.2**
Taos Black-on-white	2	1.5	6	4.0	–	–	–	–	**8**	**1.4**
Total										
	132	**100.0**	**149**	**100.0**	**205**	**100.0**	**95**	**100.0**	**581**	**100.0**

the lighter colored rock appears to be quartz and feldspar, and it was assumed that they reflect the use of granite and/or deposited acrostic sand or sandstone sources scattered across the Sangre de Cristo Mountains and associated drainages. Thus, pottery tempered with combinations of rock or mineral fragments indicative of derivation from these sources was either classified as *leucocratic rock* or *leucocratic rock and mica.* These temper types are assumed to mostly reflect the use of granite cobbles, acrostic sand or sandstone, or self-tempered clays weathered from such materials, which are common in sources across the Sangre de Cristo Mountains. Categories that may reflect alluvial sources used in the production of white wares include *self tempered, fine sand or silt,* and *fine tuff and sand*.

Other categories appear to reflect sources commonly utilized in other regions. *Sherd and sand* is characterized by rounded or sub-rounded, well-sorted sand grains and dull white to gray sherd fragments. This combination of temper is common in white wares long produced in the Cibola or Chaco region. The other temper that is clearly non-local in origin is the latite or monazite common in glaze wares produced in areas of the Galisteo Basin. This temper is characterized by dull buff, light gray, or dark-colored dull tuff particles and shiny black and white quartz particles.

Surface Manipulation. Surface manipulation categories provide information relating to the presence and type of surface textures, polish, and slip treatments. These categories were recorded for both interior and exterior sherd surfaces. *Surface missing* refers to cases where the original surface treatment could not be identified due to wear or spalling. *Plain unpolished* refers to surfaces that are unpolished and smoothed. *Plain polished* surfaces are those which have been intentionally polished after smoothing. Polishing implies intentional smoothing with a polishing stone to produce a compact and lustrous surface. Surfaces of white wares where a distinct light-colored low-iron slip was applied were classified as *polished white slip*. Those that were oxidized and have a yellow- to cream-colored slip were described as *polished cream slip*. Surfaces of red wares were assigned to a *polished red slip* category, reflecting the use of a high-iron clay slip to create a red surface. *Plain striated* refers to the presence of a series of extremely shallow parallel striations or marks presumably resulting from brushing with a fibrous tool on an unpolished surface. A variety of textured treatments, which reflect the remnants and associated treatments of obliterated coils, were recorded and include *wide coil (fillet)*, *narrow coil*, *clapboard*, *indented corrugated*, and *smeared corrugated*. The presence and type of decorations that were sometimes incised on the surface with a tool were also recorded and include *banded incised, incised herringbone shaped design*, *fingernail shaped incised,* and *indeterminate incised design*.

Vessel Form. Vessel form categories were assigned based on the shape or portion of the vessel from which a sherd most likely derived. Criteria utilized to make such identifications include rim shape and the presence and surface location of polish and painted decorations. Vessel form categories identified during the present study include *indeterminate*, *bowl rim*, *bowl body*, *jar neck*, *jar rim, jar body*, *jar body with strap handle*, *jar body with lug handle*, *indeterminate coil handle, cloud blower*, *body sherd polished interior and exterior*, and *jar rim with coil handle*.

Paste-Color Profile. Paste-color profile refers to the basic color or combinations of colors noted in the sherd profile, which reflects the qualities of the clay and atmosphere in which a vessel was fired. Overall characteristics observed in profiles are gradational and it can be difficult to assign a sherd to a specific profile. Categories identified during the present analysis include *dark gray to black*, *brown to dark brown, light gray*, *pink to orange*, *deep red*, *white*, and *gray core*.

Refired Paste Color. Refiring analysis provides comparisons based on mineral impurities in clay and ceramic pastes. This technique involved firing samples in oxidizing conditions to temperatures of 950° C. Such firings standardize the oxidation of iron compounds in clays, and fires out organic material. This allows for the common comparison of color of samples, and reflects types and amounts of mineral impurities (particularly iron). Sample color was recorded using standard Munsell color categories. For the present study, sherds exhibiting hues of 10R to 2.5YR were described as red, hues of 5Y as yellow red, hues of 7.5YR as pink, and hues of 10YR, 2.5Y, and 5Y as buff.

Post-Firing Modifications. Evidence of intentional modification by repair or for subsequent use was also recorded. Most sherds did not contain evidence of modification and were recorded as *none*. Modification categories recognized during the present study include *beveled edge* and abraded surface.

Ceramic Types and the Coyote Canyon Rockshelter Assemblage

Pottery at LA 139965 was assigned to typological categories based on combinations of traits that have spatial, functional, and temporal implications. Assigning a sherd to a particular type reflects a series of decisions that consist of first determining the associated ceramic tradition, then the ware group, and finally the defined type. *Ceramic traditions* are broad groups indicative of a postulated area of origin or "cultural" association. Placement into a ceramic tradition is based on the temper, paste, and paint characteristics indicative of types known to have been produced in particular regions. Next, ceramic items are assigned to *ware groups* based on technological attributes and surface manipulation. Finally, they are assigned to *ceramic types* based on temporally sensitive painted decorations or textured treatments. Ceramic types—as defined here—refer to convenient categories that can be used to document and relay information about the distribution of pottery with a combination of traits that have temporal, spatial, and functional significance. One difficulty encountered in this study was the rarity of ceramic studies from sites in the immediate area, although LA 139965 seems to be located between several different areas that are sometimes included within the Taos Ceramic District (Lang 1982), which is discussed below.

Because the area is poorly known, the distinct characteristics of most of the pottery examined during this study present a unique challenge in terms of their assignment to types from specific traditions and wares. Pottery from the Coyote Canyon Rockshelter was assigned to types thought to be associated with four distinct combinations of traditions or ware groups. These include those assigned to Taos tradition utility wares (n = 540, or 92.9 percent of the total sherds), Taos tradition white wares (n = 17, or 2.9 percent of the total sherds), Cibola tradition white ware (n = 1, or 0.2 percent of the total sherds), and Rio Grande glaze ware (n = 17, or 2.9 percent of the total sherds).

Taos District Ceramics

The majority of the pottery identified during the present study most closely matches pottery described from distinct, widely scattered, and still poorly understood archaeological manifestations that seem to be associated with the Taos Ceramic District (Taos District) or Taos tradition. The Taos District as defined by Lang (1982) extends north from the Española to Red River, south to the Rio Pueblo River, west to the southern San Juan Mountains and Rio Grande, and east over the Sangre de Cristo Mountains into the headwaters of the Canadian and Arkansas Rivers, and appears to reflect populations directly ancestral to groups residing today in the Northern Tiwa Pueblo villages of Taos and Picuris. The Taos District comprises the northeastern area of New Mexico long-occupied by Pueblo groups along with sites that have been attributed to groups from the Southern Great Plains (Lang 1982). Pottery produced across much of the Taos District seems to be very similar to and can usually be distinguished from that defined for other Rio Grande regions by paste and in some cases styles—such as the common occurrence of incised decorations on utility wares during certain time spans.

Taos White Ware

The only distinct formal white ware type identified during the present study is *Taos Black-on-white* (Fig. 9.1). As usually described, this type appears to be the dominant decorated pottery at sites dating to the Valdez phase (Levine 1994; Mera 1935; Peckham and Reed 1963; Wetherington 1968). One problem commonly encountered in classifying white ware types from sites in the Taos District concerns distinguishing between Taos Black-on-white from the Taos area and Kwahe'e Black-on-white from the Tewa Basin to the south (Lent 1991; Levine 1994; Mera 1935; Peckham and Reed 1963). These types are stylistically similar and seem to have been originally differentiated based on slip, temper, or stylistic characteristics (Mera 1935). Criteria and definitions previously used to distinguish these two types, however, are somewhat ambiguous or contradictory (Lent 1991; Levine 1994). It has been noted by some researchers that Taos Black-on-white is best considered a variety of Kwahe'e Black-on-white, which was defined for the Tewa or Northern Rio Grande tradition. It may potentially be distinguished by minor differences in the inclusions found in the self-tempered clays utilized in the two different areas (Lent 1991; Mera 1935). As is the case for Kwahe'e Black-on-white, the range of painted styles on pottery commonly assigned to Taos Black-on-white is similar to that noted for pottery types known to have been produced on the Colorado Plateau during the late Pueblo II period. No particular design motif seems to dominate pottery assigned to Taos Black-on-white, although hachured forms are fairly common, representing about a quarter of the pottery assigned to this type. Designs are often executed in simple and broad patterns that cover much of the vessel surface. These decorations may include single motifs presented in an all-over or banded layout, although rudimentary combinations of different design elements may occur. The design element most commonly associated with Taos Black-on-white and other regional types dating to this span consisted of a series of rectilinear bands

Figure 9.1. Taos Black-on-white sherd (FS 608).

filled with diagonal, squiggle, straight, or cross-hachure. Other designs include dots, opposing triangles, radiating triangles, step triangles, checkered triangles, checkered squares, parallel lines, and scrolls. Thus, during this analysis, pottery exhibiting fine pastes characteristic of pottery produced in regions of the Rio Grande was assigned to Taos Black-on-white although it is similar to pottery classified as Kwahe'e Black-on-white. Pottery exhibiting similar paste, but without distinctive painted decorations, was assigned to a series of descriptive types including *unpainted undifferentiated* and *mineral paint undifferentiated*.

Taos Utility Ware

All of the utility wares identified during analysis of pottery from LA 139965 are types defined for the Taos ceramic tradition. A comparison of the LA 139965 pottery with similar types from other areas that seem to reflect variations of this tradition follows the description of gray ware types recovered from this site.

Utility wares assigned to the Taos tradition tend to have paste textures that are grainy to silty. Sherds are fairly soft, particularly compared to contemporary pottery from the Colorado Plateau. Edges tend to crumble easily along an even plane. Surfaces are usually unpolished, rough, and slightly pitted, although a few examples assigned to the Taos gray ware type display at least one polished surface. Paste and surface color is distinct from that commonly noted for gray wares from the Colorado Plateau in that they tend to be dark gray to almost black, sometimes brown to dark brown, and in cases where oxidation occurs they may be reddish brown to deep red (Table 9.3). Pastes almost always fire to a red color when exposed to an oxidizing atmosphere (Table 9.4). This combination of characteristics may indicate the use of dark clays with a high carbon and iron content that were fired in reduction atmospheres.

Temper consists of a crushed leucocratic (granitic) rock or sand dominated by light-colored quartz and feldspar grains. While some variation was noted in the abundance of various possible inclusions, the only distinction made for examples with leucocratic rock was between examples with observable micaceous fragments and those without (Table 9.5). Even when present, mica tends to be rare—particularly as compared to utility ware pottery from the Tewa Basin. A very low frequency of utility ware sherds appears to have temper that

Table 9.3. Paste colors (descriptive), distribution by ware group, entire site; counts and percents.

Paste Color	Utility Ware		White Ware		Glaze Ware		Total	
	n =	%	n =	%	n =	%	n =	%
Dark gray to black	427	79.1	6	33.3	–	–	**433**	**74.5**
Brown to dark brown	96	17.8	–	–	–	–	**96**	**16.5**
Light gray	7	1.3	2	11.1	9	39.1	**18**	**3.1**
Pink to orange	7	1.3	–	–	14	60.9	**21**	**3.6**
Deep red	2	0.4	–	–	–	–	**2**	**0.3**
White	–	–	9	50.0	–	–	**9**	**1.5**
Gray core	1	0.2	1	5.6	–	–	**2**	**0.3**
Total	**540**	**100.0**	**18**	**100.0**	**23**	**100.0**	**581**	**100.0**

Table 9.4. Re-fired samples, paste colors (Munsell), distribution by ware group, entire site; counts and percents.

Paste Color	Utility Ware		White Ware		Glaze Ware		Total	
	n =	%	n =	%	n =	%	n =	%
10R	1	1.4	–	–	–	–	**1**	**1.3**
2.5YR	67	91.8	–	–	1	50.0	**68**	**88.3**
5YR	4	5.5	–	–	1	50.0	**5**	**6.5**
7.5YR	1	1.4	1	50.0	–	–	**2**	**2.6**
10YR	–	–	1	50.0	–	–	**1**	**1.3**
Total	**73**	**100.0**	**2**	**100.0**	**2**	**100.0**	**77**	**100.0**

reflects the presence of natural silt or fine sand inclusions. Observations relating to an ultimate derivation of temper from plutonic igneous sources in the Sangre de Cristo Mountains, as well as those noting a wide range of variation, are supported by petrographic analysis of ceramics assigned to these temper categories (Appendix 1, D. Hill, this report), the implications of which will be discussed later in this chapter.

Most of the gray ware sherds appear to be derived from small- to moderate-sized jars, as indicated by curvature (Table 9.6). Most (n = 412, or 76.3 percent of all utility ware sherds) are body sherds whose form cannot be definitively determined, although the great majority appear to be derived from jars. Evidence that these are from jars comes from jar neck (n = 98, or 18.1 percent of all utility sherds) and jar rim (n = 12, or 2.2 percent of all utility) sherds. Some of these jars had handles: one body sherd has a trap or coil handle, two jar body sherds have lug handles, and one jar rim has a coil handle. Other forms are represented by one bowl rim sherd, four bowl body sherds, and four sherds from cloud blower pipes.

Gray wares were assigned to different type categories based on the presence of distinct exterior surface manipulations that reflect variation and changes in coiling and finishing techniques across much of the Pueblo world (Table 9.7). The majority of gray ware sherds exhibit smoothed unpolished surfaces and seem to be very similar to pottery from the Taos Valley previously described as Taos Gray Plain (Levine 1994; Peckham and Reed 1963). Smoothed plain gray body sherds include examples

Table 9.5. Temper types, distribution by ware group, entire site; counts and percents.

Temper Type	Utility Ware		White Ware		Glaze Ware		Total	
	n =	%	n =	%	n =	%	n =	%
Indeterminate	2	0.4	–	–	–	–	**2**	**0.3**
Leucocratic rock and mica (micaceous crushed granite)	132	24.4	–	–	–	–	**132**	**22.7**
Leucocratic rock (non-micaceus crushed granite to granitic sand)	402	74.4	–	–	–	–	**402**	**69.2**
Sherd and sand	–	–	2	11.1	–	–	**2**	**0.3**
Fine tuff and sand	–	–	4	22.2	–	–	**4**	**0.7**
Latitite	–	–	–	–	23	100.0	**23**	**4.0**
Self tempered	1	0.2	–	–	–	–	**1**	**0.2**
Fine sand or silt	3	1.0	12	66.7	–	–	**15**	**2.6**
Total	**540**	**100.0**	**18**	**100.0**	**23**	**100.0**	**581**	**100.0**

Table 9.6. Vessel form, distribution by ware group, entire site; counts and percents.

Vessel Form	Utility Ware		White Ware		Glaze Ware		Total	
	n =	%	n =	%	n =	%	n =	%
Indeterminate	3	0.6	–	–	–	–	**3**	**0.5**
Bowl rim	1	0.2	2	11.1	1	4.3	**4**	**0.7**
Bowl body	4	0.7	1	5.6	22	95.7	**27**	**4.6**
Jar neck	98	18.1	1	5.6	–	–	**99**	**17.0**
Jar rim	12	2.2	–	–	–	–	**12**	**2.1**
Jar body	412	76.3	14	77.8	–	–	**426**	**73.3**
Jar body with strap or coil handle	1	0.2	–	–	–	–	**1**	**0.2**
Jar body with lug handle	2	0.4	–	–	–	–	**2**	**0.3**
Indeterminate coil handle	1	0.2	–	–	–	–	**1**	**0.2**
Cloud blower	4	0.7	–	–	–	–	**4**	**0.7**
Body sherd polished interior/exterior	1	0.2	–	–	–	–	**1**	**0.2**
Jar rim with coil handle	1	0.2	–	–	–	–	**1**	**0.2**
Total	**540**	**100.0**	**18**	**100.0**	**23**	**100.0**	**581**	**100.0**

Table 9.7. *Gray ware type categories, distribution by site area; counts and percents.*

Gray Ware Type Categories	North Shelter		North Talus		South Shelter		South Talus		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%
Plain unpolished	97	77.0	101	72.1	115	61.5	56	64.4	**369**	**63.8**
Plain polished	–	–	1	0.7	3	1.6	–	–	**4**	**0.7**
Polished smudged	–	–	–	–	3	1.6	–	–	**3**	**0.6**
Plain striated	–	–	1	0.7	–	–	–	–	**1**	**0.2**
Surface missing	–	–	–	–	–	–	1	1.1	**1**	**0.2**
Wide coils (fillets)	7	5.6	6	4.3	11	5.9	9	10.3	**33**	**6.1**
Narrow coil	–	–	3	2.1	16	8.6	8	9.2	**27**	**5.0**
Clapboard	1	0.8	–	–	–	–	–	–	**1**	**0.2**
Indented corrugated	–	–	2	1.4	5	2.7	2	2.3	**9**	**1.7**
Smeared Plain Corrugated	9	7.1	14	10.0	23	12.3	7	8.0	**53**	**9.8**
Wide banded incised	10	7.9	9	6.4	6	3.2	4	4.6	**29**	**5.4**
Plain incised herringbone (Taos Incised)	–	–	1	0.7	1	0.5	–	–	**2**	**0.4**
Fingernail shaped incisisions	1	0.8	1	0.7	2	1.1	–	–	**4**	**0.7**
Indeterminate incised line	1	0.8	1	0.7	2	1.1	–	–	**4**	**0.7**
Total	**126**	**100.0**	**140**	**100.0**	**187**	**100.0**	**87**	**100.0**	**540**	**100.0**

that could have derived from any portion of completely smoothed Taos Gray Plain vessels or from the lower portion of vessels with incised, neckbanded, or corrugated necks. Therefore, different ceramic type categories were assigned to smoothed gray ware rim and body sherds. Smoothed unpolished rim sherds, indicative of having derived from completely smoothed (Taos Gray Plain) vessels, were classified as *plain rim*. Smoothed body sherds that could have originated from plain vessels or smoothed portions of neckbanded, incised, or corrugated vessels, were classified as *plain body*. Rim sherds that were too small to determine the associated vessel treatment were classified as *indeterminate rim*. A single sherd described as *brushed scored* had a dark paste and a series of distinct and closely spaced striated lines over an unpolished surface that is characteristic of the "paddle and anvil" finishing technique noted for the Woodland Plains Village tradition (Wiseman et al. 1999). This treatment is similar to that noted on the surfaces of utility ware pottery produced in the Southern Plains area just to the east of areas generally included in the Taos District. Despite the highly striated exterior surface, the temper and paste is similar to that of other sherds assigned to Taos gray ware types, so this sherd is grouped with Taos gray ware types.

A few sherds (n = 8, or 1.4 percent) with darks pastes and temper, similar to those described here for unpolished utility wares, have polishing on at least one surface—including some examples that are highly polished with horizontal polishing streaks. These occur on the interiors, indicating that they represent bowls.

Surfaces ranged from gray, gray brown, to black. Sherds exhibiting no sooting were characterized as *polished utility,* while examples with one surface covered by a thick black-sooted deposit were assigned to a *polished smudged utility* category (Fig. 9.2). The presence of a polished brown or smudged black surface makes these sherds resemble the plain brown wares that commonly dominate assemblages in the Mogollon Highlands (Wilson 1999). But based on paste and temper characteristics, these are included in the Taos utility ware tradition. Plain polished utility wares were commonly produced in areas of the Northern Rio Grande during most of the historic period, and the possibility that these sherds reflect types such as Apodaca Gray that were produced by Northern Tiwa potters during the initial part of the historic period (Adler and Dick 1999) was initially considered as a possibility. Still, given the overall characteristics of these sherds and the associated pottery and radiocarbon dates, I think it is very likely that these polished variations were produced during the prehistoric period. Pottery assigned to these groups seems to reflect occasional attempts to produce polished bowls employing clay and temper used in the production of contemporaneous utility wares produced in the Taos District. Hopefully, data from other studies will indicate whether or not such forms were occasionally produced prior to the wide-

Figure 9.2. Smudged polished utility ware sherds (FS 581, 470, 469).

spread production of polished and smudged utility ware forms by Pueblo potters during the historic period.

During the present study, sherds exhibiting unmodified coils or fillets that usually occur along the exterior surface of the neck were assigned to several categories based on the width of or junctures between coils. This may include gray ware pottery that has been described or illustrated in other studies as Taos Plain, Taos Incised, or Taos Corrugated (Peckham and Reed 1963; Wetherington 1968). Recording the various forms of coiled treatments allows comparisons with developments in other Anasazi regions as well as for the examination of chronological trends in coil textures. *Wide neckbanded* describes sherds with exterior coils or fillets that are relatively wide (Fig. 9.3). These coils are clearly separated by distinct junctures that rest vertically on each other, and generally do not overlap. *Wiped or undulated neckbanded* are similar to wide neckbanded, but the junctures between the coils have been obliterated. The remaining coils are still visible, but display an undulating or ribbed surface. Sherds exhibiting narrow coils or treatments common in later neckbanded types were placed into two different categories. *Coiled* describes neckbanded forms with narrow rounded coils (Fig. 9.4). The common occurrence of this treatment tends to be later than that noted for wide neckbanded sherds. *Clapboarded neck* refers to an effect created by overlapping coils or fillets. Sherds belonging to this category may be similar to plain corrugated sherds—although sherds of this category tend to be narrower and limited to neck sherds. It is possible that some of the pottery in this study exhibiting coils, clapboard, and banded treatments represent variations in corrugated forms common during later periods. This seems to be supported by examples of pottery with banded textures derived from the lower portions of jars. Still, given a potentially long occupation of the rockshelter, it may be useful to distinguish banded and corrugated forms.

Taos Corrugated refers to pottery in which the exterior corrugations are partly obliterated and is common in assemblages dating to the Pot Creek phase (Adler and Dick 1999; Wetherington 1968). Pastes tend to be soft and coarse (Adler and Dick 1999). Vessels are almost exclusively represented by jars. Corrugated treatments are often limited to the neck, and therefore some of the plain body sherds in an assemblage dating to the Pot Creek phase may actually be derived from corrugated vessels. Taos Corrugated may be placed into different variants based on the degree of smoothing and subsequent emphasis of the coils (Wetherington 1968). Corrugated types were further distinguished by attributes such as the type and pronouncement of coiled treatment that can have temporal implications. Pottery assigned to an *indented corrugate*d (Fig. 9.5) category includes examples with narrow coils, regularly spaced in-

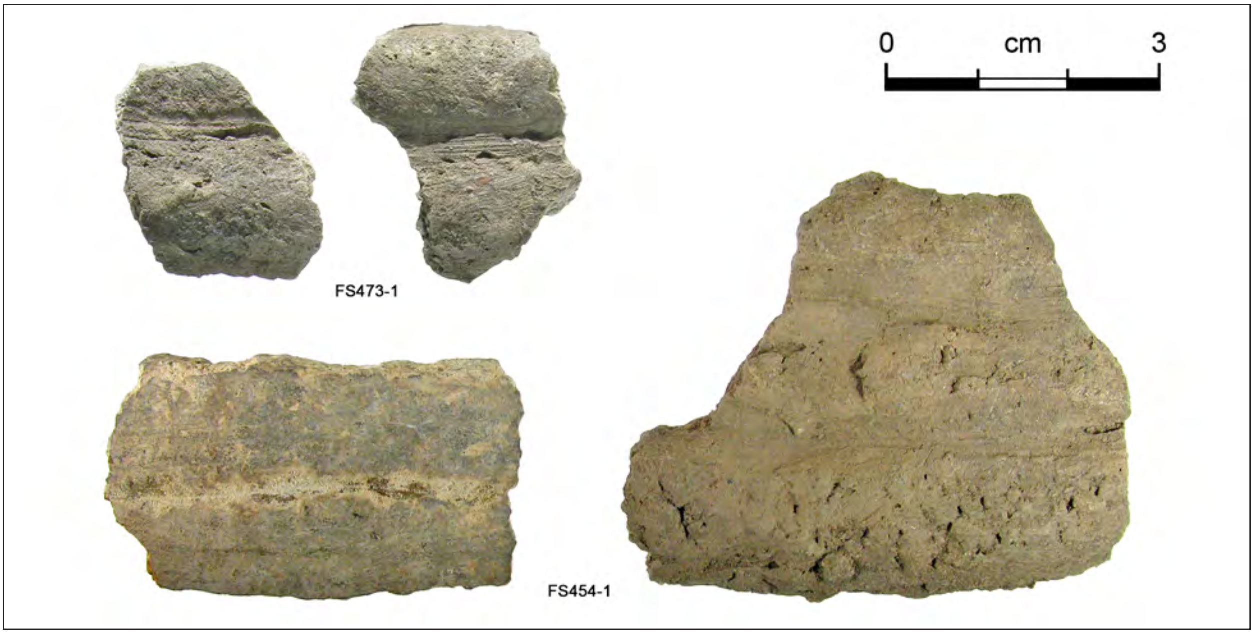

Figure 9.3. Wide neckbanded sherds (FS 473, 454).

Figure 9.4. Coiled neck sherds (FS 660).

dentations, and moderate to high contrast between coils, and represents the dominant corrugated type at sites dating to the Pot Creek phase (Wetherington 1968). Pottery characterized as *smeared corrugated* (Fig. 9.6) exhibits corrugated treatments with low relief, indicating they were smeared or obliterated during later stages of manufacture; these tend to be later than indented forms across much of the Northern Rio Grande.

A distinct aspect of ceramic assemblages described over the wide area sometimes used to define the Taos District (Lang 1982) is the common occurrence of significant amounts of *incised gray* ware (Fig. 9.7), which displays a range of incised treatments on pottery exhibiting pastes and temper that are similar to that described for other Taos gray ware types (Levine 1994; Peckham and Reed 1963; Wetherington 1968). While incised treatments over plain surfaces have been noted in pottery associated with other Pueblo ceramic traditions, the common occurrence of incised utility ware throughout the time span associated with the Taos District is unique to assemblages in the Taos District (Lang 1982), and may be ultimately indicative of influences from Plains pottery traditions to the east (Gunnerson 1987; Wedel 1961). The most common variation of this type noted in this

Figure 9.5. Indented corrugated sherd (FS 384).

study, as well as other Valdez-phase assemblages from Taos, is parallel horizontal incised lines along the neck and shoulder. The overall appearance of this decorative style is similar to and in some cases may simply represent an additional modification of neck-banded gray ware vessels. Other styles noted are a herringbone pattern and consists of a series of horizontal rows of short, nested chevron elements and one with a series of short and closely spaced fingernail-shaped incisions that has sometimes been used to define Taos Punctate.

Regional Variation and Classification of Utility Ware in the Greater Taos District

The assignment of pottery to types that have been mostly defined for the valleys historically occupied by Tiwa-speaking groups at Taos and Picuris Pueblos is somewhat complicated by the range of terminology, categories, and interpretations attributed to pottery, particular utility ware forms, which have been applied to the very large area included within the Taos District or tradition—which includes large areas of north-central and northeastern New Mexico (Lang 1982). Pottery that is assigned here to the Taos tradition is part of a larger sequence of production associated with pottery produced along the drainages of the Northern Rio Grande and with the traditions defined for areas along the Colorado Plateau that are sometimes grouped together into a single Anasazi or Ancestral Pueblo culture area. The inclusion of traditions in the Colorado Plateau and Northern Rio Grande provinces into a single culture area, separate from Mogollon culture area, where utility wares were long represented by polished brown wares, seems to partly be the result of an assumption of the long production of similar unpolished gray wares in both of these provinces. I feel that characteristics and trajectories of change, associated with the gray- to black-colored soft utility ware as well as other trends in scattered districts of the Northern Rio Grande, are distinct enough that pottery types associated with these traditions should be grouped into their own "culture area," distinct from that noted for traditions of the Colorado Plateau attributed to the Four Corners Anasazi (Wilson 2003; 2013). As is the case for the ceramic traditions grouped into the Greater Mogollon and Four Corners Anasazi culture areas, those assigned to the Greater Upper Rio Grande culture area and then the Northern Rio Grande branch represent the long use of distinct technologies that were well suited for ceramic resources associated with distinct geological provinces. Conventions of pottery production associated with traditions in the Greater Upper Rio Grande Valley seem to have developed in response to the alluvial and volcanic clay sources commonly exposed along the Rio Grande Rift. Other distinct characteristics of pottery described for regions in the Northern Rio Grande may also reflect connections between distinct Pueblo groups who can be traced to modern Tiwa- and Tewa-speaking Pueblos. Such similarities are sometimes characterized as indicating "communities of practice," described as representing connected relationships among people and the objects they made and used that ultimately resulted in a particular combination of actions leading to the persistent creation of similar and identifiable forms (Cordell and Habicht-Mauche 2012; Joyce 2012). It seems extremely likely that the distinct sequence of relatively soft utility wares with dark paste and granitic temper long produced in regions of the Northern Rio Grande reflect—at least in part—such connections.

Pottery grouped into the Taos tradition or Taos District reflects an even closer connection between groups who appear to be directly ancestral to modern Northern Tiwa groups. Pottery assigned to Taos ceramic tradition types is best known from

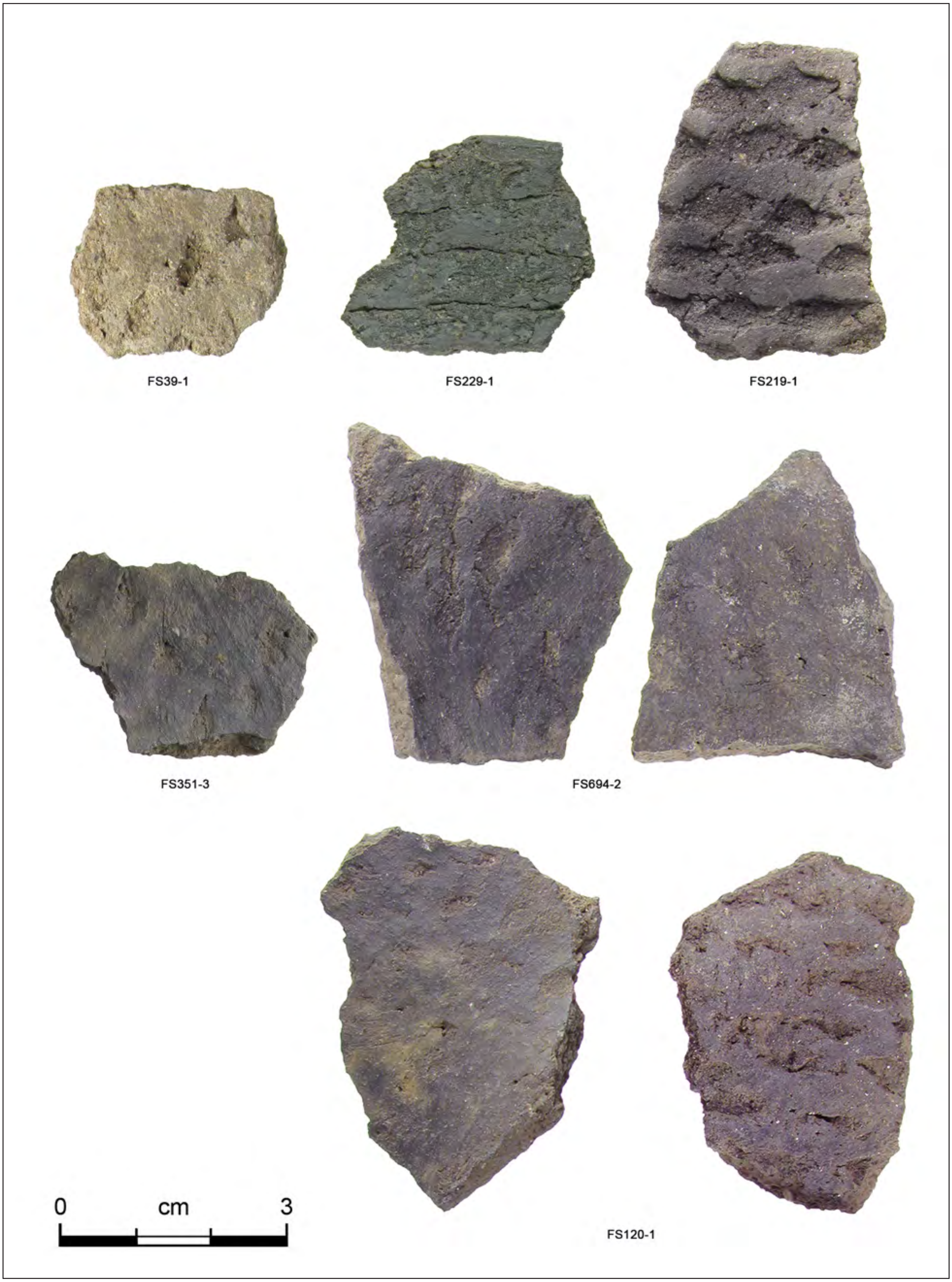

Figure 9.6. Smeared corrugated sherds (FS 39, 229, 219, 351, 694, 120).

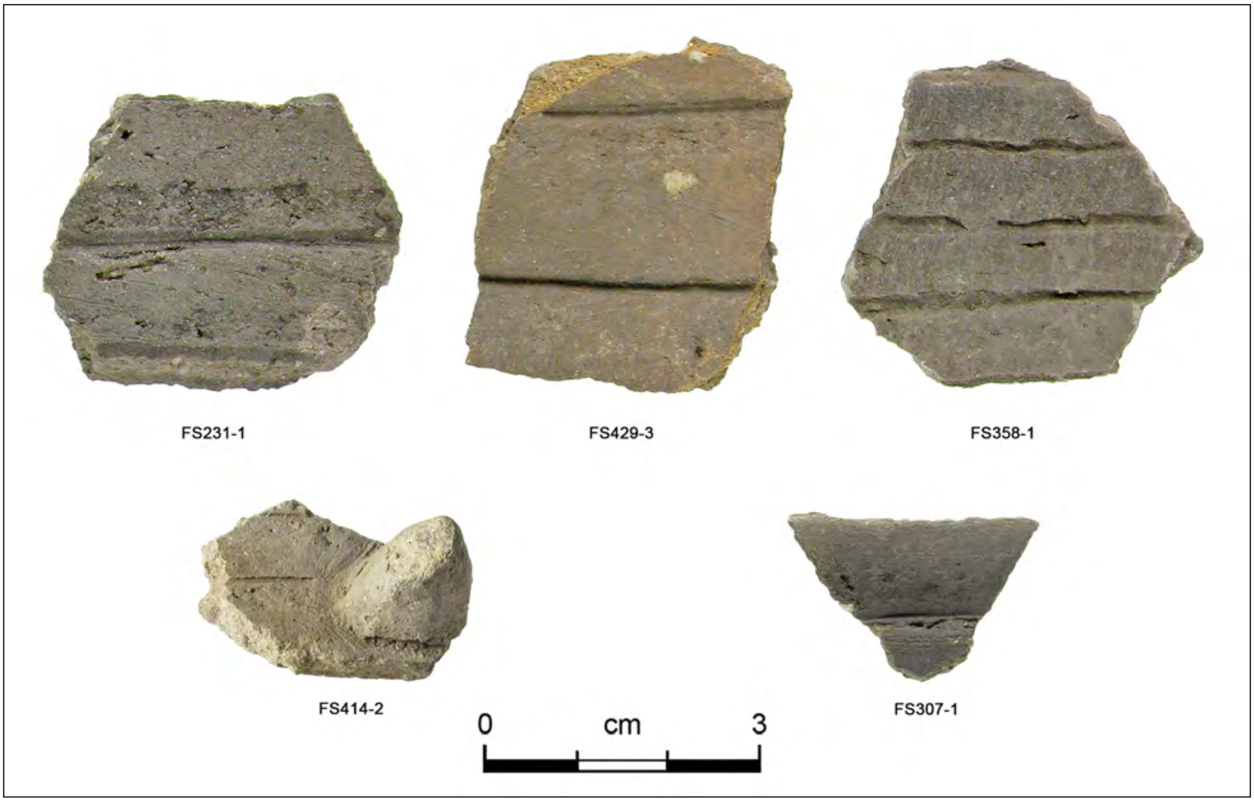

Figure 9.7. Taos Incised sherds (FS 231, 429, 358, 414, 307).

sites within or in the vicinity of the long-occupied Northern Tiwa Pueblo villages of Taos and Picuris (Adler and Dick 1999; Dick 1965; Ellis and Brody 1964; Woosley 1980). Pottery from contexts recovered within or near these two villages reflects a long sequence of production of both utility and decorated white ware types. Much of the pottery described for this area is associated with scattered communities attributed to the Valdez phase that appears to date from about AD 1050 to 1225 (Boyer and Wolfman 1997). Until about AD 1200 the population in the Taos-Picuris area was spread across several small communities. After that period the population across the Taos District appears to have aggregated into a few large villages, mostly reflected in the long occupational sequences at the Tiwa Pueblo villages of Picuris and Taos that continues today (Adler and Dick 1999; Ellis and Brody 1964). Phases associated with the occupation of this area include the Valdez (AD 1050 to 1200), Pot Creek (AD 1200 to 1250), Talpa (AD 1250 to 1350), and Vadito (AD 1350 to 1400) phases, as well as later poorly defined phases that seem to be exclusively associated with later occupation of the villages of Taos and Picuris (Adler and Dick 1999; Woosley 1980). While reflecting influences from other areas of the Rio Grande, this pottery is distinguished by the long use of distinct local clay and temper resources, although stylistic evidence indicate influences from surrounding regions, particularly other regions of the Northern Rio Grande to the south. An exception is the production of incised pottery, especially common during the Valdez phase, whose prevalence during at least some periods seems to be a good indicator of associations with the Taos ceramic tradition.

Descriptions of similar pottery from areas to the east of Taos and Picuris may also provide clues concerning the nature, duration, and extent of pottery forms that have—at least at times—been associated with a greater Taos ceramic tradition. This includes discussions of pottery from Sitio Creston, a very unusual site located just south of Las Vegas, NM. Sitio Creston consists of a series of circular stone enclosures made of rocks piled up without mortar (Wiseman 1972, 1975, 2002, 2015). Pottery from this site was exclusively utility wares that, while not assigned to distinct types or traditions, appear to largely have soft dark paste and igneous rock temper—similar to that from the Coyote Canyon Rockshelter, as well as those from Valdez-phase sites from the Taos area. Another connection with the Valdez phase is indicated by the dominance of plain utility wares and the common occurrence of examples exhibiting incised decorations identical to that described for Taos Incised, as well as those with banded and coiled exteriors (Wiseman 1975). Other archaeologists have compared this site with the Panhandle Complex as defined for the Plains Woodland culture to the east (Campbell 1976; Stuart and Gauthier 1984). Wiseman has most recently attempted to tie this site to other stone enclosure sites along the east slopes of the Rocky Mountains and the Cielo Complex in the Trans Pecos region of Texas. While Sitio Creston was originally described as dating from AD 1000 to 1150, recently submitted radiocarbon samples indicate this site was most likely occupied from about AD 800 to 1000 (Wiseman 2015) indicating an occupation earlier than the Valdez phase in the Taos area.

Another area where pottery similar to that used to define the Taos tradition has been noted is the Sopris-phase sites of the Upper Purgatoire complex near Trinidad, CO. The Sopris phase is postulated to date from about AD 1000 to 1225. This phase is sometimes interpreted as an indigenous population influenced by Pueblo groups from the Northern Rio Grande (Wood 1986; Wood and Bair 1980). Although Sopris-phase components display substantial architecture and locally made pottery, they have been described as reflecting a hunting and gathering economy with only incipient agriculture (Wood 1986). Ceramics associated with the initial phase (AD 1000 to 1100) are classified as both Taos Gray and Sopris Plain, along with Taos Incised, which may include locally made imitations of this type. This pottery may be associated with low frequencies of Red Mesa Black-on-white and Taos Black-on-white. Locally produced Sopris Plain is difficult to distinguish from Taos Gray, and pottery from sites associated with the Upper Purgatoire complex is sometimes grouped into a "Taos Gray or Sopris Plain" category. Characteristics that may be used to distinguish Sopris Plain from Taos Gray may include a lack of mica in the paste, the rarity of incised treatments, a dark to reddish paste color, and the overall crudeness (Kurota 2010). Temper appears to be a mixture of fine sand and tabular sandstone. Surfaces are usually plain, although exteriors sometimes exhibit incised decorations similar to that described for Taos Incised.

Still another possible comparison for the pottery described here is that from Tecolote Pueblo, located 16 km (10 miles) south of Las Vegas, NM. This fairly large Pueblo community was first occupied around AD 1000, with an initial aggregation at around AD 1100 and a larger occupation after about AD 1200—possibly to as late as AD 1350 (Cabebe 2002). My perusal of utility wares in a collection from Tecolote Ruin made by Lambert indicated that the majority of the utility wares exhibit smeared corrugated exteriors along with a dark gray to black paste and a non-micaceous crushed rock temper. The associated white ware was Santa Fe Black-on-white. While trends concerning utility wares from Tecolote Pueblo are poorly documented, there has been at least some suggestion that some components may also exhibit a higher amount of incised pottery (Cabebe 2002).

A fairly long, but still poorly understood ceramic sequence, has been documented at sites in the foothills and canyons of the Sangre de Cristo Mountains in the Cimarron area (Cordell 1978; Glassow 1984; Kirkpatrick 1976; Lutes 1959). The ceramic sequence begins with sites assigned to the Pedregosa phase, which dates from about AD 750 to 900, and seems to be characterized by very low frequencies of thick, plain pottery mostly represented by plain utility ware, while painted pottery appears to be absent. The Escritores phase was originally dated between AD 900 and 1100. The associated utility wares include plain ware with coarse sand temper and neckbanded gray ware similar to Kana'a Gray. Painted pottery appears to be Red Mesa Black-on-white. The Ponil phase is postulated to date from AD 1100 to 1250 and is characterized by pottery very similar to that noted for components assigned to the Sopris and Valdez phases. Associated pottery types include Taos Black-on-white, Taos Plain, Taos Incised, and extremely low frequencies of Indented Corrugated. The Cimarron phase is poorly dated but is assumed to date to the thirteenth century based on the presence of Santa Fe Black-on-white, which is thought to reflect trade with areas of

Northern Rio Grande to the west (Lutes 1959). A ceramic type defined specifically for this phase is Cimarron Plain, which includes plain and incised pottery. This type is still poorly defined but seems to be darker and cruder than the Taos gray ware types—although the distinction is not clear. This utility ware is characterized by very soft and friable paste that ranges from black to brown to red in color. Other utility ware forms, such as corrugated and basket-impressed pottery, are present in low frequencies. Possible variation within this phase is reflected by the pottery from the Lyman site just south of those described for the Cimarron region (Lister 1948). Pottery there is mostly represented by Santa Fe Black-on-white and utility ware that primarily consists of corrugated pottery—which may indicate that they are related to and contemporaneous with Tecolote Pueblo or sites elsewhere in the Pecos area.

Intrusive Pottery Types

White ware types produced in regions of the Colorado Plateau commonly exhibit blocky and light-colored pastes, indicating the use of distinctive clays weathered from Cretaceous or Jurassic shale outcrops and sand temper. These are known to have been produced in the Cibola region of the Anasazi (Goetz and Mills 1993). A single sherd exhibiting a white paste, sand and sherd temper, and decorations in mineral paint was classified as a Cibola white ware and described as *mineral paint undifferentiated*. Cibola white wares have been previously noted in Valdez-phase sites across much of the Taos District and appear to reflect broad contacts with groups in the Colorado Plateau and regions of the Northern Rio Grande.

Glaze ware types refer to either sherds with decorations in glaze paint or to unpainted sherds assumed to have been derived from vessels that were decorated with glaze paint. This ware is distinguished by the use of lead glaze paint in the production of a very distinct technological class of pottery in the Middle Rio Grande from about AD 1325 to the early 1700s (Franklin 1997; Kidder and Shepard 1936; Mera 1933; Snow 1982). Glaze wares are usually fired in oxidizing atmospheres and may exhibit buff, yellow, orange, or red surfaces depending on the paste and slip clays used.

The basic system of classification of glaze rim sherds developed by Mera (1933) is still commonly used, but is only applicable to rim sherds. Thus, body sherds that could not be attributed to a specific type were assigned to descriptive types based on surface treatments using conventions similar to those used in other recent studies in the Middle Rio Grande (Franklin 1997; Mera 1933). The single bowl rim sherd was assigned to Cieneguilla Glaze-on-yellow based on the presence of a yellow slip and evenly shaped rim. Most—if not all—of the glaze body sherds appear to have originated from a glaze ware vessel. They exhibit a similar yellow slip and when present similar designs in a black paint indicate that most if not all these sherds originated from a single glaze on yellow vessel. The single glaze rim assigned to Cieneguilla Glaze-on-yellow as well as a body sherd from the same vessel are illustrated in Figure 9.8. The presence of latite or monzonite temper indicates a vessel that was most likely produced in the Galisteo Basin (Schleher 2010; Warren 1979). Pottery assigned to Cieneguilla Glaze-on-yellow is thought to have been produced sometime between AD 1325 and 1425. While the great majority—if not all—of the glaze ware sherds identified appear to have been from a single vessel, they were assigned type designations based on combinations of characteristics observable for each sherd. Categories to which these glaze ware sherds were assigned during the present study include Cieneguilla Glaze-on-yellow, glaze-on-yellow Indeterminate, and glaze yellow unpainted.

Examination of Ceramic Trends

Interpretations of trends based on pottery distributions from the two rockshelters at LA 139965 are limited by the small sample of 581 sherds, which can be attributed to an even smaller number of vessels. Still, the overall degree and nature of variability noted for the ceramic types and attributes provides the basis for examining trends that may be reflected in the occupation of each of the two rockshelters. Discussions of ceramic trends documented at this site will focus first on the potential dating of contexts from which pottery was recovered. This will be followed by examinations of trends relating to the potential origin, production, exchange, and use of the pottery examined.

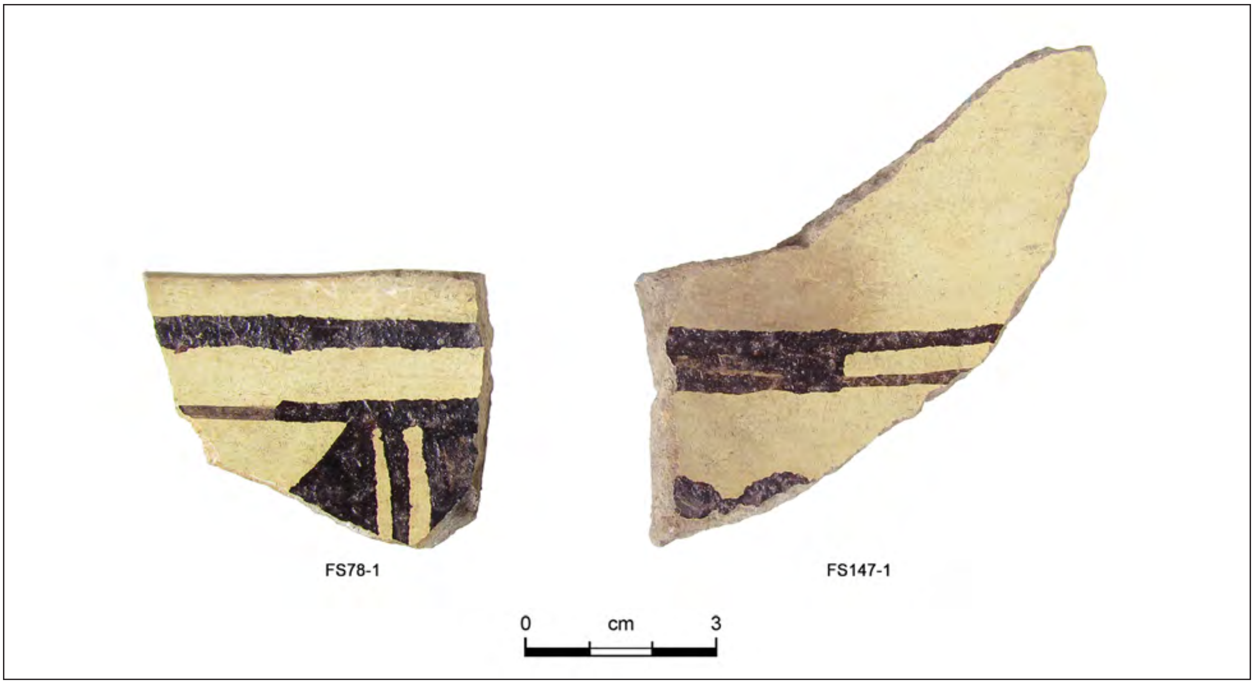

Figure 9.8. Cieneguilla Glaze-on-yellow sherds (FS 78, 147).

Ceramic Dating

Both the wide variation in ceramic forms and the radiocarbon dates from the two rockshelters indicate a long occupation by ceramic-producing groups. For example, radiocarbon dates from both shelters correspond to some of the earlier ceramic components in the Taos District and into at least the early part of the Classic period. This long span of occupation is reflected in North Shelter and South Shelter. For the most part, the fairly wide range of ceramic types from both shelter areas seems to indicate a long and similar range of occupation. In contrast to the initial interpretation of an occupation dating to the historic period, there is no ceramic evidence for an historic occupation, although the potential implication of polished and smudged utility wares has been previously discussed.

Most of the pottery recovered from the rockshelters are types associated with the Valdez phase, which is thought to date from the middle eleventh to early twelfth century, and with other similar ceramic sequences defined for various areas included in the Taos District. While much of the pottery was assigned to Taos Gray Plain, which is the dominant type from Valdez-phase components, sherds assigned to this type could also be derived from lower areas of later corrugated vessels. Evidence for the presence of completely smoothed vessels is the occurrence of some smoothed plain rim sherds. Other evidence of a component contemporary with the Valdez phase is the pottery assigned to Taos Incised Gray and Taos Black-on-white.

A slightly weaker case can also be made for the presence of a slightly earlier component that is not represented in the Taos Valley, as indicated by the presence of wide neckbanded and wide neckbanded (wiped) sherds. This could potentially indicate an occupation contemporaneous with the Escrito phase (AD 900 to 1100) in the Cimarron area, where neckbanded pottery has been noted (Gunnerson 1987). In addition, the description of pottery at Sitio Creston seems to indicate an occupation lasting from about AD 800 to 1000 that includes plain, banded, and incised gray wares but no white wares.

A later component dating to the span equivalent to the Coalition period or the Pot Creek and Valdez phases may also be reflected by the relatively high frequency of corrugated pottery dominated by smeared corrugated. While indented corrugated types can occur in extremely low frequencies at sites dating to the Valdez phase, they are very rare but become more common during later phases. It may also be significant that smeared corrugated seems to be more common in later phases, and the higher frequencies of smeared corrugated as compared to indented corrugated could potentially indicate components dating after the mid-thirteenth century. Santa Fe Black-on-white or other later organic-painted types indicative of an occupation during this time were not present in these assemblages. The strongest evidence for what appears to be the latest ceramic component is the presence of glaze-on-yellow sherds derived from a Cieneguilla Glaze-on-yellow vessel that reflects pottery produced between the fourteenth and early fifteenth century. As previously noted, the few polished sherds identified represent forms known to have been produced during historic periods, although it also possible these represent a variation of prehistoric utility ware technology.

Distributions of pottery types associated with the two rockshelters and excavation levels were also examined (Tables 9.2, 9.8, 9.9a, 9.9b). The overall distribution of pottery types is similar and seems to indicate similar sequences of occupation across the areas defined for LA 139965, although all of the glaze wares were associated with South Shelter and could indicate a longer duration of occupation. Examination of the distribution of pottery by level in the two rockshelters does not reveal any distinct trends (Tables 9.8, 9.9a, 9.9b), although this may largely be due to the small sample of ceramics represented.

Affiliation and Exchange

The great majority of the pottery in this study appears to be types previously defined for the Taos tradition that subsequently formed the basis for the Taos District. This district may reflect groups that are ancestors of those who reside in the Northern Tiwa Pueblo villages of Taos and Picuris. As previously noted, the occupational history of areas that have been included in the Taos District is varied and complex, but may ultimately reflect long sequences of movement by Tiwa groups—possibility indicated by the fact that the earliest sequences associated with Tewa tradition ceramics seem to be from sites in the Cimarron region in the eastern part of this district. The occurrence of similar pottery at later sites in the Taos Valley may reflect a westward movement of Northern Tiwa groups into the villages at Taos and Picuris where they reside today.

Most of the gray ware ceramic types found during this study were identified by combinations of dark paste and leucocratic temper—some of which also contain mica but most that do not (Table 9.5), that reflects the use of tempering materials derived from granitic cobbles, acrostic sandstone, or residual clay sources scattered across much of the Sangre de Cristo Mountains. The range of mineral and rock types identified in the petrographic analysis were assumed to reflect sources from the Taos area (Appendix 1, D. Hill, this report). This assumption may partly be a result of previous petrographic analysis for this district having been limited to pottery from the Taos Valley. Thus, both the similarities in basic rock type and variations in the rock and minerals represented could reflect the utilization of rock sources in different areas of the Sangre de Cristo Mountains. Certainly, the occurrence of a dark paste reflects the use of high-iron clays and granitic temper without mica dominating this assemblage (Tables 9.3, 9.4, and 9.5), a composition that seems to be very similar to that noted in gray wares from the Taos Valley. It is also possible that many of the gray wares with high mica concentrations, reflecting the use of residual clay, are from vessels produced in the Picuris area, while other examples with micaceous granite may have been produced in areas of the Northern Rio Grande, such as the Tewa Basin.

Pottery indicative of production in other Pueblo regions includes the single white ware sherd with decoration in mineral paint, a white paste, and sherd and sand temper similar to pottery produced in the Cibola region. Similar pottery has been found at late Developmental period sites in the Northern Rio Grande, and seem to reflect broad patterns of regional exchange during this period.

The final example of a definite trade ware is represented by glaze ware from a Cieneguilla Black-on-yellow vessel. These glaze ware sherds are tempered with a rock that has been classified as latite or monazite and is indicative of production in the Galisteo Basin. Pottery with similar temper dominates glaze wares from assemblages in the Pecos areas dating to the early Classic period, and it is possible this pottery may reflect seasonal utilization of this area by groups from Pecos Pueblo during the early Classic period.

Table 9.8. North Shelter, pottery types/categories by ware group and grid unit/level; counts and percents

Pottery Type/ Category	Level 1		Level 2		Level 3		Level 4		Levels 1 –4		Level 5		Level 6		Level 7		Level 8		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Cibola White Ware																				
Mineral paint undifferentiated	–	–	1	3.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**0.8**
Taos Utility Ware																				
Plain rim	–	–	1	3.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**0.8**
Plain body	22	75.9	21	75.0	16	57.1	14	73.7	2	100.0	10	76.9	5	100.0	2	66.7	4	80.0	**96**	**72.2**
Wide neckbanded	1	3.5	3	10.7	–	–	1	5.3	–	–	2	15.4	–	–	–	–	–	–	**7**	**5.3**
(Taos) incised gray	1	3.4	1	3.6	4	14.3	3	15.8	–	–	1	7.7	–	–	1	33.3	1	20.0	**12**	**9.0**
Clapboard neck	1	3.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**0.8**
Smeared corrugated	2	6.9	–	–	6	21.4	1	5.3	–	–	–	–	–	–	–	–	–	–	**9**	**6.8**
Taos White Ware																				
Unpainted undifferentiated	1	3.4	–	–	2	7.1	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**2.3**
Taos Black-on-white	1	3.4	1	3.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**2**	**1.5**
Totals by Level																				
	29	**100.0**	**28**	**100.0**	**28**	**100.0**	**19**	**100.0**	**2**	**100.0**	**13**	**100.0**	**5**	**100.0**	**3**	**100.0**	**5**	**100.0**	**132**	**100.0**

Table 9.9a (see 9.9b continuation). South Shelter, pottery types/categories by ware group and grid unit/level (Levels 1–8); counts and percents. *Levels 9–16 and combined totals are on Table 9.9b.*

Pottery Type/ Category	Surface		Level 1		Level 2		Level 3		Levels 2, 3		Level 4		Level 5		Level 6		Level 7		Level 8	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Middle Rio Grande Glaze Ware																				
Glaze yellow unpainted	–	–	1	6.3	2	14.3	–	–	–	–	1	6.7	2	9.1	1	5.9	–	–	1	3.2
Glaze-on-yellow Indeterminate	–	–	–	–	–	–	–	–	–	–	–	–	3	13.6	–	–	–	–	1	3.2
Cienequilla Glaze-on-yellow	–	–	–	–	–	–	–	–	–	–	1	6.7	–	–	–	–	–	–	–	–
Taos Utility Ware																				
Plain rim	–	–	–	–	1	7.1	–	–	–	–	1	6.7	–	–	–	–	–	–	–	–
Unknown rim	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	5.0	–	–
Plain body	1	33.3	9	56.3	5	35.7	11	64.7	–	–	8	53.3	10	45.5	9	52.9	8	40.0	16	51.6
Wide neckbanded	–	–	1	6.3	1	7.1	–	–	–	–	1	6.7			2	11.8	1	5.0	3	9.7
Wide neckbanded (wiped)	–	–	–	–	1	7.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(Taos) Incised Gray	–	–	1	6.3	–	–	–	–	–	–	–	–	1	4.5	2	11.8	3	15.0	1	3.2
Coiled necked	–	–	2	12.5	1	7.1	–	–	1	100.0	–	–	2	9.1	–	–	–	–	7	22.6
Indented corrugated	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	3.2
Smeared corrugated	1	33.3	2	12.5	2	14.3	4	23.5	–	–	2	13.3	3	13.6	–	–	7	35.0	1	3.2
Polished utility	1	33.3	–	–	–	–	1	5.9	–	–	1	6.7	1	4.5	–	–	–	–	–	–
Polished smudged	–	–	–	–	–	–	1	5.9	–	–	–	–	–	–	2	11.8	–	–	–	–
Taos White Ware																				
Unpainted undifferentiated	–	–	–	–	1	7.1	–	–	–	–	–	–	–	–	1	5.9	–	–	–	–
Totals by Level																				
	3	**100.0**	**16**	**100.0**	**14**	**100.0**	**17**	**100.0**	**1**	**100.0**	**15**	**100.0**	**22**	**100.0**	**17**	**100.0**	**20**	**100.0**	**30**	**100.0**

Table 9.9b (continued from 9.9a). South Shelter, pottery types/categories by ware group and grid unit/level (Levels 9–16); counts and percents. Includes combined type totals for South Shelter Levels 1–16.

Pottery Type/ Category	Level 9		Level 10		Level 11		Level 12		Level 13		Level 14		Level 15		Level 16		Totals by Type (Levels 1–16)	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Middle Rio Grande Glaze Ware																		
Glaze yellow unpainted	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**8**	**3.9**
Glaze-on-yellow Indeterminate	1	6.7	1	14.3	–	–	–	–	–	–	–	–	–	–	–	–	**6**	**2.9**
Cienequilla Glaze-on-yellow	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**0.5**
Taos Utility Ware																		
Plain rim	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**2**	**1.0**
Unknown rim	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**0.5**
Plain body	9	60.0	3	42.9	5	100.0	2	50.0	3	100.0	5	62.5	3	100.0	4	100.0	**111**	**54.1**
Wide neckbanded	–	–	1	14.3	–	–	–	–	–	–	–	–	–	–	–	–	**10**	**4.9**
Wide neckbanded (wiped)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**0.5**
(Taos) Incised Gray	–	–	–	–	–	–	–	–	–	–	3	37.5	–	–	–	–	**11**	**5.4**
Coiled necked	1	6.7	–	–	–	–	2	50.0	–	–	–	–	–	–	–	–	**16**	**7.8**
Indented corrugated	4	26.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**5**	**2.4**
Smeared corrugated	–	–	1	14.3	–	–	–	–	–	–	–	–	–	–	–	–	**23**	**11.2**
Polished utility	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**4**	**2.0**
Polished smudged	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**1.5**
Taos White Ware																		
Unpainted undifferentiated	–	–	1	14.3	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**1.5**
Totals by Level																		
	15	**100.0**	**7**	**100.0**	**5**	**100.0**	**4**	**100.0**	**3**	**100.0**	**8**	**100.0**	**3**	**100.0**	**4**	**100.0**	**205**	**100.0**

Vessel Use and Function

Trends in the overall frequency of sherds assigned to the ware groups and forms from the two rockshelters may also provide clues about the use of pottery in various activities. The small size of an assemblage, especially when considering that many of the sherds could belong to the same vessels and the assemblage represents a long period of occupation, is consistent with a long-term seasonal use of a rockshelter. It is possible, however, that the amount of pottery associated with this site was larger, given that much of the area below these rockshelters have been removed by the road.

The majority of the pottery from both rockshelters was assigned to gray ware types (Tables 9.1, 9.6). A total of 92.9 percent of the sherds are gray ware types with over 90 percent of the sherds from each major area of the site consisting of gray wares. The great majority of these gray ware sherds were from jars, although very low frequencies of gray ware sherds were assigned to bowls and cloud blower pipes. It is likely that most of these jars were utilized for cooking and storage. Only 2.9 percent of the pottery from this site is Taos white wares, which made up no more than 6.0 percent of the pottery from any area of this site (Table 9.1). Most of the white ware sherds were from jars probably used for water storage, although a few were from bowls. A total of 4.0 percent of the pottery is glaze ware bowl sherds. All of these are from the South Shelter and South Talus and seem to be mostly derived from a single bowl.

If the glaze ware pottery is removed from the assemblage, the total gray ware makes up 96.8 percent of the pottery, while 3.3 percent is white ware. While Developmental period sites across much of the Rio Grande region are characterized by very high ratios of gray wares to white wares, this ratio is particularly high and seems to reflect concentrations of activities associated with cooking and storage, which in turn reflect a long cycle of use of these rockshelters.

Conclusions

The small number of sites that have been investigated over a wide area of the Sangre de Cristo Mountains—including LA 139965—are diverse and reflect a variable range of architecture and adaptive strategies. The combination of pottery found at LA 139965 provides clues concerning the nature of the use of the rockshelters during the late Developmental, Coalition, and Classic periods in what was then an extremely sparsely occupied area of the Taos District. The great majority of this pottery is characterized by a dark paste, granite temper, and varied surface treatments that include the common occurrence of incised decorations indicative of gray wares produced in the Taos District. Pottery and other traits seem to be part of a larger and diverse pattern that includes agriculture but also hunting and foraging over a large, sparsely occupied area of the Sangre de Cristo Mountains. The overwhelming dominance of pottery derived from gray ware jars exhibiting a wide range of exterior surface textures indicates a long history of emphasis on activities that focused on cooking and storage.

10 Chipped Stone Analysis

James L. Moore

A total of 3,477 chipped stone artifacts were recovered from five areas at LA 139965. The largest percentage came from the South Shelter (n = 1,405; 40.4 percent), followed by the South Talus (n = 817; 23.5 percent), North Talus (n = 634; 18.2 percent), North Shelter (n = 617; 17.8 percent), and Central Talus (n = 4; 0.1 percent). No definite stratigraphic breaks were defined during excavation and nearly all of the chipped stone artifacts were found in Stratum 3, so further subdivision of the assemblage by potential temporal association was not attempted. Additionally, the talus deposits represent materials derived from a variety of processes. Some were probably eroded from fill in the adjacent shelters, and road construction activities probably pushed other deposits from now-destroyed parts of the site into the talus areas. Thus, while we can discuss and compare the talus assemblages, we cannot say for certain where they originated. It should also be noted that the materials recovered from each of these areas do not necessarily reflect activities that occurred in their loci of recovery. The structure of assemblages from both the shelter and talus areas suggest refuse disposal rather than the in situ performance of specific activities. This means that we don't actually know where on the site those activities were performed. Some could have been performed in the areas from which artifacts were recovered, but the likelihood that the only activity represented by each of these assemblages is trash disposal is equally high. Thus, we discuss assemblages from each major site area, but the activities reflected in those assemblages cannot necessarily be linked directly to the area in which they were found.

As discussed later, most of the projectile points are types that were manufactured and used during the Ceramic period in the northern Rio Grande, with a few late Archaic points also occurring. While the Ceramic period is also well reflected in the suite of radiocarbon dates recovered from the site, none of the dates are from the Late Archaic period. Thus, either these few points represent curated artifacts, or a Late Archaic occupation is only sparsely reflected in the chipped stone assemblage.

Judging from the ceramic assemblage and radiocarbon dates recovered from LA 139965, this site was mainly a camping location for Pueblo groups engaged in hunting and gathering activities. As such, the assemblage can be contrasted with those of Archaic sites that reflect a similar lifestyle to help define potentially important similarities or differences in approach to reduction technique and strategy. The lack of a definite Archaic occupation means that there is only a small likelihood of mixed materials from both general periods of occupation.

Four questions were posed for the chipped stone assemblage in the research design for this analysis (Akins et al. 2014). Research Question 1 concerns the use of projectile points as chronological indicators. The ability to address this question was predicated on the occurrence of individual strata or temporal distinctions in the periods of occupation represented in different parts of the site. Since it was not possible to define strata due to a high degree of bioturbation, and the radiocarbon dates do not fall into clusters that would permit the definition of zones representing different periods of occupation, this question probably cannot be fully explored with available data. Research Question 2 concerns the ethnicity of site occupants, in particular determining whether occupation was by Pueblo, Jicarilla Apache, or Hispanic groups, or a mixture of some or all of these. We should still be able to address this question, though distinguishing boundaries between occupations related to different ethnic groups may not be possible. Research Questions 3 and 4 were combined in the research design, and will continue to be combined in this study. These questions concern why the site was occupied and how it functioned in its settlement system. Sufficient data should be available to permit a close examination of these questions.

Analytic Methods

Artifacts were examined under a binocular microscope at 10X–80X magnification during laboratory analysis, with higher magnification used to examine wear patterns and platform characteristics. Utilized and modified edge angles were measured with a goniometer, and artifacts were weighed on a digital scale. Tools were re-examined by a second analyst to record further information on breakage patterns and use.

Four general classes of chipped stone artifacts are recognized, including flakes, angular debris, cores, and tools. Flakes are debitage that exhibit one or more of three characteristics—definable dorsal and ventral surfaces, bulb of percussion, and striking platform. Pieces of angular debris are debitage that lack these characteristics. Cores are nodules from which debitage were struck and that exhibit negative flake scars originating from one or more platforms. Tools are debitage or cores whose edges were damaged during use or which were modified to create specific shapes or edge angles to function in certain tasks.

Analytic Attributes

Attributes recorded for all artifacts include material type and quality, artifact morphology and function, amount of surface covered by cortex, portion, evidence of thermal alteration, and dimensions (length, width, thickness, and weight). In addition to these attributes, several pertaining specifically to flakes were recorded, including dorsal scar orientation, platform angle, bulb of percussion type, curvature, waisting, and distal termination. And for all informal and formal tools, edge wear patterns and utilized/modified edge angles were examined and measured.

In order of examination, attributes recorded are as follows:

Material Type. Materials are coded by gross category unless specific sources or distinct varieties are recognized. Codes are arranged so that major material groups fall into specific sequences of numbers, progressing from general groups to specific varieties that can be linked to sources. Cherts, rhyolites, and metaquartzites are separated into a number of distinct varieties based on color combinations because varying colors in these materials could be important indicators of source.

Material Texture and Quality. This attribute provides information on the flaking characteristics of materials. Texture subjectively measures grain size *within* rather than *across* material types, and is scaled from fine to coarse for most materials, with "fine" textures exhibiting the smallest grains and "coarse" the largest. Obsidian is classified as "glassy" by default, and this category is applied to no other material. Quality records the presence of flaws that could affect reduction and includes crystalline inclusions, fossils, cracks, and voids. Inclusions that will not affect reduction, such as specks of different-colored material or dendrites, are not considered flaws. Material texture and quality are recorded together.

Artifact Morphology. This attributes categorizes artifacts by general form, such as core flake or early stage biface.

Artifact Function. This attribute categorizes specimens by inferred use (or lack of use), such as end scraper or non-utilized flake.

Cortex. This is the chemically or mechanically weathered outer rind on nodules, which tends to be brittle and chalky and does not flake with the ease or predictability of unweathered material. The amount of cortical coverage is estimated and recorded in 10 percent increments for each artifact. For flakes the percentage of dorsal surface covered by cortex is estimated, while for all other artifact classes the percentage of total surface area covered by cortex is estimated, since artifact classes other than flakes lack definable dorsal surfaces.

Cortex Type. The type of cortex on an artifact can be a clue to its origin. Waterworn cortex indicates that a nodule was transported by water and that its source was probably a gravel deposit. Non-waterworn cortex suggests that a material was obtained where it outcrops naturally. Cortex type was identified for artifacts on which it occurred. When identification was not possible, cortex type was coded as indeterminate.

Portion. The portion represented by each flake and formal tool is recorded. Angular debris and cores are considered whole by default, because it is usually impossible to determine whether these categories broke during or after reduction.

Platform Type. This records the shape of, and any modifications to, the striking platform on whole flakes and proximal fragments.

Platform Lipping. This records the presence or absence of a lip at the ventral edge of a flake platform, and is coded as either present or absent.

Platform Angle. The angle formed by the intersection of the dorsal surface of a flake and its striking platform was recorded as either greater or less than 45 degrees.

Bulb of Percussion. These only occur on flakes and are recorded as either pronounced or diffuse.

Flake Curvature. The presence or absence of distinct curvature on the ventral surface of flakes was recorded using this attribute.

Waisted. Soft hammer percussion and pressure flaking can cause the formation of a waist between the platform and main body of a flake, which often occurs on biface flakes. Waisting is recorded as present or absent.

Thermal Alteration. When present, the type and location of evidence for thermal alteration are recorded to determine whether an artifact was purposely or incidentally heated.

Wear Pattern. In cases where debitage or cores were used as informal tools, this attribute records the pattern of edge attrition. A second group of codes was used to record formal tool edges. Wear pattern was recorded separately for every altered edge on a tool.

Edge Angle. The angles of all utilized or intentionally modified edges on tools were recorded.

Length, Width, and Thickness. These attributes were measured in millimeters for all artifacts. On angular debris and cores, length is the largest measurement, width is the longest dimension perpendicular to the length, and thickness is perpendicular to the width and is the smallest measurement. On flakes and formal tools, length is the distance between the proximal and distal ends, width is the distance between edges paralleling the length, and thickness is the distance between dorsal and ventral surfaces.

Weight. Weight was recorded to the nearest tenth of a gram.

Discussion

The analytic methods used during this study combine both typological and attribute approaches. In typological approaches, "individual artifacts are classified into types that have some kind of technological or functional meaning" (Andrefsky 2001:6). A benefit of this type of analysis is that behavior can be immediately inferred from the identification of a single artifact (Andrefsky 2001:6). For instance, the presence of a notching flake indicates that a notched tool was made at a site, even if no notched tools are found. However, this method can be criticized because there is often a lack of verification between artifact type and functional or technological interpretation (Andrefsky 2001:7). Attribute analysis examines the distribution of one or more characteristic through an entire population, usually of debitage (Andrefsky 2001:7). Among other things, various attributes can be used to assess the prevalence of specific reduction methods in a debitage population. However, problems can also occur when using this analytic strategy "for a variety of reasons related to the small size of attributes and the number of observations" (Andrefsky 2001:12). Typological and attribute analyses vary in scale; typological analysis is applied to individual artifacts, while attribute analysis is applied to entire assemblages (Andrefsky 2001:12). There is no "right" approach to debitage analysis, and the approach used can vary according to the types of information desired (Andrefsky 2001).

The methods used by this study assign typological interpretations to individual artifacts, while at the same time gather attribute data that can be used to test and augment typological data. For instance, as discussed later, a rigorous set of characteristics is used to define flakes struck from bifaces versus those struck from cores. Flakes that do not fulfill the set of characteristics used to define biface flakes are, by default, considered core flakes. However, that definition models ideal examples, and all flakes struck from bifaces (especially those from an early stage of manufacture) do not fit that ideal. By combining attribute analysis with a typological approach we are able to determine which flakes were definitely struck from bifaces (typological approach) as well as those that were probably struck from bifaces, but do not quite fit the model (attribute analysis). The two approaches complement one another and help provide a deeper understanding of reduction technology and tool use.

The main questions this analytic scheme is designed to explore include what types of materials were selected, what techniques were used for reduction, and what activities are reflected by the types of chipped stone tools used. These topics can provide information about ties to other regions, mobility patterns, and site function. Material selection studies will not always reveal *how* materials were obtained, but they can usually provide information on *where* materials came from. Cortex type can be used to determine whether certain materials were obtained at outcrops or came from secondary gravel deposits. Studies of reduction technology can help show how different people solved the problem of producing the chipped stone tools they needed from resources at hand. Various approaches could have been used, depending on the level of residential mobility, types of stone available, and the range of other materials that could be used as tools. Examination of the tools recovered from a site can help define the range of activities that occurred there; in many cases this will also aid in defining site function. Chipped stone tools can sometimes be used to provide temporal data, but are usually less time sensitive than other artifact classes like pottery. For this reason, the chipped stone assemblages are only used to provide temporal data at a very coarse-grained level.

Two attributes are used to record typological categories: artifact morphology and function. Morphology describes the basic appearance of an artifact, especially debitage. Function describes the presumed use of an artifact based on shape and evidence of wear. Information on the typological placement of debitage and cores is coded into artifact morphology, while tools are generalized by this attribute into uniface, biface, and cobble tool categories. Conversely, the typological placement of formal tools is coded into the artifact function category and is based on shape and flaking patterns, while most debitage and cores are generalized into utilized and unutilized categories. The exceptions are pieces of debitage or cores that were marginally modified by use or design into definable tool types. This category mostly includes tools such as scrapers and spokeshaves that were made on debitage with a minimum of modification, and in most cases the source of that modification (use versus purpose) is questionable. By using both artifact morphology and function, each artifact can be assigned to a specific type.

The debitage category contains flakes and angular debris. While all angular debris is assigned a single code, multiple types of flakes can occur in an assemblage, and each type can have a different origin. One of the aspirations of this analysis is to distinguish between major varieties of flakes including core flakes, biface flakes, resharpening flakes, notching flakes, bipolar flakes, blades, channel flakes, and potlids. With the exception of core and biface flakes, these categories are usually rare or absent from most assemblages. Thus, distinguishing between core and biface flakes is a critical analytic need.

Flakes are divided into removals from cores and bifaces using a polythetic set of attributes (discussed in detail later). While not all flakes removed from bifaces can be distinguished in this way, those that are can be considered definite evidence of biface reduction. Instead of providing rigid definitions, the polythetic set offers a flexible means of categorizing flakes and helps account for some of the variability seen in experiments. Other flake types are identified by unique characteristics. Notching flakes are produced when the hafting elements of bifaces are notched; they generally exhibit a recessed, U-shaped platform and deep, semi-circular scallop at the juncture of the striking platform and dorsal surface. Bipolar flakes are produced when nodules are smashed, and sometimes exhibit evidence of having been struck at one end and crushed against an anvil at the other. Channel flakes are removed when Paleoindian dart or spear points are fluted and do not occur in later sites except as curated artifacts. Blades are long, narrow removals from specially prepared cores, and are rare after the Clovis period. The traditional definition of blades in the Southwest follows that developed by Bordes (1961); his *Typologie* classifies as a blade any flake that is twice as long as it is wide. However, as Collins (1999) points out, the context of that definition is often overlooked by archaeologists in the New World:

> [Bordes] was defining the term for use in classifying Lower and Middle Paleolithic stone tools, where blades by any definition are relatively infrequent.…In contrast, during the Upper Paleolithic, blades—often called "true blades"—are far more common and they meet more stringent definitions, even in Bordes own writings…where emphasis is placed on the techniques of production, not just the proportions of the piece (Collins 1999:7).

This is important to note, because many flakes removed from large Archaic bifaces fit the proportional criteria that are often used to define blades, but result from an entirely different reduction technique. Large biface flakes often appear to be prismatic in form and are slightly curved as can be common for blades. However, blades are struck from specially prepared cores, have platform angles approaching 90 degrees, and exhibit evidence of platform preparation on the dorsal surface below its juncture with the platform (Collins 1999). Large biface flakes are struck from bifacially flaked tools or biface-cores, have platform angles approaching 45 degrees, and exhibit evidence of platform preparation across the platform as well as along the edge where the platform and dorsal surface meet. Even though there is a superficial resemblance between some of the byproducts of blade and biface reduction, they represent two distinct techniques, each with its own set of attributes.

Resharpening flakes are removed from formal tool edges that have become dull from use; these usually fit the polythetic set for biface flakes. They are often impossible to separate from other biface flakes, but can sometimes be distinguished by the presence of an extraordinary amount of damage on the platform and on the section of dorsal surface adjacent to the platform. Potlids are debitage that were blown off the surface of a chipped stone artifact during thermal alteration, and are not indicative of purposeful flaking. These artifacts are classified as flakes, but they should actually be considered a separate category.

Cores are nodules of raw lithic material that have been modified by the removal of debitage during reduction. Some cores were efficiently reduced in a standardized fashion, while flakes were removed from others in a more haphazard manner. Core shape and size are often clues to the relative availability of materials. Materials represented by small, carefully reduced cores may have been uncommon or highly desired. Materials represented by large cores, often with haphazard or unplanned flake removals, tend to be common and not highly prized. Core analysis in the Southwest tends to be rather simplistic since evidence of specialized reduction techniques is rare after the Paleoindian period. Blade technology does not occur after the Clovis period, so prismatic (blade) cores associated with this technique rarely occur. Blade technology was replaced by the manufacture of biface-cores. Biface-cores (or large generalized bifaces) were multifunctional in that they could be used as tools, as sources for informal debitage tools, or modified into other forms. While the manufacture of biface-cores wasted a lot of material, the tools themselves were an efficient adjunct to a hunting and gathering lifestyle. However, because of their multifunctional character they tend to be categorized as formal tools rather than cores.

Both cores and formal tools represent nuclei from which flakes were removed, but differ in the rationale behind those removals. Flakes were struck from cores for use as informal tools or to be modified into formal tools. Flakes were also removed during formal tool manufacture to create desired shapes or edge angles. Cores are classified with debitage as by-products of the reduction process. Formal tools are considered separately because they are evidence of other unrelated tasks. Since all chipped stone artifacts result from similar reductive processes, this division is in many ways artificial, because formal tools can be used to both aid in the examination of reduction processes and to provide information on the range of tasks performed. This is especially true for unfinished formal tools that were discarded during production because of breakage or problems encountered during reduction.

Material Selection

Examination of the materials reduced at a site and their physical attributes can provide information on several aspects of human behavior. For example, the presence of materials obtained from known nonlocal sources might be indicative of movement range or exchange ties. An examination of the texture and flaking qualities of materials can provide clues to the purpose(s) for which they were selected. By identifying materials from local sources—both primary and secondary—an analysis can provide information on how the local landscape was used. An assessment of the amount of cortical coverage on debitage can suggest the form in which materials arrived at a site. These are just a few of the possibilities that can be explored by this type of study.

Five attributes recorded during analysis are specifically aimed at providing information on material selection. Examining the type of cortex that occurs on materials provides information on where they were obtained. Non-waterworn cortex indicates procurement at an outcrop, while waterworn cortex indicates that a nodule was collected from a secondary gravel deposit. Since materials collected from gravel beds were often naturally transported a great distance from where they outcrop, this is an important distinction. The amount of cortical coverage on debitage, especially flakes, provides clues concerning the level to which cores were reduced before being brought to a site. Large amounts of cortical debitage exhibiting high percentages of cortical coverage suggest that nodules were both obtained and reduced at the same general location, while the opposite indicates that cores were transported in an already reduced condition.

The remaining attributes provide information on flaking characteristics, which can be critically important to the material selection process. The first of these is material type itself. Rocks vary considerably in their flaking characteristics; some flake with comparative ease and predictably, while others are more difficult to flake and do not always break in the desired way. Materials that flake easily tend to be brittle and elastic, while those that are harder to flake tend to lack elasticity and are less brittle. These characteristics are tied to what Cotterell and Kaminga (1990:129–130) refer to as *toughness*. Tough materials are durable and able to withstand impacts from pounding or chopping without splintering and coming apart. While materials from different sources vary in toughness, in general Cotterell and Kaminga's (1990:129) comparison indicates that obsidian, quartz, and chert are less tough than andesitic basalt, tuff, and rhyodacite. Toughness is not equated with hardness, because hard materials also tend to be brittle and fracture easily (Cotterell and Kaminga 1990:129). Thus, nondurable materials are mostly hard and brittle. Fine-grained, nondurable materials produce sharp cutting edges (Cotterell and Kaminga 1990:127) and are less tough than those that are softer and less brittle. While the former are well suited to the production of cutting and scraping tools, the latter are best for pounding and grinding tools. Nondurable materials are less suitable for pounding or chopping because the same characteristics that allow them to produce sharp edges causes them to splinter and crack when force is applied to their edges.

This system of classification is similar to one presented by Callahan (1979:16) and modified somewhat by Whittaker (1994:66), which ranks materials by degree of toughness and the effective limits of tools used for reduction. While Callahan's (1979:16) rankings are a subjective rather than a quantitative test of toughness, they are based on many years of flintknapping experience and are probably accurate. In this scheme, obsidians and heat-treated fine-grained cherts and chalcedonies are classified as brittle and can be efficiently thinned using soft hammer percussion and pressure flaking. The finest-grained basalts and rhyolites, unheated fine-grained cherts, and silicified woods are categorized as strong, and can be efficiently thinned using both soft hammerstone and soft hammer percussion as well as pressure flaking. Strong cherts can be transformed into brittle materials by thermal alteration. The coarser cherts, quartzites, quartz crystal, agate, jasper, siltstone, siliceous limestone, coarser-grained rhyolites, and most basalts are classified as tough and are best thinned using soft hammer reduction.

Luedtke (1992:80) notes that material strength (also referred to as toughness or tenacity) "is a measure of how much force must be applied to produce a fracture." Thus, strength also equates to the degree of resistance to knapping demonstrated by a material. Strong materials that require hard blows to remove flakes cannot be hit as accurately as materials that require less force to initiate a fracture (Luedtke 1992:80). Some reduction techniques, such as pressure flaking, are not applicable to very strong materials (Luedtke 1992:80). In discussing Callahan's (1979) material scale, Luedtke (1992:80–81) notes:

> Strength peaks in the middle of the range rather than at either end. The most workable materials, at the low end of his scale, are relatively weak. They should be worked with softer billets or flakers, and they require special procedures to keep platforms from collapsing. Materials at the high end of Callahan's scale, the least workable, are also somewhat less strong and prone to hinge and step fractures. Presumably, fractures start easily in materials at this end of the scale but do not propagate all the way through the stone, as desired.

Materials categorized as brittle in Callahan's scale are the most amenable to chipped stone reduction. Strong materials can be efficiently worked but require more force to remove flakes. Tough materials at the upper end of the scale generally cannot be efficiently worked because flakes struck from them often terminate in hinges or steps that make further flaking difficult to accomplish.

By combining classification systems, we can categorize materials defined as brittle and strong by Callahan (1979:16) as nondurable, and those defined as tough as durable materials. Nondurable materials are best suited to reduction because they can be efficiently flaked using a variety of methods. Durable materials are less well suited to reduction because the techniques that can be used to efficiently work them are more limited and they cannot be flaked as efficiently. By examining the toughness of materials we may be able to determine some of the use-based parameters that factored into their selection. Three attributes are tied to this examination, including material type, material texture, and material quality. The presence or absence of thermal alteration is also an important factor given Callahan's (1979) observation that strong cherts can be converted to a brittle state through proper heat treatment.

Material Type Selection

The distribution of material categories by area within the site is shown in Table 10.1. We refer to material categories rather than material types because multiple varieties of several material types occur in several cases, which have been combined into the categories shown in Table 10.1. Both basalt and andesite were identified in the overall assemblage, with most specimens (353 of 354) identified as basalt. Since distinguishing between these materials visually is difficult, they are combined into a single category. It should also be noted that what we have called basalt in this analysis may actually be dacite, which is more amenable to flaking than basalt and outcrops near Taos among other areas (Vierra and Dilley 2008:333; M. Steven Shackley, personal communication, 2014). Four of the five area assemblages are large enough to provide useable data, and only the assemblage from the Central Talus is too small for most analytic purposes. Thus, the Central Talus assemblage is dropped from many analyses to minimize the effects of sample error. Chert and silicified wood occur in equal percentages in the Central Talus assemblage, and were the only material types recovered from that part of the site, so that assemblage is not further considered. Each of the other assemblages is dominated by cherts. Silicified wood ranks second in three cases, with only the South Talus assemblage excepted where rhyolite is ranked second. Obsidian is ranked third in all four assemblages. For three assemblages—North Shelter, South Shelter, and South Talus—basalt/andesite is ranked fourth, while quartz is in that position for the North Talus. While metaquartzite is ranked fifth for the South Shelter and South Talus, that position is held by quartz in the North Shelter and basalt/andesite in the North Talus. At this point, there do not appear to be further similarities between assemblages.

Despite the general similarity in area assemblage composition, chi-square analysis suggests that the four main areas do not represent one population (chi-square = 279.8, df = 18, significance = .000, Cramer's V = .284). This analysis was run with igneous undifferentiated, limestone, and orthoquarzite eliminated because they create empty cells or cells containing too few examples. Similar results were obtained by grouping the North Shelter and North Talus assemblages (chi-square = 18.0, df = 6, significance = .006, Phi = .120), South Shelter and South Talus assemblages (chi-square = 162.8, df = 6, significance = .000, Phi = .271), both shelter assemblages (chi-square = 23.9, df = 6, significance = .001, Phi = .109), and both talus assemblages (chi-square =

Table 10.1. Material category distribution by site area assemblage; counts and percents.

Material		North Shelter	North Talus	Central Talus	South Shelter	South Talus	Total
Chert	n =	209	194	2	576	239	**1220**
	%	33.9	30.6	50.0	41.0	29.3	**35.1**
Silicified wood	n =	145	136	2	231	59	**573**
	%	23.5	21.5	50.0	16.4	7.2	**16.5**
Obsidian	n =	90	80	–	165	138	**473**
	%	14.6	12.6	–	11.7	16.9	**13.6**
Igneous	n =	–	–	–	–	1	**1**
	%	–	–	–	–	0.1	**0.0**
Basalt/Andesite	n =	64	61	–	149	80	**354**
	%	10.4	9.5	–	10.6	9.8	**10.2**
Rhyolite	n =	32	57	–	97	183	**369**
	%	5.2	9.0	–	0.4	22.4	**10.6**
Limestone	n =	1	5	–	5	1	**12**
	%	0.2	0.8	–	0.4	0.1	**0.3**
Metaquartzite	n =	37	30	–	105	64	**236**
	%	6.0	4.7	–	7.5	7.8	**6.8**
Orthoquartzite	n =	–	1	–	2	–	**3**
	%	–	0.2	–	0.1	–	**0.1**
Quartz	n =	39	70	–	75	52	**236**
	%	6.3	11.1	–	5.3	6.4	**6.8**
Total	**n =**	**617**	**634**	**4**	**1405**	**817**	**3477**
	%	**17.7**	**18.2**	**0.1**	**40.4**	**23.5**	**100.0**

111.8, df = 6, significance = .000, Phi = .278). Thus, in terms of basic material composition, all four of the major site assemblages are individual populations, despite the general similarity of their make-up.

Non-Local Materials

By defining specific material types, specimens of probable non-local origin can often be identified. Table 10.2 shows the distribution of individual material types by area. Eight materials are of special interest to this discussion, seven of which represent non-local types and the eighth is an interesting and potentially non-local material type. Material types of definite non-local origin include Pedernal chert, Madera chert, Narbona Pass chert, Zuni Spotted chert, Tecovas chert, generic obsidian, El Rechuelos obsidian, and (possibly) very fine-grained white metaquartzite. With the potential exception of the very fine-grained white metaquartzite and Tecovas chert, these materials derive from sources located far to the west of the project area. Pedernal chert outcrops in the Chama Valley and at San Pedro Mountain (Banks 1990:67–69), and occurs abundantly in gravel beds along the Rio Chama and Rio Grande. Madera chert outcrops in the Sangre de Cristo Mountains in the headwaters of Gallinas Creek near Las Vegas and along the southern and southwestern flanks of the mountains (Banks 1990:72). This material can also be found in gravel beds along the Sapello and Pecos rivers (Banks 1990:72). Since the Sapello River converges with the Mora River a good distance south of the project area, this material is considered non-local. Narbona Pass chert outcrops in the Chuska Mountains along the New Mexico-Arizona border (Banks 1990:63). LeTourneau (1997, 2000) has extensively researched the source of Zuni Spotted chert, and has determined that it eroded out of Lower Triassic or Upper Permian deposits in the Zuni Mountains, and none of it may be in place any longer. This material occurs abundantly as irregular, pebble- to boulder-sized nodules at Lookout Mountain in the Zuni Mountains, and is also found in a conglomerate formed during the Triassic. Nodules of Zuni Spotted chert are also found along the lower Rio Puerco of the east and in gravels along the Rio Grande near Socorro (LeTourneau 2000), having been transported east by the Rio San José (LeTourneau 2000). Tecovas chert sources are widespread along the eastern edge of the Llano Estacado to the south of the project area,

Table 10.2. Material types, distribution by site area assemblage; counts and percents.

Material Type		North Shelter	North Talus	Central Talus	South Shelter	South Talus	Total
Chert	n	182	176	2	465	203	**1028**
	%	29.5	27.8	50.0	33.1	24.8	**29.6**
Pedernal chert	n	20	15	–	99	23	**157**
	%	3.2	2.4	–	7.0	2.8	**4.5**
Narbona Pass chert	n	–	–	–	1	–	**1**
	%	–	–	–	0.1	–	**0.0**
Tecovas chert	n	–	2	–	1	–	**3**
	%	–	0.3	–	0.1	–	**0.1**
Madera chert	n	7	1	–	7	8	**23**
	%	1.1	0.2	–	0.5	1.0	**0.7**
Zuni Spotted chert	n	–	–	–	3	1	**4**
	%	–	–	–	0.2	0.1	**0.1**
Gray chert	n	–	–	–	–	2	**2**
	%	–	–	–	–	0.2	**0.1**
Brown chert	n	–	–	–	–	1	**1**
	%	–	–	–	–	0.1	**0.0**
Red chert	n	–	–	–	–	1	**1**
	%	–	–	–	–	0.1	**0.0**
Silicified wood	n	145	136	2	231	59	**573**
	%	23.5	21.5	50.0	16.4	7.2	**16.5**
Obsidian	n	87	78	–	153	118	**436**
	%	14.1	12.3	–	10.9	14.4	**12.5**
El Rechuelos obsidian	n	3	2	–	12	20	**37**
	%	0.5	0.3	–	0.9	2.4	**1.1**
Igneous	n	–	–	–	–	1	**1**
	%	–	–	–	–	0.1	**0.0**
Basalt	n	64	61	–	148	80	**352**
	%	10.4	9.6	–	10.5	9.8	**10.1**
Rhyolite	n	–	–	–	–	1	**1**
	%	–	–	–	–	0.1	**0.0**
Gray rhyolite	n	32	56	–	95	180	**363**
	%	5.2	8.8	–	6.8	22.0	**10.4**
Gray aphanitic rhyolite	n	–	1	–	2	2	**5**
	%	–	0.2	–	0.1	0.2	**0.1**
Andesite	n	–	–	–	1	–	**1**
	%	–	–	–	0.1	–	**0.0**
Limestone	n	1	5	–	5	1	**12**
	%	0.2	0.8	–	0.4	0.1	**0.3**
Metaquartzite	n	35	30	–	102	52	**219**
	%	5.7	4.7	–	7.3	6.4	**6.3**
Pink metaquartzite	n	–	–	–	–	1	**1**
	%	–	–	–	–	0.1	**0.0**
White metaquartzite, very fine-grained	n	2	–	–	3	11	**16**
	%	0.3	–	–	0.2	1.3	**0.5**
Orthoquartzite	n	–	1	–	2	–	**3**
	%	–	0.2	–	0.1	–	**0.1**
Quartz	n	39	70	–	75	52	**236**
	%	6.3	11.0	–	5.3	6.4	**6.8**
Total	**n**	**617**	**634**	**4**	**1405**	**817**	**3476**
	%	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

with outcrops also occurring along the northern margins of that feature (Banks 1990:92–93).

No potential source can be defined for the very fine-grained white metaquartzite. However, Banks (1990:79–80) notes that quartzites are relatively abundant in the Dakota Formation, and notes specific outcrops on the south side of the Mora River, southwest of Fort Union, and on the north side of the Sapello River, above its confluence with the Mora River. While this material is distinct, pinpointing its source any closer than somewhere in northeastern New Mexico is not possible at this time. While possible that the very fine-grained white metaquartzite represents an imported material, it more likely came from a comparatively local source.

During laboratory analysis, most obsidian was assigned a generic classification. This is because visually distinguishing between specimens from the various sources in New Mexico is virtually impossible except for two types. El Rechuelos obsidian can often be defined visually because of its gray color and the presence of numerous small ash inclusions. Similarly, obsidian from East Grants Ridge can often be defined because of its extreme opacity. While no potential examples of the latter occur in this assemblage, several pieces of probable El Rechuelos obsidian were found. In addition, a number of obsidian specimens were submitted for instrumental sourcing, which is discussed in the next section.

Obsidian Sourcing

A total of 98 obsidian specimens were submitted for sourcing, one of which proved to be too small for analysis (Appendix 2). Samples were submitted from all parts of the site except the Central Talus, which yielded no obsidian artifacts. The 97 remaining specimens all came from Jemez Mountain sources including El Rechuelos (n = 50; 51.0 percent), Valles Rhyolite (n = 31; 31.6 percent), and Cerro Toledo (n = 16; 16.3 percent). The specimen that was too small for analysis is thought to be from the Cerro Toledo source, but this remains uncertain. Thus, that specimen is eliminated from this discussion.

El Rechuelos obsidian outcrops in a number of small volcanic domes to the north, west, and south of Polvadera Peak, located just northeast of the edge of the Valles Caldera (Shackley 2005:68; Baugh and Nelson 1987; Wolfman 1994). Cerro Toledo obsidian derives from two areas: flows around Cerro Toledo on the northeast side of the caldera just south of the El Rechuelos source area and at Rabbit Mountain in the southeast part of the caldera. The latter source is adjacent to the Pajarito Plateau, with deposits occurring on Obsidian Ridge as well as on ridges to the west of Rabbit Mountain (Shackley 2005:69–70). The Valles Rhyolite obsidian source is at Cerro del Medio in the eastern part of the caldera (Shackley 2005:71).

In addition to occurring at their sources, El Rechuelos and Cerro Toledo obsidian nodules have escaped into the Rio Grande system, and can be found in gravel deposits along that river as far south as Chihuahua (Shackley 2005:64). In contrast, Valles Rhyolite obsidian is rarely found in geological deposits outside the confines of the Valles Caldera (Duff et al. 2012:3002). However, Shackley (2005:71; personal communication, 2015) notes that small nodules of this material have been found along San Antonio Creek in the Jemez Mountains. The San Antonio creek is a tributary of the Rio Jemez, which is, in turn, a tributary of the Rio Grande. Thus, small amounts of this material may have found its way into Rio Grande gravels, but is very rare in comparison with nodules from the El Rechuelos and Cerro Toledo sources.

All sourced specimens were reexamined to see if they retain any cortical surfaces, and if so, what type of cortex it is. Six of specimens still exhibit cortical surfaces, with examples occurring in each of the four major area assemblages. The North Shelter assemblage is represented by two specimens, with one apiece from the Valles and El Rechuelos sources. Two specimens also come from the North Talus assemblage, including one each of Valles and Cerro Toledo obsidian. Single specimens are from the South Shelter and South Talus assemblages, both of which are from the El Rechuelos source. The three specimens from the Valles and Cerro Toledo sources exhibit non-waterworn cortex, indicating they were collected at their sources. All three El Rechuelos specimens exhibit waterworn cortex, but in at least one case the cortex is only very slightly waterworn indicating that the nodule had not been moved very far from its source. This could indicate that all of the El Rechuelos obsidian came from stream beds very close to the source. Thus, in at least four cases and probably all six, these specimens came from nodules that were obtained directly from the source or from secondary deposits occurring very near the source. Rather than being obtained from Rio Grande gravels, the Valles and Cerro Toledo obsidian from LA 139965 was collected from its sources in the Jemez Mountains, and the El Rechuelos obsidian most likely came from one or more of the streams that drain the source area such as Rechuelos Creek, Polvadera Creek, and the Cañada del Ojitos (Shackley 2005:68; Wolfman 1994:47).

There are two main ways in which the occupants of LA 139965 could have obtained their obsidian—they either went directly to the sources themselves, or they traded with groups who accessed the sources for materials. Trade is the probable means for obtaining obsidian, though direct procurement cannot be ruled out. Since most of the obsidian at LA 139965 probably derives from late Developmental-period occupations, the most likely trading partners were the occupants of the Tewa Basin north of Santa Fe. People living in that area during the late Developmental period had access to the Jemez Mountain sources, and also used Pedernal chert that mainly had been obtained from Rio Grande gravels (Moore in prep. [a]). Source analysis of a sample of obsidian from six late Developmental-period sites between Santa Fe and Pojoaque indicate the use of obsidian from all three of the main Jemez sources between AD 900 and 1200 (Moore in prep. [a]). Examination of cortex on sourced specimens from that study indicates that all three main sources (Valles, Cerro Toledo, and El Rechuelos) were accessed directly to obtain obsidian, with El Rechuelos and Cerro Toledo obsidian also being collected from Rio Grande gravels (Moore in prep. [a]). Thus, people in the Tewa Basin made use of both primary and secondary obsidian sources. The Pajarito Plateau and Chama/Ojo Caliente river valleys can be ruled out as trade sources for this time period, since there was no permanent habitation of those areas until the Coalition period.

Only nine of 157 pieces of Pedernal chert retain some cortical coverage, with seven specimens exhibiting waterworn cortex and two non-waterworn cortex. This indicates that Pedernal chert was obtained from its source in the Chama Valley as well as from gravel beds along the Rio Chama or Rio Grande. Most cortical pieces of Pedernal chert in the Pojoaque Corridor study exhibit waterworn cortex, but a small percentage of specimens from AD 1000–1100 contexts (0.3 percent) and a much larger proportion from AD 1100–1200 contexts (7.4 percent) exhibit non-waterworn cortex, indicating increasing use of the source area for this material through the late Developmental period. Occupants of the Tewa Basin were demonstrably ranging into the Chama Valley and Jemez Mountains and probably the Pajarito Plateau to obtain materials for reduction. The similar pattern in cortex types and sources for obsidian and Pedernal chert at LA 139965 suggest that these materials were obtained in trade from residents of the Tewa Basin rather than being procured directly from their sources.

Discussion of Non-Local Materials

A total of 661 specimens from LA 139965 (19.0 percent) are derived from non-local sources. This very high percentage of non-local materials is indicative of interaction with other groups, especially to the west of the project area, as discussed above. Table 10.3 shows the distribution of non-local materials by site area assemblage, with the very fine-grained white metaquartzite eliminated from consideration because it is uncertain whether or not this material was locally available. Except for the Central Talus, which yielded few specimens and none of non-local derivation, percentages of non-local materials in the other area assemblages are similar in proportion to that of the overall assemblage. However, the percentage of non-local materials is somewhat small for the North Talus assemblage, and a bit high for the South Talus assemblage. Still, none of these percentages suggest that the occupants of the various parts of the site had differential access to non-local materials. However, there is quite a bit of difference in distribution of the various non-local materials. Narbona Pass chert and Zuni Spotted chert came from the most distant sources, and only occur in the South Shelter and South Talus assemblages, primarily the former. Though Pedernal chert is well represented in all parts of the site except the Central Talus, it was most abundant in the South Shelter. The highest percentages of obsidian occur in the North Shelter and South Talus assemblages, but this is the most common non-local material at the site and occurs in substantial percentages in all assemblages, again except for the Central Talus.

Though sparse, there is limited evidence for differential access to some non-local materials, especially those from the most distant sources. Is there any similar evidence for differential access to (or preference for) obsidian from the various sources? Table 10.4 presents the distribution of sourced

Table 10.3. Non-local materials, distribution by site area assemblage; counts and percents.

Material		North Shelter	North Talus	Central Talus	South Shelter	South Talus	Total
Pedernal Chert	n =	20	15	–	99	23	**157**
	%	3.2	2.4	–	7.0	2.8	**4.5**
Narbona Pass chert	n =	–	–	–	1	–	**1**
	%	–	–	–	0.1	–	**0.0**
Tecovas chert	n =	–	2	–	1	–	**3**
	%	–	0.3	–	0.1	–	**0.1**
Madera chert	n =	7	1	–	7	8	**23**
	%	1.1	0.2	–	0.5	1.0	**0.7**
Zuni Spotted chert	n =	–	–	–	3	1	**4**
	%	–	–	–	0.2	0.1	**0.1**
Obsidian	n =	90	80	–	165	138	**473**
	%	14.6	12.6	–	11.7	16.9	**13.6**
Total non-local	**n =**	**117**	**98**	**4**	**276**	**170**	**661**
	%	**19.0**	**15.5**	**100.0**	**19.6**	**20.8**	**19.0**
Total specimens	**n =**	**617**	**633**	**4**	**1405**	**817**	**3476**
	%	**17.8**	**0.2**	**0.1**	**40.4**	**23.5**	**100.0**

Table 10.4. Sourced obsidian samples, obsidian type by site area assemblage; counts and percents.

Obsidian Source		North Shelter	North Talus	South Shelter	South Talus	Total
El Rechuelos	n =	12	5	24	9	**50**
	%	35.3	33.3	66.7	69.2	**51.0**
Cerro Toledo	n =	10	2	3	1	**16**
	%	29.4	13.3	8.3	7.7	**16.3**
Probable Cerro Toledo	n =	–	–	1	–	**1**
	%	–	–	2.8	–	**1.0**
Valles Rhyolite	n =	12	8	8	3	**31**
	%	35.3	53.3	22.2	23.1	**31.6**
Total	**n =**	**34**	**15**	**36**	**13**	**98**
	%	**34.7**	**15.3**	**36.7**	**13.3**	**100.0**

samples by location of recovery and source. The distribution of samples from the various sources suggest that there were differences in access or preference for materials from the various sources. While El Rechuelos obsidian is the dominant type, Valles Rhyolite obsidian is also quite common, and Cerro Toledo obsidian is the least common type. The South Shelter and South Talus assemblages are heavily dominated by El Rechuelos obsidian, and contain much smaller percentages of Valles Rhyolite and Cerro Toledo obsidians than the northern assemblages. Equal percentages of El Rechuelos and Valles Rhyolite obsidian occur in the North Shelter assemblage, which also contains nearly as much Cerro Toledo obsidian. Valles Rhyolite obsidian clearly dominates the North Talus assemblage, with El Rechuelos obsidian making up a third. While considerably less of the obsidian in this assemblage is from the Cerro Toledo source than was the case for the North Shelter assemblage, this material is still considerably more abundant than it is in the southern assemblages.

Thus, while non-local materials occur in similar percentages in all four of the main site assemblages, variations in source distribution patterns suggest somewhat different acquisition patterns. Most of the non-local materials came from sources to the west of the project area, most likely the northern Rio Grande where Pedernal chert, Madera chert, and Jemez obsidians are available both at their sources and in secondary deposits. Sources to the south of the project area—with the only representative being Tecovas chert—are very sparsely represented.

Wilson's ceramic analysis (Chapter 9) concludes that LA 139965 is part of the Taos Ceramic District as defined by Lang (1982), an area much larger than the Taos archaeological district, as defined by Wetherington (1968). Since there is evidence of trade in chipped stone materials between the Tewa Basin and Taos area (Moore 1994), there is a possibility that the occupants of LA 139965 obtained their obsidian and Pedernal chert by trading with people to the north in the Taos area rather than to the west with the occupants of the Tewa Basin. If this is the case, we would expect to see smaller percentages of obsidian and Pedernal chert at LA 139965 than in contemporary Taos-area sites as a consequence of down-the-line trade. However, assemblages from the Pot Creek Valley contain somewhat smaller percentages of non-local materials than occur at LA 139965—16.2 percent, including 8.6 percent Pedernal chert and 7.6 percent Jemez obsidian, with no other non-local materials being recognized (Moore 1994:290). While obsidian is the most common non-local material at LA 139965, Pedernal chert is somewhat more common at the Pot Creek sites. While it is likely that the occupants of LA 139965 were tied into the same exchange system as those in the Pot Creek Valley, the Taos area most likely did not serve as a middleman in the trade system.

Material Texture and Quality

Table 10.5 presents information on texture and quality for each material category. Glassy and fine-grained materials are generally best suited to formal tool manufacture, and these textures dominate the assemblage, making up over two-thirds of the total. Medium-grained materials account for another 22.7 percent, while coarse-grained materials make up only 8.8 percent of the assemblage. Flawed materials, especially if fine-grained, appear to have been acceptable for reduction, since this category makes up nearly 10 percent of the overall assemblage and 17.7 percent of the fine-grained materials.

Considering only flakes related to core or biface reduction, there was a definite tendency to select unflawed glassy or fine-grained materials for tool manufacture. Of 344 biface and notching flakes, 128 (37.2 percent) are unflawed glassy material and 191 (55.5 percent) are unflawed fine-grained material. Only 19 specimens (5.5 percent) are made from unflawed medium-grained materials, one specimen (0.3 percent) is coarse grained and unflawed, and only five specimens (1.5 percent) are made from flawed fine-grained material. The core flake distribution contrasts with this, with a much lower percentage of glassy materials (10.5 percent) and a slightly lower percentage of fine-grained materials (54.4 percent). Medium-grained materials make up 25.5 percent of the core flakes, and another 9.5 percent are coarse grained. Flawed materials are also much more common in the core flake assemblage, making up 11.9 percent. When the textures of biface flakes and core flakes are compared, the combination of a much lower percentage of medium/coarse-grained materials (5.8 percent and 35.1 percent, respectively) and a much smaller percentage of flawed materials indicates that there was a definite selection for better quality materials for manufacture into formal tools.

Table 10.6 shows the distribution of material texture and quality for the various tool categories. Seventy-one percent of the core and cobble tools are made from coarse-grained materials versus only 6.5 percent of the unifaces and none of the bifaces. This distribution is not surprising, because coarse textures tend to be more suitable for pounding and chopping tasks, for which most of the utilized cores and cobble tools were used. Ten percent of the unifaces and 11 percent of the bifaces are made from medium-grained materials, and 84 percent of the unifaces and 89 percent of the bifaces are made from glassy/fine-grained materials. Flawed materials are equally uncommon in these tool categories, accounting for only 16 percent of the unifaces and 11 percent of the bifaces. Thus, glassy/fine-grained materials were mainly selected for unifacial and bifacial tool manufacture, with unflawed materials being preferred.

Table 10.7 shows the distribution of material texture and quality categories by site area. With the Central Talus excepted, there seems to be a major difference between the northern assemblages and those in the south. The South Shelter assemblage contains somewhat higher percentages of medium- and coarse–grained materials than the northern areas, and the South Talus assemblage contains the highest percentage of coarse-grained materials and lowest of glassy and fine-grained materials for the site. Despite the appearance of similarity, the two northern assemblages represent different populations (chi-square = 15.7, df = 3, significance = .001, Phi = .112). Thus, different combinations of material

Table 10.5. Material category by texture/quality; counts and percents.

Material		Glassy	Glassy, flawed	Fine-grained	Fine-grained, flawed	Medium-grained	Medium-grained, flawed	Coarse-grained	Coarse-grained, flawed
Chert	n =	–	–	866	192	146	12	4	–
	%	–	–	71.0	15.7	12.0	1.0	0.3	–
Silicified wood	n =	–	–	314	138	119	2	–	–
	%	–	–	54.8	24.1	20.8	0.3	–	–
Obsidian	n =	465	8	–	–	–	–	–	–
	%	1.7	1.7	–	–	–	–	–	–
Igneous	n =	–	–	–	–	–	–	–	1
	%	–	–	–	–	–	–	–	100.0
Basalt/Andesite	n =	–	–	240	5	104	4	1	–
	%	–	–	67.8	1.4	29.4	1.1	0.3	–
Rhyolite	n =	–	–	6	–	106	1	232	24
	%	–	–	1.6	–	28.7	0.3	62.9	6.5
Limestone	n =	–	–	1	–	10	–	1	–
	%	–	–	8.3	–	83.3	–	8.3	–
Metaquartzite	n =	–	–	97	2	118	1	17	1
	%	–	–	41.1	0.8	50.0	0.4	7.2	0.4
Orthoquartzite	n =	–	–	2	1	–	–	–	–
	%	–	–	66.7	33.3	–	–	–	–
Quartz	n =	–	–	42	–	165	6	15	8
	%	–	–	17.8	–	69.9	2.5	6.4	3.4
Total	**n =**	**465**	**8**	**1568**	**338**	**768**	**26**	**270**	**34**
	%	**13.4**	**0.2**	**45.1**	**9.7**	**22.1**	**0.7**	**7.8**	**1.0**

Table 10.6. Tool category by material texture/quality; counts and percents.

Tools		Glassy	Glassy, flawed	Fine-grained	Fine-grained, flawed	Medium-grained	Medium-grained, flawed	Coarse-grained	Coarse-grained, flawed	Total
Core Tool	n =	–	–	2	–	3	–	6	1	**12**
	%	–	–	16.7	–	25.0	–	50.0	8.3	**4.1**
Cobble Tool	n =	–	–	2	–	2	–	15	–	**19**
	%	–	–	10.5	–	10.5	–	78.9	–	**6.4**
Uniface	n =	–	1	22	3	2	1	2	–	**31**
	%	–	3.2	71.0	9.7	6.5	3.2	6.5	–	**10.5**
Biface	n =	63	1	123	22	23	2	–	–	**234**
	%	26.9	0.4	52.6	9.4	9.8	0.9	–	–	**79.3**
Total	**n =**	**63**	**2**	**149**	**25**	**30**	**3**	**23**	**1**	**296**
	%	**21.3**	**0.7**	**50.3**	**8.4**	**10.1**	**1.0**	**7.8**	**0.3**	**100.0**

Table 10.7. Material texture/quality groups, distribution by site area assemblage; counts and percents.

		Glassy	Fine-grained	Medium-grained	Coarse-grained	Total
North Shelter	n =	90	383	135	9	**617**
	%	14.6	62.1	21.9	1.5	**17.8**
North Talus	n =	80	356	169	29	**633**
	%	12.6	56.2	26.7	4.6	**18.2**
Central Talus	n =	–	4	–	–	**4**
	%	–	100.0	–	–	**0.1**
South Shelter	n =	165	850	315	75	**1405**
	%	11.7	60.5	22.4	5.3	**40.4**
South Talus	n =	138	313	175	191	**817**
	%	16.9	38.3	21.4	23.4	**23.5**
Total	**n =**	**473**	**1906**	**794**	**304**	**3477**
	%	**13.6**	**54.8**	**22.8**	**8.7**	**100.0**

texture appear to have been selected in the various site assemblages.

Table 10.8 shows the distribution of material toughness for the each assemblage. Brittle materials are quite common across the site, making up nearly a third of each area's assemblage, with the Central Talus discounted because of small sample size. Percentages of strong and tough materials are much more variable, with the highest percentages of strong materials occurring in the North Shelter and South Shelter assemblages, and the highest percentages of tough materials in the North Talus and South Talus assemblages. The only statistically discernible similarity between area assemblages occurs between the North Talus and South Shelter, which chi-square analysis strongly suggests represent a single population (chi-square = 3.3, df = 2, significance = .191, Phi = .041). However, material toughness distributions are also fairly similar for the North Shelter and South Shelter assemblages, and chi-square analysis also suggests that these assemblages may represent a single population (chi-square = 5.5, df = 2, significance = .064, Phi = .052). However, when the North Shelter and North Talus assemblages are compared, different populations are represented (chi-square = 10.1, df = 2, significance = .006, Phi = .090). When all three area assemblages are examined for this attribute, different populations are represented (chi-square = 11.6, df = 4, significance = .021, Phi = .066). Perhaps the most important aspect of toughness is that the high percentages of brittle materials seen in each assemblage indicates a considerable focus on formal tool manufacture across the site. Percentages of strong materials are higher than those of the brittle materials for all assemblages except for that from the South Talus. Though less suited for formal tool manufacture than brittle materials, strong materials are still quite satisfactory for this type of use. Both of these categories also produce informal and formal tools that are good for cutting and scraping. Except for the South Talus assemblage, tough materials—those that are the most difficult to reduce but which are eminently suitable for pounding or chopping—are less common.

Table 10.8. Material toughness, distribution by site area assemblage; counts and percents.

		Brittle	Strong	Tough	Total
North Shelter	n =	196	278	143	**617**
	%	31.8	45.1	23.2	**17.7**
North Talus	n =	196	243	195	**633**
	%	30.9	38.3	30.8	**18.2**
Central Talus	n =	2	2	–	**4**
	%	50.0	50.0	–	**0.1**
South Shelter	n =	468	559	378	**1405**
	%	33.3	39.8	26.9	**40.4**
South Talus	n =	264	198	355	**817**
	%	32.3	24.2	43.5	**23.5**
Total	**n =**	**1126**	**1279**	**1071**	**3477**
	%	**32.4**	**36.8**	**30.8**	**100**

Material Selection Viewed Through Core Assemblages

Further information on material selection parameters is available from the assemblage of cores. How cores were treated during reduction and the types and amount of cortex remaining on them can be informative about material selection locations and, potentially, about nodule size. Three core attributes are examined including cortex type, core morphology, and remaining size. As discussed earlier, cortex type is a clue to where materials were obtained. Core morphology can provide data on the intensity of reduction, especially when combined with information on cortical coverage. The remaining size of cores, especially those that were intensively reduced and retain little or no cortex, can be used to augment the other two attributes and provide a fuller understanding of reduction in relation to material source.

Logically, core morphology represents a reduction sequence from least to greatest amount of material removed. Tested cobbles had a few flakes struck from them to assess their suitability for further reduction, and therefore retain most of their cortical surfaces. These are very early stage cores that were rejected for further reduction, and their presence at a site suggests that they were obtained nearby and their transport was inexpensive in terms of time and energy. Thus, only local materials should occur as tested cobbles. Unidirectional cores are nodules that were considered suitable for further reduction, with flakes being struck from a single platform. Bidirectional cores logically follow unidirectional cores in the sequence, and represent nodules that were reduced from two opposing platforms and that should retain less cortex than unidirectional cores. Multidirectional cores were reduced from multiple platforms or from two non-opposed platforms and should retain less cortex than bidirectional cores.

Table 10.9 shows the distribution of core types by area assemblage. Unidirectional cores dominate all four of the area assemblages that contain cores, but are least abundant in the South Talus assemblage. Bidirectional cores are fairly common, though none were identified in the North Shelter assemblage, and this type is only abundant in the South Talus assemblage. A single multidirectional core was identified in the South Shelter assemblage, and one tested cobble is in the North Talus assemblage.

Table 10.10 show the distribution of material categories for each core type. Basalt and obsidian are the rarest materials in the core assemblage, but are fairly common in the overall assemblage, especially obsidian. We know that obsidian was imported to the site, and is the only example of a known non-local material represented in the core assemblage, probably because of its overall abundance at the site. As noted earlier, the black volcanic rock classified as "basalt" may actually be "dacite," another form of volcanic rock that is much better for flaking than most basalts (M. Steven Shackley, personal communication, 2014). If this is the case, then the "basalt" probably also represents an import to the site, and may have originated in the Taos area or on the Pajarito Plateau, where an extensive quarry of this material has been recorded (Vierra and Dilley 2008:332–333). If so, this would account for the comparative rarity of this material in the core assemblage. Most obsidian and basalt/dacite (termed "basalt" in the remainder of this discussion) may have been brought to the site as flakes, explaining the relative rarity of cores made from these materials. Another possibility is that cores of these mate-

Table 10.9. Core types, distribution by site area assemblage; counts and percents.

		Tested cobble	Unidirectional core	Bidirectional core	Multidirectional core	Total
North Shelter	n =	–	18	–	–	**18**
	%	–	100.0	–	–	**19.6**
North Talus	n =	1	24	5	–	**30**
	%	3.3	80.0	16.7	–	**32.6**
South Shelter	n =	–	16	1	1	**18**
	%	–	88.9	5.6	5.6	**19.6**
South Talus	n =	–	18	8	–	**26**
	%	–	69.2	30.8	–	**28.3**
Total	**n =**	**1**	**76**	**14**	**1**	**92**
	%	**1.1**	**82.6**	**15.2**	**1.1**	**100.0**

Table 10.10. Material type by core type; counts and percents.

Material Type		Tested cobble	Unidirectional core	Bidirectional core	Multidirectional core	Total
Chert	n =	–	19	3	1	**23**
	%	–	25.0	21.4	100.0	**25.0**
Silicified wood	n =	–	24	1	–	**25**
	%	–	31.6	7.1	–	**27.2**
Obsidian	n =	–	1	1	–	**2**
	%	–	1.3	7.1	–	**2.2**
Basalt	n =	–	2	–	–	**2**
	%	–	2.6	–	–	**2.2**
Gray rhyolite	n =	1	9	6	–	**16**
	%	100.0	11.8	42.9	–	**17.4**
Metaquartzite	n =	–	7	1	–	**8**
	%	–	9.2	7.1	–	**8.7**
Quartz	n =	–	14	2	–	**16**
	%	–	18.4	14.3	–	**17.4**
Total	**n =**	**1**	**76**	**14**	**1**	**92**
	%	**1.1**	**82.6**	**15.2**	**1.1**	**100.0**

rials were reduced using the bipolar method when too small for efficient flake removal, though this is less likely since no evidence of bipolar reduction was noted in the flake assemblage. Otherwise, the distribution of core types by material categories shown in Table 10.10 suggests that chert and rhyolite cores were reduced more extensively than those of other locally available materials.

Table 10.11 presents mean weights and cortical coverage for each category of core. In terms of cortical coverage, these categories follow a logical progression. Tested cobbles have the greatest remaining cortical coverage, since they (or in this case, the single example recovered) were abandoned as unsuitable for reduction after just a few flakes were removed. Unidirectional cores are nodules that were reduced from a single platform; they have the second-highest mean percentage of cortical coverage, followed by bidirectional cores, and then single multidirectional cores with no cortical coverage remaining. This follows the pattern expected, with less cortex remaining as reduction became more intense. While the progression of weights (as indicative of size) does not follow the same logical progression, the order is meaningful. The important categories in this respect are the unidirectional and bidirectional cores, since the other two categories are represented by only a single example apiece. The unidirectional cores retain more of their cortical coverage than the bidirectional cores, but weigh on average only about half as much. This suggests that, rather than a progression from one core type to another, the unidirectional cores represent smaller nodules that could only be efficiently reduced from a single platform. The bidirectional category tends to represent larger nodules that could be efficiently reduced from opposing platforms.

Table 10.11. Mean weight and cortical coverage for each core type.

Core Type	n =	Mean Weight (g)	Mean Cortical Cover
Tested Cobble	1	39.0	90.0
Unidirectional	76	64.6	16.5
Bidirectional	14	122.3	5.7
Multidirectional	1	5.0	0.0

Reduction Strategy

Two basic reduction strategies have been defined for the post-Clovis occupation of the Southwest: curated and expedient. Curated reduction entails the manufacture of tools in anticipation of use, while expedient reduction involves the production of tools as needed. A curated strategy is usually associated with the manufacture of large bifaces that can be used to fulfill a variety of needs. Kelly (1988:731) defines three types of bifaces: those used as cores as well as tools, long use-life tools that can be resharpened, and those made to replace parts of existing composite tools. The last category can also be referred to as specialized bifaces, which are tools made for one or a very limited set of purposes. Bifaces with multiple functions and those with long use-lives are mostly associated with mobile lifestyles where efficiency is critical. However, these associations are not exclusive; mobile peoples also make specialized bifaces while sedentary peoples manufacture general-purpose bifaces. The difference is more a matter of degree—there is less focus on specialized bifaces by mobile peoples and less focus on general-purpose bifaces by sedentary peoples. Thus, the number of bifaces, or amount of evidence for biface manufacture in an assemblage, is not necessarily indicative of reduction strategy and lifestyle; rather, it is the types of bifaces that were made and used and the types of debris discarded during their manufacture that provide clues to these aspects of prehistoric life.

The first two categories of bifaces defined by Kelly (1988) are necessarily large in size. Bifaces that function as cores, general purpose tools, and blanks for the replacement of broken or lost tools have to be large to be useful. Similarly, bifaces made with long use-lives in mind also have to be large to allow them to be resharpened. In contrast, specialized bifaces need be no larger than the size required for the task at hand. Projectile points provide a good comparison between these categories. In a curated tool kit, broken projectile points could be replaced using blanks that also served as cores and general purpose tools. Large projectile points could be used as knives since they possess a fairly long edge and are usually set into detachable foreshafts. When broken, these points could often be reworked into a new form, so they also served as tools with long use-lives.

Small projectile points are evidence of a different focus. They were not as useful as cutting tools because their edges are short and awkward and in-efficient to use, even when set into foreshafts. The thinness of these tools and the point of weakness formed by notching often caused them to break during use and, because of their small size and the location of most breaks, they often could not be resharpened. Small projectile points were largely limited to a single function, and quite often could only be used once before being broken and discarded. Other small bifaces, like drills, also tended to be used for a single purpose. These are specialized tools that often had short use-lives. Thus, we differentiate between the manufacture of large and small bifaces in this analysis, because they may be indicative of different lifestyle foci.

Curated and Expedient Debitage Assemblages Modeled

Several attributes can be used to assess debitage assemblages and determine whether they reflect a curated or expedient reduction strategy or a combination of both. Unfortunately, no single indicator can provide this information, so a range of attributes must be used. Assemblages that reflect a purely expedient strategy should contain lower percentages of non-cortical debitage than those in which a curated strategy was employed. Cortex is usually brittle and chalky and does not flake with the ease or predictability of unweathered material. This can cause problems during tool manufacture, so cortex was usually removed early in the process. Large biface manufacture is wasteful, and many flakes must be removed before the proper size and shape are achieved. These flakes are carefully struck, and are generally smaller and thinner than most flakes removed from cores. Thus, as large bifaces are manufactured, many interior flakes lacking cortical surfaces are removed and the proportion of non-cortical debitage increases. The removal of cortex is not as high a priority in expedient reduction, so the chance that a piece of debitage will possess a cortical surface is higher.

The presence of flakes struck from bifaces is usually good evidence that tools were made at a site, though the absolute number or types of bifaces that were made can rarely be defined. A polythetic set of attributes is used to distinguish biface flakes from core flakes in this analysis (Fig. 10.1). Flakes fulfilling at least 70 percent of the attributes in the polythetic set are classified as biface flakes, while those that do not are defined as core flakes by default. This method permits recognition of definite biface flakes, though it often does not identify biface flakes struck early in the tool manufacturing process. Other methods were used to try to distinguish some of those specimens, as discussed later. Biface flake length can be indicative of the size of the tool being made, and lengths of 15 to 20 mm or more suggest that large bifaces were manufactured. However, when only small biface flakes occur, the reverse is not necessarily true. While the presence of small biface flakes may indicate that small, specialized bifaces were made, the possibility that they are debris produced by retouching large biface edges must also be considered. Large percentages of biface flakes in an assemblage suggest that tool production was an important activity. When those flakes are long, large bifaces were probably made or used, and this suggests a curated reduction strategy. When those flakes are short, a different reduction focus may be reflected. Though a lack of these characteristics is not definite proof of an expedient strategy, it does suggest that reduction was not focused on tool making.

While platform modification is used as part of the polythetic set to help assign flakes to core or biface categories, it can also be used as an independent indicator of reduction strategy. This is because the polythetic set only identifies ideal examples of biface flakes. Many flakes produced during initial tool shaping and thinning are difficult to distinguish from core flakes. However, even at this stage of manufacture, platforms were usually modified to facilitate removal. While core platforms were also modified on occasion, this was not as common because the same degree of control over flake size and shape were unnecessary unless cores were being systematically reduced. Since this rarely occurred in the Southwest, a large percentage of modified platforms in an assemblage tends to be indicative of tool manufacture, while the opposite implies core reduction. When there is a high percentage of modified platforms but few definite biface flakes, an early stage of tool manufacture may be indicated.

Since tool manufacture is usually more controlled than core reduction, fewer pieces of recoverable angular debris are produced. This suggests that a high ratio of flakes to angular debris indicates tool manufacture, while a low ratio implies core re-

Whole Flakes

1. Platform:
   a. has more than one facet.
   b. is modified (retouched and/or abraded).
2. Platform is lipped.
3. Platform angle is less than 45 degrees.
4. Dorsal scar orientation is:
   a. parallel.
   b. multidirectional.
   c. opposing.
5. Dorsal topography is regular.
6. Edge outline is even.
7. Flake is less than 5 mm thick.
8. Flake has a relatively even thickness from proximal to distal end.
9. Bulb of percussion is diffuse.
10. There is a pronounced ventral curvature.

Broken Flakes or Flakes with Collapsed Platforms

1. Dorsal scars orientation is:
   a. parallel.
   b. multidirectional.
   c. opposing.
2. Dorsal topography is regular.
3. Edge outline is even.
4. Flake is less than 5 mm thick.
5. Flake has a relatively even thickness from proximal to distal end.
6. Bulb of percussion is diffuse.
7. There is a pronounced ventral curvature.

Figure 10.1. Polythetic set for defining biface flakes.

duction. Unfortunately, this is a bit simplistic because the production of angular debris also depends on the type of material being worked, the reduction technique used, and the amount of force applied. Brittle materials shatter more easily than elastic materials, and hard hammer percussion tends to produce more recoverable pieces of angular debris than soft hammer percussion or pressure flaking. The use of excessive force can also cause materials to shatter. In general, though, as reduction proceeds the ratio of flakes to recoverable angular debris should increase, and late stage core reduction as well as tool manufacture should produce high ratios of flakes to angular debris.

Flake breakage patterns are also indicative of reduction strategy. Experimental data suggest there are differences in fracture patterns between flakes struck from cores and tools (Moore 2003). Though reduction techniques are more controlled during tool manufacture, flake breakage increases because debitage get thinner as reduction proceeds. Thus, there should be more broken flakes in an assemblage in which tools were made, as compared to one that simply reflects core reduction. However, trampling, erosional movement, and other post-reduction impacts can also cause breakage and must be taken into account.

Much flake breakage during reduction is caused by secondary compression, in which outward bending causes flakes to snap (Sollberger 1986). Characteristics of the broken ends of flake fragments can be used to determine if breakage was caused by this sort of bending (Fig. 10.2 [a–g]). When a step or hinge fracture occurs at the proximal end of distal or medial fragments, they are classified as manufacturing breaks. Characteristics diagnostic of manufacturing breaks on proximal fragments include "pieces à languette" (Sollberger 1986:102), negative hinge scars, positive hinges curving up into small negative step fractures on the ventral surface, and step fractures on dorsal rather than ventral surfaces. Breakage by processes other than secondary compression causes snap fractures. This pattern is common on flakes broken by trampling or erosion, but also occurs during reduction. Core reduction tends to create a high percentage of snap fractures, while biface reduction creates a high percentage of manufacturing breaks. Since snap fractures can also indicate post-reduction damage, this may be the weakest of the attributes used to examine reduction strategy.

The presence of platform lipping is indicative of reduction technology, and is marginally related to strategy. Platform lipping usually occurs during pressure flaking or soft-hammer percussion, though it sometimes also occurs on flakes removed by hard hammers (Crabtree 1972). The former techniques were usually used to make tools, so a high percentage of lipped platforms suggests a focus on tool manufacture rather than core reduction. While soft hammer percussion can also be used in core reduction, some materials are very hard and more efficiently reduced using hard hammers.

The pattern of scars left by earlier removals on the dorsal surface of a flake can also help define reduction strategy. Since biface reduction removes flakes from opposite edges, some scars originate beyond the distal end of a flake and run toward its proximal end. These are opposing scars, and indicate reduction from opposite edges. Opposing dorsal scars are indicative of biface manufacture, but can also occur when cores were reduced bidirectionally (Laumbach 1980:858). Thus, this attribute is not directly indicative of tool production, but can help in defining the reduction strategy used.

The ratio of flakes to cores on a site is another potential indicator of reduction strategy. As the amount of tool manufacture increases, so does the ratio between flakes and cores. The opposite should be true of assemblages in which expedient core reduction dominates; in that case the ratio between flakes and cores should be relatively low. A potential problem, of course, is that cores were often carried to another location if still useable, while debris from their reduction was left behind. This can inflate the ratio and suggest that tool manufacture rather than core reduction occurred. The systematic reduction of cores can also produce high flake to core ratios. A third ratio that might have some utility in determining reduction strategy is the ratio of core flakes to biface flakes. A high core flake to biface flake ratio indicates the prevalence of core reduction and, consequently, a focus on expedient reduction. A low ratio suggests that the manufacture of tools was an important reduction strategy.

The final attribute that can be useful in examining reduction strategy is purposeful thermal alteration. The flaking characteristics of cherts can be altered by the proper application of heat, which makes them easier to flake and allows longer flakes to be removed more accurately. Only cherts (including chalcedony and silicified wood) are amenable to this type of alteration. A comparatively high percentage of thermally altered cherts in an assemblage may indicate a stress on formal tool manufacture, which often goes hand-in-hand with a curated strategy.

While few of these attributes are accurate independent indicators of reduction strategy, when combined they should allow us to fairly accurately determine how materials were reduced at a site. A focus on tool manufacture should evidence high percentages of non-cortical debitage, biface flakes, modified platforms, manufacturing breaks, lipped platforms, and flakes with opposing dorsal scars, and should have high flake to angular debris, flake to core, and biface flake to core flake ratios. A focus on core-flake reduction should evidence lower percentages of non-cortical debitage and low percentages of biface flakes, modified platforms, manufacturing breaks, lipped platforms, and flakes with opposing dorsal scars. They should also have low flake to angular debris, biface flake to core flake, and flake to core ratios. Unfortunately, "pure" assemblages are rare, and most assemblages can be expected to combine tool manufacture and core reduction.

Reexamining Flake Classifications

In order to accurately examine site and component assemblages to suggest the type of reduction

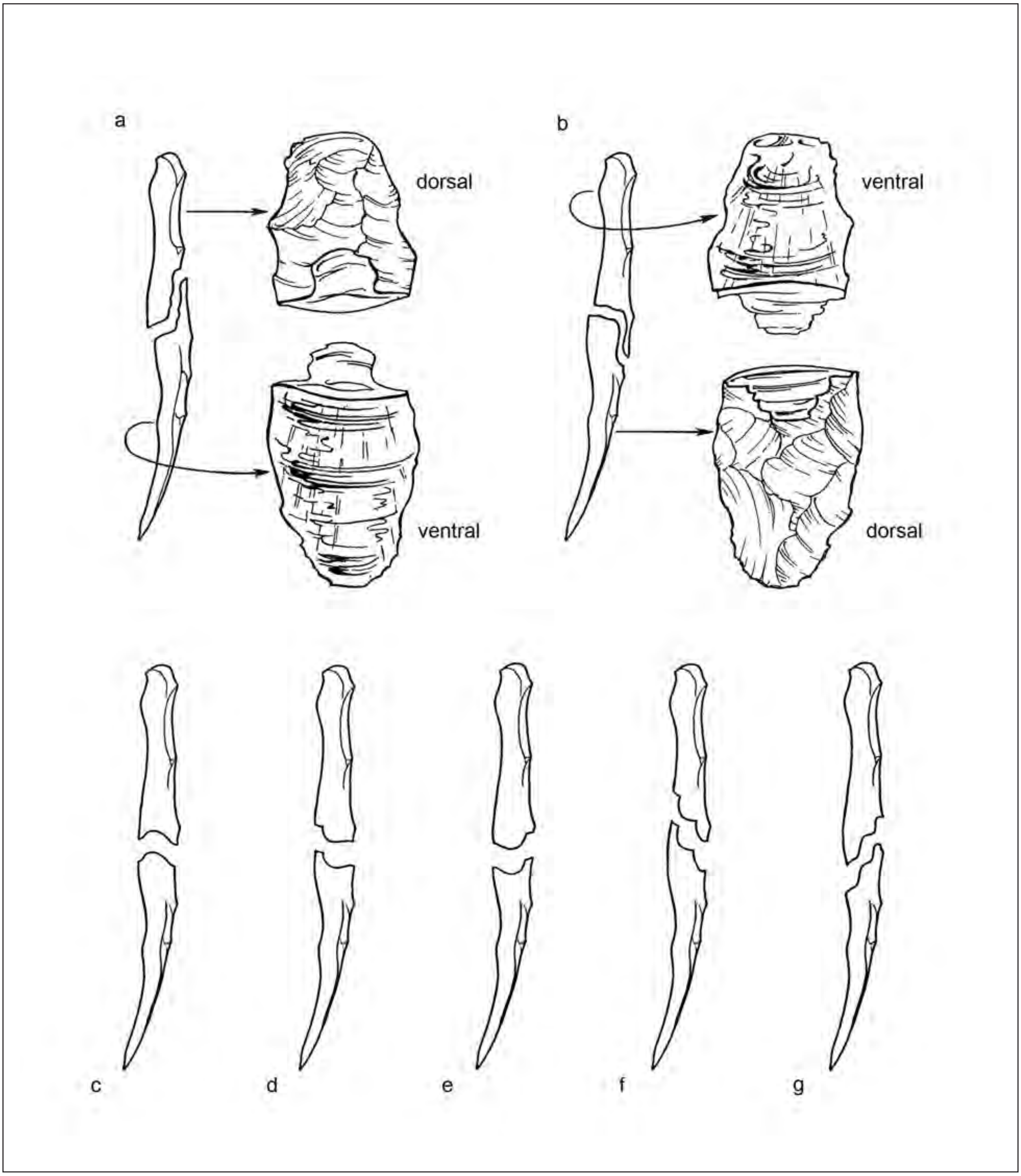

Figure 10.2. Manufacturing breakage patterns on flakes: (a–b) pieces à languette, adapted from Sollberger (1986:102); (c) negative proximal hinge, positive distal hinge; (d) positive proximal hinge with small step off ventral surface, negative distal hinge; (e) positive proximal hinge, negative distal hinge; (f) proximal step, distal step off distal surface; (g) reverse proximal step, distal step off ventral surface. Note that proximal fragments of (e) and (f) resemble natural core terminations and would usually be defined as such.

strategy that dominated, we need to ensure that flakes were properly classified during analysis. A problem with the polythetic set used to distinguish between biface and core flakes is that it often does not recognize biface flakes removed early in the manufacturing process before core surfaces became regularized by continued flaking. This problem can be corrected by using several of the attributes related to the polythetic set to provide weights for reclassification of some core flakes. The reclassified specimens probably represent flakes that were removed early in the manufacturing process, as noted previously. Eight variables are used in reclassification, including: bulb of percussion type, evidence for platform modification, platform angle, platform lipping, ventral curvature, opposing dorsal scars, waisting between platform and flake body, and thickness. Only specimens that retain their platforms can be reexamined because platform data are critical to accurate type placement.

The first step in reclassification is to determine which attributes are most important in defining flakes as removals from bifaces. Whole biface flakes, proximal fragments, and lateral fragments that retain their platforms can be ranked by the number of attributes they exhibit. While overshot and notching flakes also represent removals from bifaces, they are distinguished using a different set of variables from those used to define biface flakes and are not considered in this analysis. A suitable weighting system was devised during analysis of materials excavated at Spaceport America (Moore 2014) that dated between the Paleoindian and Historic periods. This scheme examined the prevalence of the various attributes listed above on definite biface flakes, ranking them by percentages of biface and core flakes that exhibited those characteristics. The highest-ranked attributes were those with high percentages of occurrence among the biface flakes and low percentages among the core flakes, with rankings declining as percentages of the former decreased, and factoring in decreases in percentages of the latter. In that study, diffuse bulbs of percussion occur on 90.5 percent of biface flakes and 36.87 percent of core flakes, suggesting that this attribute is a fairly strong indicator of flake type, and it was thus assigned a weight of 7. Platforms were lipped on 71.6 percent of biface flake platforms and only 18.0 percent of core flake platforms. This was considered to be another strong indicator of flake type, and it was assigned a weight of 6. Waisting occurred on 56.5 percent of biface flakes and 2.6 percent of core flakes, making this attribute another strong indicator of flake type, so it was assigned a weight of 5. Platform angles of 45 degrees or less occurred on 72.2 percent of biface flakes and on 35.7 percent of core flakes. This variable was considered a fair indicator of flake type, and it was assigned a weight of 4. Platforms were modified on 60.2 percent of biface flakes and 9.9 percent of core flakes, making this characteristic a strong indicator of flake type that was assigned a weight of 3. Ventral curvature occurred on 48.3 percent of biface flakes and 20.1 percent of core flakes, making it a fair indicator of flake type that was assigned a weight of 2. The presence of opposing dorsal scars was another fair indicator of flake type that occurred on 27.3 percent of biface flakes and 4.5 percent of core flakes, and thus was assigned a weight of 1. While 94.4 percent of the biface flakes were 5 mm thick or less, this was not as strong an indicator of flake type as it might seem, since 70.5 percent of the core flakes also fell into this thickness range. This attribute is a very weak indicator of flake type and, because of its apparent lack of importance, it was dropped from further consideration. The same system of weights was applied to the assemblage from LA 139665.

These weights were applied to all whole flakes, proximal fragments, and lateral fragments that retained their platforms. Since the three top weighting categories (diffuse bulb, platform lipping, and waisted platform) appeared to be the most distinguishing characteristics in the Spaceport America analysis (Moore 2014), their combined weight of 18 was used as a cutoff point, and core flakes that had a score of 18 or higher were reclassified as biface flakes. This procedure resulted in the reclassification of 32 core flakes as biface flakes, representing only 1.2 percent of the debitage originally defined as core flakes. These reclassifications are used in the rest of this analysis.

Examining the Reduction Strategy Indicators

Each of the reduction strategy indicators listed above can be examined separately for trends that might be meaningful. Site area assemblages are the main focus of this analysis, which looks for trends indicative of variation in reduction strategy that might correspond to shifts in site function during its multiple periods of occupation. Unfortunately, this analysis will only be able to look for gross changes in site use, since there was no way in which to differentiate between different levels of occupation in any of the areas defined during excavation.

Dorsal Cortex

While cortex type was used to examine material procurement patterns, cortex can also be employed in examining reduction strategy. Several approaches can be used to examine cortical ratios, each providing a slightly different piece of the puzzle. In this discussion we only consider debitage, which is divided into flakes and angular debris. Table 10.12 shows non-cortical to cortical debitage ratios for each area assemblage, with ground stone flakes and potlids excepted. Notching flakes are combined with biface flakes, since both directly derive from tool manufacture. The Central Talus assemblage can once again be dropped from this discussion because of small sample size. Examining the overall ratios for each of the other area assemblages, there appears to have been a higher degree of early stage reduction in the South Talus assemblage than in the others. An interesting relationship also exists between corresponding shelters and talus assemblages. In both the northern and southern sections of the site there is a higher non-cortical to cortical debitage ratio in the shelter than on the talus. This indicates that more early stage reduction was present in the talus assemblages, with the shelter assemblages reflecting most of the later stage reduction. This idea can be tested with other types of data to determine whether or not it is correct. Angular debris has a much lower non-cortical to cortical ratio than do the core flakes in each site area, suggesting that much of the shatter may have originated during initial nodule (or core) reduction when more force was needed to remove debitage. The non-cortical to cortical ratio for biface flakes is consistently very high, indicating that most cortex was removed from blanks before they were further reduced into formal tools.

Chipped stone analyses often divide flakes into groups determined by percentages of dorsal cortex. Traditionally, these classes are termed primary, secondary, and tertiary flakes. Primary flakes are those with 50 percent or more of their dorsal surfaces covered by cortex, secondary flakes are those with less than 50 percent dorsal cortex, and tertiary flakes exhibit no dorsal cortex. Primary flakes are often considered indicative of initial core reduction when the cortical surface was removed, secondary flakes were removed as the core was further reduced, and tertiary flakes have often been considered debris from tool manufacture. Unfortunately, these classifications are based on assumptions that are simplistic and erroneous. For instance, a lack of dorsal cortex is not necessarily indicative of tool manufacture, since flakes removed from a core that has been significantly decorticated will usually lack dorsal cortex. Similarly, this scheme assumes that cores are decorticated before flakes are removed for use or for shaping into formal tools, and this is also an incorrect assumption. However, stripped of their traditional meanings, these classes remain a useful way to examine flake assemblages. In this analysis, primary flakes are those with 50 percent or more of their dorsal surfaces covered by cortex, secondary flakes are those with 1–49 percent dorsal cortex, and tertiary flakes are those with no dorsal cortex. Varying percentages for these classes can be used to examine the condition of nodules or cores when they arrived at a site, and can provide information on reduction strategies.

Table 10.12. Non-cortical to cortical ratios for debitage categories, by site area assemblage.

	Core Flakes	Biface Flakes	Angular Debris	Overall
North Shelter	6.52:1	*	4.2:1	**7.36:1**
North Talus	5.76:1	39.0:1	2.86:1	**5.92:1**
Central Talus	*	*	**	*
South Shelter	5.52:1	192.0:1	3.17:1	**6.45:1**
South Talus	3.60:1	36.0:1	2.27:1	**3.94:1**
Total Site	**5.13:1**	**93.0:1**	**2.90:1**	**5.71:1**

* = no cortical examples.
** = no angular debris recovered.

Table 10.13 shows flake classifications based on dorsal cortex percentages for each area assemblage. Tertiary flakes dominate in each assemblage, but percentages are lowest for the South Talus assemblage, supporting the notion that more early stage reduction may have occurred in that assemblage. This is supported by percentages of primary and secondary flakes, both of which are the highest for the site, with primary flakes making up nearly 10 percent of the South Talus assemblage. Similarly, when examining assemblages from each shelter and its adjacent talus area, we see the same rela-

Table 10.13. Flake classifications based on dorsal cortex, by site area assemblage; counts and percents.

		Primary flake	Secondary flake	Tertiary flake	Total
North Shelter	n =	19	43	472	**534**
	%	3.6	8.1	88.4	**18.2**
North Talus	n =	32	40	448	**520**
	%	6.2	7.7	86.2	**17.7**
Central Talus	n =	–	–	3	**3**
	%	–	–	100.0	**0.1**
South Shelter	n =	64	94	1059	**1217**
	%	5.3	7.7	87.0	**41.5**
South Talus	n =	61	68	529	**658**
	%	9.3	10.3	80.4	**22.4**
Total	**n =**	**176**	**245**	**2511**	**2932**
	%	**6.0**	**8.4**	**85.6**	**100.0**

tionship noted during the examination of dorsal cortex ratios—the talus assemblages have higher percentages of primary flakes and lower percentages of tertiary flakes than the adjacent shelter assemblages, again possibly indicating that more initial reduction was accomplished in the talus assemblages, with more of the later stage reduction occurring in the shelter assemblages. Further potential support for this possibility can be derived from percentages of biface flakes, with 12.7 percent of the flakes in the North Shelter assemblage struck during tool manufacture versus 7.7 percent for the North Talus assemblage, and 15.8 percent for the South Shelter assemblage versus 11.2 percent for the South Talus assemblage. While still uncertain, there is a real possibility that there was a different reduction focus in the shelter assemblages versus the talus assemblages, which will continue to be examined as other data are generated. However, it should be noted that this does not imply that all early stage reduction occurred in the talus assemblages and all final tool manufacture occurred in the shelter assemblages. Rather the difference is in degree—at this point, more tool manufacture appears to have occurred in the shelter assemblages and more early stage reduction in the talus assemblages, but both of these activities apparently occurred in the shelter assemblages as well as in the talus assemblages.

Flake Type as an Indicator of Reduction Strategy

Flakes were typologically categorized during analysis, with type designation based on a series of analytic observations using the polythetic set discussed earlier to distinguish between biface and core flakes. This was not a perfect system since many flakes removed during the early stages of tool manufacture might not fit the polythetic set and would therefore have been erroneously classified as core flakes. This was partly corrected for by the reclassification that was conducted earlier, which hopefully identified most examples of biface flakes that were not correctly classified by strict adherence to the polythetic set.

Four categories of flakes were defined during this analysis. The origin of and definitions for core flakes and biface flakes have already been discussed. Notching flakes have a characteristic shape, and can be considered evidence for the later stages of notched formal tool manufacture. Hammerstone flakes are debitage that were inadvertently struck from hammerstones during use. Potlids are pieces of debitage that were literally blown off the surface of an artifact by the improper application of heat. While technically categorized as flakes because they possess definable ventral and dorsal surfaces, potlids have no striking platform because they were removed by an entirely different process, and so are eliminated from much of the flake analysis.

Table 10.14 presents counts and percentages of each flake type by area assemblage. Potlids are rare and make up a fairly negligible percentage of two sub-assemblages. Hammerstone flakes are a bit more common, and occur in small numbers in three assemblages. Notching flakes are much more common than potlids and hammerstone flakes, and make up over two percent apiece of three assem-

Table 10.14. Flake types, distribution by site area assemblage; counts and percents.

		Core Flake	Biface Flake	Notching Flake	Hammerstone Flake	Potlid	Total
North Shelter	n =	466	53	15	–	–	**534**
	%	87.3	9.9	2.8	–	–	**18.1**
North Talus	n =	480	32	8	1	2	**523**
	%	91.8	6.1	1.5	0.2	0.4	**17.7**
Central Talus	n =	2	1	–	–	–	**3**
	%	66.7	33.3	–	–	–	**0.1**
South Shelter	n =	1024	162	31	11	6	**1234**
	%	83.0	13.1	2.5	0.9	0.5	**41.7**
South Talus	n =	584	60	14	6	–	**664**
	%	88.0	9.0	2.1	0.9	–	**22.4**
Total	**n =**	**2556**	**308**	**68**	**18**	**8**	**2958**
	%	**86.4**	**10.4**	**2.3**	**0.6**	**0.3**	**100.0**

blages. Potlids and hammerstone flakes are eliminated from the remainder of this analysis since neither category is directly attributable to core reduction or tool manufacture. The shelter assemblages have the highest percentages of biface flakes and notching flakes, and percentages for the same categories are lower in both talus assemblages (with the Central Talus assemblage again eliminated because of small sample size). However, percentages for the South Talus assemblage are not significantly lower than those for the North Shelter assemblage. When distributions of core flakes, biface flakes, and notching flakes are compared for these two assemblages, chi-square analysis strongly suggests that they belong to the same population (chi-square = 8.4, df = 2, significance = .657, Phi = .027). This suggests that similar reduction trajectories were used in the North Shelter and South Talus assemblages and argues against the idea that there was any great differentiation in reduction trajectories between the shelter and talus assemblages.

The data in Table 10.14 suggest that expedient core-flake reduction prevailed in all area assemblages, with formal tool manufacture representing a secondary, but also quite important component. Though notching flakes make up only 2.3 percent of the total site assemblage, that percentage is actually extremely high, since notching flakes tend to be much rarer in most assemblages. This suggests that much of the tool manufacture at LA 139965 was focused on the production of notched bifaces, primarily projectile points. This possibility can be tested with data derived from the formal tool analysis later in this chapter.

Flake Platforms

What are referred to as flake platforms in this discussion only represent the small section of the original platform present on the edge of an objective piece (core or formal tool) that remained attached to flakes after they were removed. Another term for "platform" is "platform remnant." Platforms on objective pieces can be modified to facilitate removal, but the type of modification will generally vary between cores and formal tools. Core platforms tend to be modified by the removal of overhangs that would collapse when struck, producing pieces of debitage that were much shorter than intended. Unless a core was prepared to strike blades, evidence for this type of modification usually occurs as scars on the dorsal surface of flakes adjacent to the back platform edge, which are generally indistinguishable from scars left by intentional flake removal. In contrast, formal tool platforms are modified by abrasion that grinds an edge and/or removes small flakes from the intended platform, increasing the angle of the platform edge. This process strengthens the platform, allowing the removal of longer and more consistent flakes. Thus, platforms identified as having been modified to facilitate reduction represent removals from formal tools rather than cores.

Table 10.15 presents flake platform type data for each site area. Missing or obscured platforms—those that are collapsed, crushed, absent, or otherwise damaged beyond recognition—make up between a quarter and a third of each assemblage. Other platform types represent remnants of the original edge that was struck when the flake was removed, and retain characteristics of that edge. Cortical plat-

Table 10.15. Flake platform types, distribution by site area assemblage; counts and percents.

Platform Type		North Shelter	North Talus	Central Talus	South Shelter	South Talus	Total
Cortical	n =	46	46	–	107	61	**260**
	%	8.6	8.9	–	8.8	9.3	**8.9**
Single facet	n =	207	171	1	297	135	**811**
	%	38.8	33.0	33.3	24.8	20.6	**27.7**
Single facet and abraded	n =	61	73	–	229	93	**456**
	%	11.4	14.4	–	18.9	14.2	**15.6**
Multifacet	n =	79	75	1	158	114	**427**
	%	14.8	14.5	33.3	13.0	17.4	**14.6**
Multifacet and abraded	n =	9	10	–	54	54	**127**
	%	1.7	1.9	–	4.4	8.2	**4.3**
Retouched	n =	–	1	–	–	–	**1**
	%	–	0.2	–	–	–	**0.0**
Collapsed	n =	13	6	–	28	19	**66**
	%	2.4	1.2	–	2.3	2.9	**2.3**
Crushed	n =	3	3	–	6	12	**24**
	%	0.6	0.6	–	0.5	1.8	**0.8**
Absent	n =	115	133	1	334	167	**750**
	%	21.6	25.7	33.3	27.5	25.5	**25.6**
Broken in manufacture	n =	–	–	–	1	–	**1**
	%	–	–	–	0.1	–	**0.0**
Obscured	n =	–	–	–	–	1	**1**
	%	–	–	–	–	0.2	**0.0**
Total	**n =**	**534**	**520**	**3**	**1217**	**658**	**2932**
	%	**18.2**	**17.7**	**0.1**	**41.5**	**22.4**	**100.0**

forms exhibit a section of the weathered exterior surface of the original nodule on their platforms. Single facet platforms exhibit a single scar representing a previous removal from the same edge, while multiple scars from previous removals cross the platform in the multifacet type. Both of these types can also exhibit evidence of grinding along the back edge of the platform indicative of platform modification to facilitate removal. Retouched platforms have multiple small flake scars crossing the platform and originating at the juncture of the platform and dorsal surface. These scars are evidence of buffeting to reduce the angle of a platform and strengthen it.

Of the remaining platform types, single-facet platforms are the most common overall and in all area assemblages. Single-facet and abraded platforms are the second most common type, but only hold that position in one assemblage (South Shelter). Multifacet platforms are the third most common type overall, but are actually the second most common type in most assemblages. Cortical platforms hold the fourth position overall and in all assemblages except for the Central Talus. Multifacet and abraded platforms are fairly uncommon except in the South Talus assemblage, and retouched platforms only occur in the North Shelter assemblage.

To simplify the discussion of flake platforms they are combined into three categories: unmodified (cortical, single facet, and multifacet), modified (single facet and abraded, multifacet and abraded, and retouched), and obscured or missing (collapsed, crushed, absent, broken in manufacture, and obscured). Table 10.16 shows the distributions of platform categories by site area. Again discounting the Central Talus assemblage, the North Shelter and North Talus assemblages appear to be fairly similar in composition, as do the South Shelter and South Talus assemblages. However, there seem to be important differences between the north and south parts of the site. When all assemblages except for the Central Talus are compared, chi-square analysis strongly indicates that different populations are represented (chi-square = 53.3, df = 6, significance = .000, Cramer's V = .096). However, the North Shelter and North Talus assemblages appear to belong to the same population (chi-square = 4.1, df = 2, significance = .131, Phi = .062), and an even

Table 10.16. Flake platform categories, distribution by site area assemblage; counts and percents.

		Unmodified	Modified	Missing or obscured	Total
North Shelter	n =	332	70	131	**534**
	%	62.3	13.1	24.6	**18.2**
North Talus	n =	292	84	142	**520**
	%	56.4	16.2	27.4	**17.7**
Central Talus	n =	2	–	1	**3**
	%	66.7	–	33.3	**0.1**
South Shelter	n =	562	283	369	**1217**
	%	46.3	23.3	30.4	**41.5**
South Talus	n =	310	147	199	**658**
	%	47.3	22.4	30.3	**22.4**
Total	**n =**	**1498**	**584**	**842**	**2932**
	%	**51.2**	**20.0**	**28.8**	**100.0**

stronger relationship is found for the South Shelter and South Talus assemblages (chi-square = 0.2, df = 2, significance = .889, Phi = .011).

Platform modification by abrasion is common during tool manufacture, but can also sometimes be used during core reduction. Whittaker (1994:102–104) discusses the use of an abrader to modify core platforms by rounding and dulling the platform edge or removing overhangs, though trimming edges by percussion is usually the best way to accomplish this. Thus, most flakes with unmodified platforms reflect core reduction, while most flakes with modified platforms reflect formal tool manufacture. There are exceptions to both of these norms, and platform type cannot be used by itself to specify when a particular flake was struck during the reduction process. However, platform modification can be used as a proxy for the level of biface manufacture. With this in mind, we can suggest that tool manufacture was an important activity in all assemblages, but was more prevalent in the South Shelter and South Talus assemblages. There was also more damage to platforms from the force used in detachment in the southern assemblages (collapsed and crushed platforms), as well as flake breakage (absent platforms).

Flake Breakage Patterns

Flake breakage patterns can be used to examine two issues: how intact and undamaged assemblages are and the prevalence of core versus biface reduction. Flakes can break during removal, during use, and after discard. Various factors cause flakes to fracture during removal. They can break when the force applied to remove them exceeds the tensile strength of a material, often resulting in non-diagnostic snap fractures. Breaks can also occur when flaws are encountered during flake propagation. While this type of break can sometimes be correctly categorized, generally they are simply defined as non-diagnostic snap fractures. Flakes can also snap because of secondary compression, in which outward bending during removal causes them to buckle (Sollberger 1986). Cotterell and Kaminga (1987:700) indicate that this type of break occurs after a successful flake removal. Citing experiments conducted by Crabtree (1968:475) where high-speed photography captured a blade buckling in this manner after it was fully detached from a core, Cotterell and Kaminga (1987:700) suggest that this can only happen when a flake is very thin in relation to its length, and probably occurs because the compressive forces applied to remove a flake are not immediately released after a flake comes off the objective piece, but instead continue to affect the flake for a very short time after removal. Elasticity allows flakes to rebound from the compressive force unless that force exceeds the elastic limits of the material, in which case a flake will buckle. The key to this type of break is that the flake must be very thin in relation to its length, as is common during tool manufacture and blade-core reduction and is less common during core reduction.

Table 10.17 shows the distribution of flake portions by area assemblage. Nearly 60 percent of flakes in the entire assemblage are complete, but some variation in percentages is visible between area assemblages. The northern assemblages contain higher percentages of complete flakes, though there is not a great deal of difference between percentages for the North Talus and the southern assemblages. Distal fragments outnumber proximal fragments in all cases (except for the Central Talus assemblage which is again discounted). Significant percentages of medial and lateral fragments also occur in the area assemblages. Similar percentages of proximal and distal fragments can suggest that much of the breakage is due to post-occupational trampling. However, in all cases at LA 139965, distal fragments outnumber proximal fragments by a high enough margin to suggest that most of the breaks occurred during reduction. Many proximal fragments may be missing because they shattered during removal, leaving only distal fragments. Most breakage appears to have occurred during core reduction, because as Table 10.18 shows, nearly 80 percent of the biface flakes and almost 90 percent of the notching flakes are whole, versus only about 56 percent of the core flakes.

Preliminary experimental data suggest there are differences in fracture patterns between flakes struck from cores and tools (Moore 2001). The limited experimental data available suggest that snap fractures occur more often during core reduction than in tool manufacture (62.5 and 25.9 percent, respectively), and the reverse is true for manufacturing breaks (37.5 percent in core reduction and 73.2 percent in tool manufacture). Rather than hard and fast percentages, what the experimental data suggest is that snap fractures should predominate during core reduction, and manufacturing breaks should predominate during tool manufacture. Of course, the amounts and types of fracturing are probably also dependent on material type and the reduction techniques employed. Where break patterns on flakes could be securely defined, snap fractures dominated (95.1 percent), but a small percentage of manufacturing breaks were also noted (4.9 percent). The dominance of snap fractures in the LA 139965 assemblage suggests that core reduction predominated. When the flake assemblage is divided into core flakes and biface flakes, we find that manufacturing breaks are much more common on biface flakes (25.5 percent) than on core flakes (3.8 percent), and snap fractures are more common on

Table 10.17. Flake portions, distribution by site area assemblage; counts and percents.

		Whole	Proximal	Medial	Distal	Lateral	Total
North Shelter	n =	341	43	38	65	47	**534**
	%	63.9	8.1	7.1	12.2	8.8	**18.2**
North Talus	n =	311	34	37	82	56	**520**
	%	59.8	6.5	7.1	15.8	10.8	**17.7**
Central Talus	n =	1	1	–	1	–	**3**
	%	33.3	33.3	–	33.3	–	**0.1**
South Shelter	n =	705	108	118	177	109	**1217**
	%	57.9	8.9	9.7	14.5	9.0	**41.5**
South Talus	n =	376	69	61	94	57	**658**
	%	57.2	10.5	9.3	14.3	8.7	**22.4**
Total	**n =**	**1734**	**255**	**254**	**419**	**269**	**2932**
	%	**59.2**	**8.7**	**8.7**	**14.3**	**9.2**	**100.0**

Table 10.18. Flake portion by flake type, entire assemblage; counts and percents.

Flake Type		Whole	Proximal	Medial	Distal	Lateral	Total
Core flake	n =	1428	217	246	413	251	**2556**
	%	55.9	8.5	9.6	16.2	9.8	**87.2**
Biface flake	n =	245	34	8	6	15	**308**
	%	79.5	11.0	2.6	1.9	4.9	**10.5**
Notching flake	n =	61	4	–	–	3	**68**
	%	89.7	5.9	–	–	4.4	**2.3**
Total	**n =**	**1734**	**255**	**254**	**419**	**269**	**2932**
	%	**59.2**	**8.7**	**8.7**	**14.3**	**9.2**	**100.0**

core flakes (96.2 percent) than on biface flakes (74.5 percent). While these patterns do not follow those seen in the experimental data, they do demonstrate that manufacturing breaks are much more likely to occur during tool making than during core reduction.

Platform Lipping and Bulb of Percussion

Platform lipping refers to the presence of a slight overhang at the intersection of the platform and ventral surface of a flake. Lipped platforms generally develop during soft hammer reduction or pressure flaking, though they sometimes occur with hard hammer percussion (Crabtree 1972). Thus, platform lipping tends to be more indicative of tool manufacture than core reduction. Platform lipping can be used as an indicator of reduction technique, but it is not absolute and is most accurate when combined with other attributes. As Andrefsky (1998:115) notes: "Even though soft-hammer and hard-hammer flaking techniques produce detached pieces that overlap in their range of bulb morphology and amount of lipping, these characteristics may be effective discriminators in most cases." Thus, platform lipping should mostly occur on flakes that also have diffuse bulbs of percussion indicative of soft hammer reduction or pressure flaking. Platform lipping data are available for 2,108 flakes, including only those portions that retain the platform. Analysis shows that lips are much more common on flakes produced during tool manufacture. While platforms on 48.6 percent of the biface flakes and 83.3 percent of the notching flakes are lipped, only 12.3 percent of the core flake platforms are lipped.

Pronounced bulbs of percussion are most common during reduction using hard hammer percussion, while soft hammer percussion and pressure flaking tend to produce diffuse bulbs. However, these are tendencies and not hard and fast rules. Logically, lipping and diffuse bulbs should correspond, while a lack of platform lipping should correspond to pronounced bulbs of percussion. Interestingly, diffuse bulbs dominate the LA 139965 assemblage as a whole (76.7 percent), and are actually more common on core flakes (78.6 percent) than on biface flakes (70.1 percent) or notching flakes (53.0 percent). Platform lipping occurs in association with a diffuse bulb on 79.5 percent of the flakes that exhibit a lipped platform, but this accounts for only 11 percent of the flake assemblage and 20 percent of the flakes with diffuse bulbs. When these data are divided into flake type categories, we find that lipped platforms and diffuse bulbs co-occur on 7 percent of the core flakes, 37 percent of the biface flakes, and 50 percent of the notching flakes. Thus, soft hammer percussion or pressure flaking were most commonly used in tool manufacture. Soft hammer percussion also appears to have been used in core reduction, though how prevalent it might have been remains uncertain.

Opposing Dorsal Scars

When flakes removed from the surface of a biface extend past the midpoint of the tool, they leave telltale evidence behind. That evidence consists of opposing dorsal scars, which are negative scars at the distal end of the dorsal surface of a flake that indicate an earlier removal originated at the opposing tool edge. However, opposing dorsal scars also occur when cores are reduced bidirectionally (Laumbach 1980:858), and probably during multidirectional core reduction as well. Thus, like the other attributes discussed in this section, opposing dorsal scars are only meaningful when combined with other characteristics.

Opposing dorsal scars are much more common on flakes produced during tool manufacture than on those struck from cores. This type of scar occurs on 83.4 percent of the biface flakes, 54.4 percent of the notching flakes, and on only 3.5 percent of the core flakes. This suggests that, for this assemblage at least, opposing dorsal scars may be an effective means of separating biface flakes from core flakes.

Debitage Ratios

Three ratios can be used to examine relationships between various classes of debitage and cores: flakes to angular debris, flakes to cores, and core flakes to biface flakes. The flake to core ratio is probably the weakest of the three because cores can disappear from assemblages in several ways. When exhausted, cores can be smashed using the bipolar technique, turning them into multiple pieces of debitage without leaving a core behind. Cores can also be carried to another location or transformed into a tool such as a hammerstone or chopper when no longer suitable for the production of debitage, again with the potential of being moved elsewhere. Depending on whether or not any of these factors was in play, there might be considerable variation in this ratio between assemblages with attributes that otherwise suggest similar reduction strategies were used.

When objective pieces are struck, the detached pieces do not always break into recognizable flakes (Andrefsky 1998:82). These shattered pieces are classified as angular debris, and are distinguished from flakes by the lack of a striking platform and definable dorsal and ventral surfaces. Flake removal is also often accompanied by a shower of small pieces of shatter that are usually not recovered by standard excavation techniques. This is especially true of hard hammer percussion, because the blow used to remove a flake will often cause the formation of numerous partial Hertzian crack cones. While one crack will dominate and propagate to form the flake, the others result in the removal of small flakes that often terminate in a step or hinge (Cotterell and Kaminga 1987:687). These small flakes or pieces of shatter are most common in core reduction, which is usually accomplished using hard hammer percussion. Soft hammer percussion results in comparatively few secondary detachments of this type (Cotterell and Kaminga 1987:690).

Both core reduction and tool manufacture result in the production of non-diagnostic, shattered material. The main difference is in size—core reduction produces much more angular debris that is recoverable by standard archaeological techniques than does tool manufacture. Thus, logic suggests that the ratio of flakes to angular debris should increase with the amount of tool manufacture that was conducted. Other analytic results suggest that this is indeed the case (Moore 1999, 2001, 2003). Thus, high ratios of flakes to angular debris indicate tool manufacture, while low ratios indicate core reduction.

Table 10.19 shows these three ratios for each area assemblage. Only one ratio could be calculated for the Central Talus assemblage, and it holds little meaning because of the small size of that sample and is therefore not discussed any further. The highest flake to angular debris ratios were derived for the assemblages from the shelters, but the ratio for the North Shelter assemblage is more than twice as large as that for the South Shelter assemblage. When adjacent shelter and talus assemblages are compared, the talus assemblages have much smaller flake to angular debris ratios than the shelter assemblages. In each case, the ratio is still very high, suggesting that tool manufacture was a very important

Table 10.19. Debitage ratios by site area.

	Flakes to Angular Debris	Flakes to Cores	Core Flakes to Biface Flakes
North Shelter	53.8:1	29.1:1	6.8:1
North Talus	19.3:1	17.3:1	12.0:1
Central Talus	–	–	2.0:1
South Shelter	24.3:1	67.6:1	5.3:1
South Talus	13.4:1	25.3:1	7.9:1
Site Total	**19.3:1**	**31.9:1**	**6.8:1**

activity in each assemblage, or that reduction techniques that did not produce large amounts of recoverable shatter were used.

Flake to core ratios are high, and the ratio for the South Shelter assemblage is very high. If many cores were not transported elsewhere, these ratios suggest that reduction was fairly intense at LA 139965. Core flake to biface flake ratios are low, indicating that formal tool manufacture was an important activity in all area assemblages, though the higher ratio for the North Talus assemblage may indicate less of a focus on tool production.

Thermal Alteration of Cherts

Cherts can be altered by the application of heat to make them more amenable to reduction. Luedtke (1992:92) notes that different cherts are variably affected by thermal treatment. Some cherts may not respond to this process and others may not change enough to make heat treatment worthwhile. Thermal alteration causes changes at several levels. Some geochemical changes can occur, but Luedtke (1992:94) indicates heat treatment generally causes few direct changes in chert, though the mineralogy of some impurities can be altered. Thermal treatment can change the visual quality of chert, and thereby alter color, translucency, and luster (Luedtke 1992:94). Color changes usually result from the oxidation of iron compounds to hematite. Some cherts become darker when heat-treated, others have a reduced translucency. Luster changes in nearly all cherts when they are heat-treated, increasing their gloss (Luedtke 1992:95). However, the most important change is in flaking quality. Thermal alteration reduces the tensile strength of cherts (Luedtke 1992:96), making them easier to fracture and therefore to knap.

Correct thermal alteration produces a chert that tends to be lustrous and may have changed in color. It also produces a material that is easier to flake and is especially amenable to pressure flaking. Incorrect thermal alteration can damage chert by causing it to craze or explode, producing potlid fractures. While these errors do not always ruin a piece, they often create enough problems that a blank is rendered unusable. Errors such as crazing and potlidding often also happen when a piece of chert is unintentionally heat-treated, especially when discarded into an active fire. Thus, this analysis distinguishes between intentional thermal treatment and errors that might be a reflection of discard behavior rather than intent.

Intentional thermal alteration is exhibited by chert artifacts that are lustrous, display luster variation, or are flawed by mistakes made during thermal alteration but are still used to manufacture a tool. Inadvertent thermal alteration is exhibited by chert artifacts that were damaged by heating and were not used for tool manufacture. Distinguishing between intentional and inadvertent thermal alteration is critical because, while the former may be an indication of the importance of tool manufacture, the latter is not.

As Table 10.20 shows, over a third of the cherts (including silicified wood) were thermally altered at LA 139965, a very high percentage. Except for the few examples of Zuni Spotted chert, much higher percentages of the non-local cherts were altered versus the presumably local cherts and silicified wood. Since no non-local chert cores were recovered from LA 139965, those debitage and tools were most likely transported to the site in an already reduced condition, and may have been thermally altered prior to transport. Unfortunately, the timing of thermal alteration is impossible to establish for the non-local cherts, so this remains uncertain.

Of course, not all thermal alteration was purposeful. Since luster does not change on the original surface of a thermally altered artifact, any change in a material's luster can be considered evidence of purposeful alteration, since the original surface present during thermal alteration must be removed in order to reveal that luster change. Conversely, the presence of crazing or potlids on an artifact that does not also evidence luster change suggests that the thermal alteration was probably unintentional. Table 10.21 shows the distribution of evidence for intentional versus unintentional thermal alteration for each type of chert. Most of the unintentional thermal alteration occurs on generic chert and silicified wood, with only one piece of Pedernal chert and two of Madera chert having been unintentionally altered. For the most part this supports the idea that the non-local cherts were brought to LA 139965 in an already reduced state, and suggests that most (if not all) of the thermally altered non-local specimens were treated before they were transported to the site.

Table 10.20. Thermally altered cherts by material type; counts and percents.

	Thermally Altered	Percent Altered	Total
Generic chert	331	32.1	**1032**
Pedernal chert	120	76.4	**157**
Tecovas chert	2	66.7	**3**
Madera chert	15	65.2	**23**
Zuni Spotted chert	0	0.0	**4**
Silicified wood	142	24.8	**573**
Total	**610**	**34.0**	**1792**

Comparison of Reduction Strategy Indicators

As discussed earlier, none of the indicators examined here can be used by itself to determine the reduction strategy used at a site. As this discussion has shown, some indicators may primarily provide information on other aspects of chipped stone reduction. Only by using these indicators in combination and assessing the results of that analysis is it possible to determine what reduction strategy may have dominated in an assemblage and how prevalent it actually was. By using a variety of potential indicators, it may be possible to account for some

Table 10.21. Intentional versus unintentional thermal alteration in chert types; counts and percents.

		Thermal Alteration	
		Intentional	Unintentional
Chert	n =	265	66
	%	80.1	19.9
Pedernal chert	n =	119	1
	%	99.2	0.8
Tecovas chert	n =	2	–
	%	100.0	–
Madera chert	n =	15	2
	%	88.2	11.8
Red chert	n =	1	–
	%	100.0	–
Silicified wood	n =	142	40
	%	78.0	22.0
Total	**n =**	**544**	**109**
	%	**83.3**	**16.7**

of the biases introduced into assemblages by prehistoric activities as well as by archaeological recovery methods. Many indicators overlap, but are used in somewhat different ways and should be considered interrelated.

Table 10.22 summarizes data for the reduction strategy indicators by area assemblage and for the site assemblage as a whole. The Central Talus assemblage is not included because of its small sample size. To improve the interpretive value of this table, these results are compared with similar results for fourteen sites at Spaceport America, ranging in date from the Folsom period to the Historic period (Moore 2014). Each indicator was carefully examined in that study, and the division between a curated or expedient ranking was based on standard deviation ranges, though how those ranges were used varied from attribute to attribute depending on the amount of overlap in first standard deviation ranges. The meaning of each indicator for the LA 139965 assemblage is discussed, and each component is ranked according to whether the indicator suggests a curated (C), expedient (E), or mixed (M) reduction strategy, using the boundary points developed in the Spaceport America study (Moore 2014).

Cortical to Non-Cortical Flake Ratio

Low cortical to non-cortical flake ratios suggest a curated reduction strategy because biface manufacture should produce a much higher percentage of non-cortical flakes than are generated during core reduction. In turn, high ratios indicate an expedient reduction strategy. A clear division between assemblage means was seen in the Spaceport America study, but there was considerable overlap in first standard deviation ranges, so the difference between means was used as a dividing point (Moore 2014:371). Thus, assemblages having cortical to non-cortical flake ratios below 0.26:1 were considered indicative of curated behavior and those above it of expedient behavior (Moore 2014:371). All four area assemblages from LA 139965, as well as the site as a whole, have ratios below this threshold and can be rated as exhibiting evidence of a curated strategy for this attribute. However, the ratio for the South Talus assemblage is just barely below the threshold of 0.26:1, and in this case a mixed strategy could be a more accurate assignment. In any case, these ratios suggest that reduction was fairly intense in all assemblages, and was either focused on the manufacture of formal tools or the systematic reduction of cores to produce the largest amount of useable debitage possible.

Percentage of Tertiary Flakes

High percentages of tertiary flakes suggest a curated strategy because tool manufacture tends to produce larger numbers of non-cortical interior flakes than does core reduction. The opposite is indicative of an expedient reduction strategy. A clear separation in means was again found in the Spaceport America study, but there was an overlap

Table 10.22. Summary, reduction strategy indicators by site area assemblage.

Component	North Shelter	North Talus	South Shelter	South Talus	Whole Site
Cortical to non-cortical flake ratio	0.13:1	0.16:1	0.15:1	0.24:1	0.17:1
Percent tertiary flakes	88.4	86.2	87.0	80.4	85.6
Percent biface flakes	12.7	7.7	15.9	11.3	12.8
Percent modified platforms	13.1	16.2	23.3	22.4	20.0
Percent manufacture breaks	5.0	2.9	4.5	5.4	4.6
Percent whole flakes	63.9	59.8	57.9	57.2	59.2
Percent lipped platforms*	22.5	13.4	23.6	14.1	19.4
Percent diffuse bulbs*	79.2	80.4	75.8	75.2	77.2
Percent opposing dorsal scars*	13.1	6.4	15.4	13.9	13.1
Flake to angular debris ratio	53.8:1	19.3:1	24.3:1	13.4:1	19.3:1
Flake to core ratio	29.1:1	17.3:1	67.6:1	25.3:1	31.9:1
Core flake to biface flake ratio	6.8:1	12.0:1	5.3:1	7.9:1	6.8:1
Percentage of chert artifacts intentionally heated	24.3	31.5	30.4	35.9	30.3

* = Only specimens exhibiting this characteristic used in calculation.

in first standard deviation ranges so the difference between the means was again used as a dividing point, establishing the break point at 80 percent (Moore 2014:371). As was the case with the cortical to non-cortical flake ratios, all four area assemblages from LA 139965, as well as the assemblage as a whole, contain more than 80 percent tertiary flakes. The South Talus assemblage percentage is just barely higher than the threshold, again suggesting that a mixed strategy could be a more accurate assignment for this variable.

Flake type

Percentage of biface flakes in the flake assemblage is used to produce data for this attribute. High percentages of biface flakes are considered indicative of a curated strategy and low percentages of an expedient strategy. The analytic results for this indicator were somewhat mixed in the Spaceport America study, and the low end of the second standard deviation range for the Paleoindian components—10.8 percent—was used as a dividing point (Moore 2014:371).

Except for the North Talus, the various assemblages from LA 139965, as well as the assemblage as a whole, exhibit percentages of biface flakes above the threshold and are therefore ranked as exhibiting evidence of a curated reduction strategy for this attribute. While the percentage for the South Talus assemblage is the lowest of those assigned a curated strategy ranking, it is high enough above the threshold that a mixed strategy assignment is not considered potentially more accurate for this variable.

Percentage of Modified Platforms

Since platforms tend to be modified during tool manufacture but not during core reduction, a high percentage of modified platforms is considered indicative of a curated strategy and a low percentage of an expedient strategy. Mixed results were obtained when this indicator was analyzed in the Spaceport America study, leading to the use of the low end of the second standard deviation range for the Paleoindian assemblages—19.87 percent—being used as a boundary (Moore 2014:371). Both of the northern assemblages from LA 139965 fall below this threshold and are assigned an expedient reduction strategy ranking. Both of the southern assemblages, as well as the assemblage for the site as a whole, are ranked as exhibiting a curated reduction strategy.

Flake Breakage Patterns

Manufacturing breaks can occur during both core and biface reduction, but limited experiments suggest that they are much higher in the latter than they are in the former. Thus, higher percentages of manufacturing breaks in an assemblage suggest an emphasis on tool manufacture and therefore a curated reduction strategy. The analytic results for this indicator was clear for the Paleoindian assemblages in the Spaceport America study, but were mixed for the other temporal assemblages because of high standard deviations (Moore 2014: 371–372). Since a value above 33 percent was clearly indicative of a curated reduction strategy, this value was the boundary point used in that study (Moore 2014:372). All assemblages from LA 139965 fall below this threshold level and are considered indicative of an expedient reduction strategy for this indicator.

Percentage of Whole Flakes

Because flakes removed during biface reduction tend to be thinner than those struck from cores they are more prone to buckling during removal, producing assemblages with lower percentages of whole flakes. Thus, low percentages of whole flakes suggest a curated strategy while high percentages of whole flakes indicate an expedient strategy. As was the case for flake breakage patterns, the analytic results for this indicator were clear for the Paleoindian assemblages in the Spaceport America study, but were mixed for the other temporal assemblages (Moore 2014:372). Since a clear break could be discerned between the Paleoindian and some Archaic assemblages versus the assemblages from later periods, 20 percent was used as the dividing point (Moore 2014:372). Since all assemblages from LA 139965 fall above this boundary, they were considered indicative of an expedient reduction strategy.

Percentage of Lipped Platforms

Since platform lipping usually indicates soft hammer percussion or pressure flaking, and these reduction techniques are most often associated with tool manufacture, high percentages of lipped platforms suggest a curated strategy while low percentages are representative of an expedient strategy. There was a clear division between curated and expedient strategies for this indicator in the Spaceport America study (Moore 2014:372). However, since there was a large overlap between Archaic- and Formative-period assemblages in that study because of high standard deviation range for the former, the high end of the Formative-period assemblage range—20 percent—was used as the boundary (Moore 2014:372). The results of this analysis for the LA 139965 assemblages are mixed. Interestingly, both shelter assemblages and the site assemblage are classified as curated while both talus assemblages are classified as expedient. This is the first sign in the reduction indicator analysis that there may have been slightly different reduction focuses between the shelters and the talus assemblages.

Percentage of Diffuse Bulbs of Percussion

Like platform lipping, diffuse bulbs of percussion usually signify reduction using soft hammers or pressure, while pronounced bulbs tend to indicate hard hammer percussion. Since soft hammer percussion and pressure flaking are more often used in tool manufacture than in core reduction, high percentages of diffuse bulbs suggest biface manufacture while low percentages are indicative of core reduction. Analysis of this variable showed a clear break between the first standard deviation ranges for the Paleoindian- and Formative-period assemblages in the Spaceport America study, and that break—43 percent—was used as the boundary point in that study (Moore 2014:372). Since all assemblages at LA 139965 have percentages of diffuse bulbs that are far above this boundary, all are classified as exhibiting evidence of a curated strategy.

Percentage of Opposing Dorsal Scars

Opposing dorsal scars can occur during both biface manufacture and core reduction, but should be much more common during the former. Thus, high percentages of opposing dorsal scars suggest a curated strategy, while low percentages reflect an expedient strategy. Because of a very high standard deviation for the Archaic assemblages in the Spaceport America study, the break for this variable was set at the midpoint between the low end of the Paleoindian range and the high point of the Formative-period range, which was 2.9 percent (Moore 2014:372). Since percentages of opposing dorsal scars are much higher than this boundary in all assemblages from LA 139965, they are all categorized as exhibiting the characteristics of a curated reduction strategy.

Flake to Angular Debris Ratio

Since biface manufacture produces large numbers of waste flakes but few recoverable pieces of angular debris, a high flake to angular debris ratio suggests a curated reduction strategy. Conversely, while core reduction can also produce large numbers of flakes, it also produces large numbers of recoverable angular debris. Thus, low flake to angular debris ratios reflect expedient reduction. Because of overlaps in the first standard deviation, the boundary for the Spaceport America study was set at the midpoint between the top of the Formative-period range and the bottom of the Archaic range, or 5.02:1 (Moore 2014:373). Since flake to angular debris ratios for all assemblages from LA 139965 are much higher than this, they were all considered representative of a curated reduction strategy.

Flake to Core Ratio

As discussed earlier, this attribute is problematic because cores can be transported away from a site after they are partly reduced or they can be completely reduced and disappear from the record. With this in mind, biface manufacture produces a large number of flakes relative to cores, while core reduction produces a smaller number of flakes relative to cores. Thus, a high ratio suggests a curated strategy, while a low ratio represents expedient reduction. Since there was quite a bit of difference in the means for this indicator in the Spaceport America study, and no overlap in the first standard deviation ranges for the Paleoindian- and Formative-period assemblages, the boundary for this indicator was set as the midpoint between the upper end of the first standard deviation range for the Formative-period assemblage and the lower end of the first standard deviation range for the Paleoindian assemblages, which was 36.39:1 (Moore 2014:373). The only assemblage from LA 139965 with a higher ratio is from the South Shelter; all other assemblages have lower ratios and are considered indicative of an expedient reduction strategy.

Core Flake to Biface Flake Ratio

This attribute measures the relative abundance of either biface flakes or core flakes in an assemblage, with a high ratio indicating the dominance of core flakes and therefore expedient reduction, and a low ratio indicating a large proportion of biface flakes and therefore a curated strategy. The boundary for this attribute in the Spaceport America study was set at the midpoint between the high end of the first standard deviation range for the Paleoindian assemblage and the low end for the Archaic assemblage, producing a ratio of 14.15:1 (Moore 2014:373). Lower ratios indicate a curated strategy and higher percentages an expedient strategy. In all cases for LA 139965, this ratio was lower than the cutoff point, and all assemblages are considered to be indicative of a curated reduction strategy.

Percent of Intentionally Thermally Altered Chert Artifacts

As discussed earlier, cherts can be altered through the application of heat to improve their flaking qualities. This was often done to improve cherts used for tool manufacture. Thus, high percentages of thermally altered cherts suggest a curated strategy, while low percentages reflect an expedient strategy. There were high standard deviations for the assemblages used in the Spaceport America study (Moore 2014:373), but little overlap occurred between the lower end of the first standard deviation range for the Paleoindian assemblage and the upper end of the range for the Formative period. Thus, the dividing point between curated and expedient behavior was set as the midpoint between the upper limit of the first standard deviation range for the Formative assemblage and the lower end of the range for the Paleoindian assemblage, producing a figure of 25.99 percent, with percentages above that representing curated behavior and those below it suggesting expedient behavior (Moore 2014:373). Except for the North Shelter assemblage at LA 139965, percentages of intentionally thermally altered cherts are higher than this boundary, and most assemblages are considered representative of a curated reduction strategy. Though the North Shelter assemblage percentage is lower than the cutoff point, it is very close to that point and may actually be indicative of the same strategy.

Examination of Analytic Results

The results of this analysis, using the dividing points for all variables discussed above, are shown in Table 10.23. Scores were derived in the same manner used in the Spaceport America analysis (Moore 2014), which entailed assigning a value of 1 to each variable assessed as indicative of a curated strategy, then dividing the total by the number of variables. Values over 0.615 (8 out of 13 variables assigned a C designation) are considered to be those in which a curated reduction strategy was very important if not dominant. Values of 0.385 or less (8 out of 13

Table 10.23. Assessment, reduction strategy indicators for each site area assemblage and entire site (Central Talus not included).

Component	North Shelter	North Talus	South Shelter	South Talus	Whole Site
Cortical to non-cortical flake ratio	C	C	C	C	C
Percent tertiary flakes	C	C	C	C	C
Percent biface flakes	C	E	C	C	C
Percent modified platforms	E	E	C	C	C
Percent manufacture breaks	E	E	E	E	E
Percent whole flakes	E	E	E	E	E
Percent lipped platforms**	C	E	C	E	C
Percent diffuse bulbs**	C	C	C	C	C
Percent opposing dorsal scars**	C	C	C	C	C
Flake to angular debris ratio	C	C	C	C	C
Flake to core ratio	E	E	C	E	E
Core flake to biface flake ratio	C	C	C	C	C
% chert artifacts intentionally heated	E	C	C	C	C
Score	**0.615**	**0.539**	**0.846**	**0.692**	**0.769**
Reduction Strategy	**C**	**M**	**C**	**C**	**C**

** = Only specimens exhibiting this characteristic used in calculation.
C = curated strategy; E = expedient strategy; M = mixed strategy.

variables assigned an E designation) are considered to represent assemblages in which an expedient reduction strategy dominated. These values were selected because they reflect a dominance of variables considered indicative of either strategy without requiring that all indicators point to a single strategy. This was necessary, because mixed strategies are common in chipped stone assemblages, with biface reduction occurring side-by-side with expedient reduction in most cases. Thus, the values used in this analysis can reflect the dominance of a particular reduction strategy in an assemblage without suggesting that it was the only strategy used. Values falling between 0.385 and 0.615 are considered to represent more highly mixed assemblages. In this case, both expedient and curated strategies may have been used equally, or an unsuspected multi-component situation may be indicated.

Thus, even when a certain reduction strategy can be assigned to an assemblage, that strategy is only considered to be dominant and rarely means that the other strategy was not also used. Except for the North Talus assemblage, all of the main areas at LA 139965 exhibit a dominantly curated reduction strategy. In the case of the North Talus, a mixed strategy can be suggested. Thus, expedient core-flake reduction was also performed in all assemblages, but to a somewhat greater extent in the North Talus assemblage. Biface reduction—probably in the form of formal tool manufacture—was an important activity, and may have dominated the set of chipped stone reduction activities in both shelter assemblages and in the South Talus assemblage. Biface reduction was apparently less dominant in the North Talus assemblage, but was still important.

The interesting aspect of this analysis is that the LA 139965 assemblage is essentially lacking the large bifaces considered typical of a curated reduction strategy according to Kelly's (1988) model. With this lack, can the LA 139965 assemblage truly be considered indicative of a curated reduction strategy, or is it something different? For three of the reduction strategy indicators—percent of manufacture breaks, percent of whole flakes, and flake to core ratio—few of the sub-assemblages suggest use of a curated reduction strategy. Indeed, only the South Shelter assemblage does so, and only for the flake to core ratio. However, a curated reduction strategy is fairly consistently indicated for all of the other indicators. This suggests that there is more than one type of "curated" reduction strategy, or that the suite of indicators can point to more than just two types of reduction focus. This possibility is investigated in further detail later.

Chipped Stone Tools

Two categories of tools are included under this classification. First are formal tools, which are debitage or cores whose shapes or edge angles were significantly altered to fit the needs of a specific task. The second are informal tools—debitage or cores whose edges were damaged during use. Table 10.24 shows the distribution of formal and informal tools by site area. Formal tools far outnumber informal tools, which is not surprising because informal tools can usually only be identified when either very heavily used or damaged during use in a recognizable pattern. Thus, the number of informal tools identified during this analysis probably severely under-represents the actual number of informally used debitage or cores. The formal tools represent those that were discarded or lost at this location rather than the total number that were actually produced and/or used, since some were probably transported away. Thus, an examination of these types of tools can illuminate some aspects of tool manufacture and use, but others must remain unclear or undefined.

Table 10.24. Summary, informal and formal tool totals by site area assemblage.

	Informal Tools	Formal Tools	Percentage of Area Assemblage	Total
North Shelter	4	38	6.8	**42**
North Talus	9	54	10.0	**63**
Central Talus	–	1	25.0	**1**
South Shelter	6	110	8.3	**116**
South Talus	33	79	13.7	**112**
Total	**52**	**282**	**9.6**	**334**

The number of tools recovered varies considerably from assemblage to assemblage, with the largest numbers being found in the southern assemblages. However, those are also the assemblages that yielded larger numbers of chipped stone artifacts and had more excavated grid units and levels. By far, the largest number of informal tools were found in the South Talus assemblage. In contrast, the adjacent South Shelter assemblage contained the largest number of formal tools. Table 10.24 shows the proportion of tools occurring in each assemblage. With the Central Talus excepted because of small assemblage size, the South Talus assemblage contains the highest percentage of tools overall, thanks primarily to the abundance of informal tools. The assemblages from both shelters actually contain the smallest percentages of tools. The percentages even out somewhat when only formal tools are considered—6.3 percent for the North Shelter assemblage, 8.5 percent for the North Talus assemblage, 7.8 percent for the South Shelter assemblage, and 9.5 percent for the South Talus assemblage. The southern assemblages contain the highest percentages of formal tools, but the difference between them and the north assemblages is not very large. In both cases, the talus assemblages contain higher percentages of formal tools than the shelter assemblages.

Table 10.25 shows the distribution of tool types by assemblage. Again discounting the Central Talus assemblage, the South Talus assemblage stands out from the others because it contains considerably more pieces of utilized debitage, core tools, and choppers, as well as the only strike-a-light flints. Both of the southern assemblages contain many more projectile points and projectile point preforms than the northern assemblages. When examined proportionately, the northern assemblages contain smaller percentages of projectile point preforms (1.1 percent for the North Shelter assemblage and 1.4 percent for the North Talus assemblage) than do the southern assemblages (2.4 percent apiece). The reverse is true for the projectile points (4.1 percent for the North Shelter assemblage, 4.3 percent for the North Talus assemblage, 3.5 percent for the South Shelter assemblage, and 3.9 percent for the South Talus assemblage). While the same essential range of tools and activities are represented in the north and south assemblages, there are distinct differences in the amount of tool use, and that may be significant.

Projectile Points

Projectile points (including projectile point preforms) are the most common type of formal or informal tool recovered from LA 139965, making up 61.1 percent of the tool assemblage. Because of their abundance, the projectile points are discussed separately from the other tools and in more detail, because analysis of this tool type can often yield more relevant information than can be derived from other tools types, especially for sites like LA 139965 where they are especially abundant.

Projectile Point Types

The distribution of projectile points by type and

Table 10.25. Tool types, counts by site area assemblage.

Tool Type	North Shelter	North Talus	Central Talus	South Shelter	South Talus
Utilized Debitage	2	6	–	6	21
Core Tools	1	2	–	–	9
Hammerstones	1	1	–	–	1
Choppers	–	2	–	1	8
Drills	–	1	–	1	–
Gravers	–	–	–	1	–
Scraper-Graver	–	1	–	1	1
Strike-a-Light Flint	–	–	–	–	5
Unifaces	–	–	–	1	–
Scrapers	2	8	–	11	10
Bifaces	4	5	–	11	5
Knives	–	1	–	–	–
Projectile Point Preform	7	9	–	34	20
Projectile Points	25	27	1	49	32

area assemblage is shown in Table 10.26. The types listed in this table range from very specific to very general, with the latter tending to represent broken specimens that cannot be more specifically placed. Small projectile points are those considered suitable for use as arrow tips, while large projectile points are those believed to have been used on darts. The only potential dart points in Table 10.26 are the En Medio points (Fig. 10.3 [f, g]), which occur in all assemblages except for that from the Central Talus. Otherwise, only arrow points are present. Bow and arrow technology appears to have been in general use in the Southwest by about AD 500, though it appeared in some areas as many as several centuries earlier (Reed and Geib 2013). This suggests that most deposits at LA 139965 date after AD 500, which mostly agrees with the suite of radiocarbon dates from the site. Stemmed and corner-notched arrow points (Fig. 10.4 [a–g, h–o]) appear to have been among the earliest types used in the northern Rio Grande, with side-notched types (Fig. 10.4 [p–x]) appearing somewhat later (Moore 2013, in prep. [b]). All three of these notching styles can occur in the same assemblage, but some evidence suggests that stemmed arrow points mostly fell out of use after the early Developmental period (AD 600–900), though this type has occasionally been found in assemblages dating as late as the Coalition period (AD 1125–1250).

The only type found at LA 139965 that has a fairly secure date is the En Medio point, which dates to the Late Archaic period, ca. 800 BC–AD 400 (Irwin-Williams 1973). While these and the other large corner-notched points could be indicative of a Late Archaic occupation, this possibility finds little support in the radiocarbon dates for this site, and they could represent curated tools. The comparatively large number of small arrow points recovered from the site suggest that the use of LA 139965 dates primarily after AD 500.

A single arrow point assigned to the Spanish side-notched type (Fig. 10.4 [y]) is dated by association and manufacturing style. This point was found in an elevated area at the south end of the North Talus, and was associated with a cluster of domestic sheep/goat bone, a chert preform, and two ground stone tools. Hispanic-made projectile points tend to be only marginally flaked and have shallow side notches, as does the specimen from LA 139965. Chipped stone points were used by Hispanics for hunting and defense during the Spanish Colonial periods, and their use appears to have continued at least into the mid-1800s. Information gathered at Placitas, New Mexico, by WPA writers in the 1930s documents the extensive use of stone tools by nineteenth-century Hispanic residents of that area (Rebolledo and Márquez 2000), including "obsidian arrows," presumably meaning arrow shafts tipped with obsidian points. Hispanic-made projectile points were recovered from LA 4968, a Hispanic site dating ca. 1830–1868 and located south of Pojoaque (Moore in prep. [c]). Thus, we can document the continued use of this tool type well into the American period in New Mexico.

Projectile Point Manufacture and Use

Though the prehistoric projectile point assemblage from LA 139965 is not especially useful for dating the site, the condition of individual points and preforms can provide important information on how they were used, in turn providing an idea of how the site may have functioned in the settlement system. Of the 203 prehistoric projectile points and preforms from LA 139965, 183 specimens were sub-

Table 10.26. Projectile point types, counts by site area assemblage.

Projectile Point Type	North Shelter	North Talus	Central Talus	South Shelter	South Talus
Small projectile point	8	11	–	9	11
Small stemmed projectile point	2	4	1	2	–
Small corner-notched projectile point	8	5	–	11	8
Small side-notched projectile point	5	5	–	22	11
En Medio point	1	1	–	1	1
Eccentric point	–	–	–	4	1
Small point, fluted?	1	–	–	–	–
Spanish side notched point	–	1	–	–	–

Figure 10.3. Projectile point types and preforms: (a–e) eccentric arrow points; (f–g) En Medio points; (h–o) projectile point preforms.

Figure 10.4. Projectile point types: (a–g) stemmed arrow point; (h–o) corner-notched arrow points; (p–x) side-notched arrow points; (y) Spanish side-notched arrow point.

jected to a more detailed analysis to establish the source of any breaks, evidence of abandonment during manufacture, resharpening, use for purposes other than as tips for projectile shafts, and salvaging from earlier sites. Any other data considered to be of potential importance were also noted. The specimens that were not subjected to this analysis had not been set aside for this purpose during the initial analysis as had those that are included in the analysis. Specimens that were not fully analyzed came from all assemblages except the Central Talus, and varied from one to three specimens per area. As Table 10.27 shows, two-thirds of the examined specimens came from the southern areas, and only a third are from the northern areas. Since assemblage characteristics are examined for each area separately, this discrepancy in sample size should not bias the sample to any significant degree.

Table 10.27 provides a breakdown on the distribution of projectile points (points) and projectile point preforms (preforms) in the various area assemblages. During this analysis, four points were reclassified as preforms because they exhibit fracture types indicative of manufacturing breaks. While preforms occur in all assemblages except for the Central Talus, they are more common in the southern assemblages, especially the South Shelter assemblage. However, when the distribution of points versus preforms in the north and south assemblages is examined using chi-square analysis, a single population appears to be represented (chi-square = 4.1, df = 3, significance = .249, Cramer's V = .143). Thus, despite the disparity in numbers of specimens for each area, there is no significant difference in the distribution of points and preforms between major site areas.

When the north assemblages and the south assemblages are examined separately, there is an even stronger relationship between adjacent parts of the site. The North Shelter and North Talus assemblages form a single population (chi-square = .77, df = 1, significance = .378, Phi = -.108), as do the South Shelter and South Talus assemblages (chi-square = .08, df = 1, significance = .773, Phi = -.025), with the latter relationship being both closer and stronger. While comparison of assemblages from the North Shelter and the South Shelter also suggests that those assemblages represent a single population, the level of significance is much lower than it is for the adjacent shelter and talus assemblages (chi-square = 3.69, df = 1, significance = .055, Phi = .055). Thus, while all area assemblages represent a single population at one level, at another they group more strongly by proximity. This suggests that essentially the same amount of projectile point manufacture and use occurred in all of these assemblages, with a closer resemblance between adjacent area assemblages.

Table 10.28 shows the basic condition of the re-analyzed preforms for each area assemblage (except the Central Talus). The whole category (artifact is complete) includes specimens that were either abandoned during manufacture for an unknown reason or that were lost. Very few specimens fall into this category, and all are from the southern assemblages. These artifacts could represent finished unnotched projectile points, but lacking any definite evidence for that type of use they remained

Table 10.27. Prehistoric projectile points and projectile point preforms by site area assemblage; counts and percents.

		Projectile Point Preform	Projectile Point	Total
North Shelter	n =	7	25	**32**
	%	21.9	78.1	**17.5**
North Talus	n =	11	24	**35**
	%	31.4	68.6	**19.1**
Central Talus	n =	–	1	**1**
	%	–	100.0	**0.5**
South Shelter	n =	34	49	**83**
	%	41.0	59.0	**45.4**
South Talus	n =	20	32	**52**
	%	42.9	57.1	**28.4**
Total	**n =**	**72**	**131**	**203**
	%	**37.2**	**62.8**	**100.0**

classified as preforms. Most preforms in each area assemblage were discarded after being broken during manufacture or because of problems encountered during production. The former mainly consists of fragments exhibiting lateral snaps, a type of break that can occur from end shock or a side blow during production (Johnson 1981:27). Other break types related to manufacture include fractures caused by a thermal or material flaw, and damage to an edge caused by removal of an overshot flake. Types of problems encountered during manufacture include the development of a plateau on one or more surfaces, a preform that is too thick or thin for continued flaking, and difficulties occurring during notching. Non-diagnostic breaks consist of snap fractures, which could have occurred during manufacture or after abandonment. The former is most likely in the case of preforms, but cannot be demonstrated with certainty, so when and how this type of break occurs remains undefined. All preforms from the North Shelter and North Talus assemblages were abandoned during manufacture, while at least 78.8 percent of those from the South Shelter assemblage and 83.3 of those from the South Talus assemblage were similarly discarded. If the snap fractured preforms from these areas also represent manufacturing breaks, then 90.9 percent of the South Shelter assemblage preforms and 88.9 of those in the South Talus assemblage represent discards because of manufacturing problems. The numbers and conditions of preforms indicate that quite a bit of projectile point manufacture occurred in all four major area assemblages.

Besides projectile point manufacture, there is evidence for the use of these finished tools in all major area assemblages as well. Table 10.29 shows the distribution of condition categories for the re-analyzed points from each major assemblage. Slightly more than a quarter of the points are intact, while half were broken during use. The latter category includes specimens exhibiting impact fractures, haft snaps, or both. Non-diagnostic breaks account for nearly 17 percent of the total, and primarily consist of snap fractures. These tools could have been broken during use, during final manufacture, or after discard, and there are currently few ways in which to distinguish between these possibilities. Four points are whole, but are categorized separately because they exhibit wear patterns indicating they were used as cutting tools in addition to their primary function. One tool broke while being used for a secondary purpose, and five specimens were either resharpened and reused as projectiles (n = 3), or were reused in a non-projectile capacity after being broken (n = 2). The points that were broken during projectile use exhibit an interesting distributional pattern, occurring more commonly in the talus assemblages than in those from the shelters. Conversely the whole points are much more common in the shelter assemblages than in those from the talus areas. However, ascribing any meaning to this pattern is difficult, since each area represents multiple occupational episodes.

The numerous points that were broken during use were returned to the site in two different ways. Proximal fragments exhibiting impact fractures or haft snaps most likely arrived at the site while still hafted, and were removed from their hafts and discarded so they could be replaced with unbroken points. Medial fragments exhibiting haft snaps, impact fractures, or both as well as distal fragments exhibiting haft snaps were most likely brought to the site embedded in the game they were used to kill. These fragments would have been removed from carcasses during processing and discarded. In Table 10.30, the probable method of return to the site is estimated for each point in the re-analyzed assemblage. Points to which no means of return could be determined are included in the "not applicable" category, and mainly include specimens that are whole or that were used for a different purpose after being broken. Otherwise, there is a slightly higher tendency for points to be returned to the site for refurbishing versus those that returned embedded in a carcass. Points that were possibly returned to the site for refurbishing mainly consist of proximal fragments exhibiting non-diagnostic breaks. Similarly, those classified as possibly being returned while embedded in carcasses include medial and distal fragments that also have non-diagnostic breaks.

Residue Analysis of Projectile Points

Immunological methods can be employed to test chipped stone artifacts for the presence of animal or plant protein residues. Besides revealing potential game animals hunted by site occupants, this method can also be used to test our assumptions concerning the return of broken points to the site for refurbishing or in carcasses. A total of 132 tools were initially considered good candidates for residue

Table 10.28. Prehistoric projectile point preforms, condition by site area assemblage; counts and percents.

		Whole	Broken during manufacture	Discarded due to manufacturing problems	Non-diagnostic break	Total
North Shelter	n =	–	5	1	–	**6**
	%	–	83.3	16.7	–	**8.8**
North Talus	n =	–	10	1	–	**11**
	%	–	90.9	9.1	–	**16.2**
South Shelter	n =	3	18	8	4	**33**
	%	9.1	54.5	24.2	12.1	**48.5**
South talus	n =	2	12	3	1	**18**
	%	11.1	66.7	16.7	5.6	**26.5**
Total	**n =**	**5**	**45**	**13**	**5**	**68**
	%	**7.4**	**66.2**	**19.1**	**7.4**	**100.0**

Table 10.29. Prehistoric projectile points, condition by site area assemblage; counts and percents.

		Whole	Whole, non-projectile tool use	Broken during use as projectile	Broken during use as non-projectile	Reused/ resharpened after break	Non-diagnostic break	Total
North Shelter	n =	6	–	11	–	–	5	**22**
	%	27.3	–	50.0	–	–	22.7	**19.3**
North Talus	n =	3	–	13	1	1	3	**21**
	%	14.3	–	61.9	4.8	4.8	14.3	**18.4**
South Shelter	n =	17	–	19	–	2	9	**47**
	%	36.2	–	40.4	–	4.3	19.1	**41.2**
South talus	n =	4	2	14	–	2	2	**24**
	%	16.7	8.3	58.3	–	8.3	8.3	**21.1**
Total	**n =**	**30**	**2**	**57**	**1**	**5**	**19**	**114**
	%	**26.3**	**1.8**	**50.0**	**0.9**	**4.4**	**16.7**	**100.0**

Table 10.30. Probable method by which prehistoric points were returned to site, by site area assemblage; counts and percents.

		Not Applicable	Refurbishing	Possible refurbishing	Carcass	Possible carcass	Total	Total Refurbishing	Total Carcass
North Shelter	n =	6	4	–	7	5	**22**	**4**	**12**
	%	27.3	18.2	–	31.8	22.7	**19.3**	**18.2**	**54.5**
North Talus	n =	5	6	2	7	1	**21**	**8**	**8**
	%	23.8	28.6	9.5	33.3	4.8	**18.4**	**38.1**	**38.1**
Central Talus	n =	1	–	–	–	–	**1**	**0**	**0**
	%	100.0	–	–	–	–	**0.9**	**0.0**	**0.0**
South Shelter	n =	19	14	6	6	1	**46**	**20**	**7**
	%	41.3	30.4	13.0	13.0	2.2	**40.4**	**43.5**	**15.2**
South Talus	n =	8	7	2	7		**24**	**9**	**7**
	%	33.3	29.2	8.3	29.2		**21.1**	**37.5**	**29.2**
Total	**n =**	**39**	**31**	**10**	**27**	**7**	**114**	**41**	**34**
	%	**34.2**	**27.2**	**8.8**	**23.7**	**6.1**	**100.0**	**36.0**	**29.8**

analysis and were specially treated, beginning during their collection in the field. Most of these tools were isolated during excavation, wrapped in acid-free paper, placed in vials, and bagged separately or in small groups of similar tools. These artifacts were repackaged during the cleaning process, but were not washed or removed from the acid-free paper. The latter was only removed and discarded during analysis.

There were two steps to the analysis process, wearing gloves during both while handling the tools to prevent inadvertent contamination. First, the tools were examined using the standard chipped stone analysis format. They were then more intensively analyzed, recording a new series of attributes aimed at eliciting information on manufacture and use. Of the 132 tools treated in this way, analysis demonstrated that only 107 had their final use as projectile points. We decided to focus the residue analysis on projectile points to provide further information on the types of animals that were hunted.

Suitability rankings for residue analysis were based on the portion and type of break present. Points ranked as excellent candidates were distal or medial fragments that exhibit use-related breaks at one or both ends. Those that were ranked as good were mainly proximal fragments with use-related breaks at their distal ends. Though these specimens were probably broken during use and returned to the site for refurbishing, there was no way to distinguish between points that broke when an animal was hit, and those that were recovered after a missed shot. Thus, these specimens were thought to have less of a chance to provide positive results. Specimens ranked as fair were mainly proximal fragments with non-diagnostic breaks at their distal ends, which may have been use-related. Medial and distal fragments that exhibit only non-diagnostic snap fractures were ranked as poor candidates. Complete specimens were unranked because it was impossible to determine whether they had ever been used.

When selecting the sample of projectile points for analysis, the assemblage they belonged to, suitability ranking, and probable type/date were all taken into account. Specimens ranked as excellent or good candidates were primarily chosen, with all of those that were ranked excellent (n = 26) and half of those that were ranked good (n = 10) selected for analysis. Since these specimens provided a sufficient mix of area assemblages and excavation levels within the site, sub-sampling for location was deemed unnecessary. Two specimens ranked as poor and two complete projectile points were also selected for analysis because of their type/date, and were the only specimens selected for that reason. They included two side-notched points and two stemmed points.

Table 10.31 presents the results of the protein residue analysis on 40 projectile points, conducted using a variety of plant and animal antisera (Appendix 3). Three-quarters of the results were negative, which could reflect absence due to poor preservation, the presence of insufficient protein, or lack of contact with any of the plants or animals for which the specimens were tested (Appendix 3). There were 11 positive reactions on 10 specimens (Fig. 10.5), with deer being the most common (n = 5), followed by rabbit (n = 3), human (n = 2), and pronghorn (n = 1). While deer, rabbit, and pronghorn were undoubtedly hunted for food, the same is probably not true for humans, despite the two positive results. The human protein on points could represent evidence of conflict, but it could also be indicative of hunting accidents or accidental cuts during point manufacture.

While there are differences in the number of specimens with positive results from various area assemblages as well as the animals represented, the sample size is too small for any significance to be

Table 10.31. Protein residue analysis results for each site area assemblage; counts and percents.

		Negative Results	Rabbit	Deer	Pronghorn	Human	Human/ Deer	Total
North Shelter	n =	9	1	–	–	–	–	**10**
	%	90.0	10.0	–	–	–	–	**25.0**
North Talus	n =	8	–	1	–	–	–	**9**
	%	88.9	–	11.1	–	–	–	**22.5**
Central talus	n =	1	–	–	–	–	–	**1**
	%	100.0	–	–	–	–	–	**2.5**
South Shelter	n =	5	2	2	–	1	1	**11**
	%	45.5	18.2	18.2	–	9.1	9.1	**27.5**
South talus	n =	7	–	1	1	–	–	**9**
	%	77.8	–	11.1	11.1	–	–	**22.5**
Total	**n =**	**30**	**3**	**4**	**1**	**1**	**1**	**40**
	%	**75.0**	**7.5**	**10.0**	**2.5**	**2.5**	**2.5**	**100.0**

attached to these differences. However, that most of the positive results came from the southern assemblages is interesting, with only one positive result apiece for the North Shelter and North Talus assemblages. However, this difference could simply result from the fortunes of differential preservation.

Table 10.32 shows the condition and possible site return mechanism by portion for the sample of tested points. Whole specimens were assigned a "not applicable" designation for possible return mechanism, because it was impossible to determine whether or not they had ever been used. The "whole" category includes specimens for which complete or nearly complete measurements were available, rather than reflecting an entirely undamaged condition. In fact, two of the whole specimens submitted for analysis were missing small sections of their edges. In one case, the very tip was missing, removing what was considered to be a negligible amount of tip. The second specimen was missing a small part of its base, which was originally thought to represent post-depositional damage. Only one whole specimen tested positive for protein residue. This was a small corner-notched arrow point from the South Shelter assemblage, which exhibits human protein. Since this was the specimen that is missing a small section of its base, the damage may have been incurred by a twisting motion during use rather than occurring after loss or discard, but this is uncertain.

Eleven proximal fragments were submitted for analysis, nine of which were classified as broken

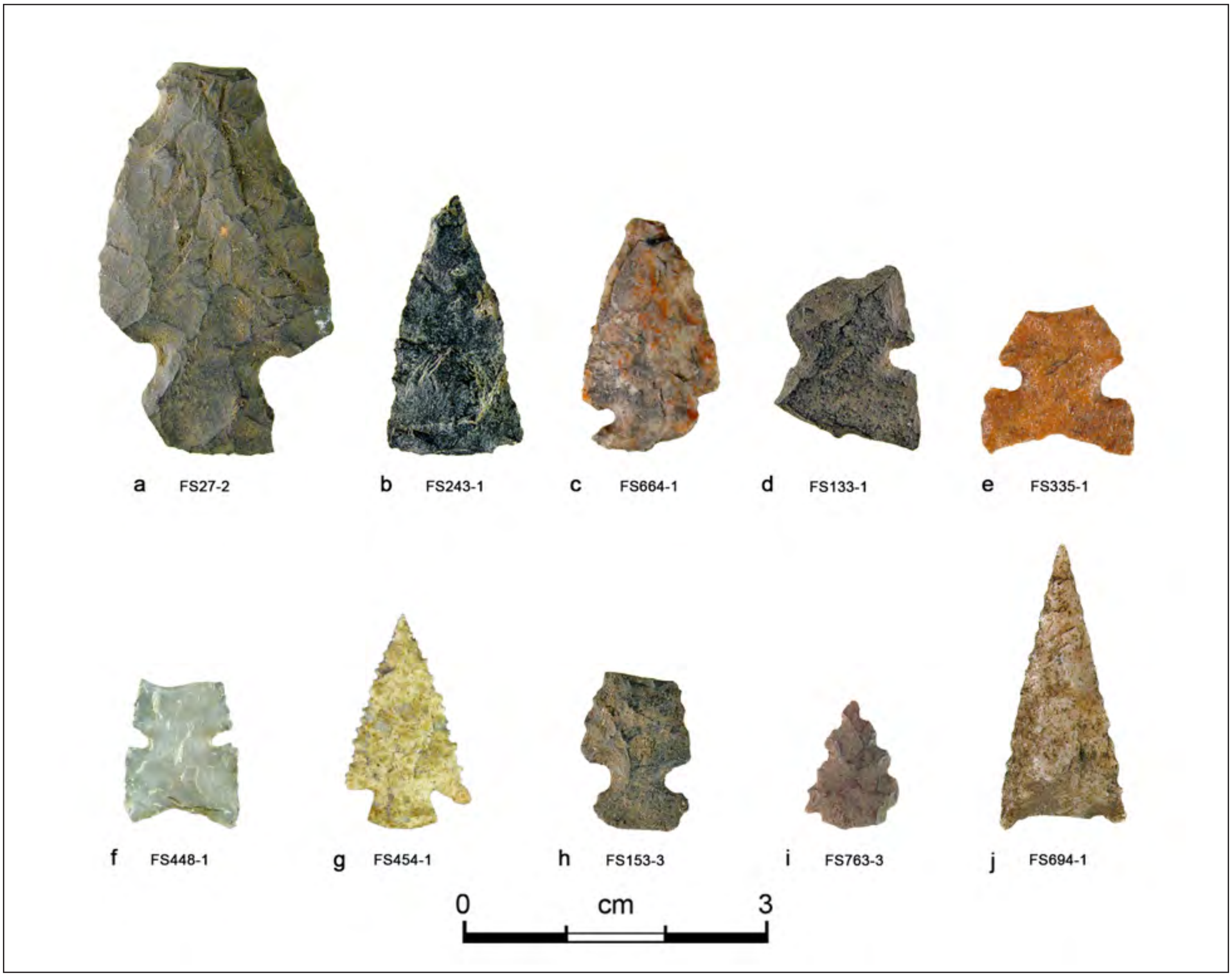

Figure 10.5. Points submitted for residue analysis that returned positive results. Specimens from the South Talus:(a) pronghorn protein; South Shelter: (b–c) deer protein; (d) deer and human protein; (e–f) rabbit protein; (g) human protein; South Talus: (h) deer protein; North Shelter: (i) rabbit protein; and from the North Talus: (j) deer protein.

Table 10.32. Summary, protein residue analysis results, with portion, condition, and probable return mechanism considered.

Portion	Condition	Non-Applicable		Refurbishing		Possible Refurbishing		Carcass	
		Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
Whole	Whole	1	3	–	–	–	–	–	–
	Discarded because of manufacturing problems	–	–	–	–	–	–	–	–
Proximal	Broken during projectile use	–	–	4	5	–	–	–	–
	Nondiagnostic break	–	–	–	–	2	0	–	–
Medial	Broken during projectile use	–	–	–	–	–	–	0	4
	Broken during non-projectile use	0	1	–	–	–	–	–	–
Distal	Broken during projectile use	–	–	–	–	–	–	3	12
	Reused/resharpened after break	0	1	–	–	–	–	–	–
Lateral	Broken during projectile use	–	–	0	3	–	–	–	–

during use and returned to the site still attached to shafts and discarded when those shafts were refurbished. The other two specimens had non-diagnostic breaks, and were considered to have possibly returned in the same manner. Since four specimens with use-related breaks and both of those with non-diagnostic breaks tested positive for animal protein residue, our conclusions concerning their return mechanism appear to be correct.

Five medial fragments were tested, four of which were classified as returning to the site embedded in animal carcasses, while the return mechanism for the fifth was undetermined because it broke during non-projectile use. All of these specimens tested negative for protein residues. Thus, the possible return mechanism cannot be substantiated for the four specimens thought to have returned via carcasses. In the fifth case, the negative results may support the assigned cause of the fracture. Sixteen distal fragments were tested, fifteen of which were probably returned in carcasses and one that was resharpened and reused for a different purpose after being broken. Since three fragments thought to have been returned in carcasses tested positive for animal protein residue, the assumed return mechanism can be considered confirmed. The negative results for the resharpened specimen may also substantiate reuse for a purpose other than hunting. Finally, three lateral fragments were tested, all of which exhibit use-related breaks and are thought to have been returned to the site and discarded during shaft refurbishing. Since none of these specimens tested positive, the proposed return mechanism cannot be substantiated.

This analysis provides several important types of information about the projectile point assemblage. First, it confirms the obvious, that these tools were mostly used to tip projectiles for hunting wild game. Proximal fragments with use-related breaks often fractured during a successful hunt, since 4 of the 9 tested specimens (44.4 percent) exhibit animal protein residue. Similarly, proximal fragments with non-diagnostic breaks may also have broken during hunting forays, since both tested specimens that fall into this category exhibit animal protein residue. Though only 3 of 15 distal specimens (20.0 percent) and none of 4 medial fragments thought to have been returned to the site in carcasses tested positive, the proposed return mechanism is probably correct for these specimens as well. One medial fragment appeared to have broken during non-projectile use and a distal fragment was reused for another purpose after being broken during projectile use, and both tested negative for animal protein residue. These results may confirm the non-projectile uses to which these specimens were put. While none of the three lateral fragments that exhibit use-related breaks tested positive, the results for the other fragments suggest that these specimens were also returned to the site attached to shafts scheduled for refurbishing, as our analysis suggested.

Three of the tested specimens were classified as En Medio points, a type considered indicative of the Late Archaic period. Since no other evidence for an Archaic occupation was found at LA 139965, these specimens could have been salvaged from earlier sites for reuse. However, all three specimens are proximal fragments exhibiting use-related fractures, and one from the South Talus assemblage tested positive for pronghorn protein. Since the likelihood that the later Pueblo occupants of LA 139965 would salvage broken points from an earlier site is very low, the presence of these specimens exhibiting use-related breaks argues for an otherwise invisible Late Archaic occupation.

The protein residue analysis confirms that deer, rabbits, and pronghorn were hunted by the various occupants of LA 139965. The occurrence of human protein residue on two specimens is more ambivalent and could be indicative of hunting accidents, accidental cuts while handling animal carcasses, as well as potential conflict. The presence of animal protein residue on some fragments considered to have been returned to the site embedded in carcasses or still attached to shafts and discarded when the shafts were refurbished provides confirmation of these return mechanisms. These are important conclusions, because they indicate that three separate though related activities were pursued by the occupants of LA 139965. Hunting parties appear to have originated at the site. They returned with carcasses that required processing, as demonstrated by the presence of medial and distal point fragments with use-related breaks. Broken hunting equipment was also returned to the site and refurbished, as shown by the presence of numerous discarded proximal point fragments with use-related breaks.

Other Types of Formal Tools

As discussed earlier, formal tools are debitage or cores that were intentionally flaked to produce a desired shape and/or edge angle. This tool category can be divided into three basic morphological types: cobble tools, unifaces, and bifaces. Table 10.33 is an inventory of the non-projectile point formal tools recovered from LA 139965, and Figure 10.6 shows some examples. No formal tools of this type were found in the Central Talus assemblage. An interesting aspect of the formal tool assemblage is that projectile points and preforms far outnumber other types of formal tools, showing just how important the manufacture and use of points was to site occupants.

Formal tools other than points and preforms appear to be somewhat under-represented in the North Shelter assemblage, where they make up only 1 percent. This tool category makes up 2.8 percent of the North Talus assemblage, 1.9 percent of the South Shelter assemblage, and 2.6 percent of the South Talus assemblage. Thus, non-point formal tools are more common in both talus assemblages than they are in the adjacent shelter assemblages, perhaps indicating a difference in either use or disposal patterns.

While a variety of other formal tool types was identified, nearly half (43.1 percent) are scrapers of one type or another. Only two scrapers were found in the North Shelter assemblage, versus nine in the North Talus assemblage, 12 in the South Shelter assemblage, and eight in the South Talus assemblage. The proportions of each area assemblage made up of scrapers are 0.3 percent for the North Shelter, 1.1 percent for the North Talus, 0.9 percent for the South Shelter, and 1.0 percent for the South Talus. Thus, scrapers occur in similar proportions in three of the four area assemblages, with only the North Shelter assemblage excepted. Of course, this possible deficiency could be made up by informal tool use or use of other materials for scraping, such as bone. Nevertheless, a much smaller proportion of the North Shelter assemblage is made up of scrapers in comparison with other area assemblages.

Bifaces are the second most common tool type, and are somewhat more proportionately distributed among proveniences. Bifaces make up 0.6 percent of the North Shelter assemblage, 0.8 percent of the North Talus assemblage, 0.8 percent of the South Shelter assemblage, and 0.6 percent of the South Talus assemblage. Choppers are also

Table 10.33. Non-point formal tool types, counts by site area assemblage.

	Chopper	**Drill**	**Graver**	**Scraper/ Graver**	**Uniface**	**End Scraper**	**Side Scraper**	**End/Side Scraper**	**Biface**	**Knife**	**Total**
North Shelter	–	–	–	–	–	–	1	1	4	–	**6**
North Talus	2	1	–	1	–	3	3	2	5	1	**18**
South Shelter	1	1	1	1	1	5	2	4	11	–	**27**
South Talus	8	–	–	–	–	3	5	–	5	–	**21**
Total	**11**	**2**	**1**	**2**	**1**	**11**	**11**	**7**	**25**	**1**	**72**

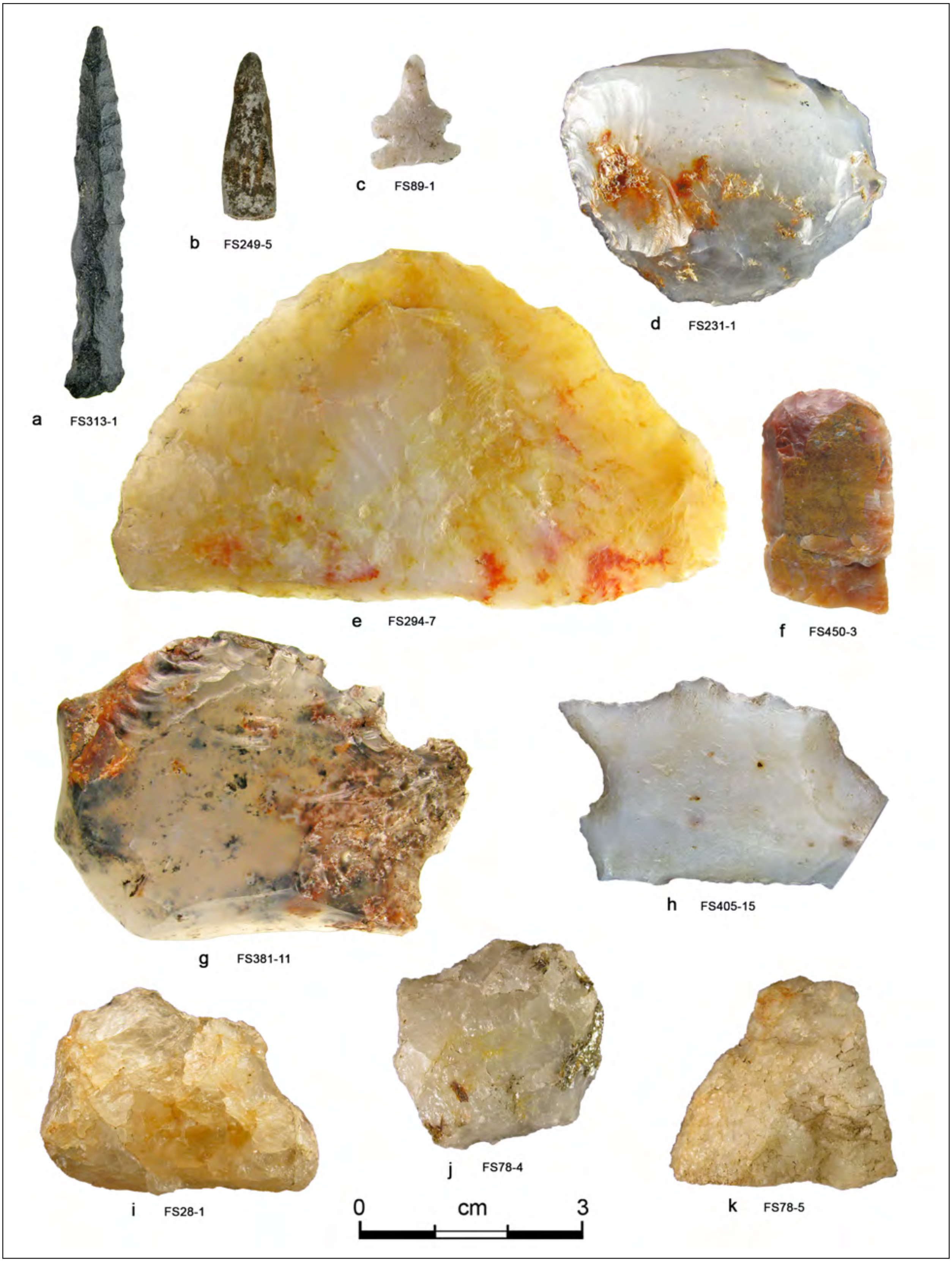

Figure 10.6. Examples of non-projectile tools: (a–b) drills; (c) projectile point reworked into drill, (d) end scraper; (e–f) end/side scrapers; (g) side scraper; (h) scraper-graver; (i–k) strike-a-light flints.

fairly common, but dominantly occur in the South Talus assemblage with none occurring in the North Shelter assemblage and only 1 or 2 in the other area assemblages. Other formal tool types are fairly rare, with none occurring in either the North Shelter or South Talus assemblages.

The formal chipped stone tools inventoried in Table 10.33 represent a variety of tasks. Scrapers were predominantly used to flesh and work hides, and considering the number of points found that were broken during use, the dominance of scrapers in Table 10.33 is no surprise. Bifaces either represent general-purpose tools or unfinished specialized tools. Most of these specimens (n = 17, 68 percent) are early stage tools, with middle stage tools accounting for most of the remainder (n = 6, 24 percent). Only 2 (8 percent) late stage tools occur. This suggests that most of the bifaces may represent blanks that were broken or abandoned for some reason before they were finished. Indeed, 11 of the 17 early stage bifaces are broken, as are 4 of the 6 middle stage bifaces and 1 of the 2 late stage bifaces. Twenty-two of the 25 bifaces were examined in more detail. At least four of the whole early stage bifaces were abandoned because of thinning problems, and a fifth was salvaged from an earlier site. One of the whole middle stage bifaces was also salvaged from an earlier site, but no good reason for abandonment was discernible for two other specimens, as was also the case for the only whole late stage biface. Except for a single early stage biface that was abandoned because of thinning problems, measurements for the whole bifaces fall within the parameters of arrow points, suggesting that most or all actually represent preforms that were not recognized as such during analysis. Thus, rather than finished general-purpose formal tools, the whole bifaces probably represent very early stage preforms that were discarded because of perceived flaking problems.

The single uniface is a medial fragment of a middle stage tool. While this specimen was not re-examined, its condition suggests that it was broken during manufacture and discarded rather than representing a finished general-purpose formal tool. The four remaining tools—two drills, a graver, and a knife–all appear to be finished tools. The drills and graver were probably used for working wood or bone. The knife would have been used as a general purpose cutting tool, suitable for processing a variety of materials.

Informal Tools

Informal tools are nodules, cores, and debitage that were used as tools without having their shapes or edge angles modified by purposeful flaking. An inventory of the types and number of informal tools from each site area is shown in Table 10.34. No informal tools were found in the Central Talus assemblage, and two-thirds of the informal tools were recovered from the South Talus assemblage. Informal tools are under-represented in the South Shelter assemblage (0.4 percent) and over-represented in the South Talus assemblage (4.8 percent). In contrast, this tool category makes up 1.0 percent of the North Shelter assemblage and 1.4 percent of the North Talus assemblage.

Utilized debitage are the most common type of informal tool identified, and dominate in all four area assemblages. Core tools are the next most common category, including specimens used as general-purpose tools, hammerstones, or choppers. Strike-a-light flints are also comparatively common, but only occur in the South Talus assemblage. Some of these tools are informal versions of types found in the formal tool assemblage, including various scrapers and a scraper-graver. The highest variety of informal tool types occurs in the South Talus

Table 10.34. Informal tool types, counts by site area assemblage.

	Utilized Debitage	Utilized Core	Hammer-stone	Core-chopper	Scraper/ Graver	Core-hammerstone	Strike-a-light Flint	End Scraper	End/Side Scraper	Total
North Shelter	2	–	1	–	–	1	–	–	–	**4**
North Talus	6	–	1	–	–	2	–	–	–	**9**
South Shelter	6	–	–	–	–	–	–	–	–	**6**
South Talus	21	1	1	6	1	2	5	1	1	**39**
Total	**35**	**1**	**3**	**6**	**1**	**5**	**5**	**1**	**1**	**58**

assemblage, with only a few hammerstones and core-hammerstones in addition to utilized debitage found elsewhere on the site.

Informal debitage tools are difficult to assign to any specific task unless they were sufficiently shaped by use, allowing a probable function to be defined. This is the case with the informal scrapers and scraper-graver, which are debitage that were shaped by use rather than purpose. Strike-a-light flints are different from other informal debitage tools, because they tend to possess distinct wear patterns and are often reshaped by use and have small metal adhesions along edges. Most informal debitage tools do not possess distinct shapes or wear patterns that would allow their functions to be more accurately classified.

These general informal debitage (and sometimes core) tools were identified by the presence of consistent wear patterns along one or more edges. Very conservative standards are applied when defining edge damage as evidence of use, since trampling, mechanical transport, and archaeological storage with other artifacts can cause scarring that could be mistaken for cultural wear. Only when scar patterns are consistent along an edge and the edge margin is regular (lacking deep scoops or projections) are artifacts categorized as informal debitage or core tools. Only specimens that exhibit extreme evidence of use tend to be identified as tools. This means that the presence of informal tools in an assemblage is only the tip of an iceberg—they indicate that debitage and/or cores were used as tools but do not allow quantification of the amount of that use. Varying percentages of informal tools are not indicators of the intensity of their use; rather, they show the amount of variation in our ability to recognize these tools. Thus, the more abundant informal debitage tools in the South Shelter assemblage only means that we recognized more examples of that kind of tool in that assemblage, not that their use was more common in that part of the site.

As use-wear experiments demonstrate, several factors contribute to consistent edge scarring, the most important of which is contact with hard materials (Vaughan 1985:22). However, nearly half of the edges used on hard materials and 80 percent of those used on medium-hard materials in Vaughan's (1985) experiments were not consistently scarred. These findings mirror experimental results reported by Schutt (1980), who found that consistent edge scarring only occurred when hard materials were contacted. Scarring also varies with the type of material used as a tool. Brittle materials like obsidian scar more easily than strong and tough materials like chert and basalt. Scars are also easier to define on glassy and fine-grained materials than on coarse-grained rocks. Foix and Bradley (1985) conducted experiments using rhyolite and found that evidence of wear was almost invisible, with coarse-grained varieties exhibiting more resistance to wear than fine-grained types. Thus, a much higher percentage of cherts and obsidians should evidence use as informal tools. These experiments also indicate that consistent scarring defined as cultural wear by our analysis probably only occurs when fairly hard materials are encountered by an edge. Thus, flakes used to cut soft materials like meat or vegetal matter probably would not be identified unless they were cut on an anvil or were used to cut or scrape bone. Wear patterns may not be identifiable on coarse-grained materials like rhyolite and quartzite, even if they were extensively used.

Our analysis tends to weakly support these conclusions. Sixty percent of the utilized debitage (informal tools that cannot be assigned to any specific task) are made from chert or silicified wood, and about 30 percent of the informal tools made from coarser-grained materials were used for pounding or chopping, tasks requiring more durable edges. However, 40 percent of the utilized debitage were made from coarser-grained materials, indicating that wear patterns can sometimes be discerned on this type of material.

The types of scars that occur can vary with the way in which a tool was used as well as the material on which it was used. Vaughan's (1985:20) experiments showed that cutting caused mostly bidirectional scarring (65 percent), though a significant number of specimens were scarred on only one surface (17 percent). Scraping or whittling produced bidirectional scarring in 46 percent of Vaughan's experiments, and unidirectional scarring in 54 percent. Thus, it is difficult to assign a specific function to these patterns. Similarly, rounding occurred during both cutting and scraping/whittling (Vaughan 1985:26). Robertson and Attenbrow (2008) summarize information on wear patterns from a variety of tasks, and note that rounding (at times extreme) can also be caused by working dry hides, especially by scraping, while abrasion is often indicative of wood-working.

While retouch could represent an attempt to resharpen an edge dulled by use, this is unlikely in most cases. Most informal tools were discarded and replaced when they dulled, because that required less effort than resharpening the dulled edge. Most retouch on informal tools was caused by use rather than intent. Retouching, as indicative of use-wear, tends to be less consistent and scars are generally shorter than those resulting from intentional retouch.

Table 10.35 presents information on the informal debitage tools including material type, wear pattern, edge angle, and presumed use. The latter is primarily based on edge angle measurements, since in most cases the type of scarring is essentially non-diagnostic. Schutt (1980) conducted experiments on the suitability of a range of edge angles for different tasks, and concludes that most edges in her experiments that measured over 40 degrees were poorly suited for cutting and were better for scraping. Thus, we assume that edge angles smaller than 40 degrees were best for cutting, while those larger than 40 degrees were better for scraping. Since this is an assumption, our conclusions must remain tentative, but represent a reasonable guess at the general type of use to which these tools were put. Cherts (including Tecovas chert and silicified wood) are most common, with 61.1 percent of the informal debitage tools being made from this material category. Surprisingly, no obsidian is included in this assemblage, and this is probably due to caution on the part of the analyst, since obsidian scars very easily. The 14 remaining specimens are all made from harder materials, suggesting they were heavily used in order to produce any evidence of use at all. Four possible functions are assigned based mainly on edge angle, with only one case assigned a function based on a distinctive wear pattern. Scraping was the most common use defined, with 24 specimens assigned to this use category. Cutting was the second most common function, with nine examples. One specimen apiece were assigned to the cutting/scraping and leather-working functions. The former case has two utilized edges that each may have been used for a different purpose, while the latter is the specimen that was assigned a more definite function based on wear pattern. The single utilized core exhibits a wear pattern and edge angle consistent with a scraping function.

The remaining informal tools have functions defined by a combination of wear patterns and edge attrition patterns. Hammerstones, including core-hammerstones, are the most common type, and were assigned to this function because of extreme battering on one or more facets. These tools were probably used for a variety of pounding purposes, including flintknapping, to break up bones, and perhaps for pulverizing vegetal materials. Core-choppers are also comparatively common, but they only occur in the South Talus assemblage. These tools were probably used to chop wood or bone, and possibly to pulverize vegetal materials. Like the formal choppers, the core-choppers only occur in the South Talus assemblage. Informal scrapers are fairly uncommon and only occur in the South Talus assemblage.

Strike-a-light flints were also only found in the South Talus assemblage, and represent a function and time period that are distinctly different from those of the other formal and informal tools from LA 139965. Strike-a-light flints were used in fire-making kits, and only occur after the Spanish colonized New Mexico. Thus, unlike the other chipped stone tools, the strike-a-light flints are indicative of a historic period use. Two strike-a-light flints are made from chert, and three are made from quartz; three occurred in the uppermost level of fill, with one apiece coming from Levels 2 and 3. Their distribution was rather scattered, and they were found in four different grid units. Since none of the other tools or debitage in the South Talus assemblage exhibit characteristics that would allow them to also be assigned to a Historic-period occupation, the strike-a-light flints and Spanish side-notched point may be the only chipped stone artifacts discarded during that use of the site. However, this is uncertain, and there is really no way in which to subdivide the assemblage into Historic and Prehistoric components. Therefore, we assume that the rest of the chipped stone assemblage was generated during multiple prehistoric occupations, but cannot substantiate this possibility.

Potential Activities Performed at LA 139965

Table 10.36 lists the potential activities indicated by the types of formal and informal tools recovered from LA 139965. Core reduction is indicated by the presence of numerous pieces of debitage and cores, which occurred in all assemblages except for

Table 10.35. Summary of wear patterns, edge angles, and projected use for informal tools from each site area assemblage.

	Material Type	Wear Pattern	Edge Angle	Wear Pattern 2	Edge Angle 2	Projected Use
North Shelter	Silicified wood	Unidirectional wear	43	–	–	Scraping
	Chert	Unidirectional wear	59	–	–	Scraping
North Talus	Chert	Unidirectional wear	51	Unidirectional wear	38	Scraping
	Chert	Unidirectional wear	43	–	–	Scraping
	Tecovas chert	Unidirectional wear	59	–	–	Scraping
	Silicified wood	Rounding/Bidirectional	46	–	–	Leather-working
	Silicified wood	Unidirectional wear	72	–	–	Scraping
	Chert	Unidirectional wear	52	–	–	Scraping
South Shelter	Metaquartzite	Unidirectional wear	65	–	–	Scraping
	Chert	Unidirectional wear	43	Unidirectional wear	26	Cutting/Scraping
	Quartz	Unidirectional wear	45	–	–	Scraping
	Chert	Unidirectional wear	32	–	–	Cutting
	Chert	Bidirectional wear	69	–	–	Scraping
	Chert	Unidirectional wear	17	–	–	Cutting
South Talus	Gray aphanitic rhyolite	Unidirectional wear	60	–	–	Scraping
	Basalt	Unidirectional wear	43	–	–	Scraping
	Basalt	Unidirectional wear	56	–	–	Scraping
	Metaquartzite	Unidirectional wear	61	–	–	Scraping
	Gray rhyolite	Unidirectional wear	65	–	–	Scraping
	Chert	Unidirectional wear	43	–	–	Scraping
	Gray rhyolite	Unidirectional wear	43	Unidirectional wear	35	Scraping
	Chert	Unidirectional wear	48	–	–	Scraping
	Chert	Unidirectional wear	47	–	–	Scraping
	Chert	Unidirectional wear	29	–	–	Cutting
	White metaquartzite	Bidirectional wear	36	–	–	Cutting
	Basalt	Unidirectional wear	33	–	–	Cutting
	Gray rhyolite	Unidirectional wear	39	–	–	Cutting
	Chert	Unidirectional wear	44	Unidirectional wear	63	Scraping
	Chert	Unidirectional wear	24	–	–	Cutting
	Chert	Unidirectional wear	30	–	–	Cutting
	White metaquartzite	Unidirectional wear	39	Unidirectional wear	43	Scraping
	Gray rhyolite	Unidirectional wear	64	Unidirectional wear	66	Scraping
	Chert	Unidirectional wear	54	–	–	Scraping
	Chert	Unidirectional wear	45	Unidirectional wear	39	Scraping
	Gray rhyolite	Unidirectional wear	29	–	–	Cutting

that from the Central Talus. Projectile point manufacture is defined by the presence of preforms that were broken in manufacture. Several potential activities are defined by the condition of projectile points. The presence of projectile points in a provenience is considered evidence of hunting, though warfare cannot be counted out. Arrow-shaft refurbishing is indicated by projectile point fragments that were broken during use and presumably returned to the site for removal from shafts and replacement with unbroken points. Meat processing is suggested by medial and distal point fragments exhibiting use-related breaks. That both of these activities occurred at LA 139965 is confirmed by the results of the protein residue analysis. Formal and informal scrapers are considered indicative of leather-working, while drills and gravers suggest that wood-working occurred, though bone-working is also possible. The presence of hammerstones and core hammerstones is evidence for general

Table 10.36. Potential activities reflected in chipped stone assemblages by site area.

Activity	North Shelter	North Talus	Central Talus	South Shelter	South Talus
Core Reduction	x	x	–	x	x
Projectile Point Manufacture	x	x	–	x	x
Arrow Shaft Refurbishing	x	x	–	x	x
Hunting	x	x	x	x	x
Meat Processing	x	x	–	x	x
Leather-Working	x	x	–	x	x
Wood-Working	–	x	–	x	–
General Pounding	x	x	–	–	x
General Chopping	–	–	–	–	x
General Scraping	x	x	–	x	x
General Cutting	–	x	–	x	x
Fire-Making	–	–	–	–	x
Total	**8**	**10**	**1**	**9**	**11**

pounding activities, while choppers and core-choppers indicate general chopping activities. Informal debitage tools are evidence of both general cutting and scraping. The single knife is also considered evidence for general cutting. Fire-making is demonstrated by the presence of strike-a-light flints.

Except for the Central Talus assemblage, which yielded only four chipped stone artifacts, each of the main area assemblages exhibit evidence for a wide range of activities, and in many cases the same general activities were accomplished in all four assemblages. Indeed, at least seven chipped stone–using activities were conducted in each of the four major area assemblages, and only two activities—general chopping and fire-making—were restricted to one assemblage—the South Talus. All four major area assemblages exhibit evidence for intensive hunting and related activities that include projectile point manufacture, shaft refurbishing, meat return and processing, and leather-working. Other, more general activities may also have been mostly focused on tasks related to hunting. While hammerstones can be used in flint knapping and choppers in wood-working, both tool types also be used to pound and break up bone. Since most of the bone recovered from the site was fragmentary (see Chapter 12), this type of use in addition to other more general pounding and chopping activities is likely. Evidence for cutting and scraping was also observed in the bone assemblage (see Chapter 12), and these tasks were probably accomplished using informal debitage tools as well as formal knives, of which we have one only example. Of course it should be remembered that the tools recovered from LA 139965 are those that were broken, abandoned during manufacture, lost, or tossed out as no longer useful. Many formal tools were probably carried away from the site when the various occupations ended.

Examining the Data for Meaning

Analysis of the reduction strategy indicators indicated a predominantly curated reduction strategy for the North Shelter, South Shelter, and South Talus assemblages as well as the site assemblage as a whole, with a mixed curated/expedient strategy for the North Talus assemblage. Yet, as noted earlier, there are really no large bifaces in this assemblage, and that tool type is expected to be an important component of a curated reduction strategy. This suggests that the reduction strategy duality expressed as curated versus expedient is too simplistic and is not indicative of the full range of variation in reduction strategies. Vierra and Dilley (2008:309) discuss the characterization of chipped stone reduction as a dichotomy between core reduction and bifacial tool production. They note that, while most types of rock can be used in a simple core-flake reduction strategy, higher quality materials are needed in biface manufacture, and the locations of suitable materials for this type of use are usually restricted on the landscape and often results in the use of non-local rocks. They also note that "[i]t is the foraging strategy—what you eat—and the foraging tactic—how you get it—that conditions the reduction strategy" (Vierra and Dilley 2008:310). This concept is important because it explains why we concluded that most parts of LA 139965 express a curated reduction strategy but lack the large bifaces that should accompany it.

The analysis of reduction strategy indicators presented earlier in this chapter is actually aimed at determining the prevalence of biface manufacture in an assemblage. Up to this point we have presumed that a reduction focus on biface manufacture represents curated behavior, but this does not always appear to be the case. A focus on biface manufacture can be indicative of a curated reduction strategy, as was concluded for the Paleoindian assemblages from the Spaceport America study (Moore 2014) as well as for two Late Archaic assemblages from the northern Rio Grande (Moore 2001, in prep. [a]). However, in cases where the manufacture of small specialized bifaces is a dominant activity, another type of reduction strategy may actually be indicated.

What has not yet been factored into this discussion are foraging strategy and foraging tactic. A curated strategy is focused on the production of large bifaces because the bands who tend to use this strategy are always on the move and large general purpose chipped stone tools are easier to carry than nodules or cores. By carrying this type of tool, high-quality tool stone can be made available in all circumstances when more specialized tools need to be replaced or very sharp flakes are needed for cutting. However, there are other instances in which large numbers of bifacial tools might be needed that do not include a focus on curated behavior. One of those possibilities is a hunting camp, where large numbers of small specialized bifaces (projectile points) are needed to replace those broken or otherwise expended in the hunt. These two variations in focus on biface manufacture also reflect differences in mobility and settlement systems.

Archaic peoples were generalized hunter-gatherers who were essentially always on the move, occupying a series of camps for varying lengths of time during the year. Most needed resources were obtained by foraging around the camp, extracting resources that were available within a range that could easily be covered in a day or less. Movement was in response to perceived resource deficiencies in the location where the band was currently residing, and new camps would be established in an area known to contain the desired resources either through prior knowledge or information supplied by other bands with whom there had been communication.

Hunting camps reflect a completely different strategy. This type of camp is a component of a sedentary settlement system in which a village was the main residence, with logistical camps established in various locations for specialized resource-extractive activities that could not be performed as part of daily circulation from the residential nexus. Curated behavior represents planning for non-specific future needs that could require new chipped stone tools, long-lived tools, or sharp flakes of high-quality stone for informal tool use (Kelly 1988). Large generalized bifaces fit all three of these requirements. Similar tools were not required in specialized hunting camps because the range of potential needs was much more limited. A hunting camp mostly required materials that could be used to replace broken equipment—mainly projectile points. The long, thin flakes that could be removed from large generalized bifaces are excellent informal cutting tools, but they are less satisfactory as blanks for small bifacial tools because of their thinness, making them difficult to modify into suitable small projectile points.

Thus, there are important differences between a hunter-gatherer foraging camp and a specialized hunting camp. The former is aimed at the extraction of generally needed resources from an area. Most of those resources will be consumed at a temporary base camp, and primarily tend to be food, medicinal plants, or other resources that can be used to repair, replace, or manufacture necessary equipment. If high-quality tool stone is locally available it might be collected and transformed into the large generalized bifaces that are commonly used in this type of settlement system. In contrast, a specialized hunting camp is focused on the procurement of meat and other animal products for transport to the main residential site, where they will be consumed. Replacements for broken equipment or tools needed to process carcasses will be made in a logistical camp of this type, and the high-quality tool stone needed for this purpose would most likely have been transported in as cores or flake blanks, unless locally available. While the assemblage from an Archaic hunter-gatherer camp should exhibit a wide range of activities aimed at general resource extraction, processing, and consumption, the assemblage from a specialized hunting camp should exhibit a more restricted range of activities, primarily focused on the extraction and processing of meat and animal parts. However, the reduction strategy in both cases may focus on biface manufacture, with core-flake reduction representing an important, but often not dominant, additional aspect of reduction at a site.

What our analysis has thus far established is that biface reduction predominates in three of the area assemblages and is a very important component in the fourth, with the Central Talus assemblage being excepted from this discussion because of its small sample size. We now need to establish the foraging strategy and tactics used in order to determine what the reduction strategy actually means. Considering the formal and informal tool analysis and the recovery of large amounts of highly fragmented bone from multiple species at LA 139965, it seems likely that the foraging strategy used there was aimed at the hunting of a variety of game animals, mainly focusing on deer. In many ways this strategy appears to be similar to a curated reduction strategy, but we also expect to find differences.

A true curated reduction strategy tends to accompany a hunter-gatherer lifestyle as was characteristic of the Paleoindian and Archaic periods. Groups were organized in bands and movement was constant, though some camps—especially winter camps—might be occupied for extended parts of a single season. During the ceramic period, most groups were organized into villages and residence was more permanent. Though villages might move every generation or two, or sooner if necessary, this represents a sedentary lifestyle. Groups might leave the village for extended periods to pursue specialized tasks such as hunting or trading, but they returned to the village when those tasks were completed, presumably with whatever resulted from their endeavors. By comparing the assemblages from LA 139965 with Paleoindian and Archaic assemblages that exhibit the use of a curated reduction strategy, we should be able to determine where the similarities and differences lie.

For comparison we use two Late Archaic workshop assemblages from the northern Rio Grande—LA 65006 near San Ildefonso Pueblo (Moore 2001) and LA 111333 near Tesuque Pueblo (Moore in prep. [a]), as well as three Paleoindian components including LA 111429, LA 155963, and LA 155968 from the Spaceport America study near Truth or Consequences (Moore 2014). Table 10.37 shows the reduction indicator values and the reduction strategy they suggest for all of these site components. When necessary, values were recalculated using the original data sets, and dividing points developed in the Spaceport America study (Moore 2014) were applied. The Archaic and Paleoindian components exhibit much higher percentages of manufacturing breaks, smaller percentages of whole flakes, higher percentages of lipped platforms, lower flake to angular debris ratios, and mostly much higher flake to core ratios. Are these differences meaningful? In general, these dissimilarities are attributable to the difference between making large and small bifaces. Large biface manufacture tends to produce flakes that are longer, thinner, and therefore more prone to break during removal. This is reflected in much larger percentages of manufacturing breaks, smaller percentages of whole flakes, and higher percentages of lipped platforms in the Archaic and Paleoindian components. The generally much higher flake to core ratios for the Archaic and Paleoindian components also supports this possibility. The reason for the much smaller flake to angular debris ratios in the Archaic and Paleoindian components versus those from LA 139965 is uncertain.

There are two ways in which to test this possibility: the sizes of bifaces and the lengths of biface flakes can be compared. As shown in Table 10.38, the average biface flake is longer in the Archaic and Paleoindian components, and percentages of whole biface flakes that are longer than 15 mm are considerably higher in most cases. Though the mean length of whole biface flakes in the Archaic and Paleoindian components may not seem to be that much higher than those from LA 139965, the thinness of biface flakes makes them prone to fracturing, with the likelihood that they will break increasing with length. As a test, mean lengths and number of specimens longer than 15 mm was computed for a single provenience from LA 111333 (Stratum 25) which represents an intense large biface manufacturing episode. In that case, the mean length of broken biface flakes is 10 mm, and 16.8 percent are longer than 15 mm. In contrast, the mean length of broken biface flakes from LA 139965 is 8.8 mm, and only 9.5 percent are longer than 15 mm. Perhaps more telling is the difference in percentages of whole biface flakes, which is 79.6 percent for LA 139965 and only 32.3 percent for the Archaic large biface workshop at LA 111333.

Table 10.37. Summary, reduction strategy indicators at LA 139965 compared to those from Archaic and Paleoindian components at five other sites.

Site	Component		Cort. to non-cort. flake ratio	% tertiary flakes	% biface flakes	% mod. plat.	% manu. breaks	% whole flakes	% lipped plat.[1]	% diffuse bulbs[1]	% oppos. dorsal scars[1]	Flake to ang. deb. ratio	Flake to core ratio	Core flake to biface flake ratio	% chert artifacts inten. heated	Score	Strategy
LA 139965	North Shelter	Value	0.13:1	88.4	12.7	13.1	5.0	63.9	22.5	79.2	13.1	53.8:1	29.1:1	6.8:1	24.3	0.615	C
		Strategy	C	C	C	E	E	E	C	C	C	C	E	C	E		
	North Talus	Value	0.16:1	86.2	7.7	16.2	2.9	59.8	13.4	80.4	6.4	19.3:1	17.3:1	12.0:1	31.5	0.539	M
		Strategy	C	C	E	E	E	E	E	C	C	C	E	C	C		
	South Shelter	Value	0.15:1	87.0	15.9	23.3	4.5	57.9	23.6	75.8	15.4	24.3:1	67.6:1	5.3:1	30.4	0.846	C
		Strategy	C	C	C	C	E	E	C	C	C	C	C	C	C		
	South Talus	Value	0.24:1	80.4	11.3	22.4	5.4	57.2	14.1	75.2	13.9	13.4:1	25.3:1	7.9:1	35.9	0.692	C
		Strategy	C	C	C	C	E	E	E	C	C	C	E	C	C		
	Whole Site	Value	0.17:1	85.6	12.8	20.0	4.6	59.2	19.4	77.2	13.1	19.3:1	31.9:1	6.8:1	30.3	0.769	C
		Strategy	C	C	C	C	E	E	C	C	C	C	E	C	C		
LA 111333	Archaic	Value	0.03:1	97.3	52.7	39.0	22.4	33.2	62.5	n/a	2.2	8.54:1	1,576.9:1	0.8:1	0.3	0.727	C
		Strategy	C	C	C	C	E	E	C	–	E	C	C	C	E		
LA 65006	Archaic	Value	0.07:1	93.2	66.1	63.8	66.9	32.9	53.3	n/a	20.6	12.4:1	2525.0:1	1.20:1	1.1	0.909	C
		Strategy	C	C	C	C	C	E	C	–	C	C	C	C	E		
LA 111429	Paleoindian	Value	0.07:1	93.6	13.7	21.9	39.9	16.0	30.6	52.4	4.7	4.6:1	180.3:1	7.7:1	35.0	0.923	C
		Strategy	C	C	C	C	C	C	C	C	C	E	C	C	C		
LA 155963	Paleoindian	Value	0.03:1	97.2	19.7	32.1	33.2	19.2	31.2	52.4	3.0	8.8:1	198.0:1	4.1:1	30.7	1.000	C
		Strategy	C	C	C	C	C	C	C	C	C	C	C	C	C		
LA 155968	Paleoindian	Value	0.14:1	87.7	16.9	25.4	47.6	17.5	38.0	50.3	3.1	7.1:1	36.1:1	5.3:1	65.5	0.846	C
		Strategy	C	C	C	C	C	C	C	C	E	C	E	C	C		

[1] Only specimens exhibiting this characteristic used in calculation.
C = curated strategy; E = expedient strategy; M = mixed strategy.

Table 10.38. Summary, dimension data for biface flakes and bifaces at LA 139965 compared to samples from Archaic and Paleoindian components at five other sites.

Site	Component	Biface Flake Lengths					Biface Size					
		n	Min. (mm)	Max. (mm)	Mean (mm)	% over 15 mm	n	Min. (mm)	Max. (mm)	Mean (mm)	% over 30 mm	% whole
LA 139965	North Shelter	39	4	21	7.6	10.3	36	6	48	14.1	5.6	30.6
	North Talus	28	5	52	13.8	25.0	42	6	32	14.2	4.8	23.8
	South Shelter	136	3	30	8.7	8.8	96	5	31	13.3	1.0	38.5
	South Talus	42	4	21	9.5	7.1	57	4	39	13.5	3.5	35.1
	Whole Site	245	3	52	9.2	6.9	231	4	48	13.7	3.0	33.8
LA 111333	Archaic	3499	3	47	11.4	22.3	36	3	37	15.7	8.3	0.0
LA 65006	Archaic	1172	3	64	17	51.2	15	6	46	20.4	40.0	0.0
LA 111429	Paleoindian	83	4	46	12.5	24.1	9	7	47	22.1	22.2	28.6
LA 155963	Paleoindian	77	5	34	10.6	19.5	14	11	30	20.4	7.1	14.3
LA 155968	Paleoindian	52	9	29	16.6	53.9	7	11	28	17.7	0.0	14.3

Turning to bifaces, the mean width of bifaces for the Archaic and Paleoindian components in Table 10.38 is greater than the mean for those in each provenience from LA 139965, and in most cases they are significantly wider. Since mean biface width was computed from all specimens available whether broken or whole, and there are mostly much lower percentages of whole bifaces from the Archaic and Paleoindian components, the difference in mean width is even more significant than the differences in mean biface flake length. Bifaces (whole and fragmentary) wider than 30 mm are also much more common in the Archaic and Paleoindian components.

These differences are indicative of variation in reduction focus. The two Archaic assemblages in Table 10.38 represent short-term residential locales where the manufacture of large bifaces was a focus of chipped stone reduction. The three Paleoindian components also represent short-term residential locales, but in those examples the manufacture of large bifacial tools was an important, but not dominant aspect of chipped stone reduction. The sheer number of finished and unfinished bifaces as well as the results of the reduction strategy indicator analysis show that the manufacture of small bifaces was a focus of chipped stone reduction at LA 139965. The Archaic and Paleoindian components reflect a focus on a curated reduction strategy, especially those from the two Archaic sites which are workshops where large bifaces were made. The LA 139965 assemblages are more indicative of a specialized reduction strategy, focused on the manufacture of arrow points. While the reduction strategy indicator analysis shows that there are many similarities between these two foci, subtle and not so subtle differences help point out the variation. The reduction strategy analysis is aimed at eliciting information on the amount of biface manufacture occurring in an assemblage, and is successful in doing so. However, the prevalent reduction strategy can only be determined when other types of information, including biface flake length and biface size, are taken into account. Rather than a simple duality of expedient or curated reduction, we find that a third category—specialized reduction—can occur.

A mixture of reduction strategies, or perhaps trajectories would be a better term, occurs in most assemblages from Developmental-period residential sites. Evidence for expedient core-flake reduction tends to be the dominant trajectory. However, there is usually also evidence for the production of small specialized bifaces, especially projectile points. Some large generalized bifaces may also have been made, reflecting a small dependence on curated reduction because Pueblo populations retained a degree of mobility, though decreased over the level reflected in Archaic and Paleoindian sites. In the case of LA 139965, specialized tool manufacture was one of the most important activities involving chipped stone reduction, with expedient core-flake reduction relegated to a somewhat lesser position. While there is little evidence for a true curated reduction strategy, the length of some biface flakes as well as the size of a few broken bifaces may indicate some reliance on that strategy as well.

Discussion

This analysis has closely examined many aspects of the assemblage, but what does the chipped stone analysis actually tell us about the occupation of LA 139965? First, when combined with the suite of radiocarbon dates recovered from the site, LA 139965 could have been used through the Developmental and Coalition periods and into the early Classic period. However, the ceramic assemblage suggests that the main use of LA 139965 was during the late Developmental and into the Coalition period, with some use during the Classic and early Developmental periods (Chapters 9, 16, 17). The presence of four En Medio points suggests there could also have been a Late Archaic occupation, and the occurrence of five strike-a-light flints and a probable Spanish side-notched point indicate a Historic-period occupation, probably in the nineteenth century, considering the results of the Euroamerican artifact analysis. This is a very long period of potential use. The four major assemblages may each represent amalgams of multiple occupations, though analysis has necessarily approached each as a single entity because artifacts could not be assigned to individual occupation levels. This may have smoothed distributions to the point that our analysis suggests the site was repeatedly used in only one way during the prehistoric period, when in fact multiple use patterns could have actually occurred. However, the apparent consistency of assemblages from area to area with only minor differences, as well as the consistently high numbers of fragmented animal bones recovered from each of the four major proveniences suggest that repeated use for one main function is indicated.

Considering the importance of projectile point manufacture in the main area assemblages and evidence for the return of broken points to the site for refurbishing or in carcasses, coupled with the results of the faunal analysis—which across the site indicates heavy exploitation of deer while also taking a variety of other wild species—we conclude that LA 139965 was repeatedly used as a specialized hunting camp during the prehistoric occupations. High percentages of lipped platforms, diffuse bulbs of percussion, and flake to angular debris ratios suggest careful reduction of cores using soft hammer percussion. This type of careful reduction may have had two aims—maximization of useable edges removed from cores, and the production of multiple blanks for potential manufacture into small specialized bifaces.

Non-local materials make up a large proportion of the LA 139965 assemblage (Table 10.3)—19 percent, ranging from 15.5 percent in the North Talus assemblage to 20.8 percent in the South Talus assemblage (and all four artifacts from the Central Talus). Most non-local materials originated in the Tewa Basin, Chama Basin, or Pajarito Plateau sections of the northern Rio Grande, including all varieties of obsidian and Pedernal chert. Madera chert might also have come from the same area, but it could also have originated in the Pecos area or along the Pecos River. Two of the rarest non-local materials—Narbona Pass chert (n = 1) and Zuni Spotted chert (n = 4) are from northwest New Mexico, and were probably obtained by trade with the Chacoan regional system. Tecovas chert could have been traded in from the south or southeast. Still, 18.8 percent of the materials used at LA 139965 originated in the northern Rio Grande, which is a substantial proportion and could indicate that site occupants also came from that region. However, the ceramic analysis argues against this possibility (C. Dean Wilson, personal communication, 2015). Much of the Developmental-period pottery recovered from LA 139965 is typical of the Taos Ceramic District, which is more widespread than the Taos archaeological district and seems to include areas on the east side of the Sangre de Cristo Mountains. At the very least, we can say that the people who used this site probably did not come from villages in the Tewa Basin, Chama Basin, or on the Pajarito Plateau. Thus, the most common non-local materials must have been obtained through trade with people who did live in those areas. Since only one of these three areas—the Tewa Basin—was occupied during the late Developmental period, trade with that area is most likely. The very high percentage of non-local materials that potentially originated in the Tewa Basin suggests either that ties with that area were fairly close, or that high-quality materials were specifically transported to the site for reduction and manufacture into formal tools, occurring in much higher percentages than would normally be the case.

An interesting aspect of the non-local materials from LA 139965 is that they essentially represent the same types of non-local materials identified during excavation of three Valdez-phase pithouse sites in the Pot Creek Valley near Taos (Moore 1994). Those sites—LA 2742, LA 3570, and LA 70577—contained an average of 21.5 percent imported Pedernal chert and obsidian, with percentages from individual sites of 11.9 percent, 20.4 percent, and 25.1 percent, respectively. Thus, what appears to be a very high percentage of non-local materials at LA 139965 is actually in line with percentages from some residential sites in the Taos area.

Analysis of the chipped stone assemblage indicates that LA 139965 most likely served as a repeatedly used specialized hunting camp where game was processed and replacement equipment manufactured and installed. Chipped stone reduction was focused on providing that equipment, mostly in the form of projectile points to replace those that were lost or broken during the hunt, as well as any other types of tools that might be necessary, such as implements for cutting and scraping. Both the ceramic analysis and the suite of radiocarbon dates suggest that the main period of use was during the late Developmental through the Coalition period, with at least one Classic-period occupation as well. Close trading ties existed with groups living in the Tewa Basin, similar to ties between Valdez-phase sites in the Taos area and the Tewa Basin. Based on the ceramic analysis (Chapter 9), the people using LA 139965 during the late Developmental period most likely did not live in a location with direct access to the non-local chipped stone materials in that assemblage, and undoubtedly acquired those materials through trade at a level similar to that of the Taos area.

Addressing the Research Questions

Three research questions were posed in the data recovery plan for this study (Akins et al. 2014). Each is summarized and then addressed with data obtained from this study.

Research Question 1

This question concerns the utility of using projectile points for the temporal placement of components lacking firm dates. A study of projectile points from mostly late Developmental-period sites in the Pojoaque Corridor between Santa Fe and Pojoaque Pueblo found that northern Rio Grande projectile point assemblages tend to be accumulative, with earlier styles continuing to co-exist with later styles, though often in lower percentages (Moore 2013, in prep. [b]). This is in contrast to the San Juan region, where one or two arrow point styles appear to dominate at a time. Thus, projectile point assemblages from the northern Rio Grande can be very difficult to place in a specific temporal framework using style alone. This is especially difficult at LA 139965, where there were no clear breaks between strata belonging to the various occupations. Six basic arrow point styles were used in the Pojoaque Corridor analysis, and only three of those types were found at LA 139965. This reduces the comparability between the two studies, so we need to look at the Pojoaque Corridor assemblage for basic trends that may be applicable to this study. Moore (2013) presents a synopsis of that analysis, and data from that discussion is used here. Stemmed arrow points were confined to the early Developmental period in the Pojoaque Corridor study, but that may have been due to a lack of this type in the late Developmental-period assemblages that were examined, because this type has been found in Coalition-period contexts. However, stemmed arrow points appear to have seen their greatest popularity during the early Developmental period, and may have been used much more infrequently after that period. In contrast, side-notched points appear early in the late Developmental period, and increase in popularity through that period. Corner-notched points were most popular in the early Developmental period and appear to have declined in popularity through the late Developmental period, but never really fell out of common use. Applying these trends to LA 139965, we can see evidence of temporal differences in the period of use for different parts of the site (Table 10.39).

Stemmed arrow points occur in most assemblages, but are most common in the northern assemblages, especially in the North Talus assemblage. Side-notched arrow points are dominant in the southern assemblages, especially in the South Shelter assemblage. This suggests that the main occupations in the northern part of the site were somewhat earlier than those in the southern part of the site.

Analysis of the projectile point assemblage also suggests that there was at least one Late Archaic-period use of the site, since four En Medio points were identified. These points occur in all assemblages except for the Central Talus, and were found at various excavation levels. All four specimens are proximal fragments that exhibit use-related breaks. As noted earlier, the likelihood that broken points would be salvaged from earlier sites for reuse is unlikely, suggesting that there was one or more Late Archaic occupations of LA 139965 that are not represented by firm dates in most assemblages.

The single point assigned to the Historic period was dated more by association than by style. Though that specimen fits the characteristics of the Spanish side-notched type (Moore in prep. [c]), those characteristics are also exhibited by expediently made Ceramic-period points. Had this point not been found in association with a deposit of sheep bone in a fairly discrete area, it would have simply been considered a crude prehistoric arrow point. Thus, this rather crude side-notched point is not an accurate temporal indicator in and of itself, and adds little to this discussion of chronology.

Projectile points, especially prehistoric points, can be used as chronological indicators, but only when exerting great care and taking the results with a grain of salt. This is especially true for the Ceramic period in the northern Rio Grande because of the accumulative nature of projectile point assemblages in that region. Percentages of certain projectile point styles may be temporally meaningful, but should also be balanced with any absolute dates and ceramic dates that are available. In this case, we can suggest that the main occupations of the northern and southern parts of the site occurred at slightly different times in the late Developmental period as well as adding a Late Archaic occupation that otherwise is not indicated. However, we must remember that data for each of the major sections of the site represent composites of what may have been multiple occupations. Thus, we can suggest these temporal trends, but cannot state them conclusively.

Research Question 2:
Ethnicity of site occupants?

This question was developed in the data recovery plan to help determine whether or not a Jicarilla Apache occupation is indicated for LA 139965, which was considered to be highly likely at the time the research design was written (Akins et al. 2014). Several characteristics of the chipped stone assemblage indicate a Pueblo ethnicity for site occupants rather than Athabaskan. Chipped stone artifacts considered potentially indicative of an Athabaskan occupation including Alibates chert, Athabaskan-style projectile points, Plains-style end scrapers, micro-cores, and elongated retouched flake knives do not occur in this assemblage. As discussed in the research design, this absence may be indicative of a Pueblo occupation, and that possibility is strengthened by the ceramic analysis, which found only Pueblo pottery types. Thus, we have concluded that the main occupations of LA 139965 can be ascribed to Pueblo groups using this location as a hunting camp, with no evidence for any long-term occupations being found.

The possibility of a Hispanic occupation was also discussed in the research design, and would be evidenced by the presence of certain diagnostic chipped stone tool types including strike-a-light flints and gunflints. While the latter did not occur at LA 139965, five strike-a-light flints were identified in the South Talus assemblage, indicating the presence of a Historic period, and probably Hispanic occupation. In addition to these tools, a projectile point of probable Hispanic manufacture was found in the North Talus assemblage. While there are other differences between the South Talus assemblage in particular and those from other parts of the site, the strike-a-light flints are the only tools that can definitely be assigned to a Historic-period component.

Table 10.39. Prehistoric arrow-point styles, percentages by site area assemblage.

Point Style	North Shelter	North Talus	Central Talus	South Shelter	South Talus
Small-stemmed arrow point	13.3	28.6	100.0	5.7	0.0
Corner-notched arrow point	53.3	35.7	0.0	31.4	42.1
Side-notched arrow point	33.3	35.7	0.0	62.9	57.9

Research Questions 3 and 4: Why was the site occupied and how did it function in its settlement system?

This question was extensively addressed by the chipped stone artifact analysis, and we concluded that LA 139965 served as a repeatedly occupied hunting camp for Pueblo groups whose villages were located elsewhere. Game animals were hunted from this site, and successful kills were returned there for processing. Broken hunting equipment was repaired and refurbished, and replacement projectile points were made there.

Other Questions

A few other questions were posed during this analysis that have not yet been fully addressed. For the most part, those questions revolve around the possibility that the shelter and talus assemblages represent somewhat different patterns of use. Another possibility that should be addressed is whether there are significant differences between area assemblages that might indicate variable patterns of use rather than a single, hunting-focused use as has been suggested.

Several characteristics of the chipped stone assemblages indicate that there was some variation in the activities reflected by the shelter versus the talus assemblages. Since materials in the shelters as well as on the talus may reflect discard rather than the actual occurrence of activity areas, the real differences in activities are between the areas where the trash was generated. In the case of the shelters, the actual activity areas could have been on the contemporary surface of the adjacent talus. The talus areas contain materials that were probably discarded during use of the adjacent shelters as well as materials moved to those locations by modern scraping and grading activities. Much sediment has also been removed from the talus areas during road construction activities, potentially skewing the content of samples from those parts of the site.

With these potential problems in mind, analysis shows that there are some differences in the artifact content of the various areas the site is divided into. The distributions of dorsal cortex percentages suggest that more early-stage core reduction occurred in the talus assemblages, while there was evidence for somewhat later-stage reduction in the shelter assemblages. Variance in cortical to non-cortical debitage ratios suggests the same differences. Smaller percentages of non-projectile point tools—both formal and informal—occur in the shelter assemblages than in the adjacent talus assemblages, and more activities were visible in talus assemblages than in those from the shelters. At the same time, examination of platform category distributions and flake category distributions suggest that adjacent shelter and talus assemblages represent single populations. Distributions of material categories are very similar for the North Shelter and Talus assemblages in most cases (Table 10.1), but differ significantly in many cases for the South Shelter and South Talus assemblages. When percentages of non-local materials are examined, the South Shelter and South Talus assemblages are very similar, while the North Talus and North Shelter assemblages are slightly different, as would be expected if some of the talus deposits were eroded down from the shelters.

Fairly close similarities between the North Shelter and North Talus assemblages for many variables suggest that the areas that generated those materials could have been used concurrently, mainly during the late Developmental period. While more early-stage core reduction and non-projectile point tool using activities are evidenced in the talus assemblage, the adjacent shelter assemblage demonstrates a heavier focus on late-stage reduction, probably mostly formal tool manufacture. While the same tendencies are also likely for the South Shelter and Talus assemblages, there is less supporting evidence for this possibility.

There are important distinctions between the South Shelter and adjacent South Talus assemblages which could indicate that both reflect different occupations, or that differences in use or number of occupations represented were more extreme between these assemblages than was apparent in the northern assemblages. The South Talus assemblage contains considerably more rhyolite than the South Shelter assemblage, chopping tools and strike-a-light flints only occur in the South Talus assemblage, and informal tools are much more common in the South Talus assemblage than in the South Shelter assemblage. The presence of strike-a-light flints in the South Talus assemblage and in no others is extremely important because it indicates a Historic-period occupation that is not otherwise well evidenced in the chipped stone assemblage. Since there are no real differences in most chipped stone debitage and tools produced during the Prehistoric and Historic periods, we have no idea what other artifacts might belong to that later occupation except possibly a single projectile point. Thus, there is a distinct possibility that unidentifiable Historic-period chipped stone artifacts in the South Talus assemblage have skewed distributions to the extent that the same similarities seen between the northern assemblages are no longer apparent in the southern assemblages. Unfortunately, there is no way to demonstrate this possibility, so it remains speculative.

While we cannot satisfactorily answer the question posed at the beginning of this section, we can suggest certain scenarios that fit the data, though not conclusively. As suggested earlier, there appears to be a temporal difference between the main periods of deposition of the northern and southern assemblages, based on distributions of projectile point types. The north assemblages may have been generated somewhat earlier in the late Developmental/ Coalition period, and the southern assemblages somewhat later in the same period. Evidence suggests that the North Shelter and North Talus assemblages were probably created concurrently during the same occupations, with some variation in the activities performed in each assemblage, but in degree more than substance. The South Shelter and South Talus assemblages may also have been generated concurrently during the same occupations, but the evidence for this is not as strong. The South Talus assemblage contains evidence for a Historic-period occupation that is not strongly reflected elsewhere in the chipped stone assemblage, but the degree to which that occupation affects chipped stone artifact distributions is questionable since only the five strike-a-light flints from that area can be assigned to this occupation with any degree of certainty. If chipped stone use during the Historic occupation in the South Talus assemblage was substantial, that component could be skewing distributions enough to mask similarities between the South Talus and the adjacent shelter assemblages. However, if this is not the case, then the differences between the southern assemblages are extreme enough to suggest that the South Talus assemblage contains the remains of one or more probable unique prehistoric occupations, altering the character of that assemblage enough that any close similarities to the South Shelter assemblage were erased.

The final possibility that should be considered is that the South Shelter and South Talus assemblages reflect concurrent use during the same occupations, with more extreme differences in how each of those assemblages are structured than is apparent in the northern assemblages. This is the least certain of the possibilities, because strong positive evidence in favor of this scenario just does not exist. Nevertheless, it must be considered because it is possible, though not strongly indicated.

Conclusions

Perhaps the most important conclusion made during the chipped stone analysis is that LA 139965 mainly served as a hunting camp on multiple occasions for people from Pueblo villages that were probably located a good distance from the site, but somewhere within the Taos Ceramic District (Research Questions 2, 3, and 4). Most of those uses may have been during the late Developmental through the Coalition period, though there is also ceramic evidence for a Classic-period occupation and radiocarbon dates suggest that there could have been uses during the early Developmental period as well. However, use during the latter two periods was probably less intensive and cannot be distinguished by the chipped stone data. There was also at least one occupation during the Late Archaic period, but the only good evidence for this occupation are four En Medio points that were broken during use and apparently discarded when the shafts to which they were attached were refurbished. A fourth period of occupation is the Historic period, represented by five strike-a-light flints in the South Talus assemblage and a projectile point in the North Talus assemblage. Not enough evidence can be derived from the chipped stone analysis to allow us to determine how the site was used during the Late Archaic and Historic periods. We found that the projectile point assemblage had limited utility for providing dates, but that some differences in styles of notching elements suggest that the north assemblages may date to a somewhat earlier period than the south assemblages (Research Question 1).

Residue analysis on a sample of projectile points confirm they were used for hunting, with rabbit, deer, and pronghorn protein found on several points. The pronghorn residue was on an En Medio point dating to the Late Archaic period, otherwise positive residue results were on Pueblo-period points. Two points also tested positive for human protein, in one case in addition to deer protein. While it is possible that the human protein is evidence of conflict, hunting or manufacturing accidents are the more likely source.

Analysis of the reduction strategy used at LA 139965 led to the conclusion that the dichotomy between curated and expedient reduction strategies was inadequate for describing the strategy used at this site. Instead, we determined that reduction at LA 139965 was related to a specialized hunting focus, characterized by large numbers of preforms discarded during manufacture, broken points, and whole points. The character of the debitage assemblage was very similar to that of a curated reduction strategy, except that evidence for the manufacture and use of large generalized bifaces—diagnostic of a truly curated strategy—is absent. Thus, many debitage assemblage characteristics are similar to those of Archaic sites where large biface manufacture was a focus, but other characteristics differ in critical ways. LA 139965 was a multi-occupational camp where game was not only hunted and processed, but needed replacement tools were manufactured in fairly large numbers.

Internal use patterns for the site were difficult to discern, owing to the lack of definable strata indicative of individual occupations. While all parts of the site exhibit the same overall function as a hunting camp, there are important differences between the major proveniences that suggest some differential use. While the North Shelter and North Talus assemblages appear to represent concurrent use during the main occupations represented in those areas, there were some differences in the types of use represented, with more early stage reduction and more tool use occurring in the North Talus assemblage, and perhaps more formal tool manufacture in the shelter assemblage. This was not necessarily the same for the South Shelter and South Talus assemblages, with greater variation observed between those assemblages that could be indicative of differences in use. Some of those differences may be attributable to a Historic-period occupation that was only found in the South Talus assemblage, but this is uncertain.

The types of non-local materials identified at LA 139965 indicate close ties with the Tewa Basin, and more attenuated ties with the Chacoan regional system in northwestern New Mexico. Evidence for ties with the Tewa Basin includes the presence of Pedernal chert and obsidian from the Jemez Mountains. These materials occur in all four major area assemblages and are only absent from the very small Central Talus assemblage. There is an interesting difference in obsidian source patterns between the northern and southern assemblages, with Valles Rhyolite and Cerro Toledo obsidians occurring in much greater percentages in the northern assemblages and El Rechuelos obsidian dominating the southern assemblages (Table 10.4). What this pattern means is unclear, but it suggests a variation in trade contacts with the Tewa Basin between the earlier occupation in the northern assemblages and the later occupation in the southern assemblages. Another difference is that evidence for trade with the Chacoan regional system only occurs in the southern assemblages. Thus, trade patterns either changed through time, or the earlier and later occupants of the site were different peoples with different trade ties.

Despite the lack of internal stratigraphy permitting the definition of distinct occupational horizons, the chipped stone artifact analysis provided considerable information on the occupation of this site. We can suggest that at least two main occupations are represented, both occurring during the late Developmental/Coalition period and in different parts of the site. These occupations probably created most of the chipped stone artifacts at the site. Those occupations probably represent multiple uses over time rather than a single, discrete use. More minor occupations—at least as far at the chipped stone assemblage is concerned—occurred during the Late Archaic, Coalition, Classic, and Historic periods. Except for the Historic-period occupation, the site was probably used as a specialized hunting camp. This can be considered certain for the late Developmental/Coalition-period occupations and probable for the other prehistoric uses.

11 Ground Stone and Ornaments

Karen Wening

Ground Stone

The ground stone assemblage from LA 139965 totals 103 tools consisting of manos (n = 38), metates (n = 11), abraders (n = 24), polishing tools (n = 6), hammerstones (n = 8), manuports (n = 2), miscellaneous items (n = 2), and indeterminate fragments (n = 13). Most of these tool categories contain subgroups. Manos are subdivided into one hand (n = 25), two hand (n = 3), and fragments (n = 10). Metates are represented by basin (n = 2), slab (n = 2), and unspecified fragments (n = 7). The abrader category contains smooth abraders (n = 15) and coarse abraders (n = 9). Manuports consist of a stone ball and an elongated cobble; the miscellaneous item is an unusually shaped, sooted cobble of indeterminate function.

Several factors affect the integrity of the ground stone assemblage. The site is located along a road through Coyote Canyon that has been in use for at least a few generations according to local residents, and has no doubt lured people upslope for a number of reasons. This has likely led to amateur collection, which affects the size and nature of the assemblage. Also, some of the fill was bulldozed up onto the slope during the construction of NM 434, which would have displaced artifacts within and downslope from the site's North Shelter and South Shelter. Portions of Stratum 3 were removed during construction, along with the artifacts within it (Akins and Boyer 2015:15). Construction activities have removed or altered the position of talus boulders as well, some of which may have been pressed into service for metates or mortars. One such metate was recovered from the South Shelter. About 18 percent of the ground stone assemblage was fire-cracked. Since many ground stone tools are fire-cracked (n = 46; 45 percent), it stands to reason that some of the other fire-cracked rocks may be unrecognizable portions of tools.

Several strong trends are evident in the ground stone tool assemblage from LA 139965. Perhaps the most prominent is the multifunctional nature of the manos and metates, which appear to be designed to process a variety of materials in small quantities. One-hand manos and basin/slab metates are by far the most numerous, but within this morphologically similar group, a diverse array of wear patterns is represented, as is a range of material asperity, both attributes indicating some degree of functional specialization.

Across the entire assemblage, very few tool types are present. Preparation and maintenance of tool use surfaces also indicate that a range of abrasive qualities were preferred. Surface rejuvenation is consistently present in some tool groups and virtually absent in others. Ground stone use surfaces are sometimes carefully prepared while others simply employ the unmodified cortex—both factors that suggest functional diversity within a fairly morphologically uniform group of tools.

Most of the stone procured for ground stone tools was close at hand. The olivine basalt that formed the overhang of the rockshelter was a primary source, as were alluvial gravels from nearby Coyote Creek and the Precambrian quartzite of the Rincon Range (Baltz and O'Neill 1990:69,75) above the shelter. Conspicuously missing is the red scoria material that forms the floor and rear of the shelter; it was probably deemed too soft and degraded for grinding tools. Pollen, starch, and phytolith analysis of 21 tools yielded an impressive array of wild plant remains and also muscle fiber, indicating meat processing. Dried seed corn was probably ground as well, though no evidence was found on ground stone tools.

Spatially, the southern area of the site yielded the most ground stone, which was fairly evenly distributed between the South Shelter and the South Talus. In the northern area, ground stone was far more likely to be provenienced in the North Talus rather than the North Shelter. Viewing the site as a whole, ground stone counts were slightly higher in the North Talus and South Talus locations as opposed to the North Shelter and South Shelter. The paucity of ground stone inside the North Shelter could owe to the impracticality of working in a shelter with a low ceiling. This in turn could indicate that the North Shelter served only for tool storage, and that activities involving ground stone in the northern site area were instead focused on the comparatively open North Talus area. However, the idea that the North Talus may have been used for ground stone–related tasks is conjecture only, since disturbance of both the North Talus and South Talus slopes during road construction removed all artifacts from their primary context, precluding any discussion of ground stone activity areas outside the shelters. Road construction-related redeposition of rock, fill, and artifacts from the base of the North Talus and South Talus to higher points at the edge of their respective shelters may have affected the shelter assemblages as well.

Two ground stone artifacts originated from dated fill levels, a mano fragment from the North Shelter was in the same level as a sample dating from AD 894–1018 AD, as was a manuport in the same level as a sediment sample dating from AD 1256–1306 (Chapter 16).

Ground Stone Analysis Methods

The OAS *Standardized Ground Stone Artifact Analysis* manual was employed for the ground stone assemblage (OAS 1994) with some modifications and additions. New attributes are based on Adams's studies (1999, 2002, 2010), and are primarily concerned with use-surface morphology and wear. Adams's ground stone terminology is also heavily employed.

All artifacts are analyzed for material type, texture and induration, function, condition, raw material form, production input, plan shape, transverse and longitudinal cross-section shapes, shaping methods, number of functions, number of wear surfaces/edges, heat exposure, adhesions, use of cortical surface, artifact dimensions, and weight. Each tool can be analyzed for up to three distinct functions on the analysis sheet.

Several attributes focus specifically on the use-surface. Each wear surface is analyzed for contour, stroke, macroscopic and microscopic wear patterns, and degree of use. These are further defined in analysis results. These attributes figure significantly in determining tool configuration, which in turn defines processing strategies used at the site. Wear patterns, in particular, have great information potential. The contour of the wear surface can inform on the stroke used to manipulate the tool, the type of companion tool used, multiple functions, motor habits, and degree of use (Adams 1993, 1999; Adams 2002:41–42, 98–114). Micro- and macroscopic wear type and location can distinguish artifacts that appear to have identical functions (Adams 1988, 2002, 2010). The LA 139965 ground stone analysis is designed with these factors in mind, with the goal of determining artifact function(s) as accurately as possible. Wear pattern analysis also greatly enhances the identification of multifunctional tools.

Ground Stone Material Types and Selection

Seven broad material-type categories are defined for the ground stone assemblage (Table 11.1). In descending order of frequency, these are: orthoquartzite, micaceous schist, basalt, metaquartzite, sandstone, quartz, and mudstone. The materials are discussed below in order of their abrasive quality, from highest (orthoquartzite) to lowest (mudstone). Subtypes within these categories are defined by color and grain size. Two primary sources for tool stone could not be more proximate: the site itself, which is olivine basalt, and the alluvial gravels of Coyote Creek, which are replete with cobbles of micaceous schist, sandstone, vesicular basalt, and metaquartzite. Above the shelter in the Rincon Range, orthoquartzite cobbles on the surface would have provided a ready source for such materials.

Orthoquartzite (n = 31). This sedimentary rock was the most common material type. Virtually all of the LA 139965 specimens were very well indurated, fine- to medium-grained stone. Though indi-

Table 11.1. Ground stone tool type counts by material type; entire site.

Tool Type	Sandstone	Ortho-quartzite	Micaceous schist	Basalt	Mudstone	Meta-quartzite	Quartz	Total
Manos	3	20	10	2	–	3	–	**38**
Abraders	1	6	9	3	–	5	–	**24**
Polishing tools	–	–	–	3	1	2	–	**6**
Metates	6	1	2	2	–	–	–	**11**
Hammerstones	–	–	1	1	–	1	5	**8**
Manuports	–	–	1	–	–	1	–	**2**
Miscellaneous	–	–	1	–	–	–	–	**1**
Indeterminate	–	4	3	4	–	2	–	**13**
Total	**10**	**31**	**27**	**15**	**1**	**14**	**5**	**103**

vidual grains were clearly defined microscopically, the material is well cemented with silica and durable, and probably produced very little grit during grinding. White (n = 29) and brown (n = 2) colors were present. Many had been exposed to heat, which reddened or blackened the stone over much of the surface area. The true color of the stone could be determined inside heat fractures or in small, unburned areas. All tools of this material were produced from cobbles where raw material could be determined. These were probably procured from Coyote Canyon gravels, which contain a variety of materials derived from the Ocate volcanic field upstream (Baltz and O'Neill 1990:73), as well as from the older metamorphic and sedimentary deposits of the Sandia Formation, Madera Group, and Sangre de Cristo Formation (McLemore 1999:19–20). Most manos were produced from this material, which was rarely used for tools other than handstones.

Micaceous Schist (n = 27). The micaceous schist from the site may be identical to what McLemore (1999:19–20) refers to as pelitic schist, a metamorphic rock that characteristically contains muscovite mica (Grambling 1990:208). Pelitic schist is one of several metamorphic rocks that outcrop in the Vadito and Hondo Groups in the Rincon Range (McLemore 1999:19–20) west of the site. Eroded boulders and pebbles of this material are found in alluvial gravels in Coyote Creek State Park (a short distance south of the site) and were frequently observed in creek gravels during fieldwork. All tools of this material were in cobble form, suggesting they were obtained from this secondary alluvial source. The unmodified cortex of this material is only moderately abrasive due to its platy mineral constituents. Rejuvenated surfaces are more abrasive.

Basalt (n = 15). Olivine basalt is perhaps the most ubiquitous material in the project area. It is immediately available in almost unlimited quantity from the rockshelter itself and in the basalt flows that are exposed along Guadalupita Canyon. Coyote Creek gravels contain vesicular basalt cobbles in a variety of colors including black, gray, dark red, and brown. McLemore (1999:20) describes the basalt from the eastern side of Guadalupita Canyon as black, fine grained, and vesicular, and consisting of olivine, clinopyroxene, augite, plagioclase, magnetite, and rare biotite, and quartz. Olivine basalt is from the Ocate volcanic field, which was formed by a series of eruptions over several million years. Most of the basalt in the ground stone assemblage is fine grained and contains only sporadic vesicles (n = 14). Though vesicular basalt cobbles were available in Coyote Creek gravels, they are rare in the ground stone assemblage (n = 1).

Metaquartzite (n = 14). Metaquartzite is also plentiful in the project area. It is present only in cobble form at LA 139965, indicating that it was probably obtained from Coyote Creek gravels. Metaquartzite outcrops sporadically in Guadalupita Canyon along NM 434 in the Hondo Group of the Ortega formation, the primary source from which the cobbles derive, where it occurs in beds up to 900 m thick (McLemore 1999:19–20; Grambling 1990:208). Within the assemblage, metaquartzite is nearly equally distributed among pink, white, gray, tan, and red colors. Ground stone tools of metaquartzite are utilized exclusively on unrejuvenated, smooth cortical surfaces, indicating that it was selected for its low abrasion quality as well as durability.

Sandstone (n = 10). Sandstone materials are less abundant than others in the assemblage. Most are fine grained, but coarser-grained sandstones are also present. White and brown are the only colors represented, neither of which are included in descriptions of sandstone outcrops in the area. Sandstone deposits are among the earliest in the vicinity, outcropping minimally along the east side of Guadalupita Canyon, referred to as La Mesa, in the Sangre de Cristo and Sandia formations (McLemore 1999:20). Sandstone materials eroding from this deposit are found in Coyote Creek. However, only gray sandstone occurs in this deposit, along with gray to brown siltstone (McLemore 1999:20). O'Neill and Mehnert (1988:A10) note that Glorieta sandstone is exposed in the north central area of La Mesa, which Baars (1974:168) describes as "usually white."

Quartz (n = 5). All quartz artifacts occur as cobbles, which likely pinpoints their source in Coyote Creek gravels or in the Rincon Range bordering the west side of the rockshelter. Quartz is one of the most common rocks of the Vadito Group of the Rincon Range, which borders the site to the west (Grambling 1990:207).

Mudstone (n = 1). Mudstone likely derives from the Pennsylvanian- to Permian-aged sedimentary deposits in the La Mesa area bordering Coyote Creek. This sedimentary outcrop is the oldest in Coyote Creek Canyon (McLemore 1999:20). It consists of gray limestone marine beds layered with sandstone, siltstone, and shale. This marine source is the most likely for sedimentary rocks in the project area, though mudstone is not specifically mentioned.

Material Selection Summary

Some general trends in ground stone material selection are evident. Perhaps the most obvious is the uniform choice of local materials. While the use of rocks immediately at hand for large, heavy tools is not surprising, several types seem to have been singled out from the large variety available. Since an array of tool stone occurs between the cliff, clifftop, and creek, it would probably be safe to assume that materials were chosen for quality rather than convenience. For example, vesicular basalt cobbles are plentiful and easily obtained from Coyote Creek, yet they are rarely used for ground stone. Sandstone cobbles are also present in the creek, but comprise less than 10 percent of the assemblage. Basalt, which could not be more proximate, accounts for less than 15 percent of the assemblage. Instead, orthoquartzite and micaceous schist appear to be the materials of choice, which together make up 58 percent of the entire assemblage. While fresh breaks of these two materials are not identically abrasive, their use surfaces have similar qualities due to the degree to which they have been rejuvenated and whether or not the cortex was used. This suggests a preference for, or even the preparation of, low-abrasion surfaces for most processing tasks since this characteristic is common to most tools in the assemblage. This varies somewhat among tool groups, but is generally true of most ground stone from the site, which will be addressed further below.

Ground Stone Assemblage

Excavation yielded a significant number of tools that shed light on the type of food processing and other tasks that occurred at the site. The handstone group consists of 68 artifacts, which include manos (n = 38), abraders (n = 24), unspecified handstones (n = 3), and polishing tools (n = 6). The mano group is subdivided into one-hand manos (n = 25; two of which are preforms), two-hand manos (n = 3), unspecified small handstones (n = 3), and mano fragments (n = 8). The netherstone category consists of metates only (n = 11). Hammerstones (n = 8), manuports (n = 2), miscellaneous items (n = 1), and indeterminate fragments (n = 13) comprise the remainder.

One-Hand Manos (n = 25)

One-hand manos are by far the most numerous ground stone type at LA 139965. Cobbles were overwhelmingly chosen for these tools whether they were shaped or unmodified. Materials are distributed among orthoquartzite (n = 14), micaceous schist (n = 7), metaquartzite (n = 2), basalt (n = 1), and sandstone (n = 1). About half are completely unmodified and simply ground on the cortical surface (n = 12). Six display little shaping modification, including the preforms, and seven are fully or mostly shaped. Those that are fully shaped tend to be consistently pecked around the perimeter, but less often on the potential use surfaces, the latter being one of several indications that low-abrasion surfaces were preferred. Those that are only slightly shaped are modified using a single method, such as flaking, rather than a combination. These are generally more crudely formed, including the two preforms. Oval or circular forms are the most common, though rectangular and triangular forms are present.

Six one-hand manos had microbotanical remains on their use surfaces. The combined remains on manos consist of grass, sedge, sage, sunflower, goosefoot, buckwheat, cattail, and possibly ephedra (Figs. 11.1–11.2, Table 11.2). Greasewood, used for fuel, was also found on one mano. The wear surfaces on these tools varied considerably and may reflect different processing methods for single materials, particularly grass. This is discussed further below.

Though several characteristics are shared among these tools, some important contrasts suggest that one-hand manos are not functionally identical. Their shared morphological traits at first glance imply that they are a fairly uniform group in terms of their role at the site. However, wear patterns are quite diverse and reveal a much more complex use-profile for these tools (Fig. 11.3). Wear patterns run the gamut from pitting, battering, and deep scratches to polish and fine striations. Even more intriguing, unexpected combinations of these exist on single tools, such as deep scratches and polish. Other wear pattern combinations appear more suitably paired, such as deep scratches and pitting.

Most tools display fine striations on the use surface, indicating the direction of the stroke, but these too vary in pattern and orientation. Linear striations are the most common and denote a reciprocal stroke. However, these are sometimes crisscrossed or underlain with patches of random striations, suggesting the tool may have been used not only in various ways for a certain task, but also in an array of tasks within its lifetime. A one-hand mano created and expended for a single purpose appears to be an anomaly at LA 139965.

Some tools display two sets of linear striations that run perpendicular to one another, indicating that the mano was rotated 90 degrees for one or more tasks. Other tools display linear striations angled to the width. Still other tools match the stereotypical notion of the so-called "biscuit" mano: two finely ground opposing surfaces, both of which are finely striated parallel to the width. To summarize wear, layers of differential wear typify some tools, others display discrete wear in multiple locations, and some have identically worn surfaces with no indication of ancillary functions.

Heavily used surfaces are equal to those with moderate use (39 percent for each), though the surfaces of nearly one-quarter (22 percent) of all one-hand manos exhibit evidence of light use only. Wear surfaces tend to be biconvex, though flat contours figure prominently as well (Fig. 11.4.). Biconvex surfaces indicate a rocking stroke, which may provide more control, as lifting the proximal edge brings grain or seed back to the user on the downward stroke (Adams 2002:114). Biconvex surfaces are also the most heavily worn. Of particular note among well-worn tools is a near-complete absence of rejuvenation (n = 39; 95 percent). This is true of surfaces that were initially pecked to shape as well as cortical surfaces, indicating that abrasive textures were generally undesirable, at least for this tool type.

The list of shared traits among one-hand manos is a shorter one. The most obvious is small size, the length of which does not exceed 14 cm for whole tools (Fig. 11.5a]. Some size difference exists among material types, with orthoquartzite the largest and metaquartzite the smallest; but the small sample size of 10 whole tools may skew this (Fig. 11.5b). Since most tools are either unshaped or minimally shaped, the size difference between material types may be a direct result of raw material size. However, it is tempting to suggest that the sheer ubiquity of tool stone in the project area would permit selection of raw material based on virtually any combination of traits, though simple convenience may have figured prominently as well. Interestingly, orthoquartzite tends to be not only the largest, but the most heavily worn material, which could be related to its durability, versatility, effectiveness in a particular task, or all three.

Most one-hand manos are broken (n = 15) and most have been exposed to heat (n = 16), but not all of these tools exposed to heat are broken. Five whole tools were reddened, sooted, or riddled with heat-induced cracks, but were not actually broken. This is interesting to consider in view of the multi-

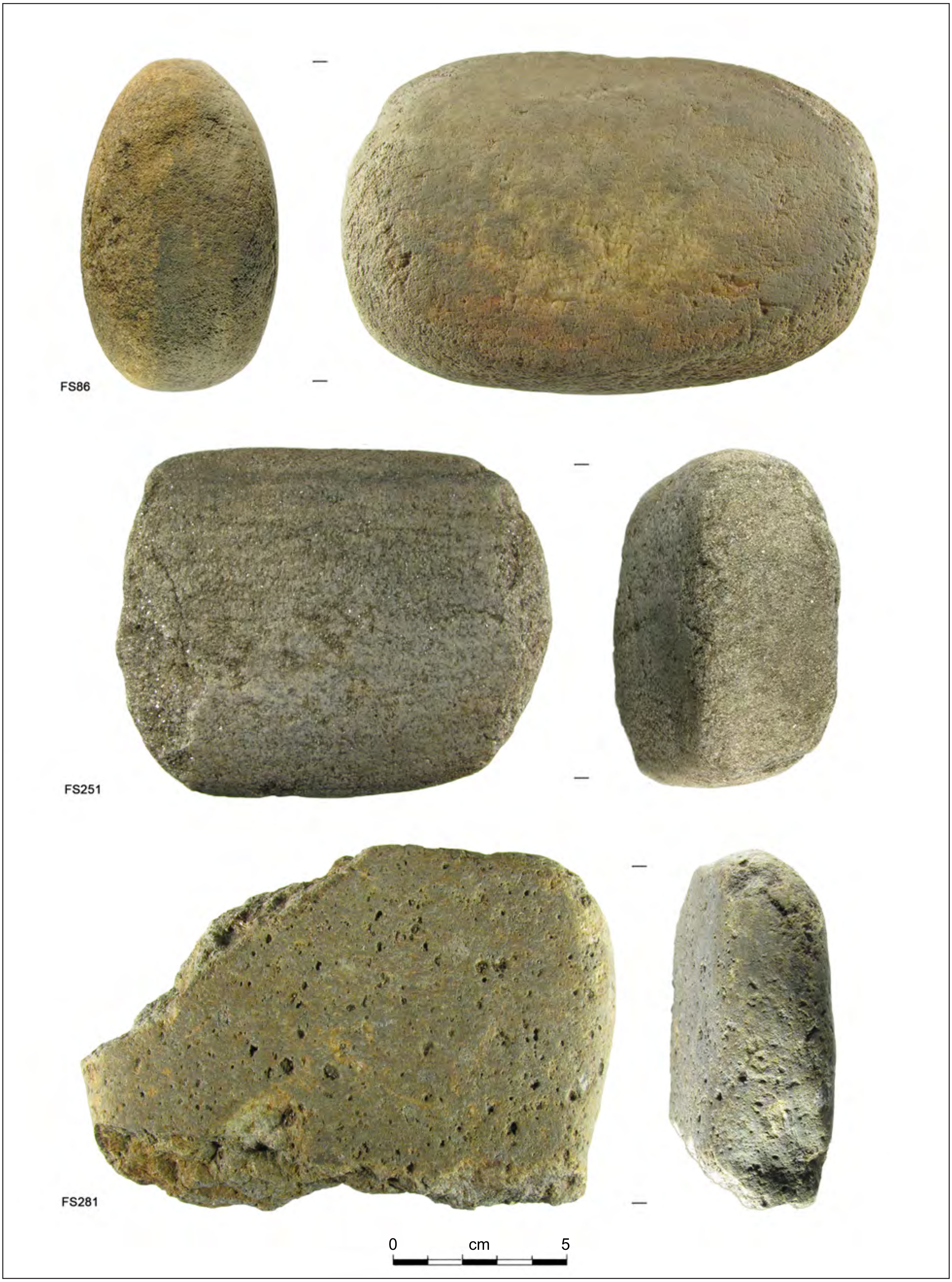

Figure 11.1. One-hand manos (FS 86, 251, 281), plan and cross-section views.

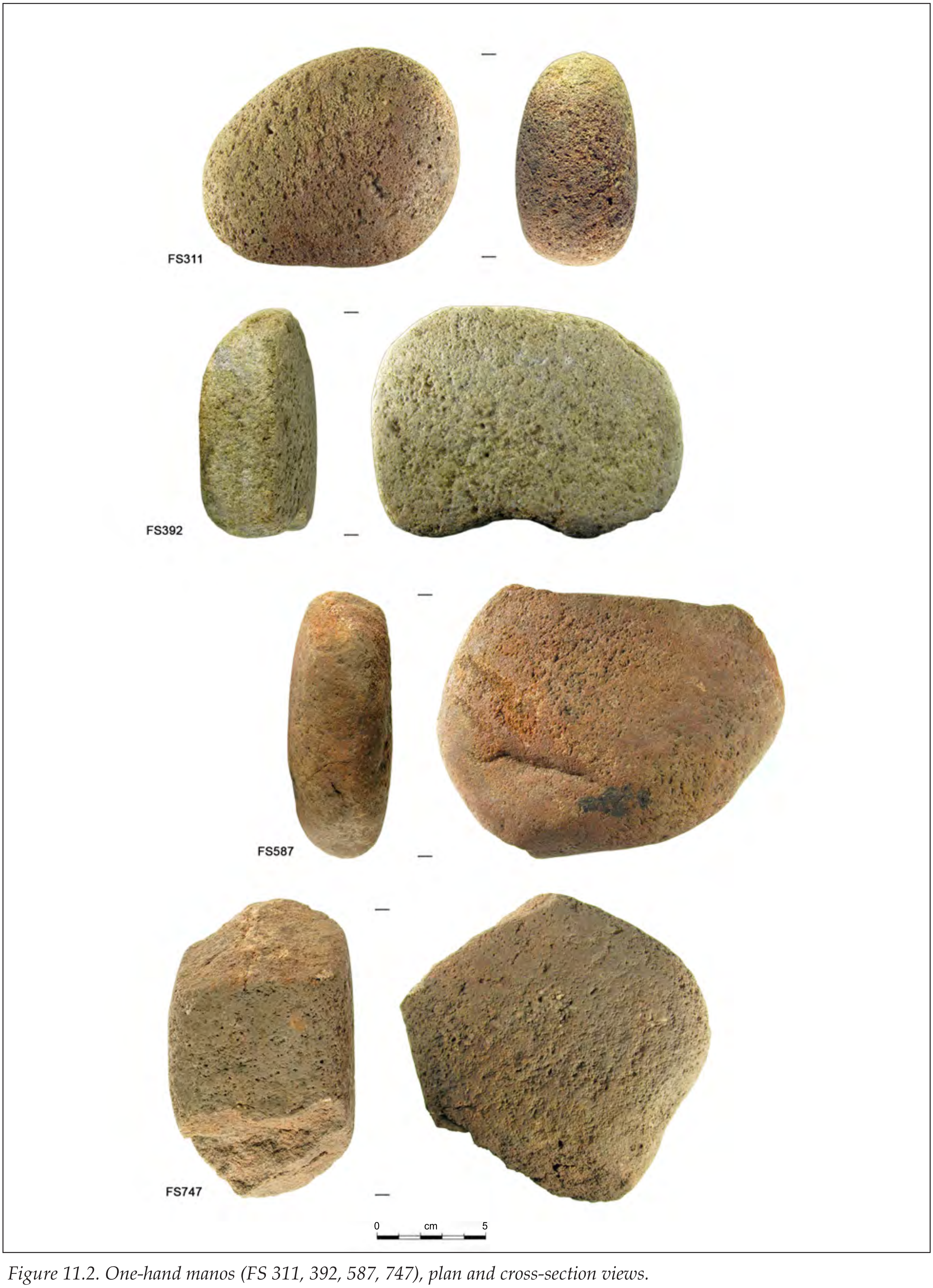

Figure 11.2. One-hand manos (FS 311, 392, 587, 747), plan and cross-section views.

Table 11.2. Summary, ground stone tools by FS no. (entire site), with respective material type, microbotanical remains, and wear detail.

FS No.	Tool type	Material type	Surface botanicals	Wear in addition to grinding and striation*
65	One-hand mano	White sandstone	goosefoot**, sunflower, wild buckwheat, cattail	–
86	One-hand mano	Micaceous schist	grass**, sedge	polish
251	One-hand mano	Micaceous schist	greasewood, grass, possible ephedra	battering
392	One-hand mano	Orthoquartzite	grass, sage**	pitting
416	Metate, basin	Brown sandstone	grass**	–
417	Metate, basin	Micaceous schist	goosefoot**, buckwheat, pea, parsley, sunflower, greasewood, ephedra, cattail, sage**; possible parching	–
506	Metate, slab	Micaceous schist	mustard, grass; possible parching	–
575	Mano fragment	Orthoquartzite	grass	
587	One-hand mano	Orthoquartzite	grass	deep scratches
623	Smooth abrader	Metaquartzite	grass**, meat	–
670	Metate, basin	Olivine basalt	grass**, ephedra, sage**; possible parching	–
713	Flaked abrader	Micaceous schist	grass	–
747	One-hand mano	Orthoquartzite	grass	–
773	Flaked abrader	Metaquartzite	no cultural indication	–

* = All tools display grinding and striation.
** = Aggregate pollen.

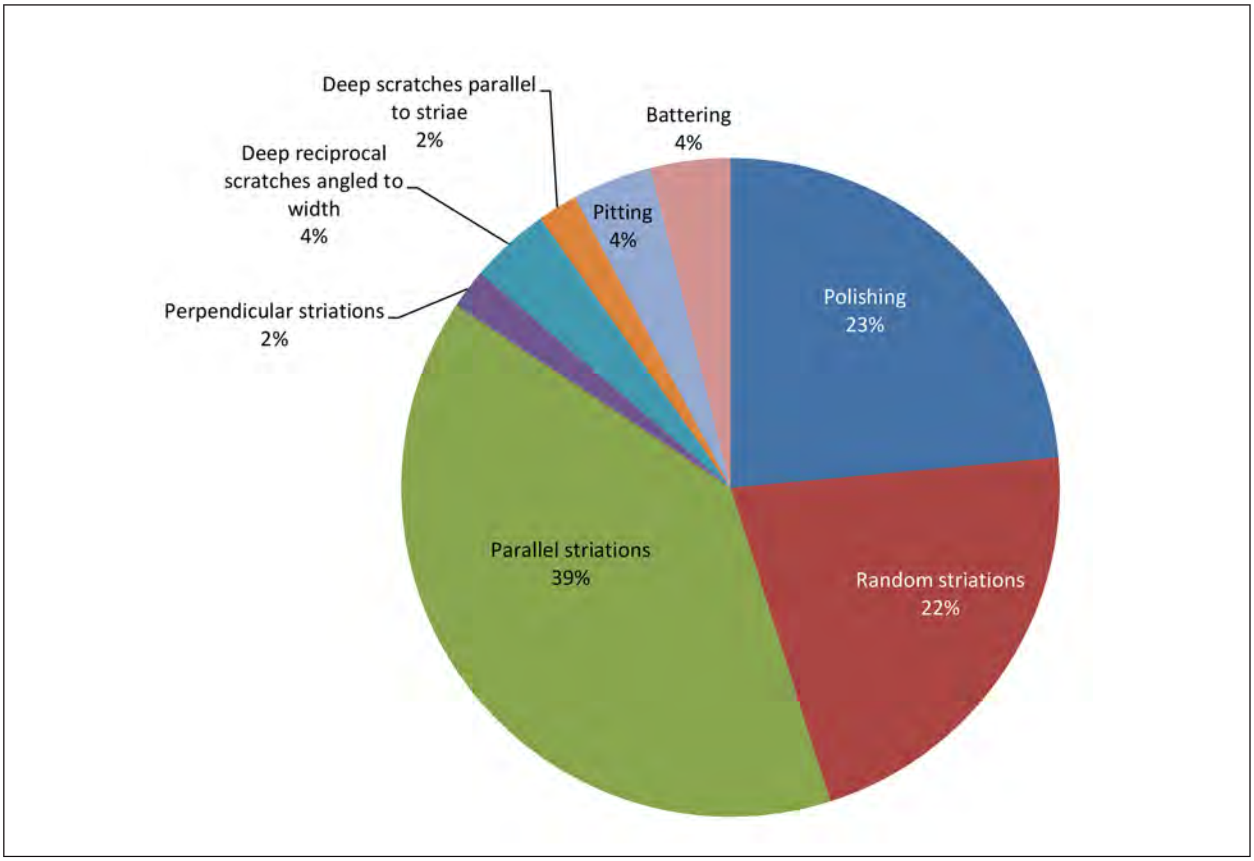

Figure 11.3. One-hand mano, wear patterns; pie chart.

functional use of many tools, which could be linked to the long use of the site, reflecting varying types of resources and processing over time; perhaps the ease of obtaining tool stone reduced the value of tools here, particularly given their generally unmodified nature, or their presence in the fire was simply accidental.

The high percentage of heat-fractured manos suggests that broken tools may have been used as thermal elements in hearths or cooking pits. Reworked broken tools are nonexistent; because most fragmentary items were heat fractured, perhaps this was to be expected. However, the absence of reworking along with the low investment in manufacture and maintenance are additional evidence of tool stone abundance. As a group, one-hand manos from LA 139965 appear to be functionally diverse. This is primarily evidenced by the variety and combinations of wear patterns rather than great differences in morphology, material type, or type of manipulation.

In descending order, manos were distributed between the South Talus (n = 13), the South Shelter (n = 11), the North Talus (n = 9), the North Shelter (n = 4), and the Central Talus (n = 1). Within the South Shelter, all 11 manos were found near the center of the shelter within an 8 sq m area. At first glance this appears to represent an activity area, however most of the manos were broken (n = 9) and scattered vertically—from the surface down to Level 10. As such, though most South Shelter manos derive from a rather restricted area within the shelter itself, they were probably left as trash. One of the two whole tools is a fully shaped biscuit mano with two extremely smooth, heavily ground surfaces (Fig. 11.6); the other is a preform. About half are fire-sooted or fractured. South Talus manos display a different pattern from the shelter. Virtually all occur in a long meter-wide strip parallel to the cliff between 144E and 145E, possibly the result of deeper fill and bulldozing along the face of the cliff during road construction.

The North Shelter has a well-defined mano concentration. All four manos there were recovered

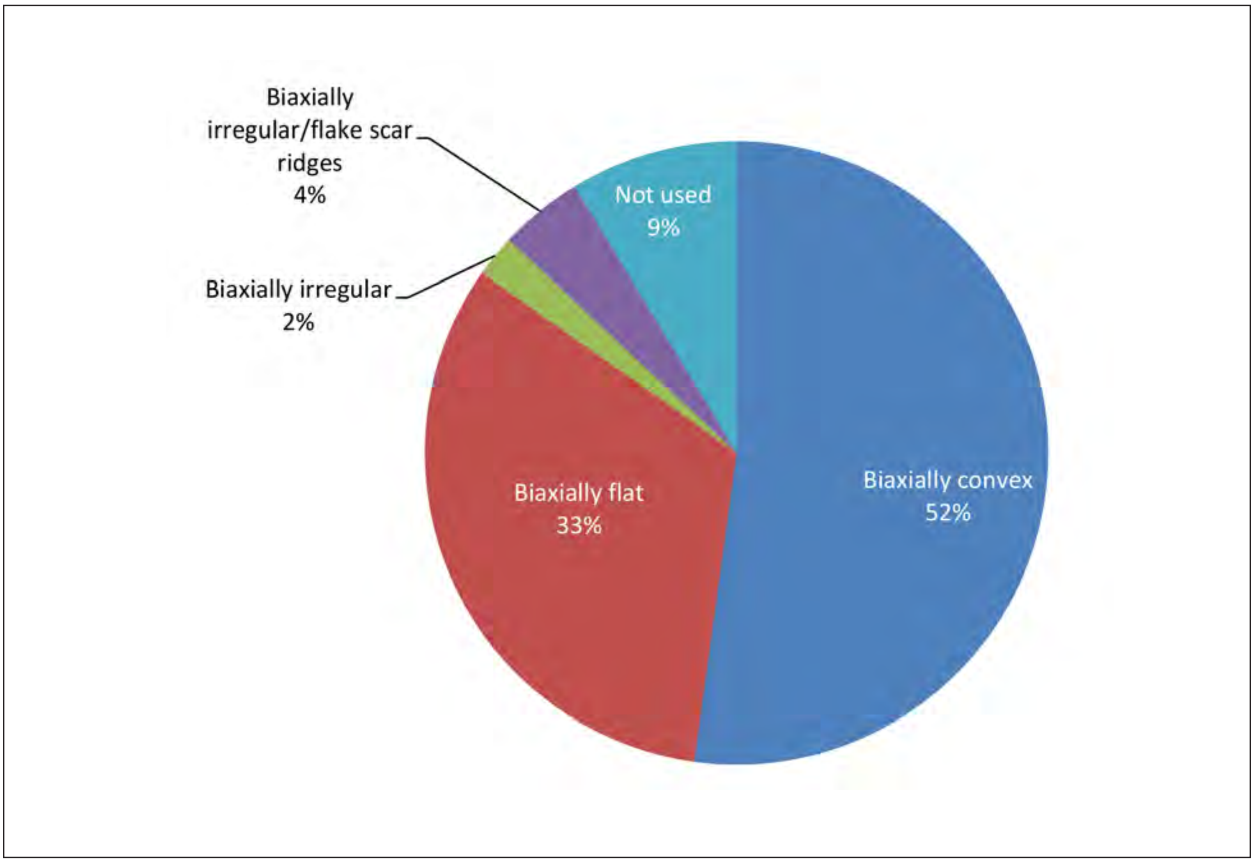

Figure 11.4. One-hand mano, use-surface contours; pie chart.

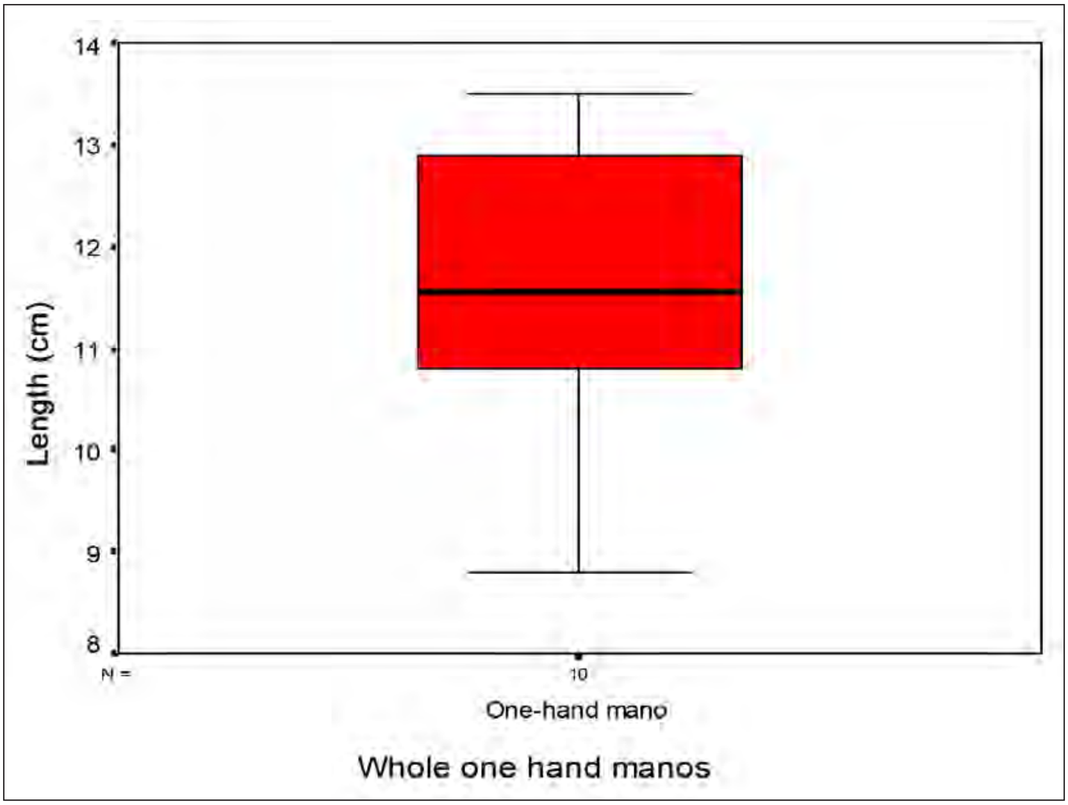

Figure 11.5a. Whole one-hand manos by length (cm) range; box plot.

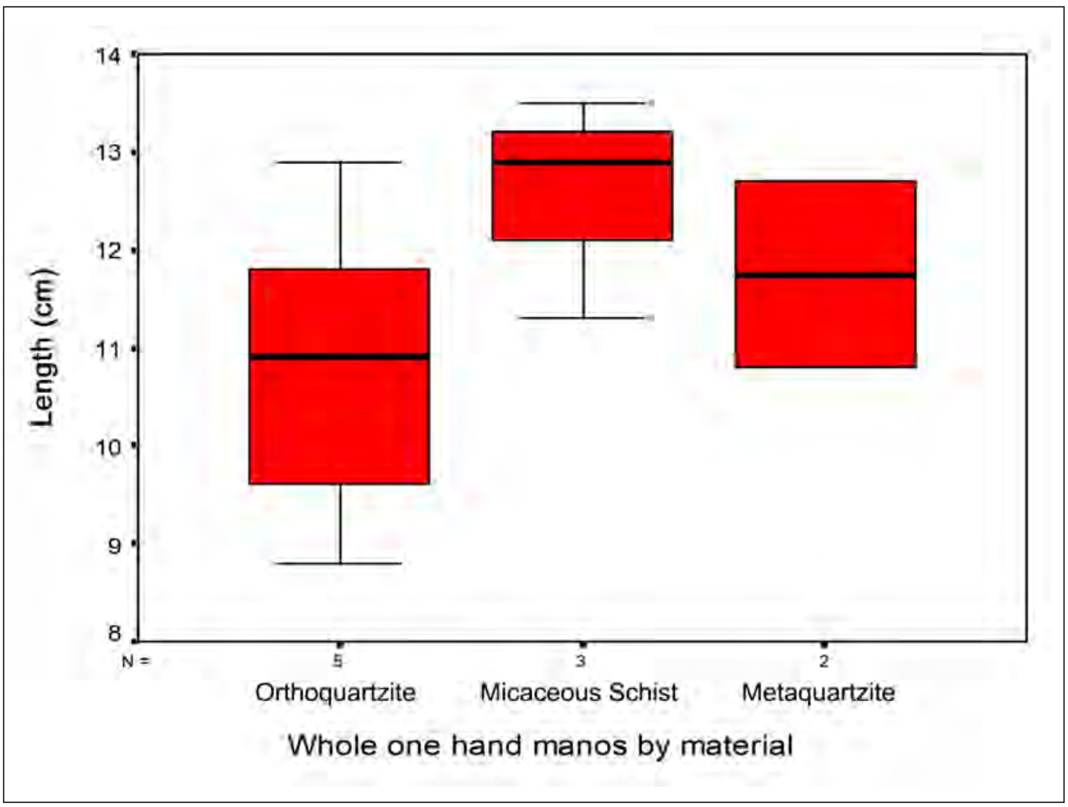

Figure 11.5b. Mean whole one-hand manos, length (cm) range by material type; box plot.

Figure 11.6. Biscuit mano (FS 235; from South Shelter), plan and cross-section views.

from a single unit in the center front of the shelter, three from Level 8. Even more intriguing, three of the tools display at least one characteristic that is atypical of site manos: highly abrasive material, high weight, or heavy-duty wear in the form of deep scratches and impact scars. All three of these tools were used to process grass, and two were additionally used for sage, and possibly ephedra and greasewood. The use of these tools is addressed further with the microbotanical results (Chapter 14). One mano fragment from the North Shelter was recovered from a level of sediments with a radiocarbon date of AD 894–1018.

Two-Hand Manos (n = 3)

The classification of two-hand manos typically conjures up images of shaped, rectangular slabs of abrasive material, such as sandstone, that are used for processing corn. However, the manos from LA 139965 bear little resemblance to this archetype, though they could have been used to process corn transported to the shelter from sites near the field (Fig. 11.7) (Chapter 14). The three two-hand manos here employed cobbles of micaceous schist (n = 2) or metaquartzite (n = 1). Though these tools are larger and heavier than the one-hand manos, they display the moderately ground and striated wear that is the common pattern in the assemblage. Heavy wear, such as battering and scratching, are absent. These three tools originated from the South Shelter, South Talus, and Central Talus.

The two micaceous schist two-hand manos are rectangular; flattened cobbles were likely chosen since little to no modification was apparently required for a serviceable tool. Only one of these is slightly shaped to blunt the corners. Use wear on both micaceous schist manos is very light and unstriated, similar to most one-hand manos. These two artifacts are so alike in material and form that they appear to be portions of the same tool, though they could not be refit (Table 11.3.). They were found about 10 m apart on the same easting, and were also from very different levels; on the surface in the Central Talus and in Level 6 in the South Shelter. The mano from Level 6 was far more proximate to the metaquartzite mano discussed below,

Figure 11.7. Two-hand manos (FS 100, 233), plan and cross-section views.

Table 11.3. Two-hand manos, material and dimensions; entire site.

FS No.	Material	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)
233	Micaecous schist	11.5	14.9	6.3	1760
100	Micaecous schist	14.6	12.0	5.6	1876
176	Metaquartzite	16.5	13.1	8.4	1287

which was found in the same level about one meter southwest.

The single metaquartzite two-hand mano is also unmodified. It is oval, with a thick triangular cross-section that may have served as an ergonomic grip, but since it is fire-spalled, this is indeterminate. The use surface is lightly polished and randomly striated. This suggests that it was abraded against a surface that was abrasive enough to produce striations but soft enough to polish the stone, possibly a plant with high silica content, such as grass or sedge seed.

Abraders (n = 24)

Abraders are distinguished from manos by comparatively small size (Fig. 11.8.) and smoothly ground surfaces. There are three subgroups within the abrader category: smooth abraders (n = 13), flaked abraders (n = 4), and coarse abraders (n = 7). All abraders are worn on unrejuvenated cortical surfaces, but the surface asperity varies. The microbotanical analyses of two abraders from the South Shelter indicates that they were minimally used for grass and meat processing (Chapter 14). One smooth abrader had grass pollen aggregates and meat fibers on the use surface; one flaked abrader had grass phytoliths (Table 11.2). Both of these tools display wear in the form of grinding, random striae, and linear striae. No polish or impact wear is present.

Smooth abraders are used exclusively on cortical cobble surfaces with very low asperity. Wear surfaces are smooth, striated, and sometimes polished. Though fresh breaks or manufactured surfaces of the raw material have the potential to be very abrasive, the weathered cortical surfaces are quite smooth. Three such materials are represented within the smooth abrader category: orthoquartzite (n = 5), micaceous schist (n = 4), and metaquartzite (n = 3). Wear surfaces are exclusively biaxially flat, indicating that the tools remained in contact with the netherstone rather than lifting the tool at either end, as in a rocking stroke. Surface striations indicate that smooth abraders were moved reciprocally and randomly, and were occasionally worn to a polish. Most are used on a single surface (n = 7).

Flaked abraders are nearly identical to smooth abraders in wear surface morphology, but the tools are produced from cobbles that have been unimarginally or unifacially flaked around a portion of the perimeter (Fig. 11.9). The flaked edges are obtuse, ranging from 51 to 86 degrees (average 68.5 degrees). The flaked edge and the adjacent flat surface are rounded and abraded, indicating the tool was used in a combination of scraping and abrading activity. Materials are micaceous schist (n = 3) and metaquartzite (n = 1).

Coarse abraders resemble smooth abraders morphologically in that all are formed from cobbles ground on cortical surfaces of higher asperity, such as basalt (n = 3) and sandstone (n = 1). Other materials are similar to those in the flaked and smooth abrader category, but exhibit less weathered and more abrasive cortical surfaces, such as orthoquartzite (n = 1) and micaceous schist (n = 2).

Collectively, most abraders are broken (n = 15), though only nine were fractured from heat. One whole tool is sooted. Since so little effort was put into the procurement and production of these tools, they may have been considered expendable and easily relinquished to the fire, where their value as a thermal element competed with that of a tool. Abraders are used to a far-less degree than manos; their mostly unmodified status and easy material availability, coupled with infrequent use, probably identifies them as expedient tools.

Abraders were distributed between the southern (n = 15), northern (n = 9), and central (n = 1) areas of the site. The most distinctive spatial difference is that in the southern area, most were found inside the South Shelter and in the northern

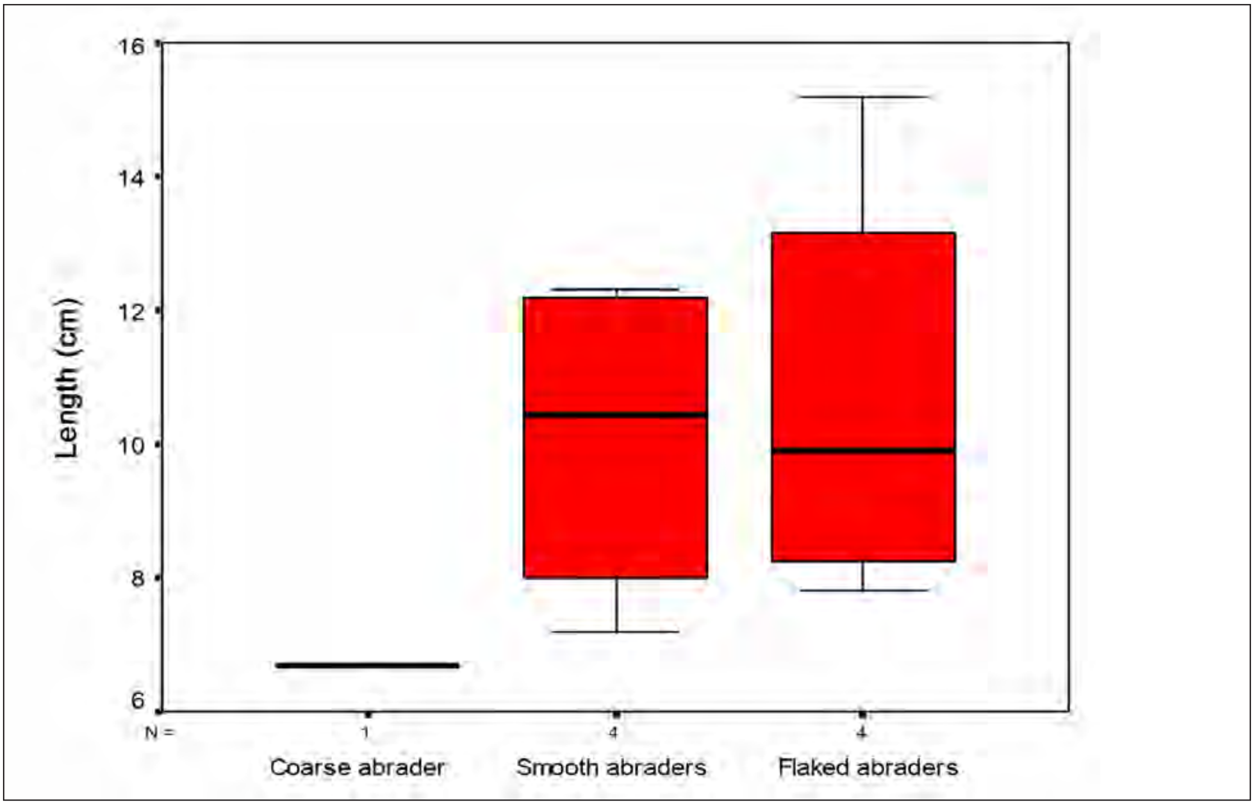

Figure 11.8. Whole abraders, length (cm) range by tool type; box plot.

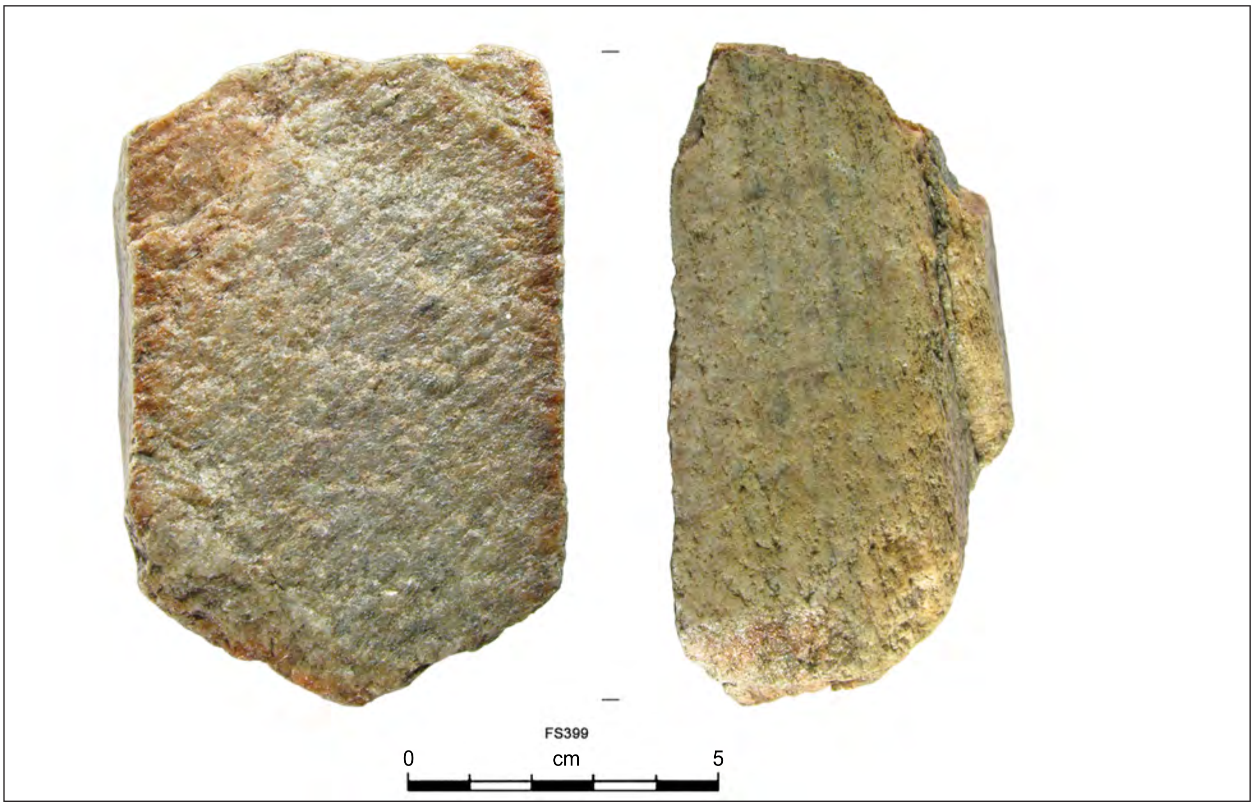

Figure 11.9. Flaked abrader (FS 399), plan and cross-section views.

area, all were in North Talus. In the North Talus, eight of nine abraders were clustered in front of the south end of the North Shelter. Most were in the upper fill of Level 2 (n = 4) or Level 1 (n = 3), and one was from Level 4. This location in front of the shelter would probably have been ideal for many activities; however, as noted earlier, due to disturbance during road construction, no artifact associations in talus fill can be stated with certainty.

As with some other tool groups such as manos and metates, abraders in the South Shelter were not concentrated in any particular level but dispersed vertically from Level 1 to 11, with a slight concentration of three tools in Level 3. Abraders from the South Talus were thinly dispersed along the length of the slope in front of the shelter in upper fill only (0–10 cm).

Polishing and Carving Tools (n = 6)

Tools in this category are somewhat variable, though alike in small size and cobble raw material. A range of asperity is indicated by the material distribution, which comprises basalt (n = 3), metaquartzite (n = 2), and mudstone (n = 1). Most of the stones are striated with linear or random patterns, but none display the deep surface sheen and shallow striae that typically results from use as a polishing stone for ceramics. Rather, a waxy surface that is an accumulation of plant or animal residue was more commonly observed; any striations found were too deep to indicate polishing activity. The mudstone artifact is particularly anomalous for polishing tasks (FS 445; Fig. 11.10). It is a slightly cupped stone that is striated perpendicular to its narrow edge; the wear pattern on it is similar to what would result from a carving motion. The largest tool in this category is an ergonomic basalt cobble that is rounded and appears polished; a waxy residue coats the entire surface (Fig. 11.11). Most potential polishing tools, including the latter, are from the North Shelter or North Talus, with all but one from Level 1 (n = 4). The mudstone tool and another with dorsal surface polishing are both from the main section of the South Shelter in upper fill.

Metates (n = 11)

Two types of metate are present at the site, basin (n = 3) and slab (n = 1). One metate preform and six indeterminate metate fragments were also recovered. All metates are fragmentary, but two are nearly analytically complete, both of which are basin metates. Though two metate types are present, the general trend indicated by use surfaces is for processing small quantities of material using short, reciprocal strokes on mostly unrejuvenated surfaces. Four metates were washed for pollen analysis with impressive results (Table 11.2); grass, goosefoot, sage, buckwheat, pea, parsley, sunflower, cattail, ephedra, and greasewood pollen represent the combined remains on these four tools. Most of these remains, though, were from a single basin metate from the North Talus (FS 417).

Basin Metates. The largest basin metate employed a sizeable angular basalt boulder, which certainly functioned as site furniture based on its weight (4.64 kg/102 pounds; Fig. 11.12). One side of the boulder is relatively flat, and is the surface into which the basin was ground. However, the grinding surface is not level when the boulder is resting on the ground, so it was probably conveniently lodged into the ground or supported by other rocks in the shelter. This metate was overturned at an angle near the dripline of the South Shelter, indicating it was

Figure 11.10. Possible carving tool (FS 445).

Figure 11.11. Basalt cobble (FS 753) with polish and waxy residue.

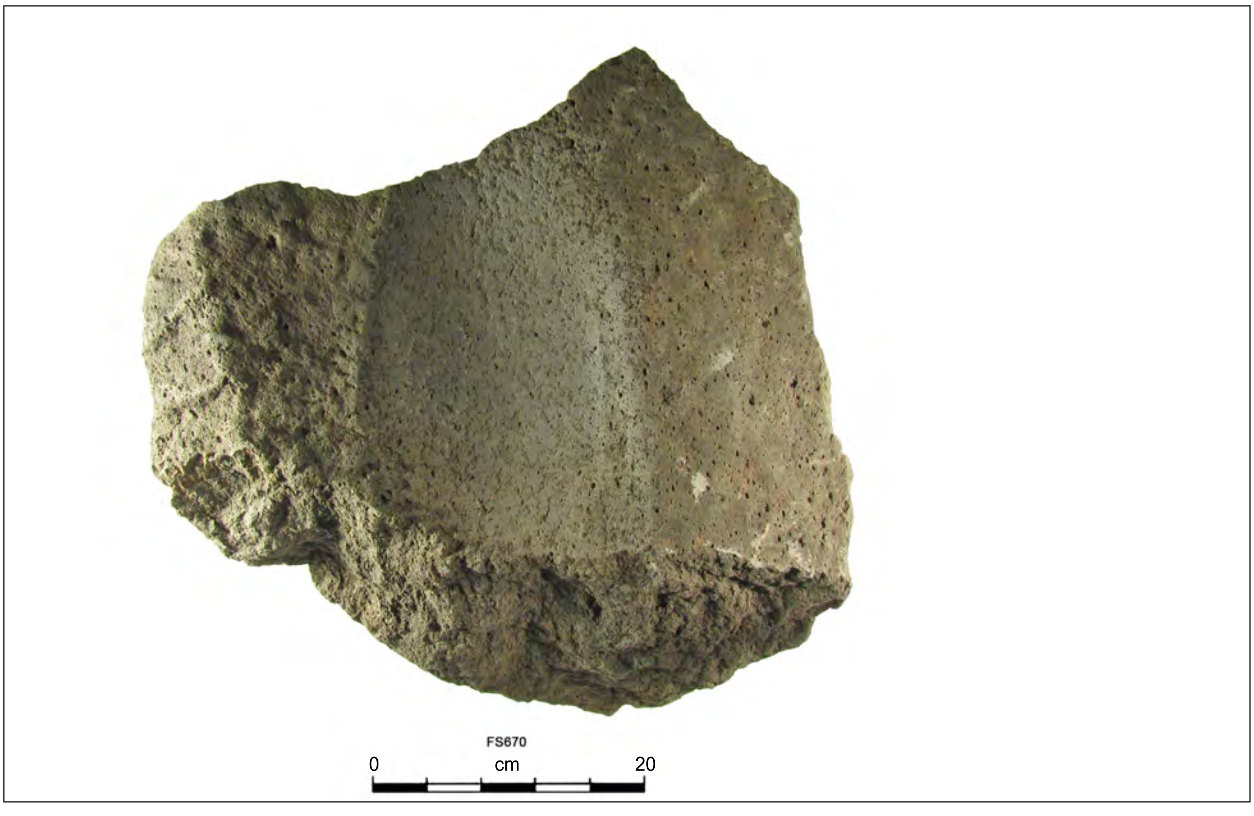

Figure 11.12. Basalt boulder basin metate (FS 670) with grass, sage, and ephedra pollen; plan and cross-section views.

probably not in situ (241.80N/144.65E). Though it would doubtless have been a permanent fixture at the site, it is unlikely that it was overturned between uses given its size and weight. The ground surface yielded grass, sage, and ephedra pollen. Both the grass and sage pollen were in aggregate form, indicating cultural processing. Parched seeds may have been ground on this metate since microscopic charcoal was present.

The flat cortical surface containing the basin is quite broad, but the basin itself is small, occupying only about one-third of the available space on the stone. The proximal end of the basin is chipped off, so it is not clear if it extended completely to the edge of the boulder, which would qualify it as a three-quarter basin metate (Adams 2002:100) since the distal end is closed. It is not extensively worn—the basin measures only 1.2 cm deep. The grinding and lengthwise striations of the wear surface indicate moderate use employing a rocking reciprocal stroke. The use surface is only lightly abrasive. The basin appears to have been lightly rejuvenated at some point, though most of evidence of it was obliterated by subsequent grinding.

The second basin metate was found in front of the North Shelter in Level 2 fill (Fig. 11.13). One of the interesting aspects of this metate is the fire-spalled edge transecting the basin; this broken edge is rounded, suggesting the metate was used following breakage, though only lightly. This distinguishes this metate as the only reused fragment at the site. Though it was level when found and located in a likely place for grinding activity, it was not in situ, since these sediments were redeposited during road construction. This metate yielded the largest variety of plant remains in the assemblage, consisting of goosefoot, buckwheat, pea, parsley, sunflower, greasewood, ephedra, cattail, and sage. Microscopic charcoal remains suggest that some of these seeds may have been parched before grinding.

This metate is formed from a large, flat micaceous schist cobble that has been sporadically pecked to shape around the perimeter. Exposure to heat has fractured it along the length, splitting off

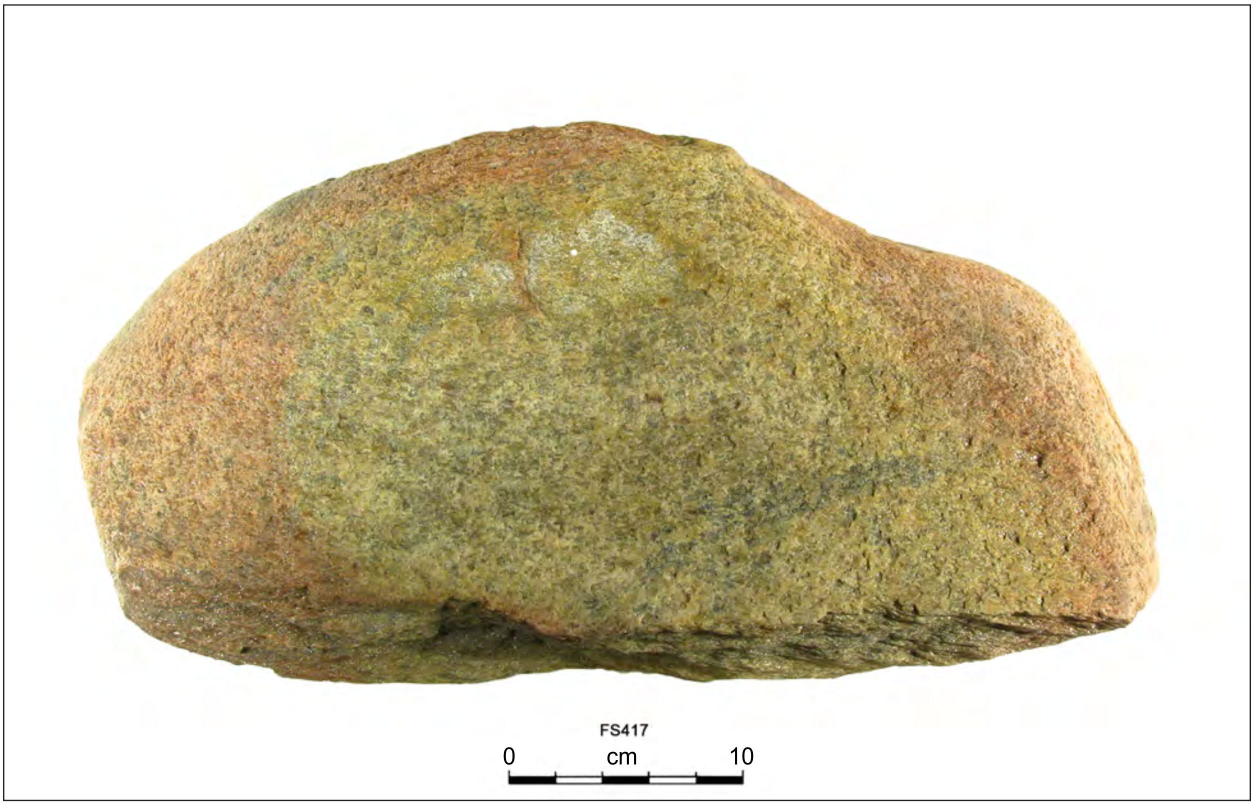

Figure 11.13. Basin metate (FS 417; from North Talus) with nine types of plant pollen.

a portion of the basin. However, the basin is intact enough to determine that it is open at the proximal end and closed at the distal end, signifying it as a three-quarter metate. The grinding surface is rejuvenated and moderately ground. The use surface of this metate was photographed with a three-dimensional laser scanner, revealing a smooth, even contour across the length and width and clear linear lengthwise striations. If manos of varying length were employed, multiple linear ridges would be evident within the use area, which was not the case with this metate. A rocking reciprocal stroke is indicated by linear striations and longitudinal curvature in both of the worn areas.

The third basin metate is a small edge-fragment of brown sandstone that retains a portion of the basin edge (Fig. 11.14). It was found in redeposited North Talus sediments on the south side of the North Shelter in Level 3. The use surface yielded grass pollen aggregates, strong evidence that grass seed was ground on this metate. The use surface was markedly concave and worn to a depth of 1.2 cm using a reciprocal stroke. The fine-grained sandstone is more abrasive than most materials in the assemblage. The use surface was moderately ground and striated, but not rejuvenated. The flat surface around the basin is ground almost to a glassy texture.

Slab Metate. The only slab metate in the assemblage is a corner fragment (Fig. 11.15). It was recovered from a fire-cracked rock and charcoal concentration from Level 13 of the South Shelter. It was produced from a large, unmodified flattened micaceous schist cobble. The ground area extends across the entire surface of the rock and overlaps the intact edge slightly, which may represent extended strokes

Figure 11.14. Basin metate fragment (FS 416) with grass pollen.

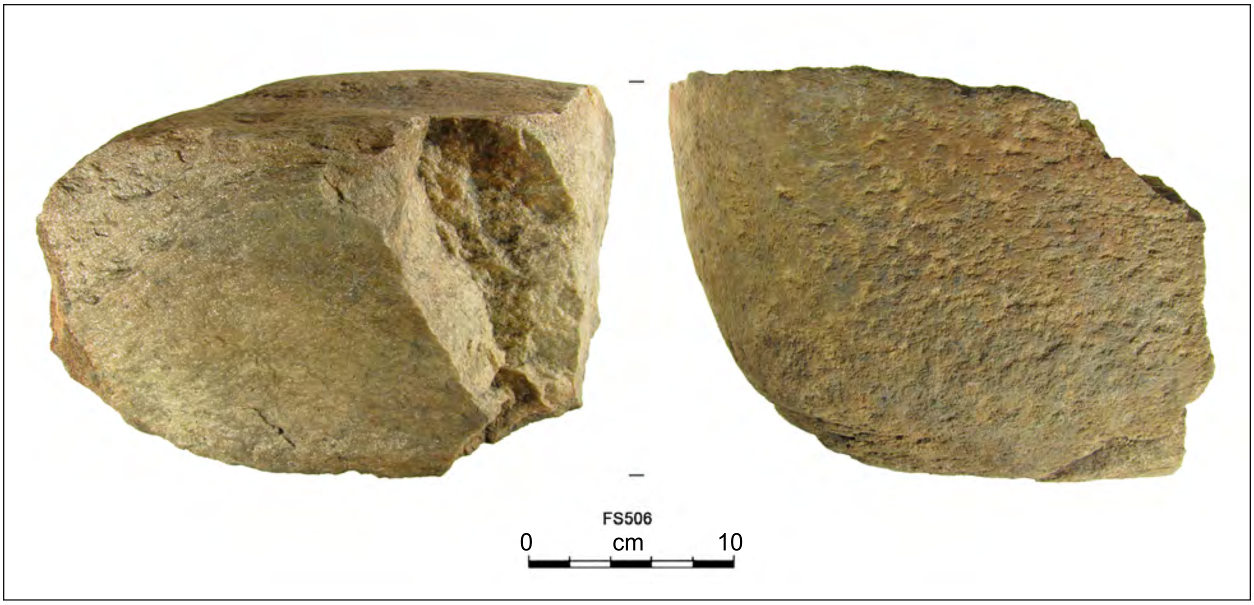

Figure 11.15. Slab metate (FS 506) with mustard and grass pollen.

or shaping. It displays rather deep linear striations indicative of a reciprocal stroke. The rejuvenated use surface is fairly abrasive, though high spots are ground nearly to a polish. Pollen analysis yielded mustard and grass. The metate would require stabilizing with rocks or earth since the unshaped base is very irregular. The moderate asperity of the use surface suggests that this texture was appropriate for grass and mustard seeds.

Indeterminate Metate Fragments. The six indeterminate metate fragments are sandstone (n = 5) or orthoquartzite (n = 1). These are distributed among the South Shelter (n =3), South Talus (n = 2), and North Talus (n = 1). Most are moderately worn on a single, unrejuvenated surface. All exhibit linear striations with the exception of one, which additionally displays pitting on the ground surface. The preform appears to be partially manufactured. It is a basalt slab that has been chipped to shape around most of the perimeter. The base is lightly ground, either the result of shaping or ground contact while the upper portion was being formed. A single large flake scar exists on the potential use surface, possibly the beginnings of ventral shaping. The preform is whole (28.5 by 21.5 by 9.5 cm; 7000 g). It was recovered from Level 4 in the South Shelter about midway between the back wall and the drip line (242.54 N/144.42E).

Some general trends are evident among metates despite the small size and fragmentary nature of the assemblage. Metates pose an interesting contrast to manos in that they are rejuvenated more often than manos, including manos and metates of identical material. However, rejuvenation still remains a practice of little use, since only four of the 11 total use surfaces were maintained in this way. Possibly, a single rejuvenated metate surface provided adequate asperity for the task at hand. All metates in the assemblage were worked using a reciprocal stroke, which suggests that manos with random striations were not companion tools. Moderate grinding wear prevails with only two exceptions; the pitted surface described above, and one heavily ground fragment. Metates are also less likely to be heat-fractured than manos. Six tools have been exposed to heat, but only three were broken as a result.

Since all of the metate assemblage is fragmentary, summary statements regarding the use surfaces are tentative. It is significant that most of the identifiable types are basins, albeit by a small margin. Their comparatively smaller, smoother use surfaces allow for processing of small quantities of material, possibly only enough to sustain the group of people collecting resources. Grinding surface area is small despite an almost unlimited potential given the high availability of tool stone. This fits well with the campsite status of the site, where one would expect processing of smaller amounts of a variety of materials rather than quantities of a few. Metates were probably permanent and versatile fixtures at the site.

Most metates were recovered from the South Shelter (n = 8), concentrated within a roughly 2 m strip in the broadest point of its southern end, from the dripline to the rear (between 242E and 244E). Within this group are most of the sandstone and both basalt metates. Vertically, metates are scattered across as many levels as there are artifacts from Level 1 to Level 13. With the exception of the large basalt boulder metate, all are fairly small fragments. Three are sooted or fire-fractured.

Three metates were found in the northern area of the site, all from the North Talus. In addition to the basin metate fragment in front of the North Shelter, mentioned above, two fragments were found outside the North Shelter on its south side (Levels 2 and 3). Since the talus in front of both shelters was disturbed during road construction, the degree to which processing involving metates took place there is uncertain. The degree to which metate use occurred in the shelters is tenuous as well, since all of these artifacts are broken and over half are sooted or heat-fractured. Though metate counts were higher in the South Shelter, this is to be expected since excavations there were broader and deeper. Also, metates were sparsely distributed vertically in the South Shelter from Level 3 to 13. Metates in the north area were far more concentrated, as all originated from Level 2 or 3.

Hammerstones (n = 8)

Hammerstones are small cobbles or pieces of angular material that display battering and crushing wear on ends or projections. These tools could have been used to produce chipped stone tools or to manufacture and maintain ground stone tools. Quartz is the most frequently used hammerstone material (n = 5), followed by metaquartzite (n = 1), basalt (n = 1), and micaceous schist (n = 1). Quartz hammerstones tend to be angular pieces with multiple battered and rounded projections, while all other materials are small cobbles with identical wear concentrated at the ends and minimally on the lateral edges. Most hammerstones range from 5 to 10 cm in length, but one outsized quartz tool bears flake scars indicating it was initially reduced as a core (11.2 cm long).

Most hammerstones were recovered from the northern area of the site, both inside the North Shelter and in North Talus fill close to the shelter (n = 6 total). Those inside the North Shelter (n = 2) were found near the back wall in upper fill, one of which was the large quartz core-hammerstone. Those outside were quite close to the shelter (n = 2) and to the north and south (n = 2) and were also in upper fill. One from the North Shelter was fire-blackened. The two hammerstones from the South Shelter and South Talus were both from Level 1. Neither had been exposed to heat.

Manuports (n = 2)

Both of these artifacts were recovered from the South Shelter. The first is an unmodified stone ball of pink metaquartzite (2 by 2.1 by 1.7 cm; 10 g). The ball does not display wear of any kind, nor residue resulting from handling. It was recovered from Level 6 in unit 242N/144E. Small pebbles such as this could have been washed into the shelter in the alluvial deposits of Stratum 3, especially given the much shallower slope in the area prior to construction of the road. The unit yielding the stone ball also contained a small charcoal stain in Level 7. Though the stone ball does not appear to have any association with the charcoal stain, the proximity of thermal activity in the same unit may strengthen its potential cultural role.

The second manuport is an end fragment of a long, cylindrical cobble of micaceous schist (9.3 by 3.0 by 2.4 cm, 115 grams). It exhibits very light pitting wear at the end; it was possibly used once or twice as a lightweight hammerstone for more controlled removal of smaller flakes (Fig. 11.16). The pitting does not appear to be the result of crushing, unless the material being processed was soft. It was recovered from Level 3 in unit 247N/144E, which was about a meter inside the overhang of the South Shelter. Charcoal from this unit and level yielded a radiocarbon date range of 1256–1306 AD.

Miscellaneous (n = 1)

This is a somewhat ergonomically shaped cobble of micaceous schist (Fig. 11.17). It is long and narrow at one end, where it could be handled with ease, and bulbous at the distal end. Though there is no wear on the cobble, the distal end is heavily blackened and slightly greasy in a well-defined area. This sooted area may simply be incidental, or

Figure 11.16. Possible hammerstone or manuport (FS 258).

Figure 11.17. Fire-blackened cobble (FS 178).

it may have occurred through use of the stone as a cooking tool. It was recovered at the far north end of the South Shelter in Level 1 of unit 252N/144E.

Indeterminate Fragments (n = 13)

Eleven of these small fragments exhibit a single ground surface but are otherwise too fragmentary to classify functionally. Two are edge fragments that retain small portions of tool shaping—the ground surface is not present, however. Material types are proportionately more abrasive than for determinate groups composed of orthoquartzite (n = 4), basalt (n = 4), micaceous schist (n = 3), and metaquartzite (n = 2). The most surprising aspect of this group is that only one is heat-fractured, a much lower percentage than the assemblage as a whole (48 percent). Three explanations are offered: that tools were being broken through use and not recycled as thermal elements; tools were simply left on site; or, that only the first step had taken place and that fragments could be collected later for thermal use. It would be interesting to know if the pitting, battering, and scratching present on more intact tools was the cause of breakage for these fragments since such wear exists on other tools, but most are too small to display the full range of wear. Linear striations are visible on five artifacts, two of which are additionally polished. Indeterminate fragments originate from the South Shelter (n = 6), South Talus (n = 4), North Shelter (n = 1), and North Talus (n = 2).

Analysis Summary

Several overarching trends apply to the ground stone assemblage from LA 139965. Perhaps most obvious from the physical environment as well as the tools themselves is an abundance of raw material. Igneous cobbles from Coyote Canyon and Rincon Ridge gravels were selected most often for tools. Basalt from the site, though available in greater quantity, was seldom used, but this could be affected by removal of boulders used as bedrock metates or mortars.

Little investment in tool manufacture and maintenance is a salient characteristic of the assemblage, though some fully formed tools are present. Most tools are unmodified or minimally shaped and surfaces are infrequently rejuvenated—both are practices that indicate little need to prolong tool life and efficiency. Metates are much more likely to be rejuvenated than manos, and are generally more abrasive in texture. Over half of all tools are unifacial (53 percent). Bifacial tools are usually well worn on a single surface only. Use surfaces tend to be small for all tools, even when the size of the raw material allows for a much larger area.

The number of tool types in the assemblage is fairly low. Manos, metates, and abraders account for the majority. Though there are subtypes within these groups, there is generally very little deviation from small, one-hand cobble manos and basin metates. Two-hand manos and slab metates are present, but in low numbers.

A preference for low to moderate abrasion is apparent. This is due to use of the cortical surface, material selection, or heavy, unrejuvenated wear. Smoothly ground surfaces with linear striations are by far the most common, though their position on the tool varies. Distinctive ancillary wear occurs in some tools in the form of pitting, battering, and deep scratches, particularly in the North Shelter and North Talus; some of these wear types are also coupled with polish. Polish wear is more common in the South Shelter.

Heat-Altered Ground Stone

Tool types directly related to fire other than fire-cracked rock—e.g., fire dogs, trivets, pikistones, griddles, and comals—were rare in the assemblage, possibly indicating a more informal food preparation, as would be expected at a campsite location. Nearly one third of all whole tools were heat-fractured or sooted. Since there were no tools specifically manufactured for use in cooking, this may indicate that ground stone was used as a thermal element, even when the tools were still functional. Shaped tools were less likely to come in contact with fire (25 percent), but the percentage was still fairly high, again reflecting low investment in tools.

The presence of whole or shaped tools in thermal contexts could result from use in various methods of cooking, heating, and sweat baths. Jackson (1998:6–20) provides a detailed description of the ways in which heated stones served these various purposes. Though these are based on ethnographic studies outside of the Southwest, most have been prehistorically and historically documented among groups in New Mexico and Arizona.

Three methods of cooking employ heated stone:

earth ovens, "rock griddle," and stone boiling (Jackson 1998). The earth-oven process is well documented in the Southwest for cooking agave and other leaf succulents (Fish et al. 1985), and for cooking meat among groups in the Great Plains and elsewhere (Wandsnider 1997:Table 5). The rock-griddle process involves roasting over a shallow bed of heated rocks laid on top of a low fire, a method more suited for meat than plants. Stone boiling involves raising the temperature of the water in a ceramic vessel or basket by inserting and removing heated rock (Jackson 1998:10–12; Crown and Wills 1995:176). Heated stone was also used to warm interior spaces and in sweat baths (Jackson 1998:18–20).

Similar or identical rock types were typically chosen for thermal use, with quartzite and limestone used most often for stone boiling (Jackson 1998:33, 35). However, at LA 139965, most of the fire-cracked rock was orthoquartzite (48 percent), rather than metaquartzite. Since both rock types were readily available at the site, orthoquartzite could have been chosen more often as a thermal element, but it is more likely that it ended up in the fire because it was preferred for ground stone tools and therefore, was more available for secondary use in thermal features. Micaceous schist was the next most numerous rock exposed to heat (22 percent), followed by metaquartzite (14 percent). Sandstone (10 percent) and basalt (4 percent) comprise the remainder.

Botanical remains from LA 139965 include several types of plants that could have been parched or boiled before grinding. If the grinding took place proximate to a fire pit or other thermal feature, it may have increased the likelihood of ground stone tools being discarded in the fire or used as thermal elements.

Ground Stone Spatial Distribution and Area Assemblages

> Neither the harvesting, husking nor winnowing of seeds takes place within caves/rockshelters. It is only at the grinding stage that processing may hypothetically be relocated to closed (i.e., wind-free) areas, such as rock-shelters. When processing does occur in shelters it is often as an emergency measure during bad weather (Gorecki, Grant, O'Connor, and Veth 1997:144, regarding food-processing activities of Australian aborigines).

Akins and Boyer (2015:15) state that in situ deposits were confined to the portions of the site in the shelters beneath the overhangs with the caveat that bioturbation did have some influence on those contexts. This intact context applies to discarded as well as active tools. Artifacts from the talus, in contrast, were in disturbed contexts as a result of erosion of shelter deposits and of blading and redeposition along the rockshelter during road construction. Since less than half of the ground stone assemblage originates from more intact shelter proveniences, potentially meaningful spatial analysis applies to only 44 percent (n = 45) of the tools. Combined talus contexts account for 56 percent (n = 58).

Ground stone was recovered from five areas of the site: South Shelter (n = 36), South Talus (n = 27), North Shelter (n = 9), and North Talus (n = 29) (Fig. 11.18). The Central Talus—where excavation was confined to the stratigraphic trench and to grids at the base of the cliff where there was little or no overhang—had only two ground stone tools, owing no doubt to the near absence of shelter in this area. The higher counts in the South Shelter and South Talus may owe to the greater depth and length of the overhang in that area (which would have provided a larger working space with higher vertical clearance) or to the greater number of excavated grid units and levels.

One of the primary differences in the South Shelter compared to other areas is the variety of tools (Table 11.4). Virtually every tool type in the assemblage was recovered from the South Shelter with the exception of large polishing tools, which were found only in the North Shelter, along with the greatest number of plant species. However, although more tool types exist here, most are subtypes of manos, metates, and abraders, as is true of the assemblage as a whole. Though there is some variation in mano morphology in the South Shelter, the main contrast is in metate variability and the presence of preforms indicating that tools were being manufactured there.

While an array of metate types can denote specialization, this is probably not the case at Coyote Canyon Rockshelter. Metates were no doubt left on

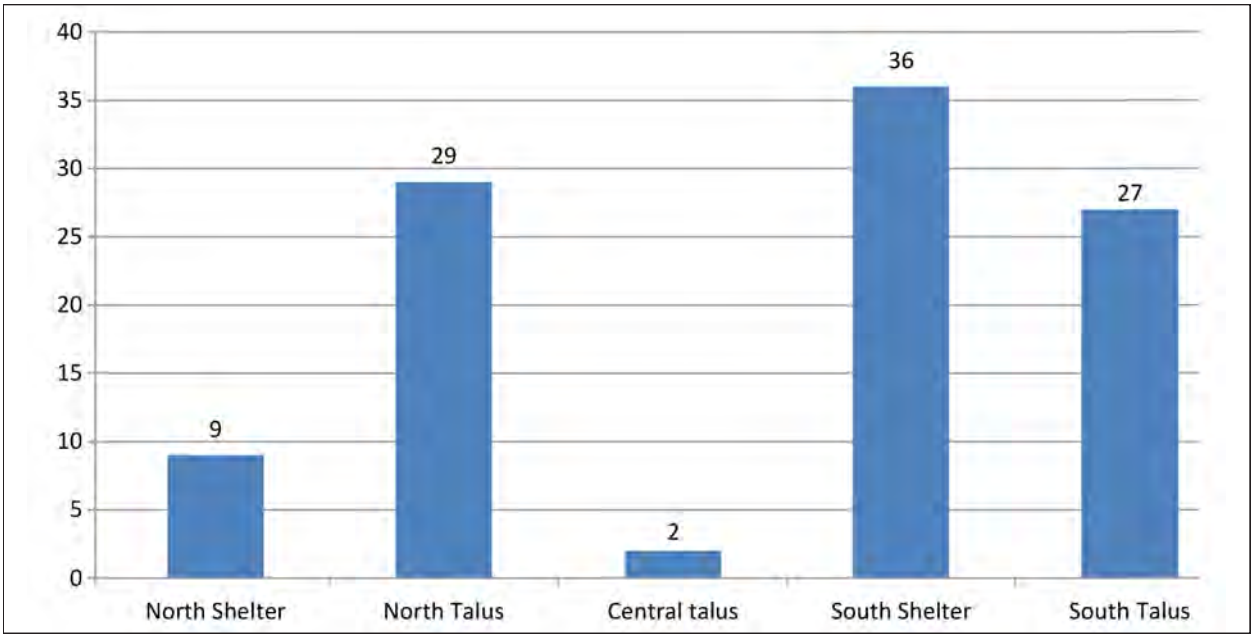

Figure 11.18. Ground stone by area; bar graph.

Table 11.4. Ground stone tools – type, heat exposure, and condition; counts by site area.

Tool Type		**North Shelter**	**North Talus**	**Central Talus**	**South Shelter**	**South Talus**	**Total**
Manos	One-hand mano	2	7	–	4	10	**23**
	Two-hand mano, nfs	–	–	1	–	1	**2**
	Two-hand mano, slab	–	–	–	1	–	**1**
	One hand mano preform	–	1	–	1	–	**2**
	Mano, nfs (fragmentary)	2	1	–	5	2	**10**
Abraders	Coarse abraders	–	3	–	2	2	**7**
	Smooth abraders	–	4	1	6	2	**13**
	Flaked abrader	–	2	–	1	1	**4**
Polishing	Polishing stone, nfs	1	2	–	1	1	**5**
	Polisher	1	–	–	–	–	**1**
Metates	Metate, basin	–	2	–	1	–	**3**
	Metate, slab	–	–	–	1	–	**1**
	Metate preform	–	–	–	1	–	**1**
	Metate, nfs	–	1	–	3	2	**6**
Hammerstones	Hammerstone	2	4	–	1	1	**8**
Manuports	Stone ball	–	–	–	1	–	**1**
	Manuport	–	–	–	1	–	**1**
Miscellaneous	Possible fire dog	–	–	–	–	1	**1**
Indeterminate	Fragments	1	2	–	6	4	**13**
Total		**9**	**29**	**2**	**36**	**27**	**103**
Number of tool types		**4**	**7**	**2**	**10**	**8**	**31**
Heat Exposure							
Exposed to heat		4	14	2	13	15	**48**
Not exposed to heat		5	15	–	23	10	**53**
Indeteminate		–	–	–	–	2	**2**
Condition							
Whole		3	12	–	10	9	**34**
Fragment		6	17	2	26	18	**69**

nfs = not further specified.

site and employed for whatever task was at hand. Preference for one over another could certainly have occurred, but manos and metates by and large were probably quite versatile. Also the small size of milling tools suggests that small quantities of material were involved, and/or that very little processing was occurring. Though some variety in the types of processing is evident, such as the heavier wear occurring on grass-processing tools, commonality is the stronger trend. So, despite the fact that many types of plants were probably harvested, most were hulled or ground in similar ways. The heavier wear on grass-processing tools is an exception to this, and assumes the wear and the plant are linked.

For a camp that was visited with the primary goal of procuring meat and hides, and secondarily for procuring plant materials that would be used for the duration of the visit, this lack of specialization makes sense. Resources would certainly vary from visit to visit, but generally, the site location served as a hunting, rather than gathering locale. Whatever resources were available at a given time would be exploited for food during hunting trips. A variety of resources were sought, but processing would be limited to the amount necessary, minimizing the need for specialized tools. Most likely, ground stone was used to process small quantities of food required for the duration of the stay.

The pattern of whole, broken, and fire-exposed tools may suggest two things: that tools were broken and left where they were used, as opposed to being deposited in a midden, and that ground stone tools have a weaker association with thermal activity in the South Shelter compared to other areas (Fig. 11.19). In the South Shelter, most broken tools were not exposed to fire and could have been fractured during use or simply left as trash. The reverse is true in the South Talus, where most broken tools are fire-cracked. These may have been used as thermal elements and tossed out when their heat-retention qualities diminished, or they were used in thermal features in other areas of the site. Shaped tools were less likely to have been exposed to heat in all southern areas, suggesting that at least some value was placed on tools with higher energy investment. The fact that whole tools in all contexts were heat-fractured is strong evidence of the abundance of tool stone and the dominant use of expedient tools. The high incidence of fragmentary tools in the shelters could also reflect secondary discard.

There is a lower variety of tools in the South Talus compared to South Shelter, consisting mostly of manos and abraders. Together with the shelter, the southern area of the site yielded the most manos, metates, and abraders, but given the larger and deeper excavations there, this is to be expected. In fact, considering the relative area of fill removed from each, the larger number of tools in the South Shelter is somewhat deceptive since ground stone density was actually slightly higher in the North Shelter. Not only were South Shelter tools dispersed across a broader excavated area, but also vertically within deep fill subjected to a variety of natural and artificial disturbances. These disturbances, along with the long-term use of the shelter, make it difficult to pin down the extent to which each area served as processing locales. One of the few reliably intact ground stone contexts was a one-hand mano recovered from a crevice just north of the South Shelter.

The distribution of material types between site areas displays some interesting contrasts. Both the northern and southern areas have a similar range of asperity in tool stone, but types vary. For instance, abrasive and non-abrasive materials occur in both areas, but different materials were chosen. The North Shelter and North Talus generally have fewer abrasive materials, but interestingly, this is coupled with a higher incidence of heavy wear such as battering, pitting, and deep scratches (Fig. 11.20). This wear probably results from crushing, cracking, and pounding of hard materials such as bone or acorns, which was evidenced in the faunal assemblage as well (Chapter 12, this report).

Additional evidence of this type of heavy use may be the comparatively high number of hammerstones in the North Talus and North Shelter, though these could just as easily result from flintknapping. Polish and rounding wear is higher in the southern areas of the site compared to the northern, which could be related to hide processing or meat pounding. Both of these wear extremes account for a small percentage of overall wear, which is typically grinding with striations, but the clear differences between the northern and southern areas suggest that some tasks were more likely to be carried out at one end of the site versus the other. Tools with heavy wear and grass botanical remains were concentrated at the North Shelter. Tools with multiple plants on their surfaces occurred at both shelters.

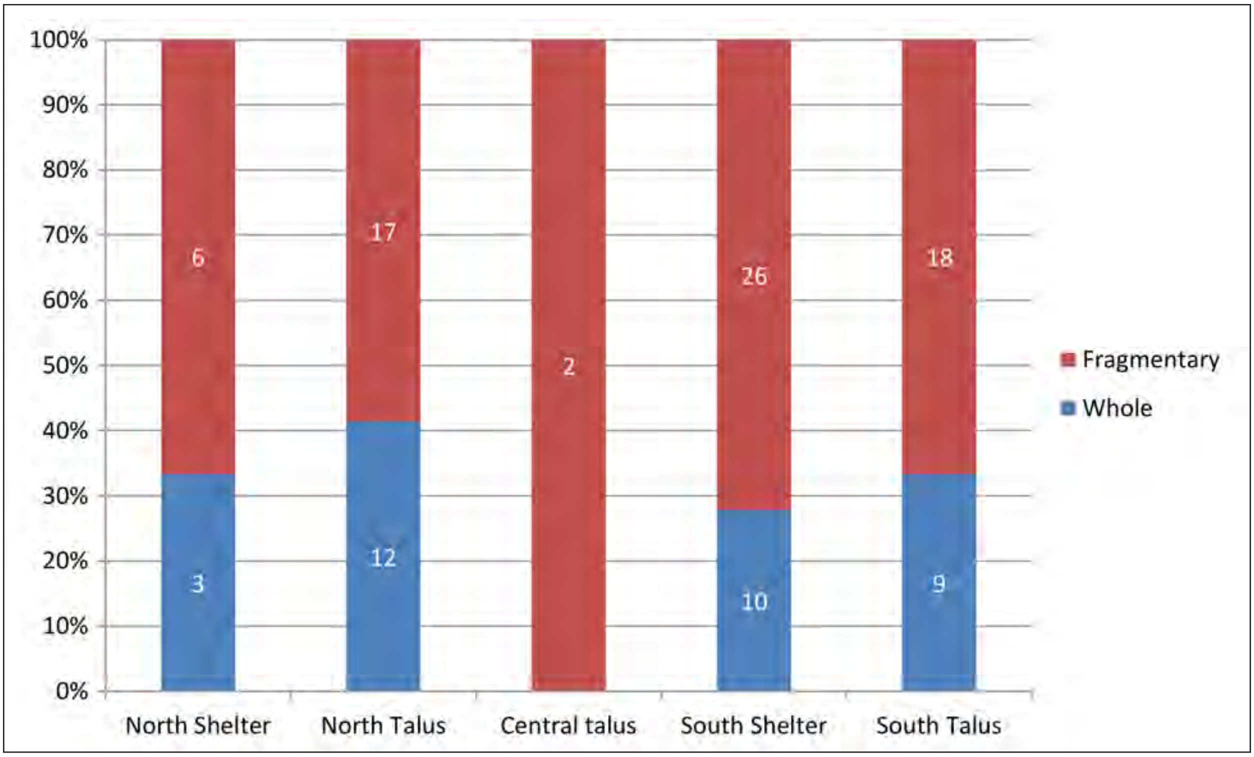

Figure 11.19. Ground stone condition by area; bar graph.

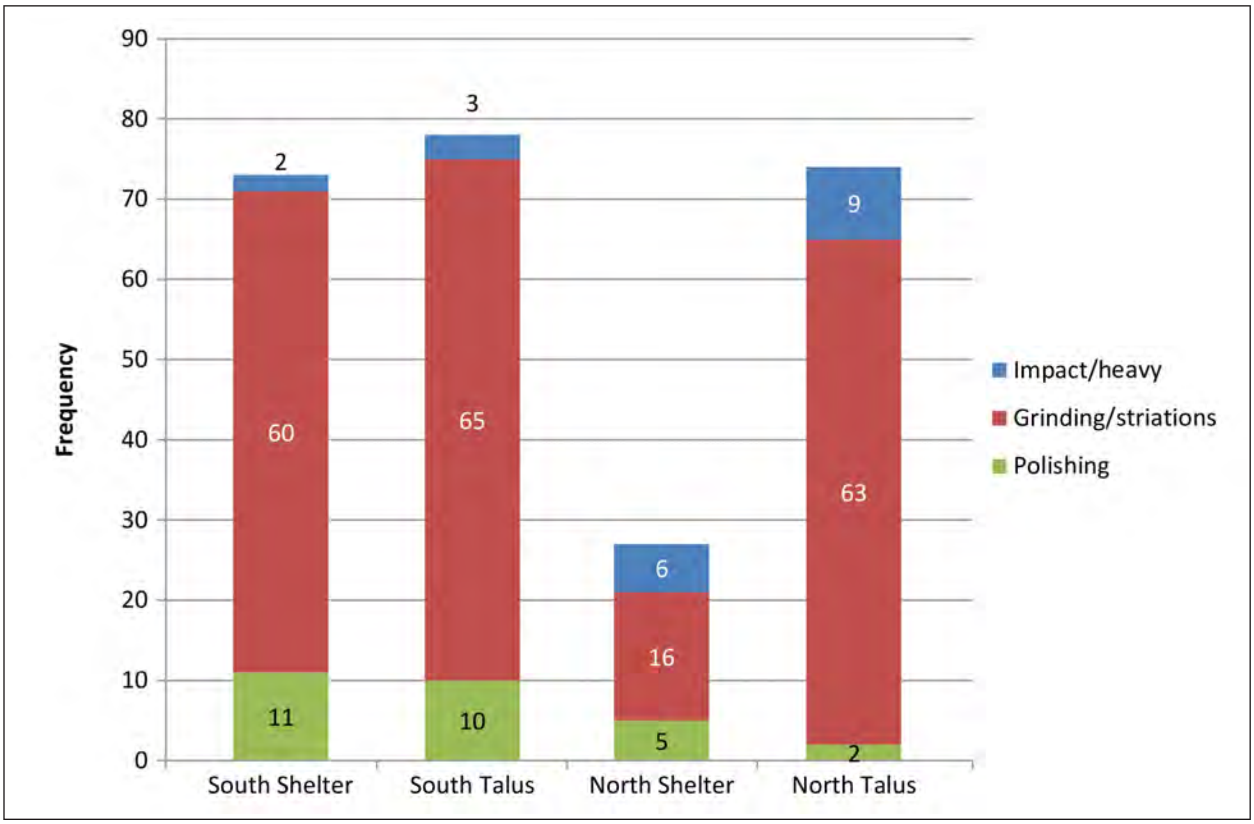

Figure 11.20. Ground stone wear by area; bar graph.

Vertical distribution of ground stone is considered here only for shelter contexts since the talus was redeposited. Shelter contexts were more secure, but identical levels across units were not necessarily contemporaneous since levels were contoured to surface irregularities. That said, some observations may be made regarding the vertical distribution of ground stone. In the combined units of South Shelter, tools occurred in every level from Level 1 to 14. Counts across these 14 levels ranged from one to six. No obvious spikes occurred, though tool counts were slightly higher from Level 3 through 8 in the South Shelter, which were generally upper to mid-level fill (Table 11.5). The pattern in North Shelter differed from this, since ground stone was recovered only from one of two concentrations in Levels 1 through 3 or Level 8, the lowest excavated level.

Table 11.5. Ground stone tools, counts by shelter area and level.

Level	North Shelter	South Shelter	Total
0	–	1	**1**
1	4	3	**7**
2	1	1	**2**
3	1	6	**7**
4	–	4	**4**
5	–	1	**1**
6	–	5	**5**
7	–	4	**4**
8	3	4	**7**
9	–	2	**2**
10	–	2	**2**
11	–	1	**1**
13	–	1	**1**
14	–	1	**1**
Total	**9**	**36**	**45**

Ground Stone Discussion

Ground Stone Microbotanical Remains

A total of 21 ground stone tools were submitted to two laboratories for microbotanical analysis: PaleoResearch Institute and EcoPlan Associates. Of these, 15 tools retained pollen, starch, or phytolith remains from a broad array of wild plants and meat. Cultigens were not observed on ground stone tools, but corn pollen occurred in sediment samples, indicating that dried seed corn was transported to the site and may have been processed by grinding. The results of both analyses are considered below as they relate to ground stone tool morphology, materials, and wear patterns.

EcoPlan Associates Analysis. Six ground stone artifacts were submitted for pollen analysis (Phillips, Chapter 14). One yielded positive results from the pollen wash, a one-hand mano of fine-grained micaceous schist from Level 3 in the North Talus (Fig. 11.1, FS 281), which is one of the most formally shaped tools in the assemblage. This tool displays wear patterns indicative of multiple types of manipulation, such as grinding, crushing, and battering. Battering is present on the ends and impact scars are scattered across the ground surfaces.

Phillips (Chapter 14) states that no cultural use of the mano is indicated by the pollen remains since they mirror those that are naturally occurring, but local resources would certainly have been utilized during hunting trips to the site. Furthermore, wild resources would presumably have a greater presence than cultigens at a campsite, particularly at Coyote Canyon since there is no indication that fields were planted there. As Phillips notes, since pollen is less likely to adhere to fine-grained materials, the positive results on this tool are particularly interesting. Perhaps a cultural source for the pollen on this mano is more likely since it is the only one of five fine-grained tools yielding positive results. Of the six pollen washes submitted for analysis, five are fine grained. Four are of identical material, micaceous schist.

The FS 281 mano surface yielded grasses, sunflower, ponderosa pine, cheno-ams, oak, pea, mustard, pinon, and cattail (Chapter 14), in similar proportions to those observed by Cummings and Varney. The high counts of sunflower and cheno-ams are partly due to their resistance to degradation, thus increasing their presence in the archaeological record (Chapter 14). However, this does not preclude their use as a resource, since the variable use of both is well-documented ethnographically. Virtually all of the plants represented on this mano yielded seeds or other parts that are processed by grinding, and all are represented in flotation and wood samples as well.

PaleoResearch Institute Analysis. A total of 15 ground stone tools were submitted to this laboratory for microbotanical analysis, 14 of which yielded positive results (Chapter 14). Remains of a broad array of wild plants were found on the surfaces of these 14 tools (Table 11.2). Potential culturally processed plants include grasses, goosefoot, parsley, pea, mustard, sedge, greasewood, sunflower, wild buckwheat, cattail, and possibly ephedra. Most of these were processed by grinding using various plant parts including seeds, roots, tubers, or flowers (Table 11.6). Microscopic carbon bits suggest some may have been parched first. Several other plants on tool surfaces primarily reflect the natural environs, though most of these were also exploited for economic reasons. These include ponderosa pine, alder, oak, juniper, pinon, fir, and club moss.

Table 11.6. Plant species and part processed by grinding or pulverizing; entire site.

Plant group	Plant part
Cheno-ams	seeds, sometimes parched
Amaranth	seeds, sometimes parched
Goosefoot	seeds, sometimes parched
Sunflower	seeds, sometimes parched
Parsley	roots, seeds, sometimes parched
Sedge	tubers, roots, rootstalks, seeds
Ephedra	seeds
Buckwheat	roots
Pea	seeds, roots
Grasses	roots, seeds, sometimes parched
Dropseed	seeds
Cattail	roots, flowers, inner cores
Mustard	seeds
Groundcherry	fruit
Hedgehog cactus	fruit
Chokecherry	seeds
Purslane	seeds
Banana yucca	root, fruit, seeds

Implications for the Ground Stone Assemblage

The seeds, flowers, roots, tubers, or fruit of the plants identified during this analysis were eaten fresh or processed in a variety of ways involving ground stone tools (Rainey and Adams n.d.). Grinding seed into meal was the most common method of processing, and was sometimes preceded by parching. Fruits and flowers of some plants were sometimes dried before grinding. Leaves and roots of some plants were also mashed or pounded. Ethnographic research documents parching or boiling of seeds and fruit prior to grinding for plants such as goosefoot, cheno-ams, hedgehog cactus, and ground cherry.

Two striking trends emerge from ground stone botanical remains. The first is that most tools displayed evidence of multiple plant types (n = 12). This was most obvious on, but not restricted to, metates, most of which had at least two plant types. The most impressive was a micaceous schist slab metate from the North Talus (Fig. 11.13, FS 417); it retained nine different plant remains, some of which may have been parched first (Table 11.2). A one-hand metaquartzite mano fragment (FS 65) also yielded an interesting variety of goosefoot, sunflower, buckwheat, and cattail. Tools used to process only one plant type were much less common and in every case had only grass remains on the surface. However, this does not indicate that grass-processing tools were specialized, since grass was the most ubiquitous plant found on ground stone tools, where it occurred most often with other plants.

The second trend indicated from tool surface remains was that the some of the links between botanical remains and wear patterns were unexpected. High-impact wear patterns such as battering, pitting, and deep scratching are mostly restricted to tools used to grind only grass seed, and lighter use such as grinding and striations occur primarily on tools with multiple plants (Table 11.2). There are exceptions to both trends and the sample is small, so these associations are probably not entirely representative. The heavy processing methods may be linked to materials that were not preserved on these tools, or they may result from tasks unrelated to food processing. They could also be taken at face value and denote two types of grass processing.

This wear pattern combination compares and contrasts with ethnographic accounts of grass-seed processing. It contrasts with the smooth-surfaced tools linked with seed grinding among Australian Aborigines (Smith 1986). This account states that grass seeds were ground on a metate with long, narrow grooves, producing very smooth, finely abraded surfaces, even to the point of polish. Small quartzite handstones were used, some of which were carefully manufactured. Rejuvenation in the form of light pecking was used only occasionally. A very different conclusion was reached by a later study of the same aboriginal group (Gorecki et al. 1997), which stressed that the process of grass-seed grinding involved pounding as well as milling. This combination of pounding and grinding is certainly reflected in some LA 139965 tools that only yielded grass pollen, but not in every case. Grass also occurs as pollen on tools with lighter wear.

Interestingly, tools with multiple plant remains display the opposite pattern; battering and pitting are absent and smoother, striated grinding surfaces prevail. Since grass pollen is often present with other plants, it could have been processed using various methods. As noted above, this pattern is not uniform and the sample is small and therefore may not reflect a consistently used processing strategy. However, taken together, the prevailing wear among ground stone tools with botanicals was moderate grinding with linear striations. Little patterning exists regarding the use of reciprocal versus random strokes with any type of plant material. Random or bidirectional strokes are more likely to be linked to grass, but reciprocal strokes apply to all plants across the board.

Other trends exist among tools with microbotanicals. There was some evidence for material choice among plant types (Table 11.2). Less abrasive stone such as micaceous schist and basalt tended to have a variety of plant remains on their surfaces. In contrast, tools with only grass were much more likely to be of more abrasive sandstone or orthoquartzite.

Also, the same plant pollen often occurs on different tools. Grass is probably the best example—though there are others—as it was found on virtually every tool type; one-hand manos, slab and basin metates, and flaked and smooth abraders—possibly the strongest indication that a plant was not always processed the same way. Additional evidence of this may be found in a single metaquartzite mano that had evidence for grinding both meat and grass on its use surface, but nothing in its morphology or wear suggested materials of such contrasting nature were processed. Possibly, the handiest tool was the best tool, and probably appropriate for the limited processing that would occur in a campsite. This in turn may imply expedient tool use, which was certainly occurring. But formal tools figured significantly also, and the choice between them may have been more related to convenience than morphology. An important caveat to this is that the 21 tools submitted for microbotanical analysis may not be representative of the whole assemblage.

It appears that similar processing methods extended to many materials and multiple processing methods applied to identical materials. In short, versatility prevails with some trending among grass-processing tools. The prevailing takeaway from the botanical analyses is reflected in the ground stone assemblage as a whole. Tools are versatile in the sense that many different types of plants and various plant parts were processed, as indicated by the microbotanical and macrobotanical remains. Versatility is also reflected in the different types of tools used to process the same material, possibly due to differences in quantity and desired end product.

Ethnographic Uses

Cummings and Varney (Chapter 14) list numerous ethnographic uses of the plants found at LA 139965, many of which involve grinding or pounding. Additional information is provided here to augment the use of grinding to process some of the plants found at LA 139965, along with the extent to which some groups depended on certain resources, particularly grasses.

Grasses figure prominently as an important or essential staple for many Southwestern groups, including those whose primary sustenance derived from agriculture (Doebly 1984:53). Chamberlin (1964 [1911]:339–340) is perhaps the most emphatic concerning the abundance and significance of chenopod and grass seed among the Gosiute of the Great Salt Lake area of Utah and eastern Nevada, stating that "plants of these genera are so often seen growing thickly over wide areas that they would seem in places to have furnished a food supply limited only by the capacity and inclination of the Indians to harvest it." While the higher elevation environs of Coyote Canyon would provide far more limited wild plant resources than the more arid environs of the Gosiute to which Chamberlin was referring, patches of open meadow thick with grasses are a common sight in the Guadalupita area. This is particularly true of lands bordering Coyote Creek.

Cheno-ams have a similar status, as they were exploited by virtually every Southwestern group. Traditional recipes used by the Havasupai, Hopi, Navajo, Yavapai, Pima, Ramah Navajo, Southern Paiute, White Mountain Apache, and Zuni involve grinding the seeds and mixing the meal with other ingredients to make mush or dumplings (Rainey and Adams n.d.). Seeds are sometimes parched before grinding. Cheno-ams were of primary importance to the Zuni prior to the arrival of corn, after which they were prepared together by grinding the seed to prepare a mush (Stevenson 1908:66; Castetter 1935:20–21). Parched goosefoot seeds were ground into meal by Navajo (Elmore 1944:44), Pima (Russell 1908:73), and Havasupai groups (Spier 1928:107). Yuma people grind the seeds of goosefoot, pigweed, panic grass, mustard, and sunflower (Castetter and Bell 1951:179–211). Australian Aborigines collect large quantities of grass and sedge seeds in just an hour, and husk them by rubbing the seeds between the hands (Cane 1989:105). Both dry and soaked seeds are ground using rounded or domed water-rolled pebbles (Cane 1989:112–113). Sedge seeds are commonly ground into mush by many groups as well, including Laguna and Acoma (Castetter 1935:25).

Yucca baccata was only evidenced by a single seed at LA 139965, but some uses of this plant did not involve the seed. The white pulp of the fruit was sometimes ground and made into large cakes after removing the outer husk and seeds (Castetter and Underhill 1935:39). The same process was applied to prickly pear fruit, which was mashed into a pulp after seeding for storage. Both processes were used by Papago groups; and both plants were recovered from flotation samples. In addition to the uses for cattail listed by Cummings and Varney (Chapter 14), the rhizomes were broken, sun-dried, and pounded in a mortar by the Mohave and Cocopa (Castetter and Bell 1951:209).

Meat fiber was found on a single tool from the South Shelter in Level 3. Fresh and dried meat was sometimes processed by pounding. Dried strips of meat were "pounded soft" with a stone and boiled by the Papago (Castetter and Underhill 1935:47) and Havasupai (Spier 1928:114). Meat pounding is referenced in a Lipan Apache narrative recorded in 1945 by Harry Hoijer (Webster 1999). The initial pemmican preparation process used by North American native groups is consistently described in ethnographic literature as pounding or pulverizing, but the tools are not always described. Driver and Massey (1957:237) may have best summed the multifunctional role of ground stone tools as: "milling stones and their hand stones often served a double purpose. Although designed for the grinding of seeds with a rubbing motion, they were also used to crack nuts or to tenderize meat by pounding."

Comparisons with Use-Wear Experiments

Some studies conclude that wild-seed grinding was best accomplished with tools and materials of low abrasive quality. Murrell (2007:37, 49–50) noted that between AD 800 and 1000 in the Middle Rio Puerco Valley small metamorphic manos were the most numerous in hunting and gathering economies when efficient corn meal production may have been less important. These same tools declined in frequency as more abrasive materials such as vesicular basalt and sandstone increased dramatically. The microbotanical remains on LA 139965 ground stone tools both confirm and refute this study. Small metamorphic manos clearly dominate the assemblage and microbotanical remains confirm their use with wild plant and seed processing. However, the campsite status of the site drives much of this association. Since corn was found at the site, it is possible that it was being processed with small manos of low asperity. If this is the case, it contrasts with Murrell's results. The link between corn grinding and less abrasive manos at LA 139965 is not confirmed but remains a likely possibility. Also of importance, use surfaces are rejuvenated more often than not among the analyzed sample, though not to the point of creating a highly abrasive surface.

In addition to the ethnographic study of the Australian aborigines mentioned above, two use-wear analysis studies from China found that certain wear patterns were produced by specific plant materials (Liu et al. 2010; Liu, Fullagar, and Field 2010). The first involved the examination of use-wear patterns on two groups of tools. The first was a replica set, and the second, a group of modern grinding stones that had been used extensively by local people in Xiazhuang, China (Liu et al. 2010:820). Many of the modern tools yielded starch grains, allowing researchers to make direct links between wear patterns and processing of specific foods (Liu et al 2010:825–827). This connection led to the conclusions that grinding of large kernels such as acorns typically resulted in smoothing and polishing wear and that grinding small seeds was more likely to produce striations since there was less cushioning between the surfaces of the tools (Liu et al 2010:829).

The second study from China (Liu, Fullagar, and Field 2010) also compared two tool groups: the first group (some of which had starch grains) and was recovered from Donghulin, a Neolithic site in the Middle Yellow River Valley; the second group was a replica tool set made from the same materials that were used prehistorically. A comparison of the two groups suggested that different foods produced different wear patterns. Specifically, grinding low-silica materials, such as seeds, produced smooth, finely striated surfaces; grinding high-silica materials, such as grass, produced polished surfaces; and processing a variety of plants produced a mixture of polish and striations (Liu, Fullagar, and Field 2010:2635–2637). The latter bears the greatest resemblance to the LA 139965 ground stone, in which smooth, striated surfaces dominate.

Though only one acorn was recovered from LA 139965, and ground stone tools did not yield acorn botanicals, the nuts were probably a resource. Manos and metates are used to pound acorn nuts by numerous Pueblo groups, the Pima (Castetter 1935:47), and Apache (Castetter and Underhill 1935:42–43). Acorns required a combination of pounding and grinding, particularly in the Southwest where the nuts were usually not leached to remove the tannins (Driver 1952:59). Though direct evidence of acorn processing was not found at LA 139965, some experiments grinding acorns produced polish wear patterns similar to a basalt handstone from Level 1 in the North Shelter. Dubreuil's (2004:1618–1619) experiments grinding fresh and dry acorns produced uneven surfaces, polished pits, and sometimes striations, though she noted that sheen may have obscured striations on some materials, particularly basalt.

Other experiments have replicated Dubreuil's results in large part (Liu et al. 2010:823, 829). Acorns ground on modern milling stones from China resulted in uneven surfaces with few or no macroscopic striations and polished pits. These experimental wear patterns compared well with those of metates with acorn-starch residue from Neolithic sites in the Middle Yellow River Valley in China. Surfaces had polished pits and uneven contours, and striations were noticeably absent. However, the manos used on these acorn-grinding metates differ greatly from those at Coyote Creek, described as "rolling pins" with battering wear on the ends (Liu et al. 2010:817–818).

The polish wear observed in experiments and on prehistoric tools is highlighted in both instances. This type of wear results from grinding substances with oils such as nuts, meat, fish, and fresh acorns (Dubreuil 2004:1619). Other pitted tools in the assemblage were not polished, which may indicate that they were not used to reduce acorns, but possibly to crush other resistant, non-oily materials such as corn. Though corn was found in the North Shelter at LA 139965, it too, requires impact for processing, particularly for dried seed (Euler and Dobyns 1983:254).

Ground Stone: Conclusions

The morphology, wear, and associated botanical remains of the LA 139965 ground stone assemblage suggest that most tools were used to process a wide variety of wild seeds as well as dried corn and meat. Two subsets of tools are indicated based on the pairing of wear patterns and botanical remains. The largest group consists of small handstones and basin metates of moderately abrasive local materials. Use surfaces tend to be heavily worn and rarely rejuvenated. Botanical remains indicate that this larger subset of tools was the most versatile, used to process multiple plants such as grasses, goosefoot, mustard, cattail, parsley, buckwheat, purslane, banana yucca, hedgehog cactus, pea, and ephedra.

Tools that yielded *only* grass botanicals had similar morphology to these but displayed heavier wear such as pitting, battering, and deep scratching—which contrasts with some ethnographic accounts of grass seed processing. Seeds of all types may have been parched first, suggested by microscopic charcoal. Corn pollen was not present on ground stone but occurs in sediment samples and this plant was probably brought to the site as dried corn. Sage pollen aggregates also occurred on ground stone but were probably environmental.

The multifunctional nature of these tools reflects the long-term use of the rockshelter as a hunting campsite. Tool design suggests low quantity hulling, husking, and cracking activities rather than high-volume flour production. The level of manufacturing input is typically low, but some fully shaped tools are present, particularly manos. Ground stone tools were likely manufactured on site and left as site furniture between visits, used repeatedly not only during individual trips, but possibly across generations and by multiple groups over a long period of time to process many wild plants, meat, and corn transported to the site.

Ornaments, Minerals, Shell, and Fossils

This group of artifacts consists of raw materials (n = 14), pigment stones (n = 5), pendant blank (n = 1), discoidal bead (n = 1), olivella shell bead (n = 1), manuports (n = 2), and a shell inlay fragment (n = 1) (Table 11.7). Eleven material types are represented: freshwater shell (n = 10), olivella shell (n =1), crinoid (n = 2), horn coral (n =1), travertine (n = 1), mica (n = 2), jet (n = 1), basalt (n = 1), limonite (n = 4), hematite (n = 1), and sandstone (n = 1). Source locations for the materials are discussed with each artifact section.

Table 11.7. Ornaments, counts by type and material; entire site.

Ornament Type	Material Type	Total
Bead	Olivella	1
Disc bead	Gray stone	1
Pendant blank	Sandstone	1
Pigment stone	Limonite	4
Pigment stone	Red ochre	1
Manuport	Horn coral or shark tooth	1
Manuport	Olivine basalt	1
Raw material	Mica	2
Raw material	Jet	1
Raw material	Crinoid	2
Raw material	Freshwater shell	9
Inlay	Freshwater shell	1
Total		**25**

Olivella Shell Bead (n = 1)

This olivella shell bead was recovered from combined fill of Levels 1–4 of the North Shelter in 272N/140E, near the back wall. Based on its small size and fairly straight-sided shape compared to other *Olivella* species, this bead is probably *Olivella dama* (Fig. 11.21). Its "torpedo silhouette" is characteristic of *O. dama* shells, which are sourced in the Gulf of California and commonly found in the Southwest (Milliken and Schwittala 2012:14). Following the pioneering work of Bennyhoff and Hughes (1987), Milliken and Schwittala (2012) have proposed an updated typology of olivella shell beads from the California coast. Several new attributes are proposed with the goal of establishing a database of uniformly analyzed beads, which will potentially inform on style variations over time and location of manufacture. These new attributes include measurements at specific points on the shell (Milliken and Schwittala 2012:10); Table 11.8 provides these for the LA 139965 bead.

The Coyote Canyon Rockshelter olivella bead is the "spire-lopped" type common across the Southwest. The spire was removed by grinding and cutting below the widest point of the shell, resulting in a large, open hole. A very small portion of the circumference is cut and snapped, creating a short, jagged length within an otherwise smooth, even spire cut. Within this short, jagged span is a tiny rectangular notch. This type of wear is common among strung beads as a result of the cord wearing into the shell (Gamble and King 2011:170). The hole created by the spire removal is large and open and ground down to the widest point of the barrel. This contrasts with many spire-lopped shells from California where only the tip end of the spire is removed (Gamble and King 2011:Fig. 8, 171). Milliken and

Figure 11.21. Spire-lopped olivella shell bead (FS 769).

Table 11.8. Summary, Olivella shell bead data.

Bead Data	Dimen. (mm)/ Descrip.
Length	9.86
Diameter of shell at widest point	6.68
Diameter of hole	5.13
Estimated percentage of end-removal below the widest diameter of the original shell	2
Angle of spire end removal	flat
Spire end perforation	large, open

Schwittala (2012:10) propose a universal attribute of estimating the percentage of shell removed below the spire. For the Coyote Canyon Rockshelter artifact this is estimated at 2.0 percent, but is admittedly subjective since the length of the unmodified shell is unobservable. The bead itself is whole.

The shell aperture has been widened by cutting and snapping the outer lip to form a roughly 90-degree angle, a modification performed to facilitate stringing (Bennyhoff and Hughes 1987:116–117). These outer lip cuts were also observed on olivella shell beads from LA 835, a late Developmental Period site near Pojoaque, NM, which yielded several of these beads (Wening in prep.). Elsewhere, outer lip cuts are infrequent in literature, as the aperture of most spire-lopped beads, as seen in photographs, is unmodified (Kozuch 2002:702; Bennyhoff and Hughes 1987:89; Milliken and Schwittala 2012:10). Bennyhoff and Hughes (1987:116–117) did not consider the outer lip cut to warrant an individual type, thus it falls within the stylistic range of spire-lopped beads. Milliken and Schwittala (2012) do not address this stringing modification.

The 6.68 mm diameter of the Coyote Canyon Rockshelter bead places it in the "medium" spire-lopped category devised by Milliken and Schwittala (2012:14). The entire exterior is striated from wear, as are all edges, both modified and natural, which are rounded and polished, particularly around the canal where the string would have run through the narrowest channel.

Disc Bead (n = 1)

This small disc bead—recovered from Level 3 in the South Talus close to the outer edge of the South Shelter—is made of pale gray stone that appears to have a cryptocrystalline structure similar to chert (Fig. 11.22). The material does not exhibit the bedding characteristic of travertine, nor does it react to hydrochloric acid. It is fully shaped and drilled biconically (5 by 2 mm). The exterior edges are rounded and polished from wear, and the exterior surfaces are lightly striated. No manufacturing cut marks are present on the flat surfaces. This type of wear and the absence of cut marks indicate that the material is durable and resists scratching and rounding far more than a softer material such as shale or jet. Beads of jet and shale from LA 835 almost universally exhibit a variety of deep striations from manufacture and wear (Wening in prep.).

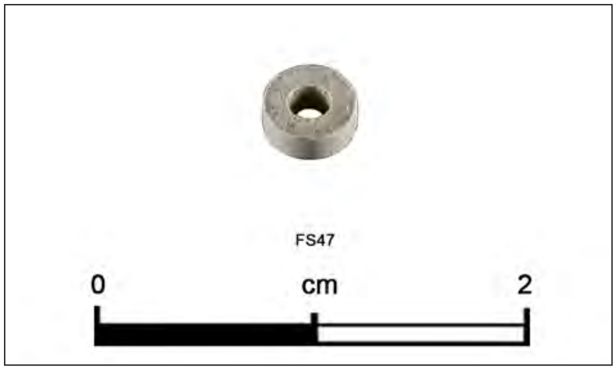

Figure 11.22. Stone disc bead (FS 47; from South Talus).

Though this bead was manufactured to be strung, the drill hole displays very little wear. Its rectangular cross section indicates that it was probably one of numerous identically sized beads that would have formed the straight section of a strand, rather than the wedge-shaped beads usually found in the curvature.

Pendant Blank or Shaped Stone (n = 1)

This artifact, recovered from Level 9 in a unit located directly outside the south end of the North Shelter, is a small, flat oval pebble of yellow micaceous sandstone that has been abraded over most of the surface, but has not been drilled (19 by 8 by 3 mm; Fig. 11.23). The sandstone pebble reflects typical pendant manufacture in that it was shaped prior to final drilling. Though most of the surface is abraded, unworked areas suggest the pebble was not significantly modified from its original state. It is also possible that this was simply a shaped stone, as

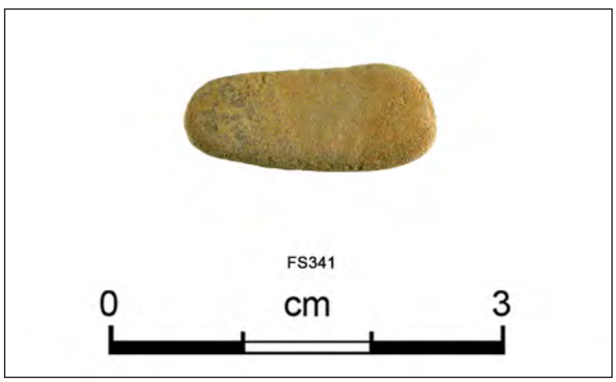

Figure 11.23. Sandstone pendant blank (FS 341).

such items were found in four subfloor ritual caches at Picuris Pueblo (Wolfman and Dick 1999:101–110). Ceramics associated with the caches suggest a date range of AD 1500–1650.

Sandstone pebbles and cobbles are found in Coyote Creek gravels, which derive in part from the Sangre de Cristo and Sandia formations along the east side of Guadalupita Canyon (McLemore 1999:20). One artifact classified as a manuport may have been collected for use as a pendant because it has a natural vesicle, which could have been used for stringing. It is described below in that section.

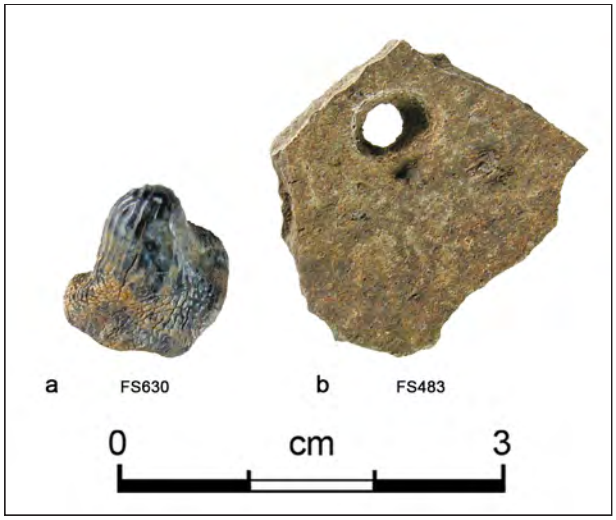

Figure 11.24 [a, b]. a. Horn coral or shark tooth fossil (FS 630); b. basalt fragment with natural vesicle (FS 483).

Pigment Stones (n = 5)

Limonite (n = 4) and hematite (n = 1) pigment stones were recovered from the North Talus (n = 3) and the South Shelter (n = 2). Only two were worked by light abrasion. Pigment stones were generally small, ranging in weight from 1.5 to 7.8 grams. The North Shelter yielded two of the smaller limonite stones and the single hematite occurrence, all of which were in the central area of the shelter. Vertically, the stones were also close to one another, occurring either in Level 3 (n = 1) or Level 4 (n = 2). Both of the worked stones were from the North Shelter. In the South Shelter, two unworked limonite pieces were in fairly deep fill near the south end (Levels 9 and 12). Hematite inclusions were ubiquitous in many of the olivine basalt ground stone tools, indicating that this mineral occurs naturally in the project area. Though specific mention of limonite and hematite were not encountered in geologic literature of the area, O'Neill and Mehnert (1988:A1) note that the basalts of the Ocate Volcanic field are rich in iron.

Manuports (n = 2)

One of the most interesting artifacts from the assemblage is a fossil that resembles horn coral or a shark tooth (Fig. 11.24 [a]). It was recovered south of the North Shelter in Level 2. The entire surface is highly polished, possibly from handling, but the artifact is otherwise unmodified. Fossils in Guadalupita Canyon are sourced in the sandstone cliffs of the Sandia formation, Madera Group, and Sangre de Cristo formation, which form the oldest layers exposed by Coyote Creek (New Mexico Geology 1983:1; McLemore 1999:20).

The South Talus manuport is a rough, unshaped spall of olivine basalt (Fig. 11.24 [b]), which has a natural vesicle perforating the piece near one edge (20 by 20 by 4 mm; vesicle: 1.9 mm). Several characteristics of this stone fragment indicate that it is a natural object, though at first glance it appears to be drilled. The surfaces are completely devoid of shaping, the first step in pendant manufacture. The vesicle is located near the center of one edge, where a drill hole would be placed. However, the hole is naturally formed. The vesicle is thinly lined with a white mineral that is likely the calcite filling in basaltic vesicles referred to by O'Neill and Mehnert (1988:A8). Also, the vesicle bows out significantly inside the hole, forming a biconvex profile that would be impossible to produce with a drill. Finally, its occurrence near the bottom of the North Talus slope in Level 1 fill reduces the chances of a cultural link with this fragment, though it is possible the stone was collected to take advantage of this feature. No wear is present inside the vesicle.

Raw Material (n = 14)

The items in this category are small, unworked fragments of freshwater shell (n = 9), mica (n = 2), crinoid (n = 2), or jet (n = 1). As such, their presence at the site may be natural, particularly since no worked pieces of these materials were found. However, all of the freshwater shell fragments were fairly concentrated in Levels 3 and 4 of two grid units in the central area of the South Shelter (244N/144E and 244/143E). This could result from the decomposition of a single bivalve shell washed into the shelter in alluvial episodes associated with Coyote Creek. The creek may have supported several species of freshwater bivalves, providing a nearby source for shell (Chapter 8, this report). The shell could also have been culturally transported, but there is no conclusive evidence to support this.

One of the unworked mica fragments is rather large (31 by 20 mm). It was found near the back of the North Shelter in Level 3, which may increase the likelihood of a cultural link. The other mica artifact is much smaller and was provenienced in shallow fill in the area south of the South Shelter. Mica is abundant in the rocks and soils of the project area, so the presence of unworked materials is to be expected.

The two crinoid artifacts are stem fragments. Though specific occurrences of crinoids are not mentioned in descriptions of Pennsylvanian outcrops in Guadalupita Canyon, crinoids are common in such layers throughout New Mexico, including the Taos and Talpa areas north of the project area (Webster 2006). The small jet fragment was recovered near the surface about halfway down the slope of the South Talus.

Historic Shell Inlay (n = 1)

This freshwater shell artifact was found in Level 1 of an excavation unit near the center of the South Shelter and appears to be an ornamental inlay fragment (Fig. 11.25). As such, it could have decorated the surface of a knife, perhaps, or another tool. While shell inlay was—and is—used for countless other items, e.g., combs and fans, these are presumably less likely to occur in a rockshelter. The LA 139965 artifact is a long, narrow piece with one flat and one rounded side. The flat, interior side exhibits very fine, straight, linear cuts across the entire surface probably from a machine cut. The exterior surface is finished by edge rounding and polishing, and covered with numerous small use-wear striations. Both ends are snapped, so only the width and thickness are complete (18 by 13 by 2 mm).

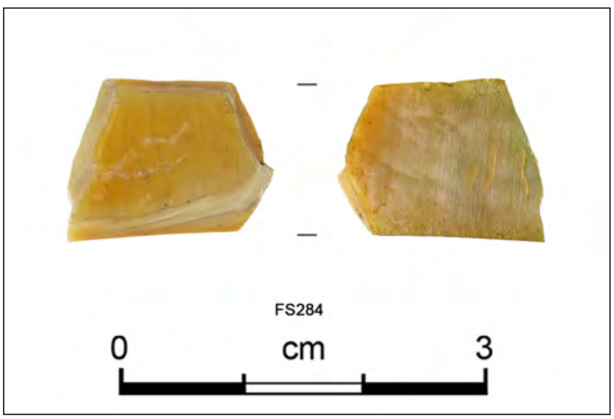

Figure 11.25. Historic shell inlay fragment (FS 284).

Spatial Distribution

Ornaments and minerals were distributed between the North Shelter (n = 2), North Talus (n = 6), South Shelter (n = 13) and South Talus (n = 4); Table 11.9. These frequencies are skewed by the high number of freshwater shell fragments in the South Shelter (n = 9)—which could represent one or two disintegrated shells, particularly since they were found in Levels 3 and 4 in adjacent units. If these nine shell fragments are reduced to two occurrences, the numbers equalize between the four areas of the site.

The northern area of the site was the location of two unique finds, the shark tooth/horn coral fossil (Fig. 11.24) and the olivella shell bead (Fig. 11.21). All freshwater shell fragments were in the South Shelter. Across the site, ornaments and minerals were concentrated in Levels 3 (n = 5) and Level 4 (n = 9), but again, if the freshwater shells are considered individual occurrences, the assemblage is scattered evenly across Levels 1, 2, 3, and 4, with single or double counts in lower Levels 5, 9, and 12. Only one of the two formal ornaments—the olivella shell bead—was in the secure context of the North Shelter, suggesting it may have had ritual significance. The disc bead was in the South Talus (Fig. 11.22). In fact, modified items, though there are only a few at Coyote Canyon Rockshelter, are only slightly more likely to be in upper level fill between Levels 1 and 4 (n = 2) versus the lower fill of Level 9 where the pendant blank occurred.

Ornaments, Discussion and Conclusions

Olivella shells are a common prehistoric trade item in the Southwest, serving as one of the hallmarks of exchange networks between the Pacific Coast, Great Basin, Southwest, and beyond. These trade networks have considerable antiquity as well as geographic extent. The antiquity of these networks

Table 11.9. Ornament type and material, counts by site area.

Ornament Type	Material Type	North Shelter	North Talus	South Shelter	South Talus	Total
Bead	Olivella	1	–	–	–	**1**
Disc bead	Gray stone	–	–	–	1	**1**
Pendant blank	Sandstone	–	1	–	–	**1**
Pigment stone	Limonite	–	2	2	–	**4**
Pigment stone	Red ochre	–	1	–	–	**1**
Manuport	Olivine basalt	–	–	–	1	**1**
Manuport	Horn coral	–	1	–	–	**1**
Raw material	Mica	1	–	–	1	**2**
Raw material	Jet	–	–	–	1	**1**
Raw material	Crinoid	–	1	1	–	**2**
Raw material	Freshwater shell	–	–	9	–	**9**
Inlay	Freshwater shell	–	–	1	–	**1**
Total		**2**	**6**	**13**	**4**	**25**

is demonstrated by the early radiocarbon dates of spire-lopped *O. biplicata* beads from sites in the Mojave Desert, which range from cal. 11,200 to 7860 BP (Fitzgerald, Jones, and Schroth 2005). Several sites in Kansas point to the longevity of the *Olivella* bead trade, where *O. dama* beads were recovered from sites ranging from AD 500–1700 (Hoard and Chaney 2010:293–294). Interestingly, the Kansan sites yielded more shells from the Gulf of California than from the more proximate Gulf of Mexico. Huge quantities of olivella beads were traded from the Gulf of California to the Spiro Mound site in Ohio, where nearly 14,000 were found in a single burial (Kozuch 2002:697).

Spire-lopped beads have a broad temporal range, and as such, are generally less time-sensitive ornaments than other olivella bead styles. This is particularly true of small assemblages (Gibson 1992), and specimens that are ground flat to remove the spire (King 1990:107–108; Bernard 2008:170–171). Some researchers note fluctuations in bead style, shell size, and shell type over the long span of California prehistory (Bennyhoff and Hughes 1987; King 1990; Gibson 1992). Others note that no consistent typology yet exists for these beads, but acknowledge their long-term presence in California prehistory dating back at least 9,000 years (Farmer and LaRose 2009:2). Bennyhoff and Hughes (1987:118–119) note that abrasion of the sutures above the aperture—in other words, the upper portion of the spire—indicates that most *O. dama* beads were strung side-by-side rather than end-to-end.

The Coyote Canyon Rockshelter bead is *Olivella dama* from the Gulf of California. Marine shell may have been transported along four major trade routes originating from the eastern coast of the gulf (Vokes and Gregory 2007:319–321). One of the most direct routes connects to Paquimé, continues north along the east side of the Sangre de Cristo Mountains, and arrives in the end at Pecos Pueblo. Another route begins at a more northerly location along the Gulf of California coast, passes through the Hohokam sites of Snaketown and Pueblo Grande, and eventually links up with the main route north to Pecos Pueblo. Marine shell generally traveled in an unmodified state to be fashioned into ornaments either at Hohokam sites in the Tucson Basin or at Paquimé; but these locations varied with time. The Hohokam produced most of the shell ornaments traded to the Anasazi until the rise of Paquimé in the fourteenth and fifteenth centuries (Vokes and Gregory 2007:330–331; Bradley 1993:126). However, there appears to be considerable overlap between uses of each culture for ornament production. Mitchell and Foster (2000:38) note that the most intensive use of Hohokam shell middens along the Sonoran coast occurred between AD 800 and 1300 or 1400. Radiocarbon dates from *O. dama* beads from CA-ORA-378, a coastal site in southern California, indicate that ca. AD 1600–1830 the primary source for shell shifted away from the Pacific Coast to the Gulf of California (Gibson and Koerper 2000:342, 350–351).

This olivella bead, found in North Shelter, is the only ornament that could represent a ritual deposit at LA 139965, since it was recovered near the back wall of the shelter. All of the radiocarbon dates for the North Shelter are from grid units to the east, at the front of the shelter. These dates range from AD 567–630 to AD 1287–1399 (Chapter 16, this report). The later date range falls within the most robust shell trade periods at Paquimé and Snaketown, but is also close to the transition date away from the Hohokam, and as such, could have been obtained from either place. However, if it was associated with an earlier date it could be linked with exchange systems between the Gulf of California and the Southwest. The temporal change in shell source and related trade networks is the object of considerable study. Hughes and Milliken (2007:269) note that recent research increasingly points up the fact that the boundaries between the Gulf of California and Pacific Coast exchange systems shifted over time. They cite several studies that conclude that southern California was the source for Early and Middle Holocene beads in the North American West, adding the important caveat that this time period is not well represented in the archaeological record. They include other researchers who focus on later time periods and arrive at very different conclusions regarding the source and extent of exchange networks based in California. Hughes and Milliken (2007:268) sum up the complexity of the overall portrait of shell bead exchange over time, noting the interrelationship of shell source location, production centers, and the extent of individual trade networks (Hughes and Milliken 2007:268).

Disc beads have an even more ubiquitous presence in Anasazi sites along with an accompanying lack of temporal sensitivity, though color popularity varies over time. Disc beads of dark-colored stone first occur in Basketmaker II, while beads of white travertine did not make an appearance until the succeeding Basketmaker III period (Jernigan 1978:28,155–156). Disc beads in general were notably few in the archaeological record until Pueblo III and IV when they were "virtually everywhere," worn in a variety of ornamentations such as bracelets, necklaces, or strings of beads worn as earrings (Jernigan 1978:158–159). Though white beads are commonly reported as having been produced from shell, Merrin's (1995) study demonstrated that most were travertine. The disc bead is serviceable and may represent an accidental loss.

Tab pendants were worn singly as necklaces, earrings, or interspersed with disc bead necklaces. A variety of materials were used, particularly in the earlier Basketmaker II through Pueblo I periods (Jernigan 1978:160, 162). These were largely replaced by turquoise during Pueblo III and later periods. Most rounded forms, as with the Coyote Canyon Rockshelter preform, were produced from stone; though Jernigan (1978:165) notes that oval pendants were probably not a standard shape among the Anasazi. Mica was also shaped and drilled for pendants, but the mica from Coyote Canyon Rockshelter was unworked and probably natural.

The Coyote Canyon Rockshelter pigments are also unmodified, so it is not clear if their presence in the site is cultural, particularly since iron-based minerals are common in the project area. Pigment stones were observed in the hills bordering the canyon. However, at Picuris Pueblo, both shaped and unshaped pigment stones were included in four large ritual caches (Wolfman and Dick 1999:101–110). All of the Picuris artifacts were deposited in subfloor pits in four individual rooms, sealed with stone slabs and topped with new adobe floors. The caches were estimated to date from AD 1500–1650 based on the design elements and spatial contexts of the Trampas Black-on-white pots within them. Though no such cache features were found at Coyote Canyon Rockshelter, the use of the site for hunting-related activity could mean that associated rituals took place there as well.

12 Fauna, Gastropods, and Human Remains Analysis

Nancy J. Akins

A large sample of fauna was recovered from LA 139965 (n = 10,000+), or Coyote Canyon Rockshelter, and all were analyzed. These were recovered from screening with two sizes of screen, from preliminary screening of flotation samples before analysis (1/8-inch screen), and during microscopic analysis of flotation samples. While the smaller-sized screen samples and screened flotation bone is more likely to recover small bones and small animal forms, no attempt was made to remove the larger bones from these samples before screening so that neither type of sample is a true reflection of what could be lost to using the larger screen size.

Fauna Analysis Methodology

The LA 139965 fauna was analyzed following the established OAS computer-coded format. Identifications were directly entered into an SPSS database that recorded the following information:

Provenience-Related Variables: Provenience information for the Coyote Canyon Rockshelter includes the area, northing and easting, level, stratum, and beginning and ending elevations. Also included is the screen size and datum. Each line was also assigned a lot number that identifies a specimen or group of specimens that fit the description recorded in that line. The count identifies how many specimens are described by that data line.

Taxon: Taxonomic identifications are made as specific as possible. Specimens that cannot be identified to the species, family, or order are assigned to a range of indeterminate categories based on the size of the animal and whether it is a mammal, bird, other animal, or cannot be determined. Assignments to an artiodactyl size taxon are based on shape, cortex characteristics, and site specific observations on how this order preserves. In this analysis, larger forms were generally identified as "small to medium artiodactyl" because of the presence of sheep or goat in the assemblage and virtual absence of other animals of comparable size. Those where the texture or other characteristics are less clearly artiodactyl were called "medium to large mammal," although the vast majority are probably from medium artiodactyls. The presence of elk and bison in the assemblage resulted in some specimens being identified as "medium to large artiodactyl." These are generally small fragments that have sufficiently thick cortex to suit either a medium or large size determination. "Unidentifiable" fragments often constitute the bulk of a faunal assemblage. By identifying these as precisely as possible, the information can supplement that from the identified taxa. When identification is less than certain, this is indicated in the certainty variable.

Each bone (specimen) is counted only once, even when broken into a number of pieces by the archaeologist. If the break occurred prior to excavation, the pieces are counted separately and their articulation noted in a variable that identifies conjoinable pieces, parts that were articulated when found, and pieces that appear to be from the same individual. Animal skeletons are considered as single specimens so as not to inflate the counts for accidentally and intentionally buried taxa.

Element (Body Part): The skeletal element (e.g., cranium, mandible, humerus) was identified then described by side, age, and the portion recovered. Side was recorded for the element itself or for the portion recovered when it is axial, such as the left transverse process of a lumbar vertebra. Age is recorded at a general level: fetal or neonate, immature, young adult (near or full size with unfused epiphysis or young bone), and mature, generally on the basis of size, epiphysis closure, or texture of the bone. Aging based on texture alone is not absolute since most growth in mammals takes place near the articular ends; diaphyseal bone can be compact and dense while the bone near an end retains a roughened or trabecular structure (Reitz and Wing 1999:73). As a result, fragments from the same bone can be coded as different ages and juvenile bone is probably under-numerated. Further refinements based on dental eruption or wear were noted as comments. The criterion used for assigning an age was also recorded. To aid in estimating how many individuals could be represented in an assemblage, the portion of the skeletal element represented in a particular specimen was recorded in detail.

Completeness: Completeness refers to how much of that skeletal element is represented by the specimen. It is used in conjunction with the portion represented to determine the number of individuals present. It also provides information on whether a species is intrusive and on processing, environmental deterioration, animal activity, and thermal fragmentation.

Taphonomic Variables: Taphonomy is the study of preservation processes and how these affect the information obtained by identifying some of the nonhuman processes that in turn affect the condition or frequencies found in an assemblage (Lyman 1994:1). Environmental alteration includes: pitting or corrosion from soil conditions, sun bleaching from extended exposure, checking or exfoliation from exposure, root etching from the acids excreted by roots, and polishing or rounding from sediment movement. Rounding can be problematic, as it can also occur from boiling and digestion. Digestion is usually easier to distinguish as it also dissolves portions of the bone, while boiling seems to alter the texture of the bone giving it a polished appearance. Animal alteration was recorded by source or probable source, e.g., carnivore, rodent gnawing, and scat.

Burning: Burn color is a gauge of burn intensity. A light brown, reddish, or yellow color or scorch occurs when bones are lightly heated, while charred or blackened bone becomes black as the collagen is carbonized, and when the carbon is oxidized, the bone becomes white or calcine (Lyman 1994:384–388). Burns can be graded, reflecting the thickness of the flesh-protecting portions of the bone, or dry, light on the surface and black at the core or blackened on only the exterior or interior, indicating the burn occurred after disposal when the bone was dry. Graded or partial burns can indicate a particular cooking process, generally roasting, while complete charring or calcine bone does not. Uniform degrees of burning are possible only after the flesh has been removed (Lyman 1994:387) and generally indicates a disposal practice. While a wide range of colors and intensities occur, this information is summarized in the burn type variable, which identifies the intent rather than a detailed visual description of the specimen. Complete and some graded burns represent discard processes and are recorded as "discard." Patterns that suggest the part was roasted (e.g., graded burns that are scorched where the flesh is thick and burned black at the end where there is little or no flesh) are recorded as "roasted." In other cases, the burn appears accidental or intentional (e.g., dry burns or a burned tip) and is recorded as such. Potential boiling is recorded as "boiled" (color change, waxy, rounded edges) or "boiled(?)" when it is less clear.

Butchering: Evidence of butchering was recorded as "cuts," "impacts," "spiral breaks," "saw cuts," or "defleshing." The location of the butchering is also recorded. A conservative approach was taken to the recording of marks and fractures that could be indicative of processing animals for food, tools, or hides since many natural processes result in similar marks and fractures.

Modification: Deliberate modifications are indicated through this variable. Manufacturing debris and tool forms are flagged as modified and analyzed as worked bone in a separate database.

Comments: A comment column was used to record additional information from the bag, comments on tool types, and other observations on the specimen. Specimens recovered from the screened flotation samples and those from the microscopic flotation analysis are flagged separately.

Data Analysis

Once the data was entered and checked, the provenience information was added. Data are tabulated and analyzed using SPSS (pc version 11 and 22).

Taxa Recovered

Coyote Canyon Rockshelter is located in an area with access to diverse resources. With scattered fir and juniper, a ponderosa pine and oak forest around the site, the creek with riparian vegetation just east of the site, and a grassy meadow beyond the creek, a diversity of animal species should have been readily available for those who used the site area. The NM Game and Fish Department's Biota Information system (Bison-M: http://www.bison-m.org) provides information on animals documented for Mora County and habitats within the county (Table 12.1). While incomplete in some areas, it shows the diversity of resources that could have been present and utilized by prehistoric and early historic groups.

Not all of the taxa recovered from the site's shelters are the result of human procurement. Natural processes, such as rodents living in the shelter and collecting bones and body parts, raptors nesting on the cliff above dropping food remnants, and carnivores eating and leaving scat all contribute to the assemblage. Table 12.2 lists the taxa and counts for the nearly 11,000 pieces of bone and eggshell recovered. The majority are small fragments representing less than 10 percent of the element (64.5 percent) or between 10 and 50 percent of the element (24.1 percent). Almost 30 percent (28.4 percent) of the bone is burned, nearly always heavy or discard burns (24.7 percent). While only a quarter of the bones exhibit environmental alteration, and even fewer carnivore or rodent alteration (7.7 percent), the breakage and burning resulted in a large number of identifications that are not positive (cf.). Most are due to burning and fragmentation but others are because there are more than one closely related species that the specimen could be and while they "compared favorably" with the OAS comparative specimens, the range of variation within these could overlap, thus making the identification less than certain. Still others are from immature individuals where the morphology strongly suggests a particular species. Before turning to the distribution in the site areas, this section briefly reviews the taxa and taxa groups

Unidentified Taxa

Unidentified specimens comprise a relatively large portion of the assemblage (29.7 percent). These include various sizes of mammals and birds as well as specimens that could be either, or could also be from reptiles, amphibians, or fish. Most of unidentified specimens are long bone (58.8 percent) or flat bone (30.5 percent) fragments and nearly all are small fragments comprising less than 10 percent of the element (96.6 percent). Burning is common (42.0 percent) and several were gnawed on or digested (3.7 percent).

Small Mammals

Bats

The four bat bones include two femurs, a maxilla, and an ulna. No attempt was made to identify the species. Six species of bats are found in Mora County ponderosa pine environments (Bison-M, accessed November 15, 2015) and those recovered from the site are probably natural deaths of bats roosting in the crevices above its rockshelters.

Squirrels

At least six species of large and small squirrels

Table 12.1. Species found in selected habitats of Mora County.

Species	Mora County	Douglas/ white fir	Ponderosa pine	Ponderosa pine/oak	Montane grassland	Montane riverine	Aquatic
Fish	24	–	–	–	–	–	–
Amphibians	7	3	1	2	1	4	7
Reptiles	25	5	9	2	6	6	6
Birds	163	63	71	42	51	92	68
Mammals	63	53	51	–	53	51	4
Mollusks	32	16	16	–	–	–	–

Bison-M, accessed November 16, 2015.

Table 12.2. Taxa recovered from LA 139965.

Common name	Scientific name	n =	%	cf.
Unknown small	Unknown small	19	1.7	1
Unknown	Unknown	1	0.0	–
Small mammal/bird	Small mammal/medium-large bird	40	0.4	3
Small mammal	Small mammal	358	3.3	12
Small-medium mammal	Small-medium mammal	249	2.3	14
Medium mammal	Medium mammal	26	0.2	3
Medium to large mammal	Medium-large mammal	2331	21.2	34
Large mammal	Large mammal	165	1.5	5
Very large mammal	Very large mammal	4	0.0	–
Bats	Order Chiroptera	4	0.0	–
Small squirrels	Small Sciuridae	2	0.0	1
Large squirrels	Large Sciuridae	2	0.0	–
Colorado chipmunk	*Eutamias quadrivittatus*	19	0.2	5
Yellow-bellied marmot	*Marmota flaviventris*	3	0.0	3
Golden-mantled ground squirrel	*Spermophilus lateralis*	23	0.2	4
Prairie dog	*Cynomys* spp.	252	2.3	34
Abert's squirrel	*Sciurus aberti*	35	0.3	4
Red squirrel	*Tamiasciurus hudsonicus*	40	0.4	8
Botta's pocket gopher	*Thomomys bottae*	24	0.2	1
Northern pocket gopher	*Thomomys talpoides*	1	0.0	1
Banner-tailed kangaroo rat	*Dipodomys spectabilis*	2	0.0	1
Beaver	*Castor canadensis*	82	0.7	20
Peromyscus spp.	*Peromyscus* spp.	11	0.1	1
Woodrats	*Neotoma* sp.	79	0.7	27
White-throated woodrat	*Neotoma albigula*	16	0.1	16
Mexican woodrat	*Neotoma mexicana*	6	0.1	6
Bushy-tailed woodrat	*Neotoma cinerea*	11	0.1	7
Voles	Voles	6	0.1	1
Montane vole	*Microtus montanus*	15	0.1	2
Muskrat	*Ondatra zibethicus*	5	0.0	1
Small rodent	Small rodent	33	0.3	3
Medium to large rodent	Medium-large rodent	72	0.7	3
Very large rodent	Very large rodent	2	0.0	–
Cottontails	*Sylvilagus* spp.	352	3.2	11
Large carnivore	Large carnivore	1	0.0	–
Large canid (large dog or wolf)	Large canid (large dog or wolf)	1	0.0	–
Dog or coyote	Dog or coyote	2	0.0	–
Dog, coyote, wolf	*Canis* spp.	1	0.0	1
Coyote	*Canis latrans*	8	0.1	1
Gray wolf	*Canis lupus*	3	0.0	3
Bear	*Ursus* spp.	3	0.0	3
Badger	*Taxidea taxus*	2	0.0	1
Bobcat	*Felis rufus*	3	0.0	1
Small artiodactyl	Small ungulate	3	0.0	–
Small-medium artiodactyl	Small-medium artiodactyl	5003	45.5	123
Medium artiodactyl	Medium artiodactyl	205	1.9	13
Large artiodactyl	Large artiodactyl	127	1.2	11
Medium to large artiodactyl	Medium-large artiodactyl	177	1.6	10
Deer or elk	Cervidae	21	0.2	–
Elk	*Cervus elaphus*	51	0.5	24
Deer	*Odocoileus* spp.	738	6.7	221
Pronghorn	*Antilocapra americana*	40	0.4	24
Pronghorn or sheep/goat	Pronghorn or sheep/goat	4	0.0	1
Cattle	*Bos taurus*	2	0.0	1
Bison	*Bos bison*	5	0.0	4
Cattle or bison	*Bos* spp.	6	0.1	–
Bighorn sheep	*Ovis canadensis*	5	0.0	5

Table 12.2. (continued)

Common name	Scientific name	n =	%	cf.
Sheep or goat	*Caprine (Ovis/Capra)*	63	0.6	29
Goat	*Capra hircus*	2	0.0	2
Bighorn or sheep/goat	Bighorn or sheep/goat	1	0.0	–
Medium bird	Medium bird	10	0.1	1
Large bird	Large bird	40	0.4	10
Medium-large bird	Medium-large bird	17	0.2	1
Very large bird	Very large bird	5	0.0	1
Eggshell	Bird egg shell	8	0.1	–
Mallard	*Anas platyrhynchos*	5	0.0	3
Green-winged teal	*Anas crecca*	1	0.0	1
Common merganser	*Mergus merganser*	1	0.0	1
Sharp-shinned hawk	*Accipiter striatus*	3	0.0	2
Cooper hawk	*Accipiter cooperii*	1	0.0	–
American Kestrel	*Falco sparverius*	1	0.0	–
Blue or dusky grouse	*Dendragapus obscurus*	13	0.1	1
Bobwhite	*Colinus virginianus*	1	0.0	–
Turkey	*Meleagris gallopavo*	39	0.4	12
Sandhill crane	*Grus canadensis*	3	0.0	1
Galliformes	Galliformes	1	0.0	1
Pigeons and doves	Columbidae	1	0.0	1
Western screech owl	*Megascops kennicottii*	2	0.0	1
Goatsuckers	Caprimulgidae	1	0.0	1
Belted kingfisher	*Megaceryle alcyon*	1	0.0	1
Flicker	*Colaptes auratus*	2	0.0	–
Cliff swallow	*Petrochelidon pyrrhonata*	3	0.0	–
Jays	Corvidae - jay size	1	0.0	1
Thrushes, solitaires, bluebirds	Turdidae	2	0.0	–
Robin	*Turdis migratorius*	1	0.0	–
Western meadowlark	*Sturnella neglecta*	1	0.0	1
Meadowlarks, blackbirds, orioles	Icteridae	1	0.0	–
Passerines	Passeriformes	4	0.0	–
Venomous snakes	Viperidae	1	0.0	–
Herp	Reptile or amphibian	2	0.0	2
Leopard frog	*Rana* spp.	2	0.0	2
Fish	Fish	29	0.3	.3
Castostomus commersoni	White sucker	10	0.1	10
Gila pandora	Rio Grande Chub	3	0.0	3
Total		**10983**	**100.0**	**773**

cf = compares favorably; spp. = species.

comprise 3.4 percent of the assemblage. All could have been found in ponderosa environs of Mora County. Chipmunk specimens are most consistent with the Colorado chipmunk but the least chipmunk is also possible. The prairie dogs presented somewhat of a problem. Nearly all (all but four) are more consistent in size and morphology with the larger black-tailed prairie dog (*Cynomes ludovicianus*) comparative specimen, which occurs in San Miguel and Mora counties but generally in shortgrass plains or open woodlands (Findley et al. 1975:130–132). The smaller Gunnison's prairie dog *(Cynomes gunnisoni)* is present in the area as a mountain variety *(Cynomes gunnisoni gunnisoni*) but Bailey (1971:119–127) gives a total length of 388 mm for the black-tailed prairie dog, 363 mm for Gunnison's *(Cynomes gunnisoni zuniensis*), and 340 mm for the mountain variety. For that reason, these are considered prairie dog without regard to species—although size differences suggest that both the black-tailed and Gunnison's could be present in the assemblage. Abert's squirrel depends on ponderosa pine for food and it is not surprising to find this species. Red squirrels are mainly found in spruce-fir forests but can also be found in mixed conifer forests. Spruce and fir seeds are their primary foods (Bison-M, accessed November 15, 2015). The marmot specimens were identified on the basis of the size of the animal and published sources (Olsen 1964). Marmots are considerably larger than prairie dogs (470–700 mm in length). These specimens (a radius, a femur, and a metacarpal) were definitely squirrel and far too large to be any other New Mexico squirrel. Marmots are most common at elevations above 2,438 m (8,000 ft) but also are found at lower elevations and live among boulders in areas of lush vegetation (Bison-M, accessed November 15, 2015).

Every squirrel taxon has at least some burning, which could indicate they were consumed and the bones discarded as waste or that the bones were noncultural but proximity to a fire caused them to scorch or burn. Prairie dogs, Abert's squirrel, and marmot have the larger proportions of burned bones but a single chipmunk, two ground squirrel, and two red squirrel bones are burned. Two of the Abert's squirrel specimens also have cut marks. Relatively few squirrel bones are complete elements with chipmunks (63.1 percent), marmots (66.7 percent), and Abert's squirrels (40.0 percent) having the most specimens that comprise at least 75 percent of the element. Prairie dogs have the most highly fragmented (less than 10 percent of the element) bones (25.0 percent) followed by red squirrels (17.5 percent). Carnivore gnawing or indications that the bone was scatological were found on a chipmunk bone, six prairie dog bones, and two Abert's squirrel bones.

Rodents

At least nine species of terrestrial rodents were found (n = 276 specimens) including two pocket gophers, a kangaroo rat, one or more *Peromyscus* species, three woodrats, and at least one vole. Flotation and water-screening flotation samples through 1/8-inch mesh recovered a good portion of these small remains—22.5 percent from water screening and 18.1 percent from flotation. Another quarter (24.1 percent) was recovered in 1/4-inch mesh and the rest by the 1/8-inch-mesh bucket (15.9 percent) or other 1/8-inch-mesh sample (18.8 percent).

These include species that likely burrowed into one of the site's shelters in search of food (pocket gophers) and others that sought shelter themselves, either occupying shallow burrows or building nests among the rocks (woodrats); certain species may also have been left behind as raptor or carnivore scat. A few have evidence they could have been eaten—or at least their bones were discarded in or near a fire. Burned specimens were found for Botta's pocket gopher (n = 1; 4.2 percent), *Peromyscus* spp. (n = 1; 9.1 percent), woodrat (n = 9; 11.5 percent), large woodrat (n = 5; 45.5 percent), small rodent (n = 3; 9.1 percent), and medium to large rodent (n = 41; 38.7 percent). A single woodrat specimen with a cut mark is the only processing found on this group.

Botta's pocket gopher is the more common pocket gopher species but a partial cranium that was too small for Botta's was identified as the northern pocket gopher (*Thomomys talpoides*). The northern pocket gopher generally lives at higher elevations, but both occur in the ponderosa zone (Findley et al. 1975: 150). A partial skeleton from a Botta's pocket gopher, as well as a wide range of other elements and a good proportion of complete (16.7 percent) and largely complete or more than 75 percent present (29.2 percent) elements indicate that at least some were there naturally. One each was rodent or carnivore gnawed and four were rounded as if digested. It is unlikely that this small, mainly underground species was much of a food source. The same is true for the few specimens of kangaroo rat, which used the area for burrowing—a live one was inadvertently killed during excavation—and small *Peromyscus* and vole species. Over half of the specimens from these taxa are complete elements. One kangaroo rat and one vole bone appear to have been digested and none are burned. Several species of *Peromyscus* inhabit the area (Findley et al. 1975:204–225), as do two species of voles (the meadow vole and the long-tailed vole) (Findley et al. 1975:255–256, 260–263).

Several species of woodrat were identified, generally by the shape of the third molar (Hoffmeister and Torre 1960:478) or by overall size (*Neotoma cinerea* or bushy-tailed woodrat). The white-throated woodrat (*Neotoma albigula*) is slightly more common in the site assemblage and inhabits cool wet areas including those where the Mexican woodrat (*Neotoma mexicana*) is common. Bushy-tailed woodrats occur in spruce-fir forests extending downward and especially around cliffs with vertical fissures (Findley et al. 1975:241–250). Burning is fairly common for woodrat bones and relatively few are complete specimens. A few woodrat specimens were probably digested (5.1 percent). Some probably were dietary items but others were probably site inhabitants.

Aquatic rodents

Two aquatic rodents are present in the assemblage. A good number of beaver bones (n = 82) from several age groups were found: immature 8.5 percent, juvenile 29.3 percent, mature 62.2 percent. Nearly 40 percent are parts of crania, but almost every body part is represented. Specimens tend to be fragmented—45.1 percent are less than 10 percent of the element and another 35.5 percent comprise from 10 to 50 percent of the element. Few are complete (6.1 percent). About a quarter are thermally altered, mostly with discard burns (19.5 percent), but a few have scorched or roasting burns (4.9 percent). Cuts and defleshing were observed on six elements. Burning and cuts, as well as the number found, suggest beavers were taken for food, and probably for their pelts. Rodent (n = 3) and carnivore gnawing (n = 1) were also found. Evidence of tree cutting by beavers was observed along Coyote Creek in the vicinity of the site and beavers were probably even more common in the past.

As with beavers, muskrats (*Ondatra* zibethicus) were probably more common in the past. Today they are found in marshes and drainage ditches, including those at higher altitudes (Findley et al. 1975:264–265). Recovered body parts include a mandible, a caudal vertebra, and two tibias that are probably from two individuals. One of the tibia fragments is burned suggesting it may have been a food item.

Rabbits

Both the more northern Nuttall's cottontail (*Sylvilagus nuttalli*) and the desert cottontail (*Sylvilagus auduboni*) could have inhabited the area. Desert cottontails are generally found in piñon-juniper woodlands and below, while Nuttall's cottontail is a more montane species. The two species can overlap (Findley et al. 1975:83), but most of those found in the site's shelters are probably Nuttall's. At least nine individuals are represented by the 352 specimens. All age groups are found from newborn to mature with more full or near full size (88.6 percent mature and 10.2 juvenile). Most body parts are found, with crania and limb bones the most common. Most specimens are fragmentary with 21.6 percent representing less than 10 percent of the element and another 48.9 percent representing from 10 to 50 percent of the element. Nearly 20 percent have evidence of thermal alteration. Most are discard burns (17.0 percent) with a few roasting burns (2.0 percent) and some from possible boiling (0.9 percent). Processing was rare, with single specimens with cuts and cut through, and two with small cuts indicating defleshing. Carnivore gnawing (n = 6), rodent gnawing (n = 3), and possible scat (n = 18) were also noted. Rabbits were definitely a resource for those at LA 139965 but were not as important as larger body forms.

Carnivores

Few carnivore elements were found (n = 24), but the few represent at least four and as many as six species. Coyotes, bobcats, badgers, and black bear are all found in the mountainous area of Mora County today (Bison-M, accessed December 1, 2015) and wolf was probably there in the past. Other carnivores found in this environment but not represented in this assemblage include gray and red foxes, mountain lion, martens, weasels, skunk, raccoon, and ringtail (Bison-M, accessed December 1, 2015).

Except for foot bones, which comprise over half of the elements (n = 13), and large parts of two coyote mandibles, most specimens are fragments. Since the site is along a road and the OAS comparative collection does not include a gray wolf, the identifications of a radius and two phalanges are not certain. The bear parts are two pieces of a radius and a femur fragment that are more like bear than any other animal in that size range but are too incomplete to be certain of the identifications. A third bear element (mandibular incisor) is not included in the counts. A badger and a bobcat specimen have discard burns and a coyote bone is roasted or scorched. The possible wolf radius has a cut on the distal end and a bobcat phalanx has a cut, both consistent with skinning for hides. A coyote mandible and phalanx have defleshing marks, possibly from skinning. The few carnivore bones and absence of several species that should have been in the area indicate that these were not particularly sought after resources.

Artiodactyls

The bulk of the fauna from Coyote Canyon Rockshelter is from artiodactyls (n = 6,452) and the amount is probably larger given the number that were considered medium to large, large, and very large mammal (n = 2,500), many of which could be from artiodactyls. Domestic sheep or goat bones on the surface of the site led to a conservative approach to assigning specimens to the artiodactyl size groups. Thus, a large amount of the artiodactyl bone was considered small to medium artiodactyl even though the amount of sheep or goat (n = 65) is much smaller than that for deer (n = 738), the more likely species represented by the pieces. The range of native artiodactyl species includes some that probably were not killed in the vicinity of the site's shelters—pronghorn, bison, and possibly the bighorn sheep. Deer and elk are the more likely to occur in the vicinity. No attempt was made to separate mule deer and white-tailed deer. The latter was once common on the eastern slopes of the Sangre de Cristo Mountains and were said to once be especially common along Coyote Creek. Mule deer are ubiquitous throughout the state (Bison-M, accessed December 1, 2015). It is possible that both species are represented in the assemblage. Some specimens are large compared with a deer from the San Juan Basin, others are comparable and smaller.

All age groups are represented in the assemblage. Most of those considered fetal or new born (n = 89) were recorded as small to medium artiodactyl (85.4 percent), small artiodactyl (1.1 percent), or medium artiodactyl (5.6 percent), but a few were close enough to the comparative specimens to assign a species—6.7 percent deer and 1.1 percent sheep or goat. More were from immature (n = 130) animals—up to two-thirds of mature size. Again, many could not be assigned to a species with 48.5 percent recorded as small to medium artiodactyl, 0.8 percent as medium artiodactyl, and 2.3 percent as medium to large artiodactyl. Most of the immature specimens were identified as deer (47.7 percent); there was also a single pronghorn specimen (0.8 percent). Juvenile specimens were fairly uncommon (n = 689; 10.7 percent) relative to those considered mature (n = 5544). A good portion of the deer bone is from juvenile animals (at least 19.8 percent) as is some pronghorn (15.0 percent) and domestic sheep or goat (15.9 percent). Lesser proportions were found for elk (5.9 percent). Both cattle specimens (a spare rib and a cf. cattle ulna shaft fragment) are both from juvenile animals. The bison specimens are all tooth fragments, some of which are from juveniles (40.0 percent).

The body-part distribution will be considered in more detail in a later section. Here, the general patterns are described (Table 12.3). Some of the general artiodactyl specimens could be identified as a particular body part, but many are long- or flat-bone fragments and a few are cancellous bone that could be from a flat bone or a long bone end fragment. Specimens from all regions of the body were found for elk, deer, and domestic sheep or goat. Pronghorn is missing only pelvis parts. The others are far more restricted.

The majority of the artiodactyl bones are small fragments (Table 12.4) with over 90 percent representing less than 10 percent of the element. Few are complete and these are all foot bones except for a rib from a fetal small- to medium-sized artiodactyl. Nearly half of the bone was also burned (Table 12.5), mainly complete burns indicating discard into a fire (52.6 percent). This is more burning than any other group of animals, with only the small mammal taxon coming close (40.2 percent).

Obvious processing is fairly rare (Table 12.6) with more impacts and defleshing than any other types. Second processing types are fairly rare (n = 34, 0.5 percent). These include an additional "cut through" for deer; three cuts for deer and one for sheep or goat; impacts for small to medium artiodactyl (n = 5), medium artiodactyl (n = 1), medium to large artiodactyl (n = 1), and deer (n = 6); a spiral break for small to medium artiodactyl, and defleshing for small to medium artiodactyl (n = 6), large artiodactyl (n = 2), medium to large artiodactyl (n = 2), elk (n = 1), and deer (n = 6).

Birds

A variety of bird taxa were recovered. All of those identified occur in Mora County or in at least one of the surrounding counties of Taos, San Miguel, and Santa Fe (Bison-M, accessed November 30, 2015). Turkey and grouse are the only identified taxa that occur with any frequency. Others tend to be represented by one to three specimens (Table 12.2). Nearly half (n = 76, 45 percent) were identified only to the size of the bird—many because they were small fragments and others because they were from immature birds. Long-bone shaft fragments are the most common body part (63.2 percent) with small numbers from flat bones (n = 7), crania (n = 3), breast bones (n = 2), wings (n = 6), legs (n = 7), and feet (n = 3). Good portions of the

Table 12.3. General body part distribution for artiodactyl specimens.

Taxon	Unknown		Long bone		Flat bone		Horn or antler		Cranial		Vertebral		Thorax		Pelvis		Front limb		Rear leg		Foot		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Small artiodactyl	–	–	1	33.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	66.7	**3**	**100.0**
Small-medium artiodactyl	2	0.0	3398	67.9	423	8.5	–	–	164	3.3	96	1.9	686	13.7	17	0.3	87	1.7	37	0.7	92	1.8	**5002**	**100.0**
Medium artiodactyl	–	–	93	45.4	1	0.5	–	–	5	2.4	11	5.4	30	14.6	3	1.5	15	7.3	27	13.2	20	9.8	**205**	**100.0**
Large artiodactyl	–	–	25	19.7	3	2.4	–	–	4	3.1	1	0.8	91	71.7	–	–	3	2.4	–	–	–	–	**127**	**100.0**
Medium to large artiodactyl	1	0.6	89	50.3	16	9.0	–	–	8	4.5	1	0.6	56	31.6	1	0.6	2	1.1	1	0.6	2	1.1	**177**	**100.0**
Deer or elk	–	–	–	–	–	–	21	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**21**	**100.0**
Elk	–	–	–	–	–	–	2	0.0	7	13.7	5	9.8	14	27.5	1	2.0	10	19.6	7	13.7	5	9.8	**51**	**100.0**
Deer	–	–	–	–	–	–	35	0.0	159	21.5	52	7.0	48	6.5	12	1.6	81	11.0	64	8.7	287	38.9	**738**	**100.0**
Pronghorn	–	–	–	–	–	–	1	0.0	5	12.5	2	5.0	1	2.5	–	–	6	15.0	5	12.5	20	50.0	**40**	**100.0**
Pronghorn or sheep/goat	–	–	–	–	–	–	–	–	3	75.0	–	–	–	–	–	–	–	–	–	–	1	25.0	**4**	**100.0**
Cattle	–	–	–	–	–	–	–	–	–	–	–	–	1	50.0	–	–	1	50.0	–	–	–	–	**2**	**100.0**
Bison	–	–	–	–	–	–	–	–	5	100.0	–	–	–	–	–	–	–	–	–	–	–	–	**5**	**100.0**
Cattle or bison	–	–	–	–	–	–	1	16.7	4	66.7	–	–	–	–	–	–	–	–	–	–	1	16.7	**6**	**100.0**
Bighorn sheep	–	–	–	–	–	–	–	–	1	20.0	–	–	–	–	–	–	1	20.0	–	–	3	60.0	**5**	**100.0**
Sheep or goat	–	–	–	–	–	–	–	–	17	2.7	1	1.6	10	15.9	1	1.6	9	14.3	2	3.2	23	36.5	**63**	**100.0**
Goat	–	–	–	–	–	–	–	–	2	100.0	–	–	–	–	–	–	–	–	–	–	–	–	**2**	**100.0**
Bighorn or sheep/goat	–	–	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Total	**3**	**0.0**	**3606**	**55.9**	**443**	**6.9**	**61**	**0.9**	**384**	**6.0**	**169**	**2.6**	**937**	**14.5**	**35**	**0.5**	**215**	**3.3**	**143**	**2.2**	**456**	**7.1**	**6452**	**100.0**

Table 12.4. Completeness of artiodactyl specimens.

Taxon	< 10%		10-50%		50-75%		75-95%		Complete		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Small artiodactyl	2	66.7	–	–	–	–	1	33.3	–	–	**3**	**100.0**
Small-medium artiodactyl	4868	97.3	112	2.2	16	0.3	4	0.1	2	0.0	**5002**	**100.0**
Medium artiodactyl	186	90.7	17	8.3	1	0.5	1	0.5	–	–	**205**	**100.0**
Large artiodactyl	126	99.2	1	0.8	–	–	–	–	–	–	**127**	**100.0**
Medium to large artiodactyl	177	100.0	–	–	–	–	–	–	–	–	**177**	**100.0**
Deer or elk	21	100.0	–	–	–	–	–	–	–	–	**21**	**100.0**
Elk	28	54.9	22	43.1	–	–	–	–	1	2.0	**51**	**100.0**
Deer	431	58.4	239	32.4	19	2.6	19	2.6	30	4.1	**738**	**100.0**
Pronghorn	17	42.5	18	45.0	2	5.0	1	2.5	2	5.0	**40**	**100.0**
Pronghorn or sheep/goat	3	75.0	–	–	–	–	–	–	1	25.0	**4**	**100.0**
Cattle	2	100.0	–	–	–	–	–	–	–	–	**2**	**100.0**
Bison	5	100.0	–	–	–	–	–	–	–	–	**5**	**100.0**
Cattle or bison	4	66.7	1	16.7	–	–	1	16.7	–	–	**6**	**100.0**
Bighorn sheep	2	40.0	2	40.0	–	–	1	20.0	–	–	**5**	**100.0**
Sheep or goat	18	28.1	20	31.3	8	12.5	3	4.7	15	23.4	**64**	**100.0**
Goat	1	100.0	–	–	–	–	–	–	–	–	**1**	**100.0**
Bighorn or sheep/goat	1	100.0	–	–	–	–	–	–	–	–	**1**	**100.0**
Total	**5892**	**91.3**	**432**	**6.7**	**46**	**0.7**	**31**	**0.5**	**51**	**0.8**	**6452**	**100.0**

Table 12.5. Burn types for artiodactyl taxa.

Taxon	Unburned		Discard burn		Roasting burn or scorch		Boiled?		Deliberate partial burn		Partial		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Small artiodactyl	2	66.7	1	33.3	–	–	–	–	–	–	–	–	**3**	**100.0**
Small-medium artiodactyl	2426	48.5	2463	49.2	86	1.7	17	0.3	4	0.1	6	0.1	**5002**	**100.0**
Medium artiodactyl	128	62.4	69	33.7	8	3.9	–	–	–	–	–	–	**205**	**100.0**
Large artiodactyl	66	52.0	59	46.5	2	1.6	–	–	–	–	–	–	**127**	**100.0**
Medium to large artiodactyl	115	65.0	58	32.8	2	1.1	1	0.6	–	–	1	0.6	**177**	**100.0**
Deer or elk	5	23.8	16	76.2	–	–	–	–	–	–	–	–	**21**	**100.0**
Elk	39	76.5	9	17.6	3	5.9	–	–	–	–	–	–	**51**	**100.0**
Deer	509	69.0	207	28.0	18	2.4	3	0.4	–	–	1	0.1	**738**	**100.0**
Pronghorn	29	72.5	8	20.0	3	7.5	–	–	–	–	–	–	**40**	**100.0**
Pronghorn or sheep/goat	3	75.0	–	–	1	25.0	–	–	–	–	–	–	**4**	**100.0**
Cattle	2	100.0	–	–	–	–	–	–	–	–	–	–	**2**	**100.0**
Bison	1	20.0	2	40.0	–	–	–	–	–	–	2	40.0	**5**	**100.0**
Cattle or bison	4	66.7	2	33.3	–	–	–	–	–	–	–	–	**6**	**100.0**
Bighorn sheep	2	40.0	3	60.0	–	–	–	–	–	–	–	–	**5**	**100.0**
Sheep or goat	59	92.2	5	7.8	–	–	–	–	–	–	–	–	**64**	**100.0**
Goat	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Bighorn or sheep/goat	–	–	1	100.0	–	–	–	–	–	–	–	–	**1**	**100.0**
Total	**3391**	**52.6**	**2903**	**45.0**	**123**	**1.9**	**21**	**0.3**	**4**	**0.1**	**10**	**0.2**	**6452**	**100.0**

Table 12.6. Primary processing types for artiodactyl taxa.

Taxon	None		Chops		Cut through		Cut		Impact		Spiral break		Deflesh-ing		Steak or roast cut		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Small artiodactyl	3	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**3**	**100.0**
medium artiodactyl	4325	86.5	2	0.0	–	–	50	1.0	443	8.9	16	0.3	166	3.3	–	–	**5002**	**100.0**
Medium artiodactyl	161	78.5	–	–	1	0.5	5	2.4	19	9.3	5	2.4	14	6.8	–	–	**205**	**100.0**
Large artiodactyl	115	90.6	1	0.8	–	–	6	4.7	2	1.6	–	–	3	2.4	–	–	**127**	**100.0**
Medium-large artiodactyl	135	76.3	–	–	1	0.6	2	1.1	29	16.4	1	0.6	9	5.1	–	–	**177**	**100.0**
Deer or elk	20	95.2	1	4.8	–	–	–	–	–	–	–	–	–	–	–	–	**21**	**100.0**
Elk	40	78.4	–	–	1	2.0	1	2.0	1	2.0	–	–	8	15.7	–	–	**51**	**100.0**
Deer	619	83.9	4	0.5	1	0.1	30	4.1	27	3.7	5	0.7	52	7.0	–	–	**738**	**100.0**
Pronghorn	36	90.0	–	–	–	–	1	2.5	1	2.5	1	2.5	1	2.5	–	–	**40**	**100.0**
Pronghorn/ sheep/goat	4	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**4**	**100.0**
Cattle	1	50.0	–	–	–	–	–	–	–	–	–	–	–	–	1	50.0	**2**	**100.0**
Bison	5	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**5**	**100.0**
Cattle or bison	6	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**6**	**100.0**
Bighorn sheep	5	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**5**	**100.0**
Sheep or goat	56	87.5	–	–	2	3.1	2	3.1	–	–	–	–	4	6.3	–	–	**64**	**100.0**
Goat	–	–	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	**1**	**100.0**
Bighorn/ sheep/goat	1	100.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Total	**5532**	**85.7**	**8**	**0.1**	**6**	**0.1**	**98**	**1.5**	**522**	**8.1**	**28**	**0.4**	**257**	**4.0**	**1**	**0.0**	**6452**	**100.0**

larger-sized bird taxa are less than 10 percent complete (95 percent of the large bird, 76.5 percent of the medium to large bird, and 80 percent of the very large bird). None of the medium-sized bird or passerine specimens fall into the less than 10 percent of the element category. Burning varies by size. None of the smallest group (passerines) are burned while 10 percent of the medium bird, 47.1 percent of the medium to large bird, 32.5 percent of the large bird, and 20.0 percent of the large bird specimens have discard burns. The only evidence of processing are single cuts and defleshing on large bird bones. Carnivore gnawing was noted on a large bird specimen, rodent gnawing on a large bird specimen, and a medium bird and two very large bird bones appear to have been digested.

Eggshell was fairly rare and was found in eight of the FS numbers for a total of 0.48 g. Nesting hawks and swifts probably account for some of the shell recovered. One of the samples was definitely too thin for turkey and the others could not be definitely assigned to turkey given that raptor eggs are also fairly large.

The remaining 85 specimens were identifiable to at least the family level. Nearly all are from mature birds, the exceptions being one of the blue grouse and the screech owl bones that are from juvenile birds. A range of body parts were found (Table 12.7) with only the grouse and turkey well represented. Leg bones are the most common part followed by wing and breast bones. The cliff swallow cranial bones are a complete skull, probably from those nesting in the cliff above the South Shelter. Few bones are complete (7.1 percent) and these are from turkeys (digits), a femur from a pigeon or dove, the cliff swallow cranium and dentary, and a thrush, solitaire, or bluebird tarsometatarsus. Nearly half (47.1 percent) of the specimens comprise from 10–50 percent of the element and another 18.8 percent comprise less than 10 percent of the element. Oth-

Table 12.7. Distribution of bird body parts by taxon.

	Cranial		Vertebra		Breast		Pelvis		Wing		Leg		Foot		Wing Tip		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Mallard	–	–	–	–	3	60.0	–	–	–	–	–	–	1	20.0	1	20.0	**5**	**100.0**
Green-winged teal	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Common merganser	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Sharp-shinned hawk	–	–	–	–	–	–	–	–	–	–	2	66.7	1	33.3	–	–	**3**	**100.0**
Cooper hawk	–	–	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	**1**	**100.0**
American Kestrel	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Blue grouse	–	–	–	–	4	30.8	–	–	5	38.5	2	15.4	1	7.7	1	7.7	**13**	**100.0**
Bobwhite	–	–	–	–	–	–	–	–	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Turkey	2	5.1	1	2.6	1	2.6	1	2.6	7	17.9	20	51.3	5	12.8	2	5.1	**39**	**100.0**
Sandhill crane	–	–	–	–	–	–	–	–	1	33.3	–	–	1	33.3	1	33.3	**3**	**100.0**
Galliformes	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Pigeons and doves	–	–	–	–	–	–	–	–	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Screech owl	–	–	–	–	–	–	–	–	1	50.0	1	50.0	–	–	–	–	**2**	**100.0**
Goatsuckers	–	–	–	–	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Belted kingfisher	–	–	–	–	–	–	–	–	1	100.0	–	–	–	–	–	–	**1**	**100.0**
Flickers	–	–	–	–	1	50.0	–	–	–	–	1	50.0	–	–	–	–	**2**	**100.0**
Cliff swallow	2	66.7	–	–	1	33.3	–	–	–	–	–	–	–	–	–	–	**3**	**100.0**
Jays	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Thrushes, solitaires, bluebirds	1	50.0	–	–	–	–	–	–	–	–	–	–	1	50.0	–	–	**2**	**100.0**
Robin	–	–	–	–	–	–	–	–	1	100.0	–	–	–	–	–	–	**1**	**100.0**
Western meadowlark	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0	–	–	**1**	**100.0**
Meadowlarks, blackbirds, orioles	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Total	**5**	**5.9**	**1**	**1.2**	**14**	**16.5**	**2**	**2.4**	**16**	**18.8**	**28**	**32.9**	**11**	**12.9**	**8**	**9.4**	**85**	**100.0**

erwise 11.8 percent are from 50–75 percent and 15.3 percent are 75–95 percent complete. Relatively few are carnivore (n = 3) or rodent (n = 3) gnawed; all are turkey (n = 2 carnivore, 1 rodent) or grouse (n = 1 each) except for a mallard bone that is rodent gnawed.

Enough of the bone is burned or roasted to suggest at least some species were food items. Single specimens with discard burns were noted for mallard, merganser, sharp-shinned hawk, grouse, and crane. Seven of the turkey bones were heavily burned and one has a roasting burn. Other taxa had single roasting burns or scorches including the sharp-shinned hawk, grouse, screech owl, and the thrush, solitaire, or bluebird. Evidence of processing was rare and includes defleshing on a grouse ulna, cuts on a turkey cervical vertebra, and a spiral break on a turkey femur. At least three of the turkey bones are large enough to be domestic varieties.

Reptiles and Amphibians

Very few specimens were from these small forms and all are probably accidental additions to the site deposits. None are burned and they tend to be complete or large portions of elements. Those considered herp are complete long bones that are more consistent with a reptile or amphibian than a small mammal or bird. A single snake vertebra is characteristic of venomous species. The leopard frog tibias probably represent two individuals. The Plains leopard frog (*Rana blairi*) and northern leopard frog (*Rana pipiens*) are found in Mora County. The plains variety is found in areas drained by the Canadian and Dry Cimarron rivers where it inhabits permanent and temporary aquatic habitats including streams. The northern leopard frog is found along the Rio Grande and is associated with streams and river valley habitats (Degenhardt et al. 1996:81–88).

Fish

A small number of fish bones were recovered, mainly from 1/8-inch screening of bucket samples and water screening of flotation samples (73.8 percent). Most of the fish bones (n = 42) could not be identified to the species level (69 percent). Parts identified as fish are mainly cranial (58.6 percent), including all of the identified specimens. Other parts include flat bones (20.7 percent) that are probably crania fragments, vertebra (13.7 percent), and ribs (6.9 percent). Most (86.2 percent) are small cranial bones or fragments representing less than 10 percent of the element with a few pieces of ribs (9.5 percent) that represent from 10–50 percent of the element. The vertebrae (n = 2) are the only parts that are more than 50 percent complete and one of these is burned. No processing was noted but one appears to be from scat.

The Rio Grande Chub is found in small to moderate streams at higher elevations and impondments and pools. They are generally about 167 mm in length (Bison-M, accessed December 1, 2015). All of the specimens from this species are premaxilla or pharyngeal teeth portions representing at least two individuals. None are burned or processed so it is hard to say whether these were taken by humans or by scavengers or arrived at the site through natural processes (flooding).

White sucker elements were slightly more common. This species is native to mid-elevations of the Canadian River drainage in lakes, streams, and rivers including areas of Ponderosa pine-Douglas fir forests. It has firm, white, sweet-flavored flesh, and is generally less than 130 mm in size (Bison-M, accessed December 1, 2015). Cranial parts include hyromandibular (n = 2), operculum (n = 1), interoperculum (n = 2), premaxilla or pharyngeal teeth portions (n = 2), and cleithrum (n = 2). Two or more fish are represented by these parts. Again, none are burned or processed so their origin may not be cultural.

Site Area Assemblages

When the fauna is viewed by site area (Table 12.8), the assemblages differ in ways that are not due to sample size. South Shelter has the largest sample size by far (n = 4644; 42.4 percent) but not the greatest density of bone. The 167 grid unit levels with bone have an average of 27.9 specimens per level. South Talus has the second-largest sample size (n = 2387; 21.7 percent) and a mean of 20.6 specimens for the 116 grid units levels with bone. North Shelter is next in counts (n = 2282; 20.8 percent) but has by far the greatest density of bone—45.6 for the 50 grid unit levels with bone. North Talus has fewer bones (n = 1601; 14.6 percent) and a density comparable to the South Talus—21.6 specimens in the 74 grid unit levels with bone. Central Talus produced few bones

Table 12.8. Distribution of taxa by site area.

Taxon	North Shelter		North Talus		Central Talus		South Shelter		South Talus		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Unknown small	6	0.3	–	–	–	–	12	0.3	1	0.0	**19**	**0.2**
Unknown	–	–	1	0.1	–	–	–	–	–	–	**1**	**0.0**
Small mammal/bird	10	0.4	4	0.2	–	–	18	0.4	8	0.3	**40**	**0.4**
Small mammal	122	5.3	45	2.8	2	3.4	163	3.5	26	1.1	**358**	**3.3**
Small-medium mammal	24	1.1	33	2.1	–	–	142	3.1	50	2.1	**249**	**2.3**
Medium mammal	1	0.0	3	0.2	–	–	19	0.4	3	0.1	**26**	**0.2**
Medium to large mammal	436	19.1	332	20.7	7	12.1	972	20.9	584	24.5	**2331**	**21.2**
Large mammal	9	0.4	13	0.8	–	–	62	1.3	81	3.4	**165**	**1.5**
Very large mammal	–	–	1	0.1	–	–	1	0.0	2	0.1	**4**	**0.0**
Bats	2	0.1	–	–	–	–	2	0.0	–	–	**4**	**0.0**
Small squirrels	1	0.0	–	–	–	–	1	0.0	–	–	**2**	**0.0**
Large squirrels	–	–	–	–	–	–	2	0.0	–	–	**2**	**0.0**
Colorado chipmunk	9	0.4	4	0.2	–	–	5	0.1	1	0.0	**19**	**0.2**
Yellow-bellied marmot	1	0.0	–	–	–	–	2	0.0	–	–	**3**	**0.0**
Golden-mantled ground squirrel	2	0.1	3	0.2	–	–	11	0.2	7	0.3	**23**	**0.2**
Prairie dogs	74	3.2	41	2.6	1	1.7	90	1.9	46	1.9	**252**	**2.3**
Abert's squirrel	5	0.2	5	0.3	–	–	21	0.5	4	0.2	**35**	**0.3**
Red squirrel	10	0.4	8	0.5	–	–	18	0.4	4	0.2	**40**	**0.4**
Botta's pocket gopher	3	0.1	4	0.2	2	3.4	8	0.2	7	0.3	**24**	**0.2**
Northern pocket gopher	1	0.0	–	–	–	–	–	–	–	–	**1**	**0.0**
Banner-tailed kangaroo rat	1	0.0	–	–	–	–	1	0.0	–	–	**2**	**0.0**
Beaver	6	0.3	10	0.6	2	3.4	44	0.9	20	0.8	**82**	**0.7**
Peromyscus spp.	3	0.1	–	–	–	–	7	0.2	1	0.0	**11**	**0.1**
Woodrats	19	0.8	5	0.3	–	–	43	0.9	12	0.5	**79**	**0.7**
White-throated woodrat	2	0.1	1	0.1	–	–	9	0.2	4	0.2	**16**	**0.1**
Mexican woodrat	3	0.1	–	–	–	–	3	0.1	–	–	**6**	**0.1**
Bushy-tailed woodrat	2	0.1	–	–	–	–	6	0.1	3	0.1	**11**	**0.1**
Voles	–	–	–	–	–	–	6	0.1	–	–	**6**	**0.1**
Montane vole	2	0.1	3	0.2	–	–	2	0.0	8	0.3	**15**	**0.1**
Muskrat	2	0.1	1	0.1	–	–	1	0.0	1	0.0	**5**	**0.0**
Small rodent	14	0.6	2	0.1	–	–	17	0.4	–	–	**33**	**0.3**
Medium to large rodent	13	0.6	8	0.5	–	–	48	1.0	3	0.1	**72**	**0.7**
Very large rodent	1	0.0	–	–	–	–	1	0.0	–	–	**2**	**0.0**
Cottontails	111	4.9	51	3.2	3	5.2	141	3.0	46	1.9	**352**	**3.2**
Large carnivore	1	0.0	–	–	–	–	–	–	–	–	**1**	**0.0**
Large canid (large dog or wolf)	–	–	1	0.1	–	–	–	–	–	–	**1**	**0.0**
Dog or coyote	1	0.0	–	–	–	–	–	–	1	0.0	**2**	**0.0**
Dog, coyote, wolf	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Coyote	–	–	–	–	–	–	1	0.0	7	0.3	**8**	**0.1**
Gray wolf	1	0.0	–	–	–	–	2	0.0	–	–	**3**	**0.0**
Bear	–	–	–	–	–	–	–	–	3	0.1	**3**	**0.0**
Badger	–	–	1	0.1	–	–	1	0.0	–	–	**2**	**0.0**
Bobcat	1	0.0	–	–	–	–	2	0.0	–	–	**3**	**0.0**
Small artiodactyl	–	–	–	–	–	–	2	0.0	1	0.0	**3**	**0.0**
Small-medium artiodactyl	1126	49.3	812	50.7	29	50.0	2078	44.6	958	40.1	**5003**	**45.6**
Medium artiodactyl	11	0.5	14	0.9	–	–	81	1.7	99	4.1	**205**	**1.9**
Large artiodactyl	18	0.8	13	0.8	–	–	49	1.1	47	2.0	**127**	**1.2**
Medium to large artiodactyl	29	1.3	31	1.9	3	5.2	80	1.7	34	1.4	**177**	**1.6**
Deer or elk	6	0.3	3	0.2	–	–	11	0.2	1	0.0	**21**	**0.2**
Elk	4	0.2	4	0.2	–	–	24	0.5	19	0.8	**51**	**0.5**
Deer	108	4.7	81	5.1	5	8.6	308	6.6	236	9.9	**738**	**6.7**
Pronghorn	1	0.0	3	0.2	–	–	18	0.4	18	0.8	**40**	**0.4**
Pronghorn or sheep/goat	1	0.0	1	0.1	–	–	2	0.0	–	–	**4**	**0.0**
Cattle	1	0.0	–	–	–	–	1	0.0	–	–	**2**	**0.0**

Table 12.8 (continued)

Taxon	North Shelter		North Talus		Central Talus		South Shelter		South Talus		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Bison	–	–	–	–	–	–	5	0.1	–	–	**5**	**0.0**
Cattle or bison	–	–	2	0.1	–	–	3	0.1	1	0.0	**6**	**0.1**
Bighorn sheep	–	–	1	0.1	–	–	1	0.0	3	0.1	**5**	**0.0**
Sheep or goat	19	0.8	20	1.2	–	–	20	0.4	5	0.2	**64**	**0.6**
Goat	–	–	1	0.1	–	–	–	–	–	–	**1**	**0.0**
Bighorn or sheep/goat	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Medium bird	2	0.1	2	0.1	–	–	5	0.1	1	0.0	**10**	**0.1**
Large bird	16	0.7	7	0.4	–	–	13	0.3	4	0.2	**40**	**0.4**
Medium-large bird	7	0.3	1	0.1	–	–	6	0.1	3	0.1	**17**	**0.2**
Very large bird	1	0.0	–	–	–	–	2	0.0	2	0.1	**5**	**0.0**
Eggshell	2	0.1	1	0.1	–	–	3	0.1	2	0.1	**8**	**0.1**
Mallard	–	–	–	–	–	–	4	0.1	1	0.0	**5**	**0.0**
Green-winged teal	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Common merganser	1	0.0	–	–	–	–	–	–	–	–	**1**	**0.0**
Sharp-shinned hawk	–	–	1	0.1	–	–	2	0.0	–	–	**3**	**0.0**
Cooper hawk	–	–	–	–	–	–	–	–	1	0.0	**1**	**0.0**
American Kestrel	–	–	1	0.1	–	–	–	–	–	–	**1**	**0.0**
Blue grouse	3	0.1	1	0.1	–	–	6	0.1	3	0.1	**13**	**0.1**
Bobwhite	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Turkey	8	0.4	4	0.2	2	3.4	13	0.3	12	0.5	**39**	**0.4**
Sandhill crane	1	0.0	–	–	–	–	2	0.0	–	–	**3**	**0.0**
Galliformes	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Pigeons and doves	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Screech owl	–	–	1	0.1	–	–	1	0.0	–	–	**2**	**0.0**
Goatsuckers	–	–	1	0.1	–	–	–	–	–	–	**1**	**0.0**
Belted kingfisher	–	–	–	–	–	–	–	–	1	0.0	**1**	**0.0**
Flickers	1	0.0	1	0.1	–	–	–	–	–	–	**2**	**0.0**
Cliff swallow	–	–	–	–	2	3.4	1	0.0	–	–	**3**	**0.0**
Jays	–	–	1	0.1	–	–	–	–	–	–	**1**	**0.0**
Thrushes, solitaires, bluebirds	–	–	2	0.1	–	–	–	–	–	–	**2**	**0.0**
Robin	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Western meadowlark	1	0.0	–	–	–	–	–	–	–	–	**1**	**0.0**
Meadowlarks, blackbirds, orioles	–	–	–	–	–	–	–	–	1	0.0	**1**	**0.0**
Passerines	1	0.0	1	0.1	–	–	2	0.0	–	–	**4**	**0.0**
Venomous snakes	–	–	–	–	–	–	1	0.0	–	–	**1**	**0.0**
Herp	–	–	–	–	–	–	2	0.0	–	–	**2**	**0.0**
Leopard frogs	–	–	–	–	–	–	2	0.0	–	–	**2**	**0.0**
Fish	9	0.4	4	0.2	–	–	15	0.3	1	0.0	**29**	**0.3**
White sucker	4	0.2	5	0.3	–	–	1	0.0	–	–	**10**	**0.1**
Rio Grande chub	2	0.1	1	0.1	–	–	–	–	–	–	**3**	**0.0**
Total	**2282**	**100.0**	**1601**	**100.0**	**58**	**100.0**	**4655**	**100.0**	**2387**	**100.0**	**10983**	**100.0**

(n = 58; 0.5 percent), with a mean of 7.3 specimens in the 8 grid unit levels with bone. More of the talus samples were recovered by 1/4-inch mesh—largely because some levels in the talus were excavated in 10 cm levels and would have fewer flotation and bucket samples screened through 1/8-inch mesh. South Talus had the largest proportion recovered by screening through 1/4-inch mesh (79.4 percent), followed by North Talus (69.0 percent), Central Talus (58.6 percent), North Shelter (54.7 percent), and South Shelter (45.8 percent).

The North Shelter has more small mammal (small mammal, rodent, beaver, muskrat, squirrel, cottontail) specimens (18.8 percent) than other areas. The second-largest proportion is for Central Talus (17.2 percent) but it has a small sample size.

South Shelter is next (14.4 percent), followed by North Talus (12.2 percent) then South Talus (8.4 percent). Carnivores are rare in all, comprising less than 0.5 percent in all and 0.2 percent overall. Taxa representing medium-sized artiodactyls (deer, pronghorn, bighorn sheep, and small to medium and medium artiodactyls) comprise most of the assemblage with some variation in the areas. South Talus has the most with 82.9 percent, followed by North Talus (78.7 percent), South Shelter (75.9 percent), North Shelter (74.4 percent), and Central Talus (70.7 percent). South Shelter (3.5 percent) and South Talus (4.3 percent) have more large artiodactyl (large artiodactyl, elk, and bison) than North Shelter (2.3 percent) and North Talus (3.1 percent), but less than the small sample from Central Talus (5.2 percent). Birds other than turkey are more common in North Shelter (1.5 percent) and North Talus (1.2 percent) than in South Shelter (1.1 percent) and South Talus (0.7 percent). Again, the small sample from Central Talus has a larger proportion (3.4 percent). Turkey varies very little. Fish specimens are rare but slightly more common in North Shelter (0.7 percent) and North Talus (0.6) than in South Shelter (0.4 percent) and South Talus (0.0 percent). Domestic animals (sheep, goat, and cattle) are better represented in North Shelter (0.9 percent) and North Talus (1.3 percent) than in South Shelter (0.5 percent) and South Talus (0.3 percent).

More of the talus bone was subjected to environ-

Table 12.9. Taphonomy by site area.

	North Shelter		North Talus		Central Talus		South Shelter		South Talus		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Environmental Alteration												
Not applicable/egg shell	2	0.1	1	0.1	–	–	3	0.1	2	0.1	**8**	**0.1**
None	1850	81.1	1242	77.6	19	32.8	3889	83.5	1483	62.1	**8483**	**77.2**
Pitting/corrosion	13	0.6	31	1.9	8	13.8	103	2.2	377	15.8	**532**	**4.8**
Sun bleached	5	0.2	4	0.2	–	–	12	0.3	20	0.8	**41**	**0.4**
Checked/exfoliated	372	16.3	309	19.3	27	46.6	599	12.9	480	20.1	**1787**	**16.3**
Root etched	2	0.1	5	0.3	–	–	21	0.5	20	0.8	**48**	**0.4**
Rounded/polished	38	1.7	8	0.5	2	3.4	25	0.5	3	0.1	**76**	**0.7**
Fresh/greasy	–	–	–	–	2	3.4	–	–	–	–	**2**	**0.0**
Precipitate coating	–	–	1	0.1	–	–	3	0.1	2	0.1	**6**	**0.1**
Total	**2282**	**100.0**	**1601**	**100.0**	**58**	**100.0**	**4655**	**100.0**	**2387**	**100.0**	**10983**	**100.0**
Animal Alteration												
Absent	2172	95.3	1573	98.3	54	93.1	4478	96.2	2303	96.5	**10580**	**96.4**
Carnivore	48	2.1	10	0.6	–	–	50	1.1	7	0.3	**115**	**1.0**
Rodent	12	0.5	8	0.5	4	6.9	69	1.5	61	2.6	**154**	**1.4**
Carnivore and rodent	1	0.0	2	0.1	–	–	3	0.1	2	0.1	**8**	**0.1**
Scat	45	2.0	8	0.5	–	–	54	1.2	14	0.6	**121**	**1.1**
Total	**2282**	**100.0**	**1601**	**100.0**	**58**	**100.0**	**4655**	**100.0**	**2387**	**100.0**	**10983**	**100.0**
Thermal Alteration												
Unburned	1351	59.2	848	53.0	51	87.9	2502	53.7	1571	65.8	**6323**	**57.6**
Discard burn	896	39.3	735	45.9	6	10.3	1989	42.7	777	32.6	**4403**	**40.1**
Roasting burn or scorch	14	0.6	13	0.8	1	1.7	149	3.2	32	1.3	**209**	**1.9**
Boiled?	19	0.8	3	0.2	–	–	5	0.1	3	0.1	**30**	**0.3**
Deliberate partial burn	–	–	1	0.1	–	–	3	0.1	3	0.1	**7**	**0.1**
Partial	2	0.1	1	0.1	–	–	7	0.2	1	0.0	**11**	**0.1**
Total	**2282**	**100.0**	**1601**	**100.0**	**58**	**100.0**	**4655**	**100.0**	**2387**	**100.0**	**10983**	**100.0**
Completeness												
< 10%	1945	85.2	1416	88.4	42	72.4	3933	84.5	2028	85.0	**9364**	**85.3**
10-50%	203	8.9	103	6.4	6	10.3	441	9.5	235	9.8	**988**	**9.0**
50-75%	50	2.2	23	1.4	2	3.4	109	2.3	51	2.1	**235**	**2.1**
75-95%	50	2.2	27	1.7	6	10.3	99	2.1	55	2.3	**237**	**2.2**
Complete	34	1.5	32	2.0	2	3.4	73	1.6	18	0.8	**159**	**1.4**
Total	**2282**	**100.0**	**1601**	**100.0**	**58**	**100.0**	**4655**	**100.0**	**2387**	**100.0**	**10983**	**100.0**

mental alteration (Table 12.9), indicating that shelter bone was better preserved. More was checked or exfoliated and the talus had higher proportions with this type of alteration. Animal alteration was relatively rare (Table 12.9). The North Shelter and South Shelter have more carnivore gnawing and scat than the talus areas. Rodent gnawing was more prevalent in the southern areas of the site. All areas but Central Talus have large amounts of burned bone (Table 12.9). Most are discard burns (40.1 percent overall).

Taphonomic processes definitely contributed to the condition of the assemblage. Relatively few specimens are complete elements (1.4 percent) and the vast majority are highly fragmented (85.3 percent). Differences between the areas are relatively minor (Table 12.9), suggesting that taphonomy may not have had a large effect on the assemblage.

North Shelter

All but one of the levels in North Shelter had bone. Sample sizes ranged from 2 to 141 with a mean of 45.6 per level for the levels with bone and 44.7 for all excavated levels. There are differences between small mammal and medium-sized artiodactyl proportions in the first and last levels of the grid units, especially those at the back of the shelter (140E). Small mammals (not including rodents but including squirrels) increase from 13.0 percent in the upper two levels to 25.6 percent in Levels 5–6, and to 30.8 percent in the very small sample from the base levels. Medium artiodactyls (small to medium and medium artiodactyl, deer, pronghorn, and bighorn sheep) are reduced from 85.6 percent in the upper levels to 69.2 percent at the base, and large artiodactyl (large artiodactyl, elk, and bison) specimens are only found in the first four levels (see Table 8.33). Front grid units (141E), perhaps because they are more disturbed, do not have the same clear trend. Increases in small mammals are smaller in the first six levels before they decrease to the lowest percentage for the 141E grid units and are only slightly more in the lowest level. Small-mammal proportions are never as great as corresponding levels in the back grid units. This suggests that if the levels have any integrity from top to bottom, the earlier groups relied more on small mammals than those that came later. Deer were by far the most important species but the array of animals included more small forms.

Most of the identified taxa occur as one specimen per level where they are found. Table 12.10 gives the number of levels and ubiquity (number of levels found divided by 50—the number of levels with bone) for those identified taxa with more than 10 specimens (combining the woodrat and fish taxa) and for elk. Cottontail rabbits and deer tie for the largest ubiquity scores (0.80) followed by prairie dogs (0.56) and woodrats (0.36). Given the size difference between a rabbit and a deer, there is little question that deer was the most important animal resource represented at North Shelter.

The amount of burning for animal groups has similar results (Table 12.11) in that the more likely food animals have more burning. Rodents have relatively little burning, squirrels have more than rodents, and cottontail has more than any other small form. Deer and elk have considerable burning, as does turkey. Fish has none. If we assume that dietary items are more likely to be burned, then the unidentified taxa with large proportions of burned bone probably represent food debris as does the occasional rodent and bird.

Table 12.12 gives the age distribution for the animal groups. Only one cottontail specimen is immature but animals this age could be found throughout the warm season. Most of the fetal or neonate and immature specimens are from artiodactyls. The sheep or goat specimen is a cranial base portion from 270N/140E Level 2 and indicates a presence during spring. The majority are from small to medium artiodactyls and deer. Assuming that most of the small to medium artiodactyl specimens are deer, the fetal specimens suggest a human

Table 12.10. North Shelter, ubiquity for elk and identified taxa with sample sizes of 10 or greater.

Taxon	Count	Levels	Ubiquity
Squirrel	28	19	0.37
Prairie dogs	74	30	0.56
Woodrats	26	18	0.36
Cottontail	111	40	0.80
Elk	4	3	0.06
Deer	114	40	0.80
Sheep/goat	20	11	0.22
Fish	15	10	0.20

* Levels found/total levels.

Table 12.11. North Shelter, animal group burn types.

	Unburned		Discard burn		Roasting burn or scorch		Boiled?		Partial		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	26	78.8	6	18.2	1	3.0	–	–	–	–	**33**	**100.0**
Small mammal	78	59.1	49	37.1	4	3.0	1	0.8	–	–	**132**	**100.0**
Rodent	34	89.5	4	10.5	–	–	–	–	–	–	**38**	**100.0**
Beaver and muskrat	8	100.0	–	–	–	–	–	–	–	–	**8**	**100.0**
Squirrels	90	88.2	11	10.8	–	–	–	–	1	1.0	**102**	**100.0**
Prairie dog	62	83.8	11	14.9	–	–	–	–	1	1.4	**74**	**100.0**
Woodrats	26	100.0	–	–	–	–	–	–	–	–	**26**	**100.0**
Cottontail	84	75.7	24	21.6	1	0.9	2	1.8	–	–	**111**	**100.0**
Carnivores	4	100.0	–	–	–	–	–	–	–	–	**4**	**100.0**
Sheep/goat/cattle	19	95.0	1	5.0	–	–	–	–	–	–	**20**	**100.0**
Small and medium artiodactyl	830	52.5	730	46.1	6	0.4	15	0.9	1	0.1	**1582**	**100.0**
Deer	80	70.2	34	29.8	–	–	–	–	–	–	**114**	**100.0**
Pronghorn and bighorn	1	50.0	1	50.0	–	–	–	–	–	–	**2**	**100.0**
Large artiodactyls	28	59.6	17	36.2	1	2.1	1	2.1	–	–	**47**	**100.0**
Elk	3	75.0	1	25.0	–	–	–	–	–	–	**4**	**100.0**
Birds	19	55.9	14	41.2	1	2.9	–	–	–	–	**34**	**100.0**
Turkey	4	50.0	4	50.0	–	–	–	–	–	–	**8**	**100.0**
Fish	17	100.0	–	–	–	–	–	–	–	–	**17**	**100.0**
Total	**1351**	**59.2**	**896**	**39.3**	**14**	**0.6**	**19**	**0.8**	**2**	**0.1**	**2282**	**100.0**

Table 12.12. North Shelter, animal groups by age.

	Not Applicable/ Eggshell		Fetal, Neonate		Immature		Juvenile		Mature		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	2	6.1	–	–	–	–	2	6.1	29	87.9	**33**	**100.0**
Small mammal	–	–	–	–	1	0.8	1	0.8	130	98.5	**132**	**100.0**
Rodent	–	–	–	–	3	4.7	18	28.1	43	67.2	**64**	**100.0**
Beaver and muskrat	–	–	–	–	–	–	2	25.0	6	75.0	**8**	**100.0**
Squirrels	–	–	–	–	1	1.0	17	16.7	84	82.4	**102**	**100.0**
Cottontail	–	–	–	–	1	0.9	4	3.6	106	95.5	**111**	**100.0**
Carnivores	–	–	–	–	–	–	–	–	4	100.0	**4**	**100.0**
Sheep/goat/cattle	–	–	1	5.0	–	–	4	20.0	15	75.5	**20**	**100.0**
Small and medium artiodactyl	–	–	24	1.5	34	2.1	128	8.1	1396	88.2	**1582**	**100.0**
Deer	–	–	1	0.9	15	13.2	20	17.5	78	68.4	**114**	**100.0**
Pronghorn and bighorn	–	–	–	–	–	–	–	–	2	100.0	**2**	**100.0**
Large artiodactyls	–	–	–	–	2	4.3	6	12.8	39	83.0	**47**	**100.0**
Elk	–	–	–	–	–	–	–	–	4	100.0	**4**	**100.0**
Birds	–	–	–	–	–	–	1	2.9	33	97.1	**34**	**100.0**
Turkey	–	–	–	–	–	–	–	–	8	100.0	**8**	**100.0**
Fish	–	–	–	–	–	–	–	–	17	100.0	**17**	**100.0**
Total	**2**	**0.1**	**26**	**1.1**	**57**	**2.5**	**203**	**8.9**	**1994**	**87.4**	**2282**	**100.0**

presence in early spring. Mule deer breed in October and November and fawns are born from May to early June. Information on white-tailed deer comes from Arizona and may not be as applicable to northern New Mexico. In Arizona, the white-tails breed from December to March—peaking in January—and young are born in July and August (Bison-M, accessed December 7, 2015). This would place human hunters at the site from at least May—maybe as early as March, and throughout the warm season. Nine of the small to medium artiodactyl specimens have notations of "fetal" and another five of "very fetal." This and the numbers from immature artiodactyls indicate that females were hunted regardless of whether they were pregnant or were accompanied by young. In contrast, few pieces of antler (n = 6 deer or elk; n = 6 probable deer) were recovered from North Shelter, perhaps suggesting that most hunting took place before antler was formed, they avoided hunting large bucks, or the antler was fully utilized and rarely left behind.

North Talus

Several of the North Talus levels (nine of 83) contained no bone. Sample sizes ranged from 1 to 83 with a mean of 21.6 specimens for the North Talus levels with bone and 19.3 for all levels. When three body sizes of subsistence animals are considered and levels arbitrarily combined into three or four groups and three general areas (see Table 8.25), grid units fronting the southern half of North Shelter have the most small mammal remains. Proportions increase with depth in the south, decrease with depth in the north, with no particular trends in those fronting the shelter. Large artiodactyl proportions are generally similar—except for one very small sample. Compared to North Shelter, the North Talus sample has fewer small mammal specimens in almost every fill division. Large artiodactyl proportions in North Talus tend to be slightly greater than for North Shelter (see Tables 8.25, 8.33). Some of the differences could be due to larger excavation levels in the North Talus and fewer 1/8-inch screen and flotation screen samples, as well as the disturbed nature of the deposits.

Most of the animal groups that are more common in the North Shelter are also those most common in North Talus (Table 12.13). The main differences are that the North Talus had fewer woodrats and more beaver. Otherwise every group in Table 12.13 has a smaller ubiquity than North Shelter—often by a considerable amount. In both the North Talus and North Shelter, deer is the most widespread taxon, followed by cottontails and prairie dogs, suggesting these were the main food items used by the groups at the shelter.

Table 12.13. North Talus, ubiquity for elk and identified taxa with sample sizes of 10 or greater.

Taxon	Count	Levels	Ubiquity
Squirrel	20	14	0.19
Prairie dogs	41	26	0.35
Beaver	11	10	0.14
Cottontail	51	32	0.43
Elk	4	4	0.05
Deer	84	41	0.55
Sheep/goat	21	6	0.08
Fish	10	8	0.11

* Levels found/total levels.

Even more of the North Talus sample is burned (47.0 percent), with higher proportions of burning for those groups considered food (Table 12.14 percent). Over half of the small and medium artiodactyl bone is burned, as are large amounts of deer, pronghorn, bighorn sheep, beaver, and small mammal bone.

Fewer of the specimens are from very young animals (Table 12.15) and only one of these was noted as "very small fetal" and it was from the elevated platform and likely to be sheep or goat. Two others from the first level just outside the North Shelter were also noted as "fetal." Again, the range of animals represented by immature and juvenile specimens suggests a presence throughout the warm season. Antler is more common in the North Talus assemblage, with three recorded as deer or elk and nine deer. Two of the deer were shed antlers. Mule deer shed their antlers in January and early February (Mackie et al. 1982:864). If recently shed and returned to the site, these could indicate a winter presence—but they are more likely to have been picked up at a later time and returned for use.

Central Talus

Only 58 specimens were recovered from excavating 20 levels in 18 grid units. All of the bone

Table 12.14. North Talus, animal group burn types.

	Unburned		Discard burn		Roasting burn or scorch		Boiled?		Deliberate partial burn		Partial		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	17	44.7	20	52.6	1	2.6	–	–	–	–	–	–	**38**	**100.0**
Small mammal	29	59.2	20	40.8	–	–	–	–	–	–	–	–	**49**	**100.0**
Rodent	13	76.5	4	23.5	–	–	–	–	–	–	–	–	**17**	**100.0**
Beaver and muskrat	6	54.5	3	27.3	2	18.2	–	–	–	–	–	–	**11**	**100.0**
Squirrels	16	80.0	4	20.0	–	–	–	–	–	–	–	–	**20**	**100.0**
Cottontail	38	74.5	13	25.2	–	–	–	–	–	–	–	–	**51**	**100.0**
Prairie dog	30	73.2	8	19.5	3	7.3	–	–	–	–	–	–	**41**	**100.0**
Woodrats	6	100.0	–	–	–	–	–	–	–	–	–	–	**6**	**100.0**
Carnivores	1	50.0	1	50.0	–	–	–	–	–	–	–	–	**2**	**100.0**
Sheep/goat/cattle	21	100.0	–	–	–	–	–	–	–	–	–	–	**21**	**100.0**
Small and medium artiodactyl	552	47.1	610	52.1	4	0.3	3	0.3	1	0.1	1	0.1	**1171**	**100.0**
Deer	57	67.9	27	32.1	–	–	–	–	–	–	–	–	**84**	**100.0**
Pronghorn and bighorn	3	60.0	2	40.0	–	–	–	–	–	–	–	–	**5**	**100.0**
Large artiodactyls	29	61.7	18	38.3	–	–	–	–	–	–	–	–	**47**	**100.0**
Elk	3	75.0	1	25.0	–	–	–	–	–	–	–	–	**4**	**100.0**
Birds	15	75.0	3	15.0	2	10.0	–	–	–	–	–	–	**20**	**100.0**
Turkey	2	50.0	1	25.0	1	25.0	–	–	–	–	–	–	**4**	**100.0**
Fish	10	100.0	–	–	–	–	–	–	–	–	–	–	**10**	**100.0**
Total	**848**	**53.0**	**735**	**45.9**	**13**	**0.8**	**3**	**0.2**	**1**	**0.1**	**1**	**0.1**	**1601**	**100.0**

Table 12.15. North Talus, animal group ages.

	Egg Shell		Fetal, Neonate		Immature		Juvenile		Mature		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	1	2.6	–	–	2	5.3	5	13.2	30	78.9	**38**	**100.0**
Small mammal	–	–	–	–	–	–	2	4.1	47	95.9	**49**	**100.0**
Rodent	–	–	–	–	–	–	1	4.3	22	95.7	**23**	**100.0**
Beaver and muskrat	–	–	–	–	1	9.1	2	18.2	8	72.7	**11**	**100.0**
Squirrels	–	–	–	–	1	1.6	11	18.0	49	80.3	**61**	**100.0**
Cottontail	–	–	–	–	–	–	3	5.9	48	94.1	**51**	**100.0**
Carnivores	–	–	–	–	–	–	–	–	2	100.0	**2**	**100.0**
Sheep/goat/cattle	–	–	–	–	–	–	1	4.8	20	95.2	**21**	**100.0**
Small and medium artiodactyl	–	–	14	1.2	22	1.9	118	10.1	1017	86.8	**1171**	**100.0**
Deer	–	–	–	–	–	–	16	19.0	68	81.0	**84**	**100.0**
Pronghorn and bighorn	–	–	–	–	–	–	–	–	5	100.0	**5**	**100.0**
Large artiodactyls	–	–	–	–	–	–	7	14.9	40	85.1	**47**	**100.0**
Elk	–	–	–	–	–	–	–	–	4	100.0	**4**	**100.0**
Birds	–	–	–	–	2	10.0	1	5.0	17	85.0	**20**	**100.0**
Turkey	–	–	–	–	–	–	–	–	4	100.0	**4**	**100.0**
Fish	–	–	–	–	–	–	–	–	10	100.0	**10**	**100.0**
Total	**1**	**0.1**	**14**	**0.9**	**28**	**1.7**	**167**	**10.4**	**1391**	**86.9**	**1601**	**100.0**

came from the first level of fill in eight of the grid units, although those located along the cliff were often thick levels from between cracks in boulders. Of these, 15.4 percent are from small mammals, 78.8 percent are from medium-sized artiodactyls, and 5.8 percent are from large artiodactyls. Only two grid units have sample sizes greater than 10, and half have only a single specimen. Small to medium artiodactyl specimens were recovered in five of the grids, deer and cottontail in three, rodent and large artiodactyl in two, and small mammal, beaver and muskrat, prairie dog, and bird in only one each. Overall ubiquity is similar to North Shelter, with deer and cottontail the most common species by count and in number of grid units they were found, followed by muskrat and beaver and turkey by counts alone.

Very few of the Central Talus bones were burned (n = 7). Both of the small mammal, four of the small and medium artiodactyl, and one large artiodactyl specimen are burned. One small to medium artiodactyl specimen is from a fetal animal, the rest are juvenile (19.0 percent) and mature (79.3 percent).

South Shelter

Most of the 178 levels excavated as South Shelter had bone (167 or 93.8 percent) and 128 (71.9 percent) had sample sizes greater than 10. The largest sample sizes were found in the 245–246N grid units (Fig. 12.1). Sample sizes range from 1 to 89 with a mean of 27.9 per level for those that had bone and 26.5 for all excavated levels. When body size is considered and defined as for North Shelter (see Table 8.33), 16.8 percent in South Shelter are small mammal, 80.8 percent are medium-sized artiodactyls, and 2.4 percent are large artiodactyl. Proportions vary by level (Table 12.16), with small mammals never comprising more than 21.4 percent of the three groups. Large artiodactyl proportions are greatest on the surface and in Levels 1 and 13. Medium artiodactyl remains dominate in every level for South Shelter.

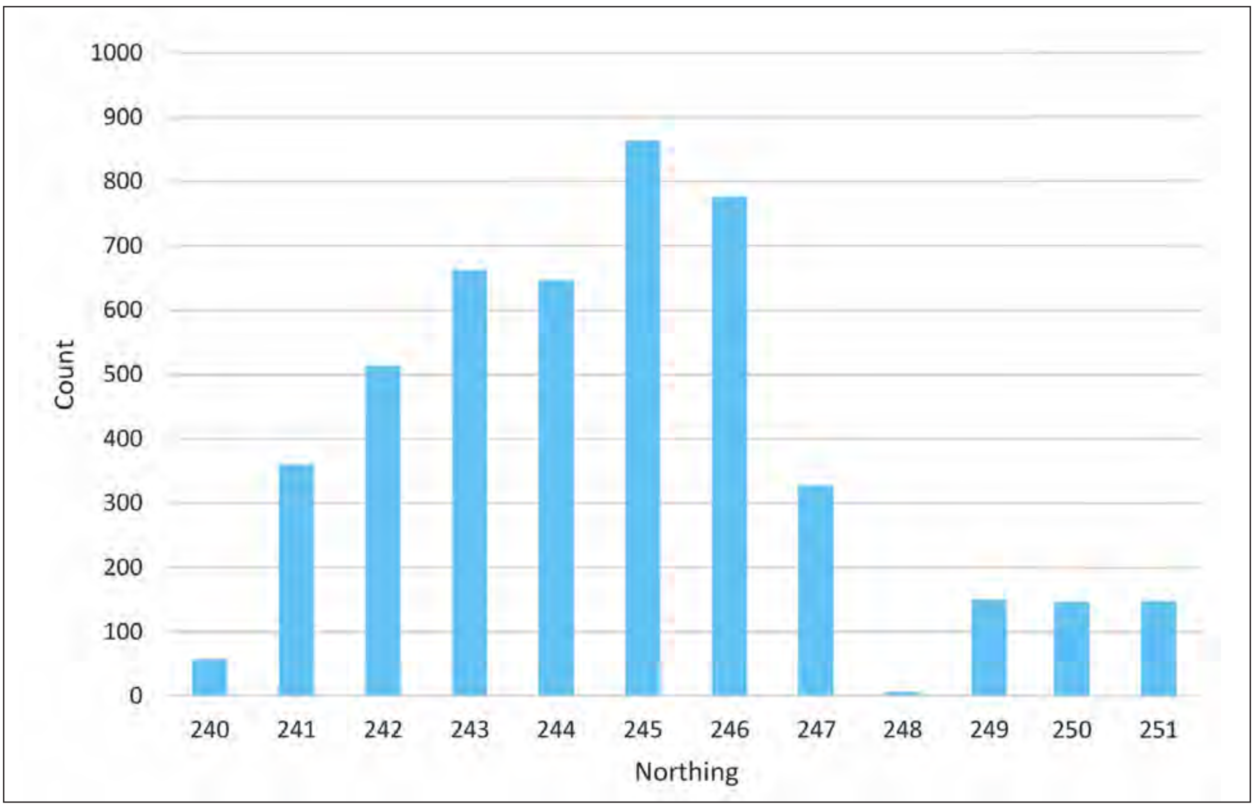

Figure 12.1. South Shelter, bone counts by northing.

Table 12.16. South Shelter, ubiquity for elk and identified taxa with sample sizes of 10 or greater.

Taxon	Count	Levels	Ubiquity
Squirrel	60	42	0.25
Prairie dog	90	53	0.32
Woodrat	61	21	0.13
Beaver and muskrat	45	36	0.22
Cottontail	141	72	0.43
Sheep/goat	23	17	0.10
Deer	319	119	0.71
Pronghorn and bighorn	21	16	0.10
Elk	24	17	0.10
Turkey	13	13	0.08
Fish	16	15	0.09

* Levels found/total levels.

Dividing the South Shelter into three areas (see Table 8.16) reveals that only the main part of the shelter (244–246N) has the same general trend observed in the North Shelter, wherein the proportion of small mammal remains increases with depth, doubling from 6.0 to 12.4 percent. In the grid units at the northern end (247–251N) of South Shelter, small mammal remains decrease by half (20.9 to 9.2 percent). Grid units to the south (240–243N) have the largest proportion in the central levels and have the largest proportion of large artiodactyl remains.

In South Shelter, the larger number of excavated grid units and large sample size resulted in more identified taxa with sample sizes greater than 10 (Table 12.17). As with North Shelter, deer was found in South Shelter in more levels than any other identified animal or animal group and was followed by cottontails and prairie dogs. Sheep or goat was not as common as in the North Shelter, while beaver and elk are more widespread than in other areas.

More South Shelter (Table 12.18) bone is burned than that found in North Shelter; proportions are comparable to North Talus. All of the animal groups have some burned bone. The small number of bison specimens have the largest percentage followed by the largest taxon—small and medium artiodactyl. High proportions of burned bone in the "other taxa" group are due to the large number (n = 142) of small pieces that could only be identified as small to medium mammal. Most of the burning is discard burns with a fair number that are scorched or roasted.

Very young and immature specimens from several animal groups were found (Table 12.19). All indicate warm-weather deposition. Antler frag-

Table 12.17. South Shelter, animal size by level.

Level	Small mammal		Medium artiodactyl		Large artiodactyl		Total	
	n =	%	n =	%	n =	%	n =	%
Surface	7	15.2	34	73.9	5	10.9	**46**	**100.0**
1	33	15.9	161	77.4	14	6.7	**208**	**100.0**
2	49	17.3	224	79.2	10	3.5	**283**	**100.0**
3	28	9.0	272	87.7	10	3.2	**310**	**100.0**
4	35	8.1	382	88.0	17	3.9	**434**	**100.0**
5	49	10.2	420	87.7	10	2.1	**479**	**100.0**
6	61	11.1	465	84.2	26	4.7	**552**	**100.0**
7	43	9.3	399	86.6	19	4.1	**461**	**100.0**
8	59	13.1	373	82.7	19	4.2	**451**	**100.0**
9	77	20.8	283	76.5	10	2.7	**370**	**100.0**
10	19	10.2	162	86.6	6	3.2	**187**	**100.0**
11	9	10.1	78	87.6	2	2.2	**89**	**100.0**
12	14	10.5	112	84.2	7	5.3	**133**	**100.0**
13	13	14.9	68	78.2	6	6.9	**87**	**100.0**
14	15	21.4	55	78.6	–	–	**70**	**100.0**
15	5	17.9	23	82.1	–	–	**28**	**100.0**
16	–	–	8	100.0	–	–	**8**	**100.0**
Total	**516**	**12.3**	**3519**	**83.9**	**161**	**3.8**	**4196**	**100.0**

Does not include specimens from multiple levels.

Table 12.18. South Shelter, animal group burn types.

	Unburned		Discard burn		Roasting burn or scorch		Boiled?		Deliberate partial burn		Partial		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	114	62.3	67	36.6	2	1.1	–	–	–	–	–	–	**183**	**100.0**
Small mammal	99	54.7	77	42.5	5	2.8	–	–	–	–	–	–	**181**	**100.0**
Rodent	63	70.0	25	27.8	2	2.2	–	–	–	–	–	–	**90**	**100.0**
Beaver & muskrat	32	71.1	11	24.4	2	4.4	–	–	–	–	–	–	**45**	**100.0**
Squirrels	48	80.0	8	13.3	3	5.0	–	–	1	1.7	–	–	**60**	**100.0**
Cottontail	115	81.6	19	13.5	6	4.3	1	0.7	–	–	–	–	**141**	**100.0**
Prairie dog	72	80.0	14	15.6	4	4.4	–	–	–	–	–	–	**90**	**100.0**
Woodrats	49	80.3	12	19.7	–	–	–	–	–	–	–	–	**61**	**100.0**
Carnivores	6	85.7	1	14.3	–	–	–	–	–	–	–	–	**7**	**100.0**
Sheep/goat/cattle	20	87.0	3	13.0	–	–	–	–	–	–	–	–	**23**	**100.0**
Small & medium artiodactyl	1513	47.4	1573	49.2	100	3.1	3	0.1	2	0.1	3	0.1	**3194**	**100.0**
Deer	196	61.4	106	33.2	15	4.7	1	0.3	–	–	1	0.3	**319**	**100.0**
Pronghorn & bighorn	14	66.7	3	14.3	4	19.0	–	–	–	–	–	–	**21**	**100.0**
Large artiodactyls	78	58.6	52	39.1	2	1.5	–	–	–	–	1	0.8	**133**	**100.0**
Elk	16	66.7	5	20.8	3	12.5	–	–	–	–	–	–	**24**	**100.0**
Bison	1	20.0	2	40.0	–	–	–	–	–	–	2	40.0	**5**	**100.0**
Birds	40	81.6	8	16.3	1	2.0	–	–	–	–	–	–	**49**	**100.0**
Turkey	11	84.6	2	15.4	–	–	–	–	–	–	–	–	**13**	**100.0**
Fish	15	93.8	1	6.3	–	–	–	–	–	–	–	–	**16**	**100.0**
Total	**2502**	**53.7**	**1989**	**42.7**	**149**	**3.2**	**5**	**0.1**	**3**	**0.1**	**7**	**0.2**	**4655**	**100.0**

Table 12.19. South Shelter, animal groups by age.

	Not Applicable/ Eggshell		Fetal, Neonate		Immature		Juvenile		Mature		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	3	1.6	4	2.2	9	4.9	34	18.6	133	72.7	**183**	**100.0**
Small mammal	–	–	–	–	2	1.1	11	6.1	168	92.8	**181**	**100.0**
Rodent	–	–	–	–	2	2.2	21	23.3	67	74.4	**90**	**100.0**
Beaver and muskrat	–	–	–	–	5	11.1	12	26.7	28	62.2	**45**	**100.0**
Squirrels	–	–	1	1.7	–	–	6	10.0	53	88.3	**60**	**100.0**
Cottontail	–	–	1	0.7	2	1.4	16	11.3	122	86.5	**141**	**100.0**
Prairie dog	–	–	–	–	1	1.1	21	23.3	68	75.6	**90**	**100.0**
Woodrats	–	–	–	–	5	8.2	11	18.0	45	73.8	**61**	**100.0**
Carnivores	–	–	–	–	1	14.3	2	28.6	4	57.1	**7**	**100.0**
Sheep/goat/cattle	–	–	1	4.3	–	–	6	26.1	16	69.9	**23**	**100.0**
Small and medium artiodactyl	–	–	40	1.3	76	2.4	346	10.8	2732	85.5	**3194**	**100.0**
Deer	–	–	3	0.9	28	8.8	61	19.1	227	71.2	**319**	**100.0**
Pronghorn and bighorn	–	–	–	–	–	–	6	28.6	15	71.4	**21**	**100.0**
Large artiodactyls	–	–	–	–	–	–	14	10.5	119	89.5	**133**	**100.0**
Elk	–	–	–	–	–	–	2	8.3	22	91.7	**24**	**100.0**
Bison	–	–	–	–	–	–	2	40.0	3	60.0	**5**	**100.0**
Birds	–	–	–	–	–	–	4	8.2	45	91.8	**49**	**100.0**
Turkey	–	–	–	–	–	–	–	–	13	100.0	**13**	**100.0**
Fish	–	–	–	–	1	6.3	–	–	15	93.8	**16**	**100.0**
Total	**3**	**0.1**	**50**	**1.1**	**132**	**2.8**	**575**	**12.4**	**3895**	**83.7**	**4655**	**100.0**

ments include no pieces that indicate shed antler. One was large enough to indicate it was from an elk, 11 could have been from either elk or deer, and seven are more like deer in size.

The bison specimens from South Shelter are teeth or tooth fragments. All but one are from the same grid unit (244N/141E, Levels 7, 8, and 9); the exception is from deep in a nearby grid unit (241N/145E, Level 8). Those from 244N/141E are burned and the other is not. Three additional elements are large enough that they could be from bison but were classified as *Bos/Bison*. These are unburned tooth fragments from grid units 244N/143E (level unknown—the fragments fell from the profile) and 242N/145E, Level 7, and a burned partial sesamoid from 244N/144E, Level 4.

Domestic sheep or goat specimens were found from the surface through Level 5. Most (60 percent) were within the first two levels of fill, with 20 percent in Level 3, and 10 percent each in Levels 4 and 5. The Level 5 and one of the Level 4 specimens are from adjacent grids in an area disturbed by the placement of a large boulder in the shelter. The other Level 4 specimen is from a more northern grid unit. Construction disturbance and rodent burrowing could account for finding domestic species in these middle levels of fill.

South Shelter had the only snake and frog specimens, probably due to the larger sample size. Otherwise, the assemblage is consistent with the other site areas, indicating a similar use for the two shelters.

South Talus

South Talus has the second-largest sample size for the site areas, but it is only slightly larger than that for North Shelter. Of the 131 grid units excavated in this area, 116 (88.6 percent) contained bone. Sample sizes range from 1 to 252 for a mean density of 20.6 for the levels with bone and 18.22 for all levels. The largest sample sizes are in grid units at the north end of the South Talus, where 252 came from Level 3 of 252N/143E and the next largest sample (n = 110) is from Level 2 of that same grid unit. The majority of the bone came from the upper two levels of fill (69.1 percent), with proportions decreasing with depth with the lowest three levels contributing only 0.1 percent each to the total.

Small mammals contribute little to the South Talus assemblage (see Table 8.7), but show a general trend toward more small forms in the deeper levels. South Talus grid units to the north (248–253N) and south (237–242N) have more large artiodactyl remains than grid units fronting South Shelter. Proportions decrease in the far south area of South Talus, peak in the middle levels in front of South Shelter, and increase in its far north grid units.

Several animals have sample sizes greater than 10 (Table 12.20) and the general sequence for ubiquity is similar to the other site areas. However, the scores are generally the lowest found. Deer was found in more levels than any other taxon, followed by cottontail and prairie dog, but the ubiquity scores are considerably lower for each.

All but two of the animal groups (turkey and fish) have burned bone (Table 12.21). With the exception of the small mammal group, the smaller body forms tend to have less burning. The overall amount of burned bone is less than in the northern site areas and South Shelter, but greater than the small Central Talus sample.

Young deer and beaver (Table 12.22) at South Talus suggest deposition during the warm season. Antler was fairly common and recorded for deer or elk (n = 1), elk (n = 1), and deer (n = 12). In addition, one partial deer cranium had the antler broken off, suggesting it was taken in late summer or fall (Mackie et al. 1982:864).

Site Areas Compared

For the most part, the proveniences are similar across LA 139965 and suggest little or no differences in the animals used. Deer, cottontail, and prairie dog are always the most common animals found—although the ubiquity differs (Fig. 12.2). Both the

Table 12.20. South Talus, ubiquity for elk and identified taxa with sample sizes of 10 or greater.

	Count	Levels	Ubiquity
Squirrel	16	14	0.11
Prairie dog	46	25	0.19
Woodrat	19	14	0.11
Beaver and muskrat	21	15	0.16
Cottontail	46	32	0.24
Deer	237	60	0.46
Pronghorn and bighorn	21	16	0.12
Elk	19	12	0.09
Turkey	12	8	0.06

* Levels found/total levels.

Table 12.21. South Talus, animal group burn types.

	Unburned		Discard burn		Roasting burn or scorch		Boiled?		Deliberate partial burn		Partial		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	39	69.9	16	28.6	1	1.8	–	–	–	–	–	–	**56**	**100.0**
Small mammal	21	61.8	12	35.3	1	2.9	–	–	–	–	–	–	**34**	**100.0**
Rodent	36	94.7	2	5.3	–	–	–	–	–	–	–	–	**38**	**100.0**
Beaver and muskrat	18	85.7	3	14.3	–	–	–	–	–	–	–	–	**21**	**100.0**
Squirrel	52	83.9	7	11.3	3	4.8	–	–	–	–	–	–	**62**	**100.0**
Cottontail	42	91.3	4	8.7	–	–	–	–	–	–	–	–	**46**	**100.0**
Carnivore	10	90.9	–	–	1	9.1	–	–	–	–	–	–	**11**	**100.0**
Sheep/goat/cattle	4	66.7	2	33.3	–	–	–	–	–	–	–	–	**6**	**100.0**
Small and medium artiodactyl	1062	61.7	633	36.8	22	1.3	1	0.1	3	0.2	1	0.1	**1722**	**100.0**
Deer	176	74.3	56	23.6	3	1.3	2	0.8	–	–	–	–	**237**	**100.0**
Pronghorn and bighorn	16	76.2	5	23.8	–	–	–	–	–	–	–	–	**21**	**100.0**
Large artiodactyl	51	60.7	32	38.1	1	1.2	–	–	–	–	–	–	**84**	**100.0**
Elk	17	89.5	2	10.5	–	–	–	–	–	–	–	–	**19**	**100.0**
Bird	14	82.4	3	17.6	–	–	–	–	–	–	–	–	**17**	**100.0**
Turkey	12	100.0	–	–	–	–	–	–	–	–	–	–	**12**	**100.0**
Fish	1	100.0	–	–	–	–	–	–	–	–	–	–	**1**	**100.0**
Total	**1571**	**65.8**	**777**	**32.6**	**32**	**1.3**	**3**	**0.1**	**3**	**0.1**	**1**	**0.0**	**2387**	**100.0**

Table 12.22. South Talus, animal groups by age.

	Not Applicable/ Eggshell		Fetal, Neonate		Immature		Juvenile		Mature		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Other taxa	2	3.6	1	1.8	2	3.6	12	21.4	39	69.6	**56**	**100.0**
Small mammal	–	–	–	–	–	–	4	11.8	30	88.2	**34**	**100.0**
Rodent	–	–	–	–	3	7.9	3	7.9	32	84.2	**38**	**100.0**
Beaver and muskrat	–	–	–	–	1	4.8	9	42.9	11	52.4	**21**	**100.0**
Squirrel	–	–	–	–	–	–	10	16.1	52	83.9	**62**	**100.0**
Cottontail	–	–	–	–	–	–	11	23.9	35	76.1	**46**	**100.0**
Carnivore	–	–	–	–	–	–	–	–	11	100.0	**11**	**100.0**
Sheep/goat/cattle	–	–	–	–	–	–	2	33.3	4	66.7	**6**	**100.0**
Small and medium artiodactyl	–	–	38	2.2	39	2.3	187	10.9	1458	84.7	**1722**	**100.0**
Deer	–	–	2	0.8	19	8.0	46	19.4	170	71.7	**237**	**100.0**
Pronghorn and bighorn	–	–	–	–	1	4.8	–	–	20	95.2	**21**	**100.0**
Large artiodactyl	–	–	–	–	1	1.2	5	6.0	78	92.3	**84**	**100.0**
Elk	–	–	–	–	–	–	1	5.3	18	94.7	**19**	**100.0**
Bird	–	–	–	–	–	–	1	5.9	16	94.1	**17**	**100.0**
Turkey	–	–	–	–	–	–	–	–	12	100.0	**12**	**100.0**
Fish	–	–	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Total	**2**	**0.1**	**41**	**1.7**	**66**	**2.8**	**291**	**12.2**	**1987**	**83.2**	**2387**	**100.0**

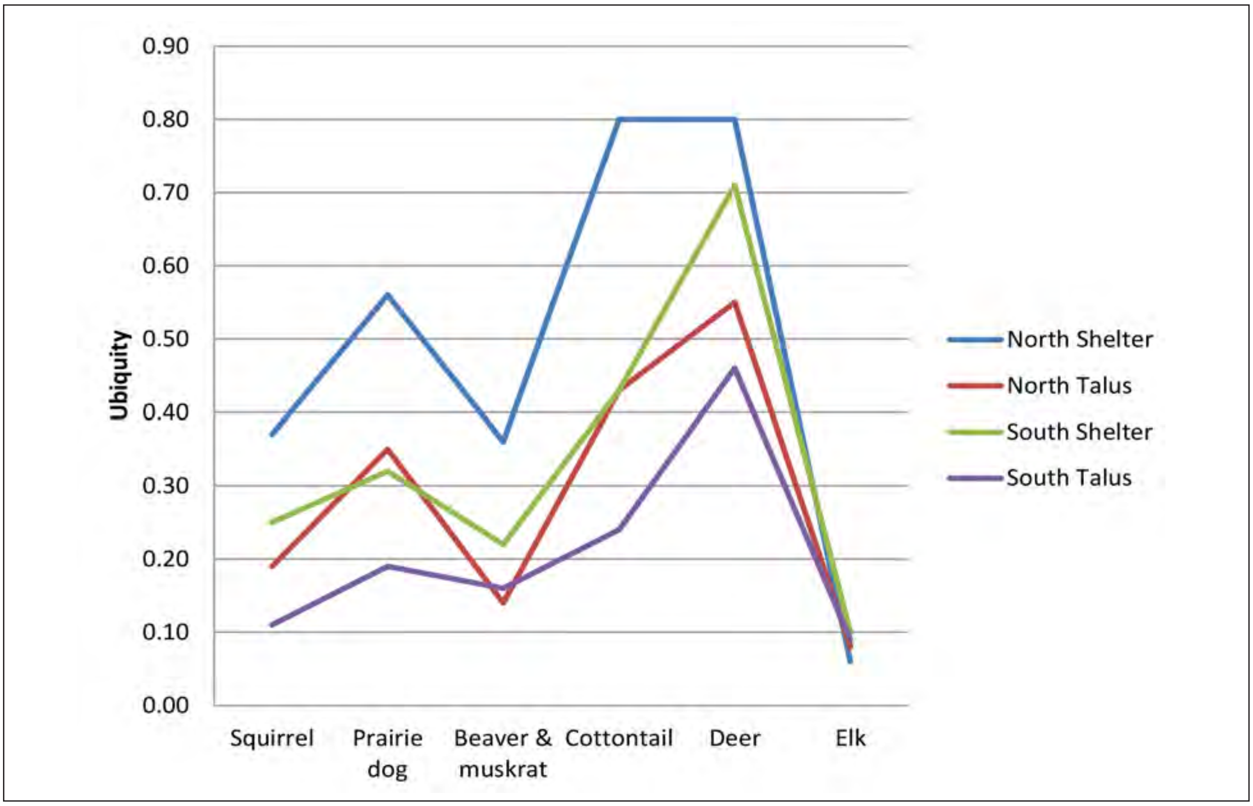

Figure 12.2. Ubiquity for selected taxa by site area.

chipped stone assemblage (Chapter 10) and results of the protein residue analysis (Appendix 3) confirm the focus on hunting in general and particularly on hunting of deer.

Focusing on the most important animal resource—deer—finds some differences in body parts and processing. Feet (metacarpals, metatarsals, tarsals, carpals, and phalanges) are the most common part in all site areas, followed by cranial fragments (Fig. 12.3, top). Antler and front leg parts are more common in the northern areas while ribs (thorax) and vertebrae are more common in the southern areas. Adding the small to medium and medium artiodactyls to the graph (Fig. 12.3, bottom) shows that the northern-area bone was more heavily processed, resulting in larger proportions of specimens identifiable only as long or flat bones; the proportion of ribs increases to a level comparable to the southern site areas. Adding these fragments also evens out the proportions of the other body parts and suggests that the amount of processing strongly affects the body-part distribution. No parts appear to be missing in proportions that indicate particular elements were consistently taken from this site and returned to a residential site.

Definite processing was fairly rare for deer and small sample sizes probably account for much of the variation (Fig. 12.4, top). Defleshing, cuts, and impacts are the most common overall with proportions differing by area. Adding the small to medium and medium artiodactyl specimens (Fig. 12.4, bottom) greatly increases the proportions with impacts in all areas. Yet, the differences between the areas are not of a magnitude that suggests animals were treated differently in the northern and southern areas. Certainly the amount of bashed bone indicates processing for marrow, and the burning indicates that after processing, many of the pieces were discarded into a fire. Defleshing could be an indication that meat was stripped for drying or smoking.

The same can be said of the next-most common animal—cottontail (Fig. 12.5). Proportions are similar enough to suggest there are no substantial differences in how cottontails were processed. Foot parts are relatively rare but crania and limbs fairly abundant.

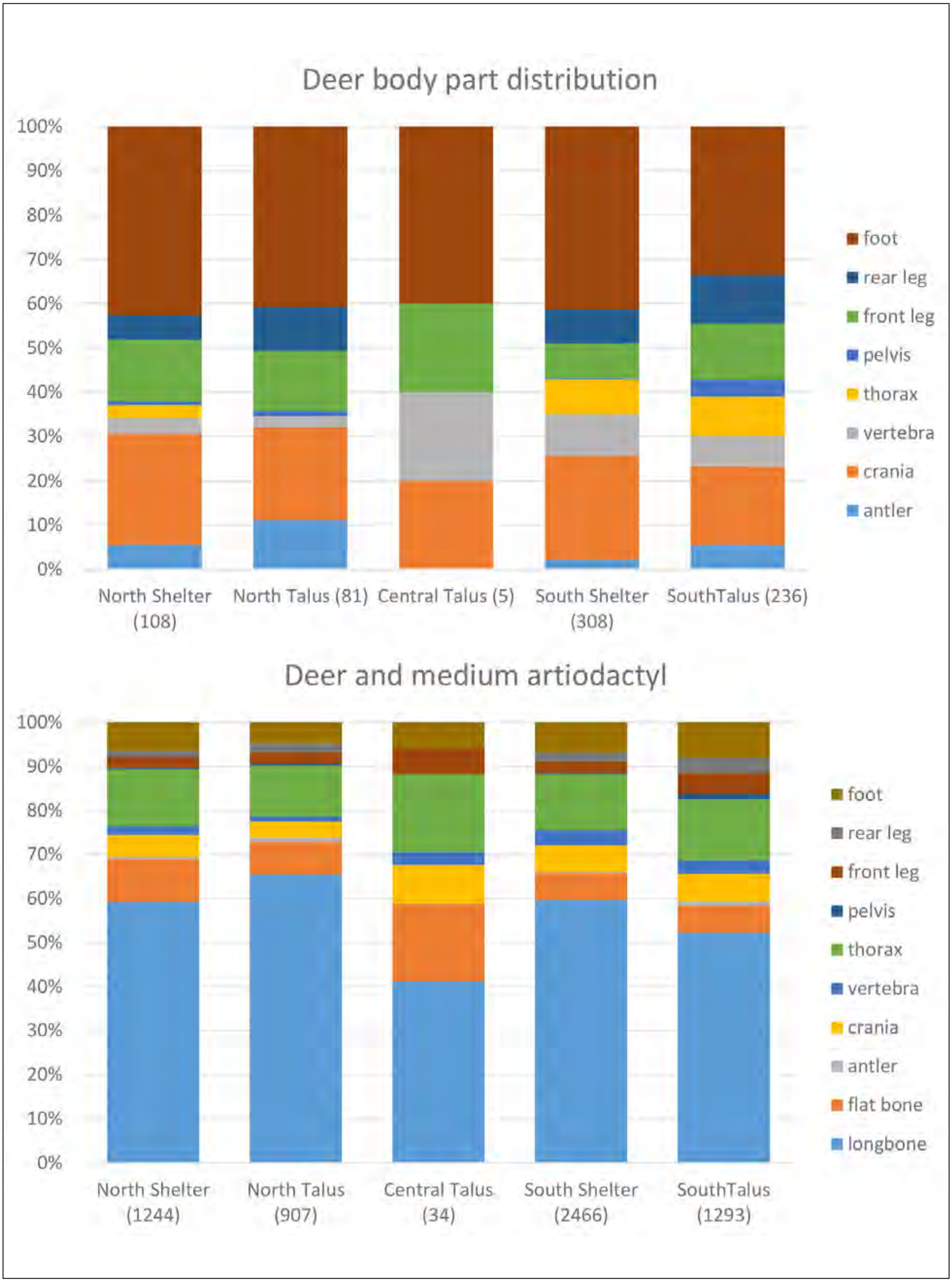

Figure 12.3. Deer and deer and medium artiodactyl body-part distribution by site area.

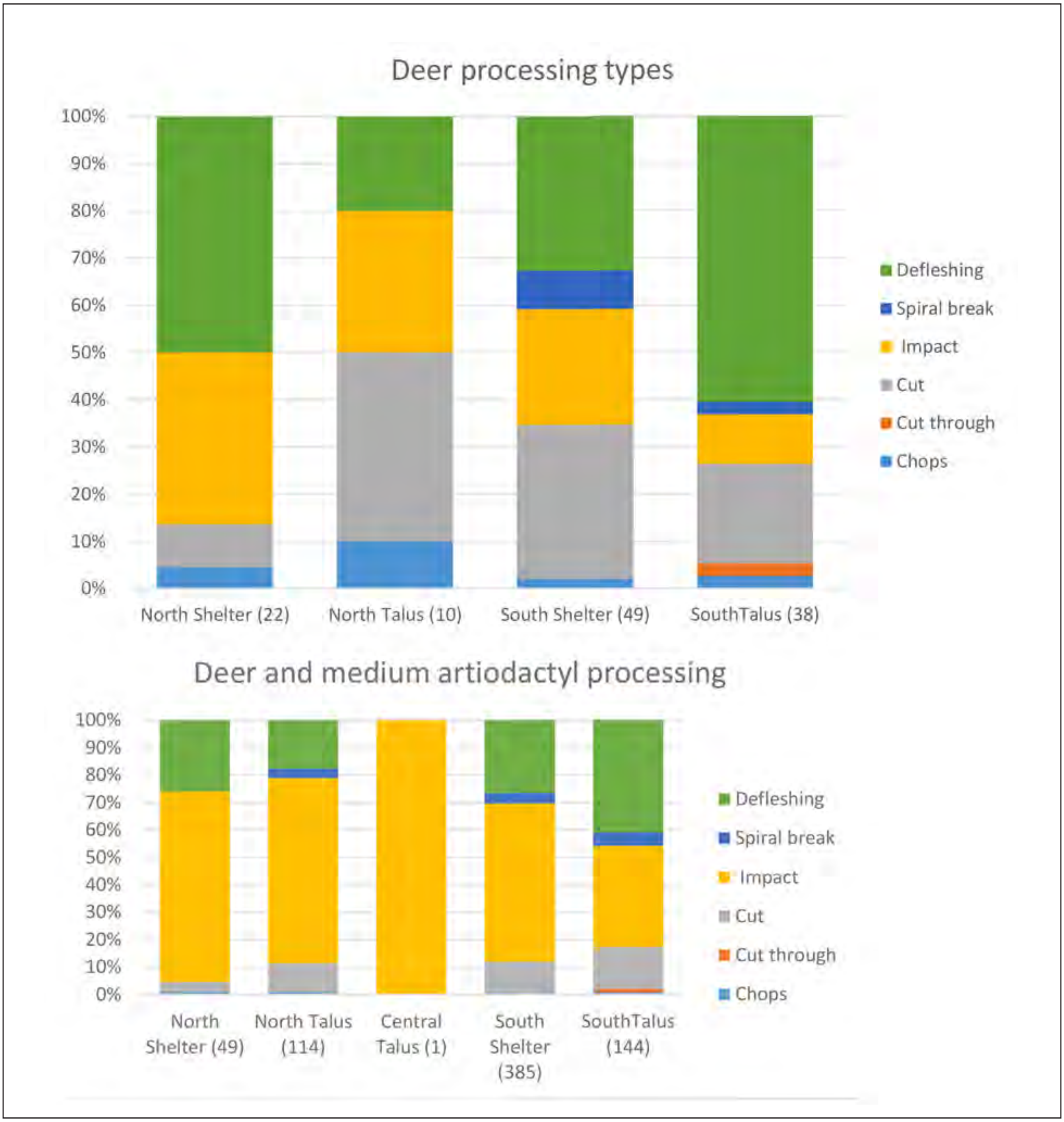

Figure 12.4. Processing for deer and for deer and medium artiodactyl by site area.

Regional Comparisons

Few sites have faunal assemblages that can be compared with that from Coyote Canyon Rockshelter (LA 139965). As noted in Chapter 10, contemporaneous residential sites have more diverse chipped stone tool assemblages without the focus on hunting found at the Coyote Canyon Rockshelter site, and neither the Archaic nor Paleoindian comparative assemblages have the same focus on projectile point manufacture. Differences related to the hunting focus should be reflected in the LA 139965 faunal assemblage. To assess those, or any other differences, results of analyses of fauna from another rockshelter site in New Mexico, a pueblo site near Las Vegas (NM), a small site in Colorado, a small

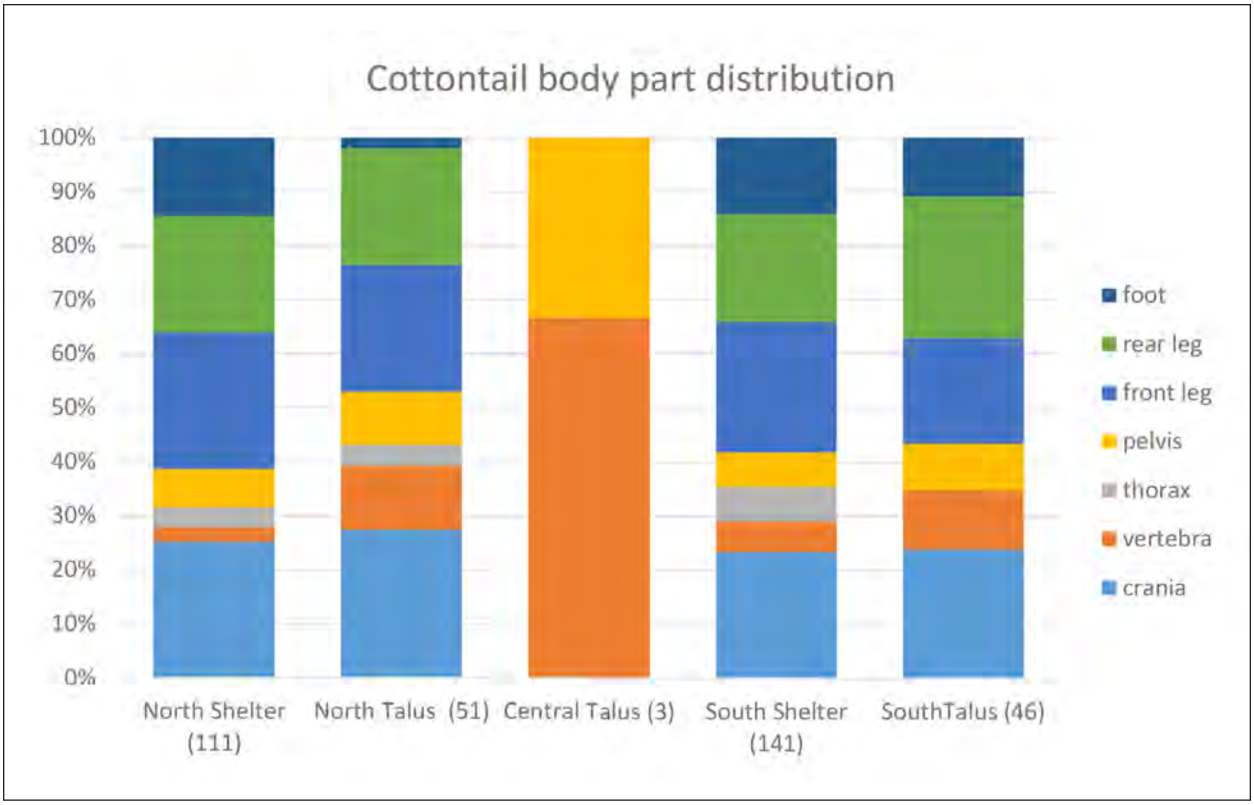

Figure 12.5. Distribution of cottontail body parts by site area.

site near Tesuque Pueblo, and a small site in the Galisteo Basin are examined. These sites, discussed below, were chosen for their locations or because they had enough artiodactyl bone to examine their body-part distribution.

The assemblage that we might expect to be most similar comes from Red Bow Shelter (*aka* KS 100 and LA 87332), a north-facing rockshelter in the Vermejo region of New Mexico that was named for a hematite pictograph bow painted on its back wall. Located at an elevation of 2156 m (7075 ft), it is set in a narrow valley with a nearby stream (100 m to the north) and a mixed conifer forest. The shelter measured 20 m long by 5.5 m deep. Excavation of about 10 percent of the shelter recovered a fairly large artifact assemblage along with 31 hearth and pit features and a low rock wall that probably served as a wind break (Campbell 1984:292–294; Kershner 1984:117–121). Radiocarbon dates indicate intermittent occupation from at least 900 BC to AD 1200 (Campbell 1984:334). The chipped stone assemblage (n = 1,562, including ground stone) included 88 projectile points and point fragments, 45 bifaces, 20 cores, 18 scrapers, 7 knives, 4 drills, 3 spokeshaves, and other tools. Flakes comprised 66 percent of the assemblage; angular debris comprised 14 percent. Chert, quartzite, basalt, and chalcedony were the most common material types (Campbell 1984:319–320, 334). Fauna was more abundant (n = 7,315). A good portion of the assemblage was identifiable only to the size of the animal (75.7 percent); unidentifiable pieces that were potentially from artiodactyls were considered medium to large mammal. Cottontail rabbit was the most abundant taxon (n = 631), with fewer deer (n = 249 deer; n = 247 c.f. deer) and no other artiodactyl species. Burned bone was fairly abundant (37.9 percent of the total assemblage). Deer (21.5 percent) and c.f. deer (18.6 percent) were frequently burned, while only 8.9 percent of the rabbit was burned. The medium to large mammal taxon had the greatest amount of burning (53.2 percent) (Gillespie 1984:345–354). Unfortunately, no identification of body parts is presented for any faunal group here, but the extent of fragmentation and burning of deer bone suggests a similar treatment of deer at Red Bow as compared to

Coyote Canyon Rockshelter. However, the amount of rabbit here suggests that the site occupants did not have the same focus on deer hunting as found at Coyote Canyon. The presence of two-hand manos (Campbell 1984: 328–331) and a milling area in the ceramic-occupation level may suggest that corn was grown in the vicinity. Most of the botanical remains suggest seasonal occupations where gathering activities centered on plant resources found in the valley bottom in summer to early fall (Donaldson 1984:377–379).

Another site used for faunal assemblage comparison is Tecolote Pueblo (LA 296). Located south of Las Vegas (NM), it is at the edge of the High Plains and Sangre de Cristo Mountains, just south of the Tecolote River. It consists of several house mounds that have been examined by various groups and individuals for the past 70 years. Dating to the Developmental and Coalition periods (AD 1000–1300), fauna recovered between 1970 and 2002 was reported in a thesis by Diana Sherman (2004). The sample was from three areas with both architectural and non-architectural fill. Some of the fill was screened through 1/4-inch mesh (Sherman 2004:2–5, 29–31). The assemblage of 7,716 specimens included 57 percent that could not be identified beyond the size of the animal and 22 percent that could be identified to species or order. Deer (n = 400) and pronghorn (n = 169) are relatively abundant in an assemblage that also included a good amount of rabbit (n = 231) (Sherman 2004:40–42, 140–142). Burning varied by area, ranging from 7 to 31 percent. Artiodactyls and unidentified medium to extra-large taxa have the most burning (Sherman 2004:78–81). The distribution of body parts led Sherman to conclude that deer and pronghorn were probably returned whole to the site for processing (Sherman 2004:101).

Like Tecolote Pueblo, the Leone Bluff Site in Colorado is located at a transition of the Sangre de Cristo Mountains and the High Plains, however further north, on the Park Plateau at Trinidad Reservoir. Occupied between about AD 900 and 1040, the site has a number of small habitation structures (Cordero and Hogan 2010). Relatively few bifaces were found at the site, and only 13 of the 29 bifaces—in a sample collected during the most recent excavation—are projectile points. Informal tools were mainly used on wood or bone rather than softer materials such as hides or for processing meat (Herhahn, Hogan, and Mack 2010:93–95). A relatively small sample of fauna was recovered from the rather unsystematic collection and excavations, with the majority (n = 1,126 of 1,982) gathered from surface contexts (Cordero 2010:143). Specimens from deer and probable deer are common, as is rabbit (n = 184 deer; n = 64 deer or antelope; n = 7 pronghorn; n = 1077 large mammal; n = 114 rabbit). Although the 2010 report lacks detailed information on body parts, Leone Bluff is included in this discussion because—due to the absence of ribs and vertebrae—the body-part distribution for deer and pronghorn remains is interpreted there as selective transport of higher utility portions (cranium and upper limbs plus their rider elements—foot bones). Portions returned were fractured for marrow. This and the taxonomic diversity are interpreted as resource stress (Cordero 2010:146–149).

LA 391, just north of Tesuque Pueblo tribal land, is a late Developmental-period site located in a piñon-juniper woodland. The only structures are small temporary shelters; also found there were good trash deposits and a large number of thermal features. However, LA 391 is surrounded by sites with more substantial architecture and it may have served as a center-place for a number of small habitation structures that were not investigated. It is included in this analysis because it has a good sample of deer bone (n = 110; n = 1,497 medium artiodactyl bones) and detailed body-part analysis, and because it could represent the kind of site from which hunters traveled to procure artiodactyls (Akins in prep. [a]).

LA 3333, the final comparative site for the Coyote Canyon Rockshelter (LA 139965) faunal assemblage, is on the east side of the Galisteo Basin at an elevation of 1,964 m (6,445 ft) in a piñon-juniper woodland. It consisted of a number of small, expedient pit structures and two kivas dating to the early part of the Coalition period. This site is unusual in that corn was present in most of the flotation samples yet ground stone was scarce, and there was a good sample of fauna (n = 2542) that comprised mainly pronghorn (n = 416) and considerable deer (n = 100) and medium artiodactyl (n = 874). LA 3333 data also contains detailed information on body-part distribution (Akins in prep. [b]).

Taxa Distribution

In all five of the comparative site assemblages (Fig. 12.6) discussed above, medium artiodactyl remains (which, due to differences in how analysts record unidentifiable specimens, include medium to large and large mammal and small to medium and medium artiodactyl) comprise the bulk of the assemblage. Tecolote Pueblo appears to have the least small mammal, but some of that result could be due to the use of a larger screen size and the areas excavated. LA 391 has the most, and perhaps it should, since it probably represents a residential site where agriculture contributed more to the diet—yet hunting artiodactyls remained important. In the other comparative site assemblages, small forms represented between 20 and 30 percent of the assemblage. Large artiodactyls, turkey, bird, and fish never account for more than 10 percent and usually substantially less. Thus, it is reasonable to focus on artiodactyl procurement for all of these sites.

Body-Part Distribution

If Coyote Canyon Rockshelter was a location that was repeatedly used by logistically organized hunters whose main prey was deer, we might expect that the body-part distribution there would be different from that found at residential sites. If, as suggested by Cordero (2010:146), only high-utility parts, such as crania and hind- and forelimbs plus their riders (feet), were transported back to residential sites while the other parts were left behind, we would expect to find more of the "other" parts at a hunting camp such as Coyote Canyon Rockshelter. On the other hand, if the groups spent considerable time at the site and the meat was stripped from the bone and marrow extracted, we would expect a full array of body parts. This, of course, might be true

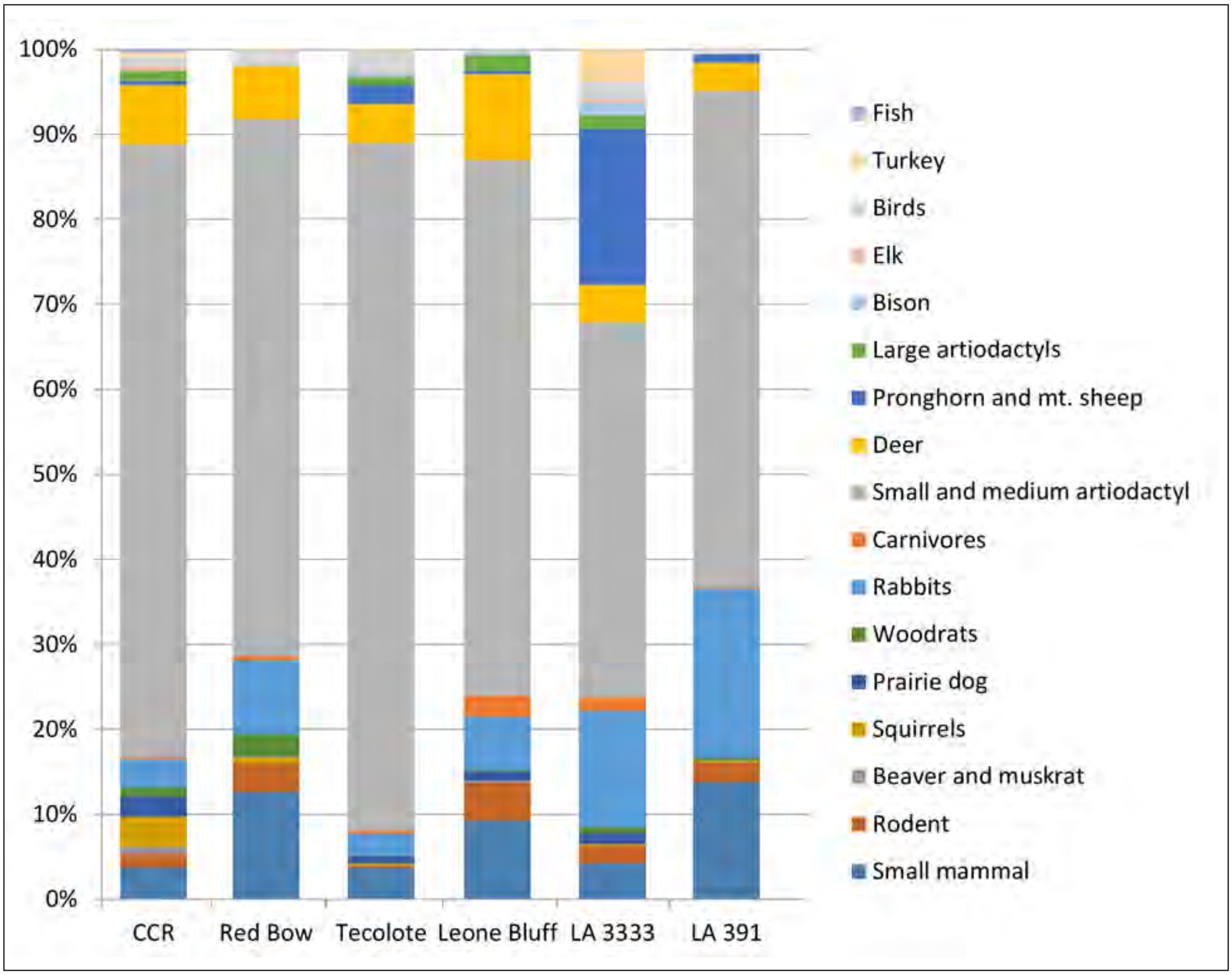

Figure 12.6. Distribution of animal groups for regional sites.

whether those who used the site were agriculturalists on logistic hunting and gathering expeditions or if the groups using the site continued a hunter-gatherer subsistence strategy while occasionally trading animal products for corn with agricultural groups.

There were three sites in our comparative study that recorded body-part distribution *and* had a deer or pronghorn sample size that was at least 100: Tecolote Pueblo, LA 391, and LA 3333. Figure 12.7 (top, middle, bottom) compares Coyote Canyon Rockshelter's body-part distribution with these sites (Coyote Canyon Rockshelter, deer: n = 739; Tecolote Pueblo, deer: n = 400; Tecolote Pueblo, large mammal: n = 2065; LA 391, deer: n = 110; LA 3333, deer: n = 100; LA 3333, pronghorn: n = 413), then further evaluates the data.

The topmost bar graph in Figure 12.7 includes only the identified deer—and for LA 3333 also the pronghorn—specimens (Tecolote numbers are from Sherman 2004:58; percentages were converted to counts). To gauge the effect on the assemblage, the middle bar graph adds the medium artiodactyl body parts for all but Tecolote—where the graph is the totals for Sherman's large mammal group and number of bones examined (Sherman 2004:42, 62). Long-bone shaft fragments contribute a considerable proportion to all but Tecolote, where deer is the most abundant artiodactyl. However, the only part distribution that includes parts like ribs and vertebra—which are absent from the deer counts (Sherman 2004:62)—are the large mammal remains, but this group might not accurately reflect the deer and medium artiodactyl distribution. The bottom bar graph removes the long- and flat-bone fragments from the data used in the middle graph, but retains the identifiable elements that could not be identified to a particular species.

In the top graph, foot elements are always the most numerous skeletal part. This is due in part to the distinctiveness of deer, and to a lesser extent pronghorn. Metapodials—even when broken into small pieces—as well as carpals, tarsals, and phalanges are small, compact bones that often remain intact or at least recognizable. Distributions at all of the sites are slightly different, with the two from LA 3333 the most similar—suggesting deer and pronghorn were treated the same at that site. Coyote Canyon Rockshelter has fewer leg and foot parts than all of the other assemblages but the difference is not of the magnitude to suggest these supposedly high-utility parts were selectively removed from the site—especially given the large number of long-bone shaft fragments in the middle graph.

Tecolote Pueblo stands out in the middle graph, probably because the assemblage contained samples of all body parts for large mammal remains. Long- and flat-bone fragments make up large parts of most faunal assemblages. Adding the medium artiodactyl counts results in similar proportions for Coyote Creek Rockshelter, LA 391, and the LA 3333 deer. In all three, thorax or ribs are the most common part followed by crania or foot parts. If any of these assemblages shows a preference for high-utility parts, it is the LA 3333 pronghorn. Given that pronghorn were undoubtedly transported farther than the deer brought to the site, it is not surprising.

As shown in the bottom graph, removing the long- and flat-bone fragments from the counts used in the middle graph results in fairly similar proportions for all sites. The LA 3333 pronghorn still has the most limb and foot bones, which might suggest more distant and selective transport. Thus, the body-part distribution does not seem to imply that Coyote Canyon Rockshelter was a logistic camp from which the high-utility parts of deer were taken and the lesser ones left behind. Rather, the amount of long- and flat-bone fragments indicate these parts were heavily processed and fragmented. At the same time, the Tecolote Pueblo, LA 391, and LA 3333 deer part distributions do not support the idea that only the higher utility parts were taken back to their home base. The parts "left behind"—such as ribs, vertebra, and pelvis—are represented in the more general taxa categories. Failure to consider the amount of long- and flat-bone fragments can lead to erroneous conclusions.

Faunal Data Conclusions

The faunal data document the repeated use of Coyote Canyon Rockshelter as a base for hunting during the warmer seasons. While the focus was on deer hunting, animals ranging from wood rats and squirrels to cottontail, beaver, and turkey also provided meat and other byproducts. Elk and various carnivores were probably taken when encountered, and parts from pronghorn and bison brought from more distant hunts or camps. Smaller animals—such

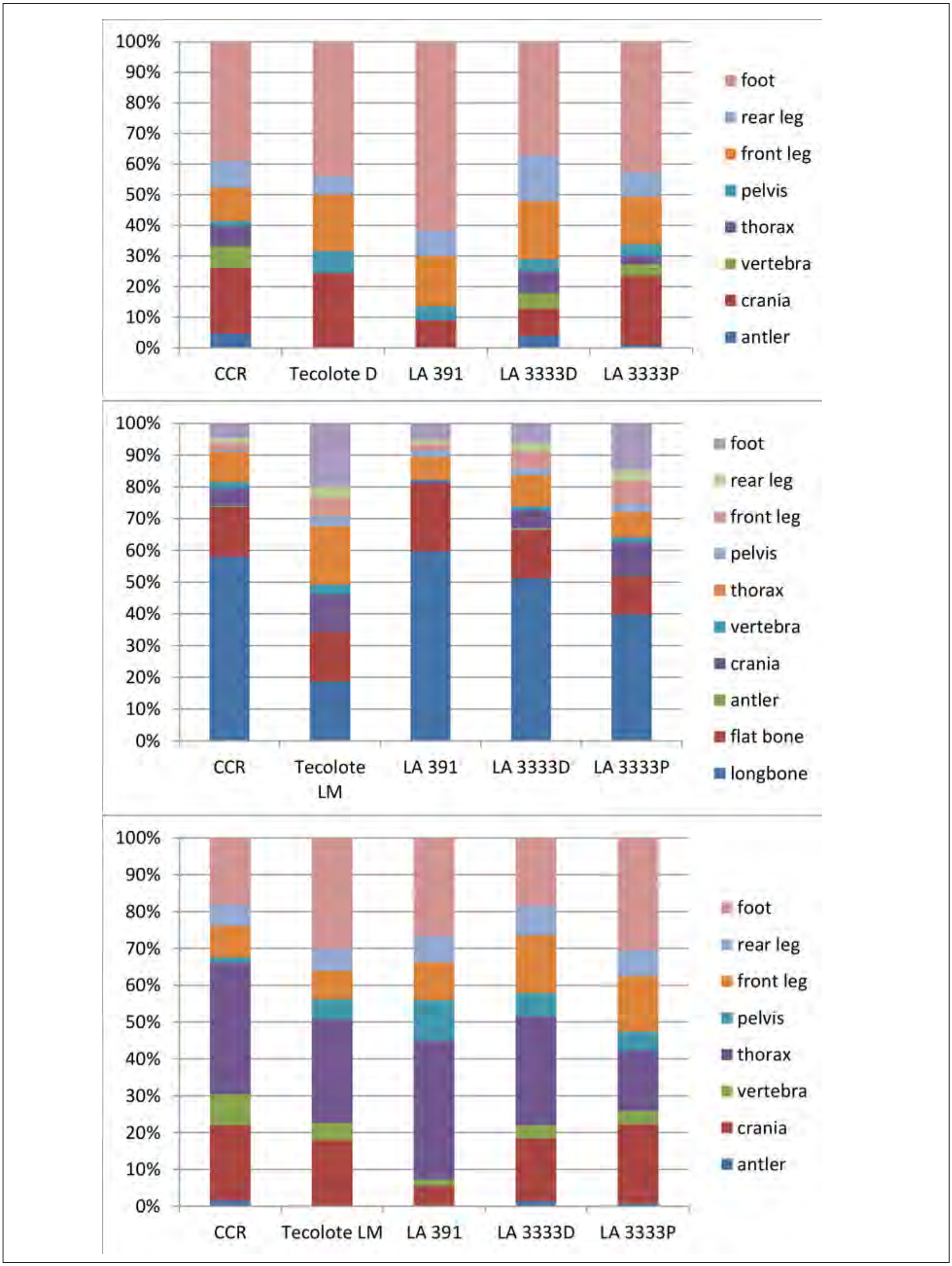

Figure 12.7. Distribution of body parts for (top) deer and pronghorn body parts, (middle) with medium artiodactyl-sized animal parts added, and (bottom) without long and flat bones.

as squirrels, rodents, rabbits, and birds—could have been trapped or hunted by women and children who remained at the base. The earlier excavation levels at the site tend to have more small mammal remains and could indicate a change in group composition over time paired with an increasing focus on acquiring deer.

Human presence at the site was undoubtedly timed to take advantage of favorable deer habitats. From April until the start of winter snows, mule deer inhabit high-elevation forests while white-tailed deer prefer lower-elevation forest edges and clearings but occasionally use ponderosa pine forests (Bison-M, accessed January 12, 2016). This timeframe includes the seasons when animals attain their greatest weight—increasing in summer and early fall before decreasing in late fall and winter. Female weight peaks in October and is lowest in April; male weight also peaks in October but is lowest in March. Mule deer tend to be dispersed during much of the year, but they also use common feeding areas (Mackie et al. 1982:863, 868) and may have provided a consistent presence in the vicinity of the site.

Perhaps more surprising is that the body-part distribution for deer at Coyote Canyon Rockshelter is similar to that found in regional residential sites. Rather than performing initial processing tasks and transporting the higher utility parts to a residential site, the body-part distribution suggests these too were processed at the site to at least the same, if not a greater, extent than seen at residential sites. A similar distribution was also observed at High Rolls Cave, with predominantly Archaic-era deposits and representing a hunting and gathering subsistence strategy. Here, too, deer were the most common animal hunted and were hunted throughout the year regardless of the condition of the animal. All body parts were represented and indicate treatment similar to that found at Coyote Canyon Rockshelter (Akins 2005:98, 132). Perhaps, more than anything, this suggests that our concept of logistic hunts by sedentary groups does not apply to Northern Rio Grande groups as long as the region was not densely populated.

Worked Bone

Worked bone comprised a relatively small proportion of the faunal assemblage (n = 67; less than 1 percent) but includes a number of tool and ornament types (Table 12.23). More were recovered from South Shelter with near equal numbers from the North Shelter and the talus areas (Table 12.24).

Worked Bone Methods

All of the worked bone was analyzed and recorded using the standard OAS format, which includes the attributes of site number, field specimen number (FS), lot number, provenience information, taxon, element, condition of the specimen, completeness, thermal alteration (if any), tool type, modification, general shape including cross-section, use wear, and a variety of measurements. All specimens were examined under a binocular microscope at a magnification of 7X to 45X to aid in determining type and amount of modification and detect any evidence of use wear.

Condition refers to the overall physical condition of the tool. A rating of poor means that surface pitting or checking altered the object to the extent that little or no evidence of surface treatment remains, while good condition means that surface treatment is visible on most of the artifact. Excellent condition is used when all surface treatment is clearly visible.

Completeness refers to the portion of the object that was recovered. Essentially complete includes those with only a small portion missing (i.e., awl with very tip missing). Incomplete awls are described as proximal or butt end, shaft or midsection, and distal or functional end. Fragmentary specimens are either too incomplete to determine artifact type or the portion represented could not be determined.

Thermal alteration includes any evidence of burning. Heavy burning is intense burning that generally results from discard into a fire. Scorches, spot burns, and partial burns can be accidental—like from a fire burning over the object or discard onto a cooling fire. Tips may be burned to harden the bone or for some function that requires heat.

Modification, or deliberate shaping of the object, is recorded by type and location. Proximal modification includes natural ends that are unmodified,

Table 12.23. List of worked bone by site area.

North	East	Level	FS No.	Tool Type	Completeness	Heat Alteration	Common Name	Element	Portion
					North Shelter				
270	141	3	499	Fragmentary	Fragmentary	Heavy	S-M artiodactyl	Long bone fragment	Shaft fragment
271	140	1	546	Fragmentary	Proximal	Unburned	Deer	Metatarsal	Proximal shaft fragment
	141	2	491	Small tubular bead	Medial or lateral	Heavy	Small mammal	Long bone fragment	Shaft fragment
		5	526	Use defined	Distal	Unburned	S-M artiodactyl	Metapodial	Distal shaft fragment
			525	Coarse-point awl	Distal	Unburned	S-M artiodactyl	Metapodial	Shaft fragment
272	140	2	755	Fine-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
			755	Small, tubular bead	End	Unburned	Large bird	Long bone fragment	Shaft fragment
		4	760	Fine-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
			759	Pin	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
	141	3	719	Fragmentary	Midsection/shaft	Heavy	M-L artiodactyl	Long bone fragment	Shaft fragment
		7	742	Fine-point awl	Essentially complete	Unburned	M-L mammal	Long bone fragment	Shaft fragment
273	140	3	612	Fine-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
	141	5	543	Fragmentary	Fragmentary	Heavy	S-M artiodactyl	Long bone fragment	Shaft fragment
			543	Coarse-point awl	Distal	Heavy	S-M artiodactyl	Long bone fragment	Shaft fragment
274	141	1	476	Awl; no tip	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
					North Talus				
269	143	3	637	Small tubular bead	Medial or lateral	Heavy	Small mammal	Long bone fragment	Shaft fragment
		4	649	Coarse-point awl	Essentially complete	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
270	142	1	405	Small tubular bead	Essentially complete	Unburned	S-M Mammal	Long bone fragment	Shaft fragment
			405	Unknown function	Essentially complete	Unburned	Medium artiodactyl	Rib	Shaft fragment
	143	2	303	Scraper	Essentially complete	Unburned	Large artiodactyl	Long bone fragment	Shaft fragment
		5	321	Fine-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
		9	341	Fragmentary	Midsection/shaft	Heavy	Large artiodactyl	Long bone fragment	Shaft fragment
271	142	4	386	Fragmentary	Fragmentary	Unburned	M-L artiodactyl	Long bone fragment	Shaft fragment
	143	1	231	Bead or tube fragment	End	Unburned	Large bird	Long bone fragment	Shaft fragment
272	142	2	694	Fragment	Midsection/shaft	Unburned	Deer	Metatarsal	Shaft split - lateral
	143	1	659	Small tubular bead	Midsection/shaft	Heavy	Small mammal	Long bone fragment	Shaft fragment
			659	Small tubular bead	Medial or lateral	Unburned	Small mammal	Long bone fragment	Shaft fragment
273	143	3	381	Fine-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
274	142	2	397	Pendant	Essentially complete	Unburned	Medium artiodactyl	Rib	Shaft fragment
	143	1	311	Pendant blank or gaming piece	Essentially complete	Unburned	M-L mammal	Long bone fragment	Shaft fragment
					South Shelter				
241	145	8	682	Coarse-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
242	144	15	634	Awl; no tip	Distal	Partial	Deer	Metatarsal	Shaft fragment
	145	2	550	Awl; no tip	Essentially complete	Unburned	Tassel-eared squirrel	Tibia	Proximal, 2/3 shaft

Table 12.23 (continued)

North	East	Level	FS No.	Tool Type	Completeness	Heat Alteration	Common Name	Element	Portion
242	145	4	558	Coarse-point awl	Essentially complete	Unburned	Deer	Metacarpal	Split-distal, shaft fragment
		7	571	Coarse-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
243	144	9	482	Small tubular bead	Essentially complete	Unburned	Cottontail	Metapodial	Shaft fragment
	145	3	438	Antler flaker	Distal	Heavy	Deer	Antler	End fragment
		8	518	Awl; no tip	Proximal	Unburned	Deer	Metatarsal	Distal shaft fragment
244	143	4	125	Fragmentary	Fragmentary	Light to heavy	M-L mammal	Long bone fragment	Shaft fragment
		6	131	Fragmentary	Midsection/shaft	Calcined	Large mammal	Long bone fragment	Shaft fragment
	144	7	102	Unknown	Distal	Light /scorch	S mammal/M-L bird	Long bone fragment	Shaft fragment
244.83	144.59	5	82	Awl; no tip	Essentially complete	Unburned	Deer	Metatarsal	Split-proximal, shaft fragment
245	144	7	207	Spatulate	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
		8	210	Fine-point awl	Essentially complete	Unburned	M-L mammal	Long bone fragment	Shaft fragment
246	143	2	335	Antler flaker	Distal	Unburned	Deer or elk	Antler	End fragment
		3	337	Use defined	Essentially complete	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
	144	8	308	Spatulate	Essentially complete	Tip only	Deer	Tibia	Distal, shaft fragment
			308	Small tubular bead	Medial or lateral	Unburned	Cottontail	Tibia	Shaft fragment
		10	316	Pendant blank or gaming piece	Incomplete	Unburned	M-L mammal	Long bone fragment	Shaft fragment
		11	318	Spatulate	Distal	Unburned	Medium artiodactyl	Metacarpal	Shaft fragment
247	144	6	271	Coarse-point awl	Essentially complete	Unburned	Deer	Metatarsal	Shaft, split-medial
250	143	2	95	Manufacture debris	Proximal	Unburned	Pronghorn	Metatarsal	Proximal, split shaft
		3	112	Coarse-point awl	Distal	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
251	143	1	87	Small tubular bead	Essentially complete	Calcined	S-M artiodactyl	Rib	Shaft fragment
						South Talus			
242.79	145.82	0	14	Fine-point awl	Distal	Unburned	Medium artiodactyl	Long bone fragment	Shaft fragment
244	145	2	59	Awl; no tip	Midsection/shaft	Heavy	Large mammal	Long bone fragment	Shaft fragment
		5	85	Antler flaker	Distal	Heavy	Deer	Antler	End fragment
		8	96	Small tubular bead	Medial or lateral	Unburned	Cottontail	Tibia	Shaft fragment
	147	2	44	Awl; no tip	Midsection/shaft	Unburned	Large mammal	Long bone fragment	Shaft fragment
245	145	3	169	Fine-point awl	Distal	Heavy	M-L artiodactyl	Long bone fragment	Shaft fragment
246	145	6	156	Pendant blank or gaming piece	Essentially complete	Unburned	S-M artiodactyl	Flat bone fragment	Fragment
		8	160	Small tubular bead	Medial or lateral	Unburned	S-M artiodactyl	Rib	Shaft fragment
			161	Small tubular bead	End	Heavy	S-M artiodactyl	Rib	Shaft fragment
247	145	3	232	Fragmentary	Fragmentary	Unburned	S-M artiodactyl	Long bone fragment	Shaft fragment
	146	1	13	Use defined	Distal	Heavy	Medium artiodactyl	Long bone fragment	Shaft fragment
249	146	1	127	Awl; no tip	Distal	Unburned	Medium artiodactyl	Long bone fragment	Shaft fragment
252	143	4	216	Fragmentary	Midsection/shaft	Heavy	Large mammal	Long bone fragment	Shaft fragment

S-M = small to medium; M-L = medium to large.

Table 12.24. Worked bone types by site area.

	North Shelter		North Talus		South Shelter		SouthTalus		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%
Manufacturing debris	–	–	–	–	1	4.2	–	–	**1**	**1.5**
Fragmentary	4	26.7	3	20.0	2	8.3	2	15.4	**11**	**16.4**
Use defined	1	6.7	–	–	1	4.2	1	7.7	**3**	**4.5**
Scraper	–	–	1	6.7	–	–	–	–	**1**	**1.5**
Awl; no tip	1	6.7	–	–	4	16.7	3	23.1	**8**	**11.9**
Fine-point awl	5	33.3	2	13.3	1	4.2	2	15.4	**9**	**13.4**
Coarse-point awl	1	6.7	1	6.7	5	20.8	–	–	**8**	**11.9**
Pin	1	6.7	–	–	–	–	–	–	**1**	**1.5**
Spatulate	–	–	–	–	3	12.5	–	–	**3**	**4.5**
Bead or tube fragment	–	–	1	6.7	–	–	–	–	**1**	**1.5**
Small tubular bead	2	13.3	4	26.7	3	12.5	3	23.1	**12**	**17.9**
Pendant	–	–	1	6.7	–	–	–	–	**1**	**1.5**
Pendant blank or gaming piece	–	–	1	6.7	1	4.2	1	7.7	**3**	**4.5**
Antler flaker	–	–	–	–	2	8.3	1	7.7	**3**	**4.5**
Unknown function	–	–	1	6.7	1	4.2	–	–	**2**	**3.0**
Total	**15**	**100.0**	**15**	**100.0**	**24**	**100.0**	**13**	**100.0**	**67**	**100.0**

degrees of grinding and polishing, flaking, and unmodified breaks. Shafts can be unmodified or modified by splitting, or degrees of grinding and polishing. Distal modification includes degrees of grinding and polishing or flaking. The degrees of grinding and polishing are minimal, moderate, heavily, and completely modified. Modifications such as drilling, incision, or grooving are recorded as other modification.

Shape and cross-section categories are descriptive. Shapes include unmodified/irregular, flattened or squared, rounded or convex, concave, sides parallel or converging, broad or fine points, and articular surfaces. Cross-sections can be round, oval, square or rectilinear, flattened, crescent-shaped, triangular or pyramidal, domed, or irregular.

Evidence of use is recorded as striations, polishing, step fractures, pitting, or flaking. Striations and polish due to use are not always easy to distinguish from the manufacturing process.

Measurements include total length, functional length (i.e., the taper in awls), width and thickness for proximal, shaft, and distal portions, and tip width for awls and some spatulates. Only complete measurements are recorded, and all measurements are in millimeters.

Worked Bone Descriptions

The typology used for worked bone generally follows that of Kidder (1932), for his work at Pecos Pueblo, with modifications developed by Beach and Causey (1984) for their work at Arroyo Hondo. The following describes each worked bone type, attributes, and frequencies for LA 139965. Bone objects are described under the general categories of piercing implements, spatulate or rubbing tools, beads or tubes, ornaments and gaming pieces, flakers, and fragments and manufacturing debris.

Piercing Tools

Kidder (1932:203) defined awls as tools "whose points are apparently sharp enough to have been of use for perforating hides or for the manufacture of coiled basketry" (Kidder 1932:203). Determining the attributes of the awls used for these two purposes has met with varying results. Working with objects that were well preserved, Beach and Causey suggested that a high polish and brown staining on a short, sturdy awl indicated hide-working, while bleaching and a long, thin form with evenly tapered shafts could indicate the working of vegetal material (1984:192–193). Yet experiments by Hayes (1981:141) found that it was sharp, round tips that punched through tanned buckskin and raw hide and could also penetrate tightly coiled baskets. Thick, stubby awls were also the best form for tucking back the selvage edge of rush matting. Flat-bladed tips could separate elements of twined basketry. Since most archaeological collections do not have the kind of preservation that retains staining from animal grease or the bleaching that can occur in the process of working plant material, analytic types tend to be more descriptive, with a reluctance to assign specific functions. Given that many piercing tools were probably multifunctional—especially at sites such as Coyote Canyon Rockshelter—a descriptive approach may be best.

Kidder's awl typology was based on whether the tool is: made from a mammal leg bone, mammal rib, or bird bone and whether an articular end is left intact; unworked, except by splitting; partially worked; removed; or, it is made from a splinter of bone lacking an articular end (Kidder 1932:203, 211). Beach and Causey (1984:188) distinguish: combinations of split metapodials and whether the proximal or distal ends have been retained; splinter awls; reworked awl tips; rib awls for mammals; and use categories similar to Kidder's for birds and small mammals. Stubbs and Stallings (1953:127) also subdivide Kidder's original groups. Hayes (1981:141–142) began with Kidder's system but soon found that his divisions were overridden by differences in the working tips, which probably reflect different functions, so his descriptions are given by tip type.

The categories used in the OAS analyses also rely on working end or tip type (Figs. 12.8–12.11). Coarse-point awl tips tend to be sturdier but not necessarily less sharp than fine-point awls, especially since where the tip is measured is somewhat arbitrary. In many cases the distinction between point types may reflect no more than when it was last sharpened, rather than a difference in function. More of the LA 139965 awls have finer points, but few have very fine tips. Just over a quarter of the awls are complete (26.9 percent) and most of these are from South Shelter (Table 12.25). Only two fragments are completely burned and one is scorched at the broken butt end.

Bone from a variety of animals was used for the awls from LA 139965. These include only one small form—a tassel-eared or Abert's squirrel—to medium to large artiodactyl. Most are from artiodactyl bones that were too fragmented or too modified to specify an element. Except for the squirrel tibia, other identifiable elements are all metapodials, mainly metatarsals. This is in part due to the suitability of these elements for splitting and tool making and to distinctive characteristics that are often retained in small fragments. Only two use portions of the articular ends as the butt ends—a coarse-point awl made from a distal metacarpal from a deer and an awl missing the tip from part of the proximal end and shaft of a metatarsal. The rest are long-bone splinters or are missing the butt end.

Except for the tips, modification is generally minimal or moderate. Butt ends were generally missing (69.2 percent) with few that were unmodified or lightly modified natural ends, and three each of unmodified breaks and minimal grinding or polish. Shafts were less likely to be moderately (15.4 percent) or well ground (7.7 percent) and polished than unmodified (19.2 percent), split only (7.7 percent), or minimally ground and polished (19.2 percent). Tips were most often completely modified (53.8 percent), with equal numbers of moderate and well-shaped (19.2 percent) examples. One was flaked. Fine-point awls tend to have completely modified tips (88.9 percent), while coarse-point tips are equally divided between well and completely shaped (37.5 percent), with others that were flaked or moderately shaped (12.5 percent each).

The shape of the butt end was generally unmodified or irregular (n = 5) with two natural ends and one flattened or squared. Midshafts were generally parallel (n = 10), with fewer converging (n = 4), and one irregular. Tip shapes are fine (n = 14) or broad points (n = 7). Cross-sections for butt ends are most often irregular (n = 5), with single examples that are ovoid, flattened, and crescent-shaped. Midsection cross-sections are predominately crescent-shaped (n = 11), with single examples that are ovoid, rectangular, flattened, and pyramidal. Tips are predominately round (n = 12) or triangular/pyramidal (n = 4), with single examples of tips that are ovoid, squared, and crescent-shaped.

Wear is difficult to distinguish from evidence of manufacture on these awls. Nearly all of those with tips have polish (7 fine point, 4 coarse point, and 2 missing the very ends of the tip), and many also have pitting or flaking (7 fine point, 6 coarse point, and the pin); two have more extensive flaking or spalling (1 with no tip and 1 fine point). Four awls have no discernible wear (3 with no tip and 1 coarse point).

Table 12.26 summarizes measurements on the

Figure 12.8. North Shelter, awls: fine-point awls (a–d, f: FS 543, 612, 742, 755, 760); coarse-point awls (e: FS 525); pin (g: FS 759); no-tip awls (h: FS 476).

Figure 12.9. North Talus, awls: fine-point awls (a, b: FS 321, 381), coarse-point awl (c: FS 649).

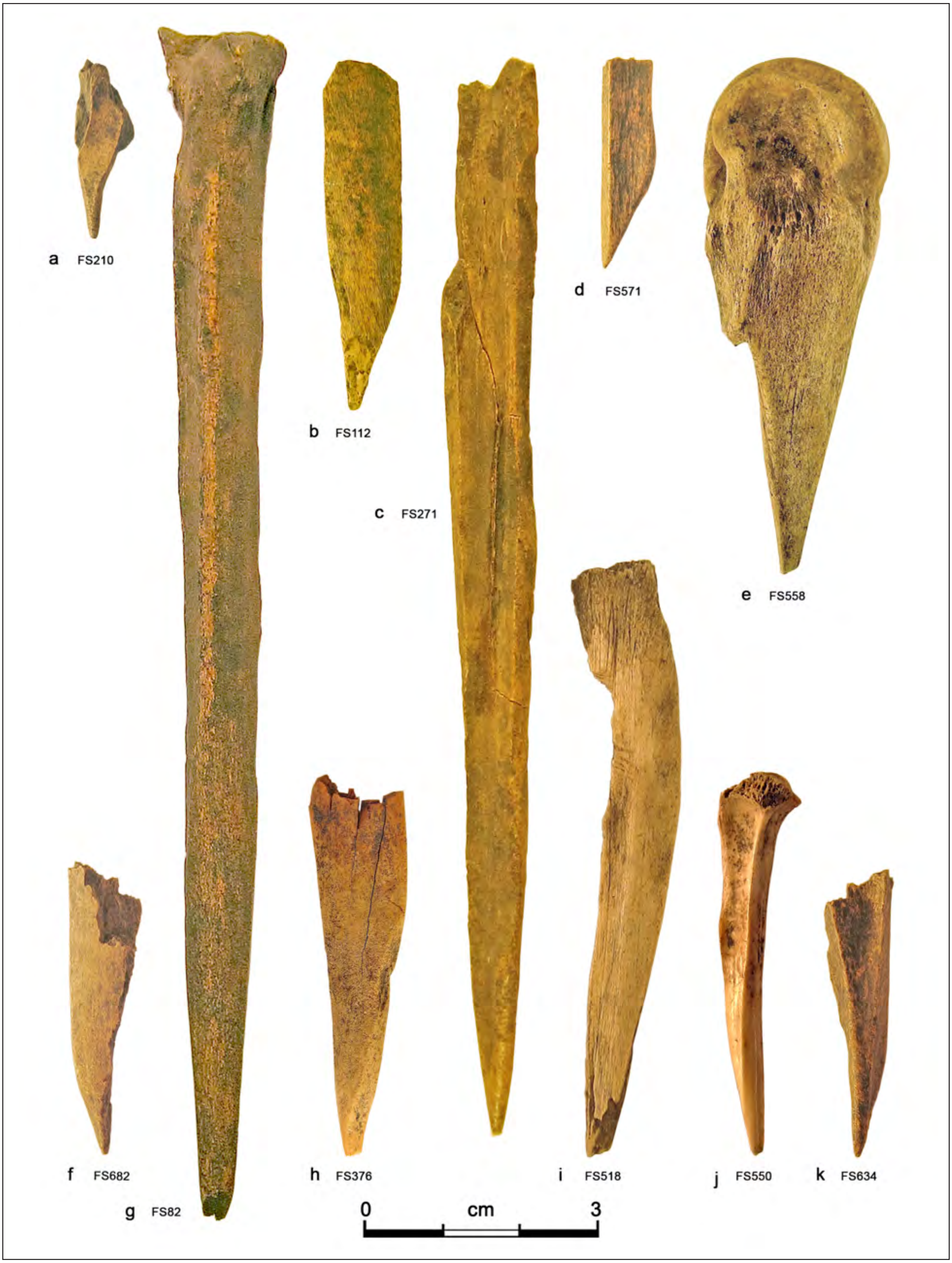

Figure 12.10. South Shelter awls: fine-point awl (a: FS 210), coarse-point awls (b–f: FS 112, 271, 571, 558, 682), no-point awls (g–k: FS 82, 376, 518, 550, 634).

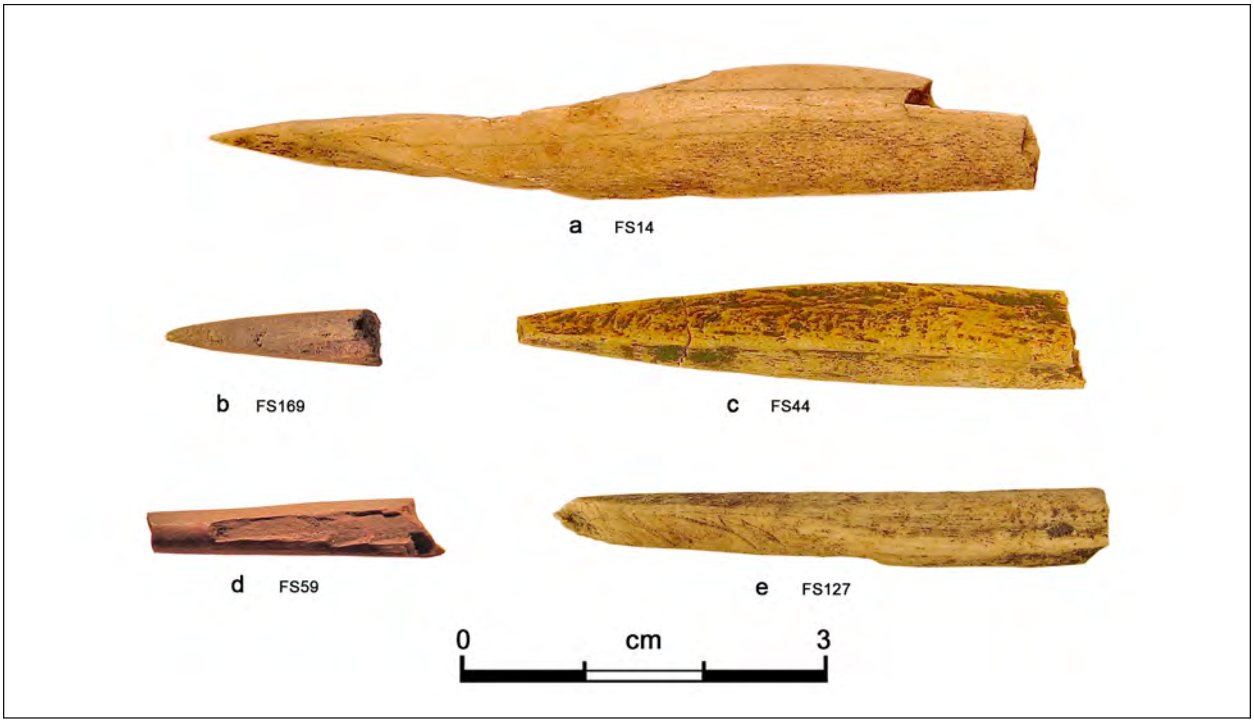

Figure 12.11. South Talus, awls: fine-tip awls (a, b: FS 14, 169), no-tip awls (c–e: FS 44, 59, 127).

awls. Complete measurements reflect the distinctions between the awl types. Coarse-point awls are longer and sturdier and have slightly larger tips, than the other awl types.

Most of the Coyote Canyon Rockshelter awls are expedient tools made from readily available splinters from artiodactyl bones. Few are well made or curated tools. A large enough quantity are broken, though, to indicate a good deal of leather working and/or basket-making took place at the site.

Rubbing, Scraping, and Flaking Tools

Most of the items placed in this group are fairly unique (Fig. 12.12) and were probably used for rubbing, scraping, or flaking. All three of the spatulate tools were found in South Shelter. They are characterized by rounded distal ends and resemble objects that Kidder called polishers, bone flakers, rubbers, and skinning tools (Kidder 1932:216, 228, 230, 243). One is complete and the others are distal ends. One is scorched on the distal end. Polish is evident on the distal ends and two also have pitting or flaking. Except for the distal ends, which are only moderately ground, none of the spatulates show much evidence of manufacture. One has a crescent-shaped cross-section at midshaft and the distal end and the other two have flattened distal cross-sections. Complete measurements are variable (Table 12.27) and do not suggest a standardized tool form.

Antler tips with bevels or wear were considered flakers (Fig. 12.12) and were probably used for flaking lithic material. All three examples are from South Shelter or South Talus. Completeness is difficult to determine unless there is modification on the butt end. Since none have proximal modification, they are considered distal fragments. Two are heavily burned. Two are more consistent with deer antler and the other is larger and could be deer or elk. All have some form of distal modification. One is flaked and the others have minimal and moderate grinding or polish. One has a round tip and the others are D-shaped. All have flaking or pitting on the tip and one has spalling. Complete measurements can be found in Table 12.27.

The use-defined objects (Fig. 12.13 [a–f]) include two with flaked ends and one with polish over an end and edge, with step fractures from some type of use. The two with flaked ends are incomplete and have unmodified shafts. The other has minimal

Table 12.25. Awls, completeness by site area.

	Proximal		Distal		Midsection/ Shaft		Essentially Complete		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%
North Shelter										
Awl; no tip	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Fine-point awl	–	–	3	75.0	–	–	1	20.0	**4**	**100.0**
Coarse-point awl	–	–	2	100.0	–	–	–	–	**2**	**100.0**
Pin	–	–	1	100.0	–	–	–	–	**1**	**100.0**
Area Total	–	–	**7**	**87.5**	–	–	**1**	**12.5**	**8**	**100.0**
North Talus										
Fine-point awl	–	–	2	100.0	–	–	–	–	**2**	**100.0**
Coarse-point awl	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Area Total	–	–	**2**	**66.7**	–	–	**1**	**33.3**	**3**	**100.0**
South Shelter										
Awl; no tip	1	25.0	1	25.0	–	–	2	50.0	**4**	**100.0**
Fine-point awl	–	–	–	–	–	–	1	100.0	**1**	**100.0**
Coarse-point awl	–	–	3	60.0	–	–	2	40.0	**5**	**100.0**
Area Total	**1**	**10.0**	**4**	**40.0**	–	–	**5**	**0.5**	**10**	**100.0**
South Talus										
Awl; no tip	–	–	1	25.0	2	66.7	–	–	**3**	**100.0**
Fine-point awl	–	–	2	100.0	–	–	–	–	**2**	**100.0**
Area Total	–	–	**3**	**50.0**	**2**	**40.0**	–	–	**5**	**100.0**
Total										
	1	**3.8**	**16**	**61.5**	**2**	**7.7**	**7**	**26.9**	**26**	**100.0**

Table 12.26. Awl measurements, summary statistics.

	Length (mm)		Width (mm)				Thickness (mm)			
	Total	Functional	Proximal	Midsection	Distal	Tip	Proximal	Midsection	Distal	Tip
Awl, no tip										
N	1	1	3	4	4	1	3	3	3	1
Mean	47.14	12.94	12.44	8.41	6.93	1.93	6.99	6.01	3.91	0.84
Minimum	47.14	12.94	8.73	3.77	3.79	1.93	1.88	4.77	3.39	0.84
Maximum	47.14	12.94	16.61	12.06	10.59	1.93	9.92	7.89	4.32	0.84
Fine-point awl										
N	2	6	2	3	6	9	2	2	5	8
Mean	21.21	14.04	3.33	7.52	5.10	1.21	3.11	2.61	2.99	1.12
Minimum	19.15	6.98	2.97	4.33	2.64	0.84	2.10	1.90	1.58	0.49
Maximum	23.27	22.24	3.68	10.81	7.61	1.90	4.11	3.31	4.11	1.51
Coarse-point awl										
N	2	6	3	4	7	6	3	6	7	6
Mean	106.55	12.20	15.33	12.04	5.53	2.26	9.81	5.42	3.57	1.21
Minimum	75.89	2.77	11.47	10.17	1.40	1.07	5.01	3.01	1.59	0.56
Maximum	137.20	24.13	22.52	16.71	13.88	5.92	16.14	11.09	6.17	1.78
Pin										
N	–	1	–	1	1	1	–	1	1	1
Mean	–	10.86	–	2.63	2.77	1.01	–	2.12	1.70	1.12
Minimum	–	10.86	–	2.63	2.77	1.01	–	2.12	1.70	1.12
Maximum	–	10.86	–	2.63	2.77	1.01	–	2.12	1.70	1.12
Totals										
N	**5**	**14**	**8**	**12**	**18**	**17**	**8**	**12**	**16**	**16**
Mean	**60.53**	**12.95**	**11.25**	**8.92**	**5.55**	**1.61**	**7.07**	**4.82**	**3.34**	**1.14**
Minimum	**19.15**	**2.77**	**2.97**	**2.63**	**1.40**	**0.84**	**1.88**	**1.90**	**1.58**	**0.49**
Maximum	**137.20**	**24.13**	**22.52**	**16.71**	**13.88**	**5.92**	**16.14**	**11.09**	**6.17**	**1.78**

Figure 12.12. Spatulates (a–c: FS 207, 308, 318); flakers (d–f: FS 85, 335, 438).

grinding or polish on one end. One of the flaked objects is heavily burned. Both of the flaked objects have pitting or flaking use-wear on the distal end, and one of these and the third object have polish on the distal end. Complete measurements can be found in Table 12.27. These objects are expedient, low-input tools that may have been used for scraping or in a manner similar to that of the spatulates. The large tip measurement for the polished object is due to both the thickness of the bone cortex and crescent-shaped cross-section of the distal end.

The scraper (Fig. 12.13 [d], FS303) is reminiscent of a well-made chipped stone scraper. Made from a large artiodactyl long bone, it is flaked on both ends with polish on the edge of the shaft. The distal end has pitting and flaking from use.

Two objects are complete or largely complete but do not fit into any other category. One (Fig. 12.13 [e], FS 102) is made from a thin-walled long bone from a bird or small mammal. It has a broad tip with slight polish and flaking use wear on the curved edge. Intact edges have minimal grinding. It is partially scorched and has six sets of squiggly lines that could be deliberate modification but are also reminiscent of root-etching and are unique for the bone at this site. The other has a U-shaped notch in the distal end (Fig. 12.13 [f], FS 405). It is made from a medium-sized artiodactyl rib shaft fragment and has minimum to moderate grinding or polish modification on both ends and the shaft. The only wear is possible polish—unless the notch is a step-fracture caused by use on a spatulate edge. Complete measurements for both of these objects can be found in Table 12.27.

Table 12.27. Complete measurements for spatulates, antler flakers, use-defined objects, scrapers, and objects with unknown functions.

Tool Type	FS No.	Length (mm)		Width (mm)				Thickness (mm)			
		Total	Functional	Proximal	Midsection	Distal	Tip	Proximal	Midsection	Distal	Tip
Spatulate	207	–	–	–	–	–	–	–	–	1.80	–
Spatulate	308	96.80	23.37	22.97	22.23	20.03	6.45	12.19	10.3	8.01	4.25
Spatulate	318	–	12.74	–	–	6.71	3.97	–	7.24	5.34	1.62
Antler flaker	85	–	–	–	–	3.49	–	–	–	2.77	–
Antler flaker	335	–	10.49	–	14.32	7.08	2.25	–	16.12	8.02	2.49
Antler flaker	438	–	–	–	–	3.16	–	–	–	–	3.48
Use-defined	13	–	11.05	–	8.6	3.86	–	–	4.82	1.87	–
Use-defined	337	54.46	32.5	12.72	16.99	9.02	–	4.63	5.09	6.15	–
Use-defined	526	–	–	–	–	–	4.16	–	–	–	1.83
Scraper	303	30.79	8.44	16.66	26.29	25.7	25	3.04	6.25	6.89	2.51
Unknown function	102	–	–	–	6.44	1.06	–	–	1.71	1.33	–
Unknown function	405	57.09	–	9.56	14.65	10.87	–	2.55	3.47	1.56	–

Beads or Tubes

As a group, beads are the second-most common type of worked bone recovered from the site (Fig. 12.14 [a, b, d–i], Fig. 12.15 [a–c, e–g] Tables 12.23, 12.24). With three exceptions, these are all small tubular beads made from the long bones of small mammals (n = 4), small to medium mammals (n = 1), cottontail (n = 3), or large bird (n = 2). The exceptions—FS 87, 160, 161— are made of artiodactyl ribs; see Table 12.23). Most are fragments—only three are complete and five are burned. Some of the burning may have been intentional to achieve a shiny black bead (e.g., Fig. 12.14 [d, i], FS 397, 659b). Ends tend to be well shaped by polish and grinding (n = 7), with fewer moderately (n = 3 beads and the bead or tube) and minimally (n = 2) modified. Shafts are most often unmodified (n = 5 beads and the bead or tube) or have minimal polish or grinding (n = 4). One has moderate modification and two are well shaped by polish or grinding. None have evidence of wear (such as cord wear). Table 12.28 provides complete measurements for these. No measurements were possible on some of the bead fragments.

Bone beads were found in both shelters and the North Talus and South Talus. Few are complete. Lengths range from 8.38 to 178.24 mm (n = 10); proximal widths vary from 2.25 to 10.6 mm (n = 6). The larger diameters are from the rib bead.

Pendant and Pendant or Gaming Pieces

The object called a pendant or flat bead (Fig. 12.14 [d], FS 397) is a piece of artiodactyl rib that is moderately to well ground and polished on the edges and one surface. The portion with the rib cancellous bone is unmodified. A hole is partially drilled into the polished surface suggesting it was a byproduct in the process of manufacture. The object itself is a rounded square shape. Measurements can be found in Table 12.29. Similar, but most often more fully round, objects have been found throughout the Southwest. A small round disk (11.9 mm diameter, 2.5 mm thick) with a partially drilled hole was found at a late Developmental-period site during the Pojoaque Corridor project (Akins in prep. [c]). Complete discs with dimples at their center were recovered from just north of Bernalillo at LA 109129 (Brown 1999:123) and are common in southeastern New Mexico sites in the Sierra Blanca region (Farwell 1992; Kelley 1984). Kidder (1932:236) found a number of round discs with drilled holes at Pecos; most were larger than the Coyote Canyon Rockshelter specimen and made of long bones rather than ribs.

The remaining similar objects in the LA 139965 assemblage are small and rectilinear with rounded edges. None are convincingly pendants or gaming pieces but have some resemblance to both. The object from the North Talus (Fig. 12.14 [c], FS 311) is flaked at both ends and edges with an essentially unmodified back side. Edges have small, rounded step fractures that could be modification or wear. The small size of the object (less than 3 cm long) makes it more likely to have an ornamental rather than a functional use. The other two (Fig. 12.15 [d,

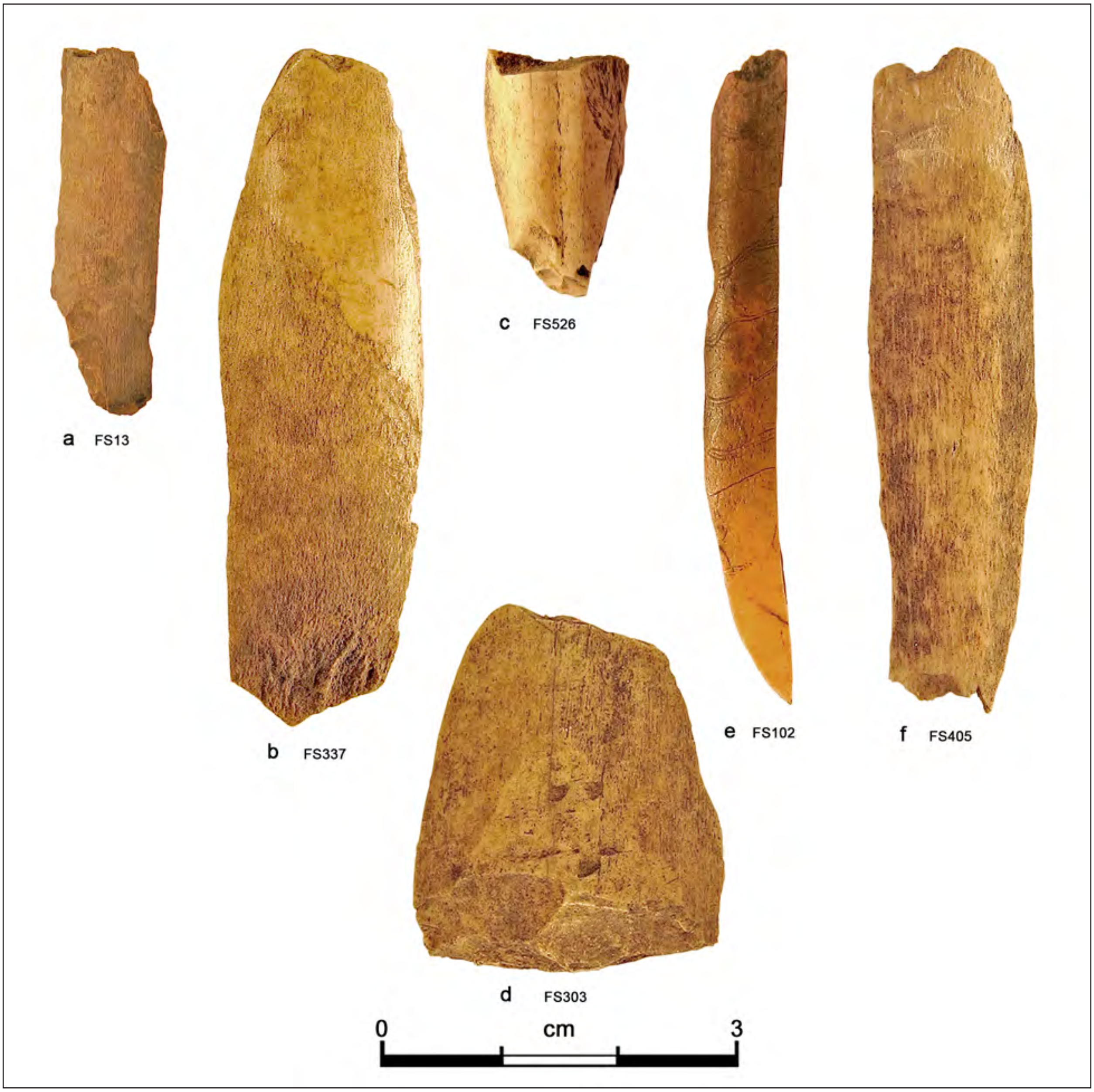

Figure 12.13 [a–f]. Use-defined bone objects (a–c: FS 13, 337, 526), scraper (d: FS 303), unknown function (e, f: FS 102, 405).

h], FS 316, 156) are more like blanks that could have become pendants or gaming pieces.

Manufacturing Debris and Fragments

The remaining objects are small fragments that could not be assigned to a particular tool type. Only one piece is manufacturing debris. All are made from large animal long bones and over half are burned (59.3 percent).

Worked Bone Summary

The small but fairly diverse worked-bone assemblage is mainly expedient tools and small tubular beads. None of the types are unique and the proportions are fairly similar to other Northern Rio Grande site assemblages analyzed in the same manner (Table 12.30). Piercing implements generally make up about a third of the assemblages—exceptions

Figure 12.14 [a–i]. North Shelter and North Talus, bone ornaments: beads (a, b, e–i), bead/pendant (d), pendants (c); North Shelter (a, b: FS 491, 755), North Talus (c–i: FS 231, 405, 637, 659a, 659b, 311, 397).

are one dominated by a tubular-bead necklace and bracelets (LA 391) and one that is mainly structure fill (LA 3119). Bone beads comprise between 14.0 and 24.7 percent of most assemblages and 19.4 percent of that from Coyote Canyon Rockshelter. The Galisteo Basin site, LA 3333, is similar in that bone was used for tools such as a scraper and chopper. That site also has a large amount of fauna and small structures, suggesting mobility. A smaller portion of the Coyote Canyon Rockshelter bone is worked but it is also far more fragmented than the others.

Gastropods

An unexpected consequence of the large number of flotation samples was the recovery of numerous gastropods (n = 1,433 from 110 proveniences). All but two were found in flotation samples. These small, fragile shells pass through 1/8-inch screen and are so fragile that the screening process probably destroyed most.

Faced with the need to identify a large number and considerable variety of gastropods, a list of those currently found in Mora County was obtained through Bison-M (accessed October 22, 2015). In addition, a key to land snails of New Mexico (Metcalf

Table 12.28. Bone beads, complete measurements.

Bead Type	FS No.	Length (mm)	Width (mm)			Thickness (mm)		
			Proximal	Midshaft	Distal	Proximal	Midshaft	Distal
North Shelter								
Small tubular bead	491	13.45	4.18	–	–	–	–	–
Small tubular bead	755	–	–	–	–	–	–	–
North Talus								
Bead or tube fragment	231	–	–	–	–	–	–	–
Small tubular bead	405	11.01	4.98	5.06	4.93	5.18	4.93	4.53
Small tubular bead	637	10.76	–	–	–	–	–	–
Small tubular bead	659	14.6	–	–	–	–	–	–
Small tubular bead	659	15.62	–	–	5.27	–	–	–
South Shelter								
Small tubular bead	87	8.38	10.6	11.2	11.2	3.85	3.89	3.88
Small tubular bead	308	13	4.57	4.46	4.64	–	–	–
Small tubular bead	482	12.77	2.47	2.25	2.31	2.54	2.53	2.42
SouthTalus								
Small tubular bead	96	14.51	4.13	–	–	–	–	–
Small tubular bead	160	17.24	–	–	–	–	–	–
Small tubular bead	161	–	–	–	–	–	–	–

Table 12.29. Pendants, pendant blanks, or gaming pieces, complete measurements.

Area	Item Type	FS No.	Length (mm)	Hole Diameter (mm)	Width (mm)			Thickness (mm)		
					Proximal	Midshaft	Distal	Proximal	Midshaft	Distal
North Talus	Pendant	397	15.4	2.86	9.61	12.25	10.17	2.33	2.3	2.05
North Talus	Pendant blank or gaming piece	311	29.21	–	9.97	11.34	9.14	1.88	2.39	2.68
South Shelter	Pendant blank or gaming piece	316	17.74	–	7.42	–	–	1.62	1.59	1.27
South Talus	Pendant blank or gaming piece	156	23.66	–	3.36	7.28	3.96	2.86	2.5	2.14

and Smartt 1997) and photographs from Google Images that were linked to the species descriptions in Bison-M were used to make the identifications. Each batch (FS number) was observed at least four times under a microscope, resulting in the identification of at least 15 species. All but one of the species are land snails, the exception is a peaclam that must have originated in Coyote Creek. The variety of species is probably the result of the riparian habitat. LA 139965 is in what would be considered the Transition life zone (elevation range: 2,134–2,591 m; 7,000–8,500 ft), which is just below the Canadian life zone (2,591–3,505 m; 8,500–11,500 ft), where more types and numbers of snails are found. However, the effect of the habitat along Coyote Creek would be a lowering of life zones so that species from the Canadian life zone would also thrive in the vicinity of the site (Metcalf and Smartt 1997:5–6). The New Mexico land snails are herbivores that eat many kinds of plants, fungi, and lichens and are commonly found in leaf litter and among rotting logs. Little is known about particular niches, but elevation and precipitation are important (Metcalf and Smartt 1997:4–5).

Gastropod Taxa

All of the land snails belong to the order Stylommatophora with a number of families represented. This section briefly describes the gastropods iden-

Figure 12.15. South Shelter and South Talus, bone ornaments: beads (a–c, e–g), pendant blanks/gaming pieces (d, h); South Shelter (a–d: FS 87, 308, 482, 316), South Talus (e–h: FS 96, 160, 161, 156).

tified in the collection. It begins with the tightly coiled but elongated types, followed by the more common disc or flattened types, and finally, the only aquatic species found. Distribution data for the Coyote Canyon Rockshelter gastropods is also included in this section and Table 12.31.

Columnar Forms

These small snails were often filled with sediment and too fragile to adequately clean. Since identifications are usually based on the number, arrangement, and size of their "teeth," many had to be left at the family level (usually *Pupilla* or *Gastrocopta*) because the aperture was filled.

Glossy Pillar Snail (Cionella lubrica) (n = 4). This distinctive snail is widespread and found in forested montane habitats throughout the state (Metcalf and Smartt 1997:25). Only four were recovered from the site, all from North Shelter and each from separate grid units. Three were found in the uppermost levels.

Rocky Mountain Column Snail (Pupilla blandi) (n = 47). Usually found above 2,134 m (7,000 ft) ele-

Table 12.30. Comparative worked bone assemblages by region.

	Coyote Canyon Rockshelter		Pojoaque Corridor						Galisteo Basin		Santa Fe	
			LA 391		LA 835		LA 3119		LA 3333		LA 1051	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Use defined	3	4.5	–	–	–	–	–	–	2	2.2	–	–
Chopper	–	–	–	–	–	–	–	–	1	1.1	–	–
Scraper	1	1.5	–	–	–	–	–	–	1	1.1	–	–
Rasp	–	–	–	–	–	–	–	–	1	1.1	–	–
Piercing Implements												
Awl; no tip	8	11.9	2	1.4	2	7.4	3	18.8	1	1.1	4	4.5
Fine-pointed awl	9	13.4	1	0.7	3	11.1	2	12.5	19	20.4	20	22.5
Coarse-pointed awl	8	11.9	3	0.0	4	14.8	5	31.3	4	4.3	3	3.4
Complex awl	–	–	–	–	–	–	–	–	1	1.1	–	–
Pin	1	1.5	–	–	–	–	–	–	–	–	–	–
Spatulate/Rubbing Tools												
Small spatulate-ended tool	3	4.5	1	0.7	1	3.7	–	–	4	4.3	1	1.1
Rubber	–	–	–	–	3	11.1	–	–	–	–	–	–
Polisher/rubber	–	–	–	–	–	–	2	12.5	1	1.1	–	–
Mat weaving tool	–	–	–	–	–	–	–	–	1	1.1	1	1.1
Beads or Tubes												
Bead/short tube	1	1.5	9	6.1	1	3.7	–	–	2	2.2	8	9.0
Tube	–	–	–	–	3	11.1	–	–	2	2.2	8	9.0
Bead or tube fragment	–	–	1	0.7	–	–	–	–	5	5.4	3	3.4
Small tubular bead	12	17.9	126	85.1	1	3.7	–	–	4	4.3	3	3.4
Bead manufacturing debris	–	–	–	–	–	–	–	–	–	–	2	2.2
Whistle	–	–	–	–	–	–	–	–	3	3.3	4	4.5
Ornaments/Gaming Pieces/Miscellaneous												
Pendant	1	1.5	–	–	–	–	1	6.3	–	–	–	–
Pendant blank/gaming piece	3	4.5	–	–	1	3.7	1	6.3	2	2.2	1	1.1
Ornament fragment	–	–	–	–	–	–	–	–	1	1.1	–	–
Tibia tinkler	–	–	–	–	–	–	–	–	–	–	1	1.1
Antler flaker	3	4.5	–	–	–	–	–	–	–	–	–	–
Unknown function	2	3.0	–	–	–	–	–	–	4	4.3	1	1.1
Preforms	–	–	–	–	–	–	–	–	–	–	2	2.2
Fragmentary	–	–	–	–	–	–	–	–	–	–	–	–
Manufacturing debris	1	1.5	2	1.4	–	–	1	6.3	11	11.8	9	10.1
Fragmentary	11	16.4	3	2.0	8	29.6	1	6.3	23	24.7	18	20.2
Total	**67**	**100.0**	**148**	**100.0**	**27**	**100.0**	**16**	**100.0**	**93**	**100.0**	**89**	**100.0**
Total Percent	**10982**	**0.6**	**3508**	**4.2**	**2839**	**0.9**	**1839**	**0.9**	**2542**	**3.6**	**3985**	**2.2**

vation, this species is found on the eastern slopes of the Sangre de Cristo Mountains in grasslands and bordering stream valleys (Metcalf and Smartt 1997:25). With its fairly uniform whorls and short parietal tooth (Metcalf and Smartt 1997:14–15), this species was fairly easy to recognize and fairly common in the sample. It was found in 22.5 percent of the North Shelter samples, 25.0 percent of the North Talus samples, and 29.8 percent of the South Shelter samples. They tended to be found in the upper levels in the northern area of the site, while the South Shelter specimens were more likely to be in deeper levels. Fragmented specimens of this species are also present in the *Pupilla* fragment category.

Vertigo Snail (Vertigo gouldii) (n = 23). This species is widespread in the Transition and Canadian life zones (Metcalf and Smartt 1997:33) and is distinguished by an angular or basal tooth (Metcalf and Smartt 1997:17). It was found in 10 percent of the North Shelter proveniences, 25 percent of the North Talus proveniences, and 17.5 percent of those from South Shelter. Three were found in the single sample from the Central Talus. In the North shelter few were found and these tended to be in the middle

Table 12.31. Gastropod distribution, by site area and level.

	North Shelter			North Talus		Central Talus	South Shelter				Total
	Levels 1–3	Levels 4–6	Levels 7–8	Levels 1–3	Levels 5 & 7	Levels 1–3	Levels 1–3	Levels 4–6	Levels 7–10	Levels 11–15	
Sample count	22	14	4	10	2	1	12	19	17	9	**110**
Sample weight (in grams)	22.86	15.40	4.02	9.72	2.32	0.40	12.70	28.26	23.62	10.46	**129.76**
Taxa											
Glossy pillar	3	1	–	–	–	–	–	–	–	–	**4**
Column	10	4	1	3	–	–	7	15	5	2	**47**
Column or domed	5	7	6	6	–	–	4	3	6	3	**40**
Vertigo	1	2	2	3	2	3	1	5	4	–	**23**
Lambda snaggletooth	–	–	–	–	–	–	–	1	–	–	**1**
Montane snaggletooth	21	20	4	12	1	–	5	28	29	1	**121**
Gastropota spp.	11	10	4	10	2	–	3	17	7	10	**74**
Trumpet vallonia	114	101	46	54	15	3	35	109	113	54	**644**
Vallonia-like	36	30	9	22	4	3	8	30	24	8	**174**
Compound coil	27	22	10	10	2	–	6	30	25	19	**151**
Smooth coil	10	6	5	20	4	–	2	12	8	5	**72**
Ambersnail	–	–	–	1	–	–	–	–	–	1	**2**
Quick gloss	3	3	1	7	3	–	–	1	2	3	**23**
Carved glyph	5	2	1	1	–	–	–	6	3	3	**21**
Minute gem	–	3	2	1	–	–	–	1	–	1	**8**
Western glass	–	–	–	–	–	–	–	1	–	–	**1**

and lower levels of fill. All of those from the North and the Central Talus were from the upper levels. South Shelter Vertigo Snails tend to come from lower levels.

Montane Snaggletooth Snail (Gastrocopta pilsbryana) (n = 121). The majority of the snaggletooth snails were most consistent with the Montane Snaggletooth Snail, but four other snaggletooth snails are found in Mora County (Bison-M, accessed October 22, 2015) and 75 specimens were considered *Gastrocopta* spp. One specimen from South Shelter resembles the Lambda Snaggletooth Snail (*Gastrocopota holizingeri*) and others may belong to this species. It has been found along the Mora River Valley and in the Oscura Mountains. The Montane Snaggletooth snail is a southwestern mountain snail found throughout the state in forested mountains from the Upper Sonoran into the Canadian life zone. They can be so common that hundreds can be found by screening (Metcalf and Smartt 1997:29–30). Montane Snaggletooth specimens were found in 60 percent of the North Shelter samples, 58.3 percent of those from North Talus, and 42.1 percent of the South Shelter samples. In the North Shelter samples, counts are nearly equal in the upper and middle levels with fewer in the lower levels. All but one of those from the North Talus was in the upper three levels. In South Shelter, more were found in the middle and lower levels.

Disc Forms

Several of the disc forms are difficult to distinguish, which is particularly true of the coil and gem snails. Others are distinctive—at least when complete.

Trumpet Vallonia Snail (Vallonia parvula) (n = 644). By far the most common snail in the collection, this small (less than 2.0 mm) snail has prominent ribs and a thick trumpet-like peristome (Metcalf and Smartt 1997:17). This species is only found in the eastern part of New Mexico. In northeastern New Mexico they are less common than the larger (2.5–3.0 mm) multirib vallonia snail (*Vallonia gracilicosta*). However, the trumpet villonia prefers riparian habitats and extends to the foothills of the Sangre de Cristo Mountains (Metcalf and Smartt 1997:34). The Coyote Canyon Rockshelter specimens were considered trumpet vallonia snails mainly due to their small size. Vallonia snails were found in all but one (97.5 percent) of the North Shelter samples, all of the North Talus samples, in the Central Talus sample and most of those from South Shelter (94.7 percent). Counts are large in all levels.

c.f. Vallonia Snails. Another 174 snails could not be positively identified as a vallonia snail. Some were damaged and lacked the aperture. Others lacked the aperture and were so degraded that the distinctive ribs were not evident even under higher magnification. Others strongly resembled a villonia snail in the spiral and umbilicus but have a smooth uncallused peristome. Some could be gem snails but the surfaces were more like ribs than growth lines.

Smooth Coil Snail (Heliodiscus singleyanus) (n = 72). Distinguished by its flat spine, absence of spiral lire, fairly obscure growth lines, and a shallow and wide umbilicus the smooth coil snail is mainly found in Lower and Upper Sonoran Life zones, commonly under stones or in leaf litter but also along canyon walls and hillslopes (Metcalf and Smartt 1997:18–19, 40). Specimens from Coyote Canyon Rockshelter were identified by the criteria above and size (less than 3.5 mm). This relatively rare snail was found in 40.0 percent of the North Shelter samples, 75.0 percent of the North Talus samples, and 47.4 percent of the South Shelter samples. While found at all levels, smooth coil snails tended to be in the upper levels of North Shelter and North Talus, but the middle and lower levels of South Shelter.

Compound Coil Snail (c.f. Helicodiscus parallelus) (n = 151). A *Helicodiscus* with well-developed spiral lire was fairly common. Both Bison-M (accessed October 22, 2015) and Metcalf and Smartt (1997:40) list the Mexican Coil Snail (*Helicodiscus eigenmani*) as the only coil snail with spiral lire in New Mexico. However, the Mexican Coil Snail is greater than 3.5 mm in width (Metcalf and Smartt 1997:18) and those from Coyote Canyon Rockshelter are 3.0 mm or smaller. Metcalf and Smartt state that these two species are similar in appearance but the Mexican Coil Snail is larger and more robust than the Compound Coil Snail and some have speculated that it is a subspecies of the Mexican Coil. The Mexican Coil is found in mountains throughout the state, mainly in Upper Sonoran and Transition life zones where there are woodlands that produce sufficient leaf litter. Numbers are typically low, generally less than 5.0 percent of specimens taken in a collection (Metcalf and Smartt 1997:40). This coil snail is far from rare in this collection, however—it is present in 75.0 percent of the North Shelter samples, 66.7 percent of the North Talus samples, and 61.4 percent of those from South Shelter. In the North Shelter, these are more common in the upper levels, with fewer in the middle (n = 6) and lower levels. Most of those from North Talus were in the upper fill but only two samples came from the middle levels. Fewer were found in the upper fill of the South Shelter and counts increased with depth.

Suboval Ambersnail (Catinella vermeta) (n = 2). Metcalf and Smartt (1997:50) provide no information other than noting that this species is found in Mora County. This translucent suboval snail was found in only two of the samples, one from North Talus (272N/140E, Level 4) and the other from South Shelter (243N/144E, Level 12).

Quick Gloss Snail (Zonitoides arboreus) (n = 23). This widespread species is associated with trees and found in most forested mountains, typically in Transition and Canadian life zones and in collections of leaf litter in these zones (Metcalf and Smartt 1997:51). The distribution at Coyote Canyon Rockshelter is unusual in that it is most common in North Talus. It is present in only 15.0 percent of the North Shelter samples and only 8.8 percent of the South Shelter samples, but in 53.8 percent of those from North Talus, where all but 1 of the 10 found were in the upper fill. The North Shelter gloss snails were mainly in the upper and middle levels of fill. Conversely, the South Shelter specimens are mainly from deep in the fill.

Carved Glyph Snail (Glyphyalina indentata) (n = 21). This species is widespread in the state and often occurs in collections made in montane habitats from the Upper Sonoran to the Canadian Zone (Metcalf and Smartt 1997:50). Glyph snails were found in 20.0 percent of the North Shelter samples, 8.3 percent of the North Talus samples, and 15.8 percent of the South Shelter samples. Again, the distribution between the northern and southern areas of LA 139965 is different. In the north, North Shelter specimens are mainly from the upper fill with few in the middle and lower levels. The only North Talus specimen is from the first level of fill. South Shelter glyph snails are equally divided between the middle and lower levels.

Minute Gem Snail (Hawaiia minuscula) (n = 8). As noted above, this species is difficult to distinguish from the Smooth Coil Snail and degraded vallonia snails and could easily be more common than suggested by the count. It is common in New Mexico extending from the Upper Sonoran to the Canadian Life Zone and is most common in the Transition Zone but occurs in low numbers in leaf litter from montane habitats (Metcalf and Smartt 1997:51). The specimens identified from the site were found in 7.5 percent of the North Shelter samples, 8.3 percent of the North Talus samples, and 3.5 percent of those from South Shelter.

Western Glass Snail (Vitrina pellucida) (n = 1). This tiny fragile snail is found in the higher mountains of New Mexico and is typical of the Canadian and Hudsonian life zones. They are usually found in low vegetation like sedges and grasses, in damp montane meadows, and along streams (Metcalf and Smartt 1997:51). A single specimen of this species was found in South Shelter grid unit 243N/144E, Level 6.

Striate Disc Snail (Discus shimeki shimeki) (n = 18). This species occurs in the northern mountains of New Mexico at higher elevations, inhabiting the Canadian life zone and above (Metcalf and Smartt 1997:40–41). It was found in 15 percent of the North Shelter samples, 33.3 percent of the North Talus samples, and 8.8 percent of those from the South Shelter. In the North Shelter, most came from the upper three levels with fewer in the middle levels, and none in the lower levels. All but one of the four from the North Talus came from the upper levels. Once again, the distribution is different in South Shelter where more were found in the lower levels.

Aquatic

Both valves of a peaclam were recovered from grid unit 245N 144E, Level 8, in South Shelter. Both the ridged-beak peaclam (*Pisidium compressum*) and striate peaclam (*Sphaerium striatinum*) are found in Mora County. The two are difficult to separate, but both are river species that are known to inhabit the Mora River (Bison-M, accessed January 14, 2016).

Gastropods, Site Distribution

Most of the gastropods in the LA 139965 shelters were probably in the overbank sediment that filled each shelter, rather than recent foragers. Some of those from the North Talus could have arrived later and lived in the grass and tree litter. Plants grew up to the edge of the shelters but not within them, so there would have been no forage for snails within the shelters. The highway was probably a formidable barrier for species living along Coyote Creek and it could have prevented movement from that direction once the paved road was built.

A few gastropod fragments are burned: one from Level 7 in North Shelter and four from the South Shelter (Levels 3, 7 (n = 2), and 9). A partially burned smooth coil shell was from the same North Shelter level and grid unit as a packed and possibly burned surface. A pocket of ash was found in the level just above the burned surface. None of the burned snails from South Shelter were directly associated with a burn or charcoal concentration but all had one or the other at the same level in adjacent grid units. Rather than arriving in duff from a natural burn, these snails were probably in the shelter sediment and burned in place.

Using the counts in Table 12.31 and assigning each species to a life zone based on Metcalf and Smartt's (1997) description allows a rough assessment of the collection. Figure 12.16 considers the column, trumpet, and peaclams as riparian; the glossy pillar, montane snaggletooth, compound coil, and gem as Upper Sonoran-Transitional; vertigo and quick gloss as Transitional-Canadian; and the striate disc and western glass as Canadian-Hudson. The other species either have very large ranges or information was insufficient to place them in one of these categories. It is clear from the graph that Coyote Creek influenced the gastropod composition both directly and indirectly. Riparian species are by far the most common, comprising between about 60 and 75 percent for all but the small Central Talus sample. Species that inhabit the Upper Sonoran and Transitional zone are the next-most common in all but the fairly small sample from middle-level fill in the North Talus. Larger amounts of Transitional-Canadian species in the North Talus probably reflects modern conditions, such as the grass growing along the road on and at the base of the talus. Species typical of elevations higher than Coyote Canyon

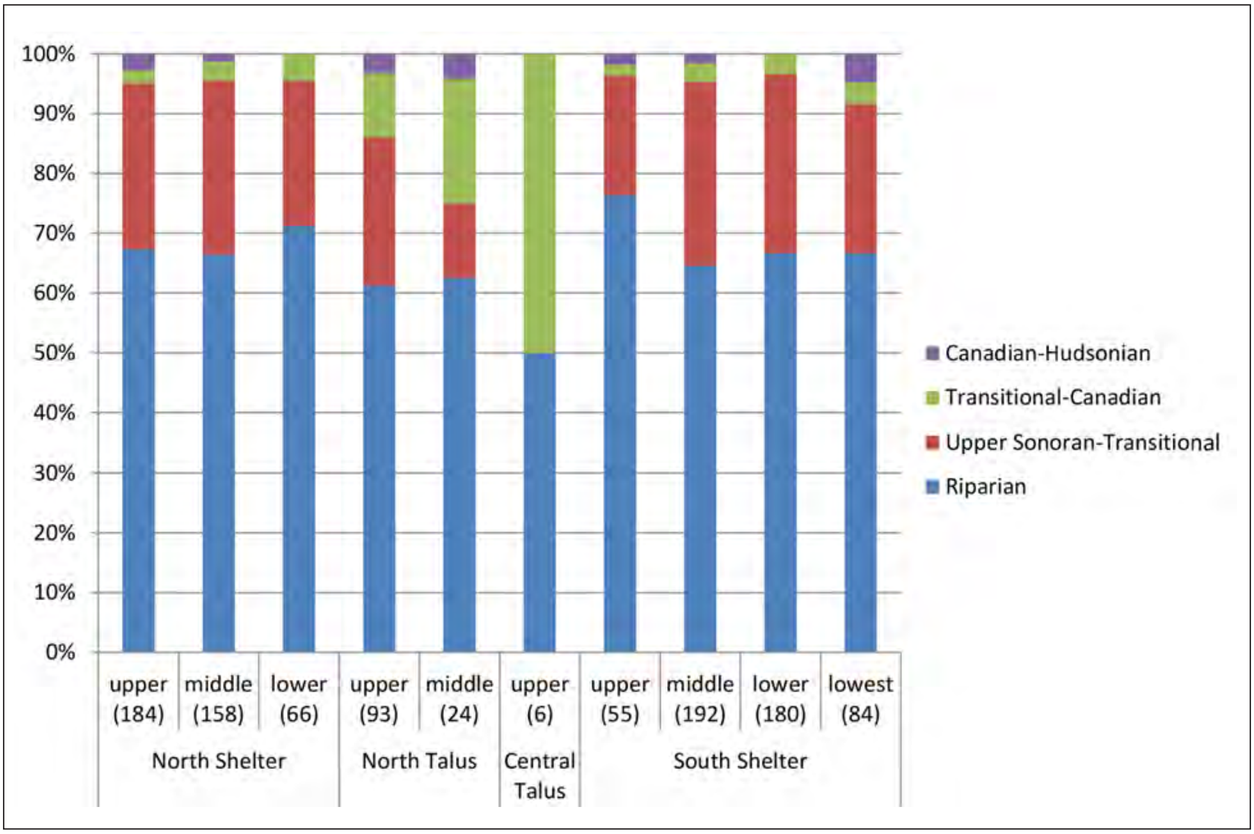

Figure 12.16. Gastropod life zone proportions by area and fill location (sample size).

Rockshelter are rare but occur in many of the proveniences and could have washed down the creek from higher elevations upstream.

Tooth (Not Human)

A tooth found in the second level of fill in the North Talus (270N/143E) was originally thought to be human. Careful cleaning in the lab revealed three small lingual cusps that—along with the angle of the crown to the root and the wear pattern—indicate it is an incisor from a large carnivore, probably bear. Measurements also indicate it is smaller than any human tooth with similar morphology (maxillary canine). The identification as not human was confirmed by Dr. Heather Edgar, dental anthropologist at the University of New Mexico (March 7, 2016). NMDOT and HPD were notified about the change in species designation. This tooth was not counted in the faunal analysis, as the report was complete and it would not impact the results.

13 ⚶ Flotation, Macrobotanical, and Wood Analysis

Pamela J. McBride

This chapter presents results of analysis of 162 flotation samples, 47 macrobotanical samples, and 43 wood samples from LA 139965 (Coyote Canyon Rockshelter). Many more samples were collected, but because of monetary and time constraints, samples were selected for analysis by Nancy Akins based on context and the presence of other cultural artifacts. Emphasis was placed on the analysis of samples collected from the shelters where deposits were less disturbed; 89 percent of the samples from North Shelter and 50 percent of samples from South Shelter were analyzed. Cultural deposits in the talus areas below the North Shelter and South Shelter and in between the two shelters were the result of heavy equipment relocating deposits from elsewhere on the site or erosion of deposits downhill from the shelters. Disturbance by worms, rodents, and insects also impacted cultural deposits. Carbon 14 dates clearly indicate the site was repeatedly used by Ancestral Pueblo groups from at least the early Developmental period into the Classic period. There is also evidence for use of the site in the Archaic and Historic periods, during the latter by Hispanic sheepherders. However, without definitive use surfaces or strata, plant remains will be discussed on a site-wide basis for the most part, rather than by time period.

Prior to excavation, a vegetation survey was conducted in the project area in April of 2014. The area was revisited in October 2015 to collect plant seed and catalog any taxa that might have been missed. Table 13.1 presents a list of plants observed along Coyote Creek and NM 434 as well as on the slopes adjacent to the site. Ponderosa pine (*Pinus ponderosa*) was the dominant tree growing in the site vicinity; Douglas fir (*Pseudotsuga menziesii var. glauca*) and Rocky Mountain juniper (*Juniperus scopulorum*) were occasionally present as well. More evidence of the presence of Rocky Mountain junipers in the site area is found in photos taken just prior to excavation; the NM Department of Transportation removed them from in front of the North Shelter and South Shelter to help facilitate the project work. During occupation of the site, Douglas fir must have been much more abundant considering that Douglas fir needles were identified in 50 percent of the flotation samples with carbonized plant material. Chokecherry (*Prunus virginiana*) and stands of willow that resemble coyote willow (*Salix* cf. *exigua*) can be found growing adjacent to South Shelter and Coyote Creek.

Gamble oak (*Quercus gambleii*) is the primary non-conifer growing on the east-facing slopes next to the shelters. Hedgehog cactus (*Echinocereus* sp.), scattered prickly pear cactus (*Platyopuntia* sp.), wax currant (*Ribes cereum* var. *pediculare*), red raspberry (*Rubus idaeus*), cliffbush (*Jamesia americana*), and thicket creeper (*Parthenocissus vitacea*) are part of the understory vegetation. Typical riparian vegetation besides chokecherry and coyote willow found growing along the creek include common horsetail (*Equisetum arvense*), silverweed cinquefoil (*Potentilla anserine*), Western water hemlock (cf. *Cicuta douglasii*), and thinleaf alder (*Alnus incana* ssp. *tenuifolia*). Narrowleaf goosefoot (*Chenopodium* cf. *leptophyllum*), stinging nettle (*Urtica dioica* ssp. *gracilis*), blunt tansy mustard (*Descurainia obtusa*), spike verbena (*Verbena macdougalii*), and yellow sweet clover (*Melilotus officinalis*) are some of the common weedy species that thrive along NM 434.

Table 13.1. Plant taxa in the vicinity of LA 139965.

Scientific Name	Common Name	Economic Uses
Annuals		
Chenopodium cf. *leptophyllum*	Narrowleaf goosefoot	Yes
Descurainia obtusa	Blunt tansy mustard	Yes
Lactuca serriola	Prickly lettuce	No
Pyrrhopappus pauciflorus	False dandelion	No
Urtica dioica spp. *gracilis*	Stinging nettle	Yes
Biennials		
Arctium minus	Lesser burdock	Yes
Melilotus officinalis	Yellow sweet clover	Yes
Grasses		
Bromus catharticus	Rescue grass	No
Elymus canadensis	Canadian wild rye	No
Elymus elymoides	Squirreltail	No
Pascopyrum smithii var. *molle*	Western wheatgrass	No
cf. *Phleum pratense*	Timothy	No
Sporobolus cryptandrus	Dropseed grass	Yes
Other		
Erigeron spp.	Fleabane	No
Perennials		
Achillea millefolium var. *lanulosa*	Yarrow	Yes
Allium cernuum	Nodding onion	Yes
Alnus incana spp. *tenuifolia*	Thinleaf alder	Yes
Artemisia frigida	Fringed sage	Yes
Brickelia grandiflora	Tasselflower	No
Campanula rotundifolia	Harebell	No
cf. *Cicuta douglasii*	Western water hemlock	Yes
Cirsium cf. *arvense*	cf. Canada thistle	No
Echinocereus spp.	Hedgehog cactus	Yes
Equisetum arvense	Common horsetail	Yes
Geranium caespitosum	Purple geranium	No
Geranium richardsonii	Richarson geranium	No
Geum macrophyllum	Largeleaf avens	No
cf. *Grindelia squarrosa*	Curlycup gumweed	No
Humulus lupulus var. *neomexicana*	Common hop	Yes
Jamesia americana	Cliffbush	No
Juniperus scopulorum	Rocky Mountain juniper	Yes
Linum lewisii	Blue flax	No
Marrubium vulgare	Horehound	Yes
Medicago sativa	Alfalfa	Yes
Mirabilis spp.	Four o"clock	Yes
Parthenocissus vitacea	Thicket creeper	No
Penstemon barbatus spp. *torreyi*	Scarlet penstemon	No
Pericome caudata	Taperleaf	Yes
Pinus ponderosa	Ponderosa pine	Yes
Platyopuntia spp.	Prickly pear cactus	Yes
Potentilla anserina	Silverweed cinquefoil	No
Prunus virginiana	Chokecherry	Yes

Table 13.1 (continued)

Scientific Name	Common Name	Economic Uses
Pseudotsuga menziesii var. *glauca*	Douglas fir	Yes
Quercus gambleii	Gamble oak	Yes
Ratibida columnifera	Prairie coneflower	No
Ribes cereum var. *pediculare*	Wax currant	Yes
Ribes leptanthum	Trumpet gooseberry	Yes
Rubus idaeus	Red raspberry	Yes
Rudbeckia laciniata	Cutleaf coneflower	No
Rumex crispus	Curly dock	Yes
Salix cf. *exigua*	Coyote willow	Yes
Toxicodendron rydbergii	Rydberg's poison ivy	No
Tragopogon dubius	Yellow salsify	Yes
Trifolium pratense	Red clover	Yes
Verbascum thapsus	Mullein	Yes
Verbena macdougalii	Spike verbena	No

cf.= resembles taxon.

Analysis Results

Uncharred Plant Remains from Flotation Samples

Various studies have addressed the uncertain origins and difficulty of interpreting uncharred plant remains from archaeological sites (Minnis 1981; Keepax 1977). Rockshelters have a higher probability of preserving unburned plant material, especially if post-depositional disturbance has not adversely affected deposits. However, it can be impossible to determine if uncharred material was discarded by humans or rodents, particularly if wild plant taxa that are recovered do not display clear tooth marks or signs of human alteration (parching, shaping, cutting, etc.). Due to these kinds of questions, this report will focus on charred plant remains. When present, uncharred remains were recorded during full-sort analyses, but most of these were presumed to be intrusive (transported by rodents or insects into the interior of the shelters) and unassociated with the prehistoric or historic use of the site. The most common plant remains of the 48 uncharred taxa (Table 13.2) observed in flotation samples were weedy annual seeds, grass family plant parts, aster family achenes, and hedgehog cactus seeds. Amaranth, goosefoot, and purslane (the three most frequently encountered annuals) are weedy taxa that are found in virtually any disturbance situation and are widespread throughout the Southwest. A single amaranth or goosefoot plant can produce thousands of seeds, so it is not surprising that seeds from these disturbance-loving plants show up as modern intrusives in almost every archaeobotanical assemblage. A member of the goosefoot family that compared favorably with strawberry blite seeds (*Cheopodium capitatum*) and occurred in 46 percent of samples, may belong to another species of goosefoot; a search for this species in Mora County on the Biota of North America website (http://www.bonap.net/tdc, accessed December 2015) produced negative results. Grasses and plants in the aster family were abundant along NM 434. The high ubiquity of hedgehog cactus seeds could be associated with rodent activity; rodent fecal pellets were present in 67 percent of the 162 flotation samples analyzed (App. 4.1a–c). On the other hand, because there are very few hedgehog cacti growing in close proximity to the site, they may also represent discarded seeds from eating the uncooked fruits. Further, at least 22 of the unburned taxa have economic uses, including acorn nutshell, which was found in 34 percent of flotation samples; some had signs of gnawing, but the majority were intact, without rodent damage. These could be the remains of seeds and fruits collected for consumption, but there is no way to determine the source of deposition with certainty.

Table 13.2. Ubiquity of uncharred taxa from flotation samples.

Scientific Name	Common Name	Total Count*	Ubiquity**
Annuals			
Amaranthus spp.	Amaranth	116	75
Chenopodium spp.	Goosefoot	137	89
Grindelia squarrosa	Curlycup gumweed	1	<1
Lepidium spp.	Pepperweed	1	<1
Portulaca spp.	Purslane	118	77
Euphorbia spp.	Spurge	43	28
Mentzelia spp.	Stickleaf	24	16
Chenopdium cf. capitatum	cf. Strawberry blite	71	46
Helianthus annuus	Sunflower	15	10
Salsola spp.	Tumbleweed	2*	1
Grasses			
Bromus inermis	Brome grass	23	15
Sporobolus cryptandrus	Dropseed grass	27	18
Poaceae	Grass family	89	58
Paniceae	Panic grass tribe	11	7
Other			
Asteraceae	Aster family	87	56
Fabaceae	Bean family	3	2
Boraginaceae	Borage family	2	1
Polygonaceae	Buckwheat family	2	1
Cactaceae	Cactus family	1	1
Oenothera spp.	Evening primrose	1	1
Physalis spp.	Groundcherry	63	41
Lamiaceae	Mint family	13	8
Verbascum thapsus	Mullein	46	30
Solanaceae	Nightshade family	1	1
Portulacaceae	Purslane family	3	2
Phacelia spp.	Scorpionweed	9	6
Cyperaceae	Sedge family	33	21
Scutellaria spp.	Skullcap	1	1
Boerhavia	Spiderling	1	1
Verbena spp.	Vervain	49	32
Lactuca spp.	Wild lettuce	23	15
Perennials			
Alnus spp.	Alder	28	18
Scirpus spp.	Bulrush	1	1
Prunus virginiana	Chokecherry	26	17
Taraxacum officinale	Common dandelion	1	1
Rumex spp.	Dock	22	14
Pseudotsuga menziesii var. *glauca*	Douglas fir	11	7
Sphaeralcea spp.	Globemallow	1	1
Echinocereus spp.	Hedgehog cactus	93	60
Juniperus spp.	Juniper	23	15
Quercus gambleii	Oak	52	34
Pinus spp.	Pine	9	6
Pinus edulis	Piñon pine	1	1
Pinus ponderosa	Ponderosa pine	32	21
Eleagnus angustifolia	Russian olive	1	1
Rubus spp.	Raspberry	6	4
Fragaria spp.	Strawberry	12	8
Rhus spp.	Sumac	4	3

sp. = species unknown. * = number of samples with uncharred taxon.
** = number of samples with uncharred taxon divided by total number of samples with uncharred taxa (154).

Charred Plant Remains from Flotation, Wood, Dendro, and Macrobotanical Samples

The richest array of carbonized plant taxa (Table 13.3) was recovered from the South Shelter, which is not surprising since the largest number of flotation samples was analyzed from this section of the site and the South Shelter was slightly deeper and longer than North Shelter (South Shelter was approximately 12 m by a maximum of about 2.5 m, compared to the North Shelter dimensions of 4.2 m by 2.05 m). The richer plant assemblage from South Shelter could indicate that it was the principal locus of food-preparation activities or, because of its size, perhaps the principal locus of any activity. Although 33 carbonized taxa were identified from South Shelter, only seven of those were recovered in a substantial number of samples and included amaranth, cheno-am, goosefoot, maize, grass family, Douglas fir, and ponderosa pine (App. 4.2a–s). The latter two taxa were represented by needles and fascicles (bundles of needles) and were probably primarily artifacts of firewood use.

The same seven taxa were encountered most frequently in samples from the North Shelter as well (App. 4.3a–l). Four of these taxa (cheno-am, goosefoot, Douglas fir, and ponderosa pine) were identified in more samples from South Talus than the other eight taxa from this area (App. 4.4a–l), while cheno-am and goosefoot were the most common from North Talus (App. 4.5a, b, d–f). Unidentifiable seeds, pine bark, and ponderosa pine needles were the only charred non-wood plant materials found in the two Central Talus samples (App. 4.5c, e).

Wood assemblages from flotation, wood, dendro, and macrobotanical samples were dominated by ponderosa pine, oak, and alder (Table 13.4; Apps. 4.2–4.5). Cottonwood/willow was the next most abundant wood (Table 13.4). Small quantities of juniper, possible Douglas fir, pine, piñon, and unknown conifer comprise the rest of the conifer assemblage, while non-conifers besides oak, cottonwood/willow, and alder consisted of chokecherry, currant, sagebrush, and unknown non-conifer.

Discussion

Charred goosefoot was recovered in 86 percent of flotation samples from South Shelter and 83 percent of samples from North Shelter (Table 13.2), while cheno-ams were identified in a similar percentage of samples from South Shelter (80 percent) and considerably less from North Shelter (55 percent). Cheno-am is a category that includes seeds from the genus *Amaranthus* and *Chenopodium* that cannot be identified to either genus with confidence because of degraded seed coats. Pollen aggregates in the amaranth family were observed in pollen wash samples of a mano found in South Shelter deposits and from one of two metates from North Shelter deposits (Chapter 14, Cummings and Varney, this report). The analysts report that the presence of aggregates suggests goosefoot or related seeds were ground using the tools, lending support to the evidence provided by macrobotanical analysis.

Probably the most intriguing annual taxon that was identified was a charred tobacco seed; it was recovered from a Level 6 sample from excavation grid 247N/143E at South Shelter. The recovery of tobacco implies use of this important ceremonial plant. Adams and Toll (2000) document tobacco recoveries at several shelters and caves that may have been used primarily for hunting forays; those sites range in age from pre- AD 750 to European contact. The specimen from Coyote Canyon measured 0.7 mm in length and 0.4 mm in width and is most likely a wild tobacco taxon. Adams and Toll (2000:145) state that seeds that fall within these size parameters are one of the following species: *N. glauca*, *N. tabacum*, or *N. trigonophylla*. When the Biota of North America website was consulted, however, it appears that *N. obtusifolia* is the only native tobacco known to occur in Mora County. There are no morphometric data for this species, so measurements cannot be compared to any of the three listed by Adams and Toll. Either the tobacco was one of the three listed by Adams and Toll and was transported to the site from elsewhere, or it was the species common in Mora County and was collected nearby.

Grass family seeds are another type that was identified frequently in flotation samples, particularly in those from South Shelter; they occurred in 43 percent of the LA 139965 samples. Grass pollen aggregates were recorded in pollen washes from a smooth abrader, a mano, and a basin metate from

Table 13.3. Carbonized plant taxa recovered from flotation, dendro, and macrobotanical samples.

Plant Type		South Shelter (76)	North Shelter (42)	South Talus (23)	North Talus (13)	Central Talus (2)
Scientific Name	**Common Name**	**Plant Part**				
Amaranthus	Amaranth	Seed/26	Seed/10	Seed/5	–	–
Kallstroemia	cf. Caltrop	Seed/1	–	–	–	–
–	Cheno-Am	Seed/61	Seed/22	Seed/11	Seed/6	–
Chenopodium	Goosefoot	Seed/65	Seed/34	Seed/12	Seed/10	–
Portulaca	Purslane	Seed/1	–	–	–	–
Nicotiana	Tobacco	Seed/1	–	–	–	–
Helianthus	Sunflower	Seed/4	–	–	–	–
Zea mays	Maize	Cupule, glume, kernel/33	Cupule, kernel/10	Cupule, embryo/3	Cupule/1	–
Sporobolus	Dropseed grass	Caryopsis/1	–	Caryopsis/1	–	–
Poaceae	Grass family	Caryopsis/33	Caryopsis/8	Caryopsis/3	Caryopsis/1	–
Asteraceae	cf. Aster family	Seed/2	Seed/1	Seed/3	–	–
Fabaceae	cf. Bean family	–	–	Seed/2	–	–
Polygonaceae	cf. Buckwheat family	Seed/1	Seed/1	–	–	–
Cucurbita	cf. Bufflalo gourd/Squash	Rind/1	–	–	–	–
Cactaceae	Cactus family	cf. areole/3	–	–	–	–
Physalis	cf. Groundcherry	Seed/3	–	–	–	–
Lamiaceae	Mint family	–	–	–	Seed/1	–
Monocotyledonae	Monocot	Stem/2	–	–	–	–
Convulvulaceae	cf. Morning glory family	Seed/2	–	–	–	–
Phacelia	Scorpionweed	Seed/3	–	Seed/1	–	–
Cyperaceae	Sedge family	Seed/11	Seed/3	Seed/1	–	–
Verbena	Vervain	Seed/3	Seed/1	–	–	–
Eriogonum	cf. Wild buckwheat	Seed/1	–	–	–	–
Yucca baccata	Banana yucca	Seed/1	–	Seed/1	–	–
Prunus virginiana	cf. Chokecherry	Seed/7	Seed/3	–	–	–
Rumex	Dock	Seed/1	–	Seed/1	–	–
Pseudotsuga menziesii	Douglas fir	Needle/51	Needle/14	Needle/10	Needle/2	–
Echinocereus	Hedgehog cactus	Seed/6	Seed/2	–	Seed/1	–
Quercus	cf. Oak	–	–	Acorn/1	–	–
Pinus	Pine	Bark, conescale	Bark	Bark, conescale	–	–
Pinus edulis	possible Piñon pine	Needle/4 Nutshell/2	Nutshell/1	Needle/1	–	–
Pinus ponderosa	Ponderosa pine	Fascicle, needle/51	Needle/20	Needle/12	Needle/1	Needle/2
Platyopuntia	Prickly pear cactus	Embryo/1	–	–	–	–
Rubus	Raspberry	Seed/1	–	–	–	–
Yucca	possible Yucca	caudex/1	–	–	–	–
Salix	cf. Willow	Bud, poss. Node/1	–	–	–	–

( ) number of samples with carbonized remains, plant part/number of samples with plant part.
cf. = compares favorably.

Table 13.4. Wood taxa from flotation, macrobotanical, wood, and dendro samples.

Category	Taxon	Count	% of samples containing taxon*
Conifers	cf. Douglas fir	9	4
	Juniper	6	3
	Pine	30	13
	cf. Piñon	5	2
	Ponderosa pine	212	95
	Unknown conifer	34	15
Non-Conifers	cf. Alder	118	53
	cf. Chokecherry	23	10
	possible Currant	1	<1
	Cottonwood/willow	72	32
	Oak	173	77
	Sagebrush	6	3
	Unknown Non-Conifer	32	14

* Total number of samples: 224.

South Shelter and from pollen wash samples of two metates from North Shelter; elevated grass family pollen concentrations were also reported in the pollen wash from a one-hand mano. Further, a flaked abrader from South Shelter and a mano from North Shelter deposits produced elongate dendritic forms of phytoliths that originate in the bracts of grasses that are not entirely removed during the winnowing and parching processes prior to grinding; their presence on the tools above a frequency that would merely indicate a local environmental signature suggests use of the abrader and mano for grinding grass. The pollen aggregates indicate similar processing of grasses with the smooth abrader, mano, and basin metate.

Aside from Douglas fir and ponderosa pine duff, chokecherry, and hedgehog cactus seeds were the most frequently encountered perennial plant remains. Chokecherry fruits, although somewhat astringent, were eaten fresh or dried for winter use by the Puebloan people and the Jicarilla Apache would grind the berries and make cakes from the meal (Castetter 1935:46). The presence of hedgehog cactus seeds implies the fruits were processed and eaten fresh after removing the spines or they were dried for the winter. Cactus areoles were also recovered in three samples from South Shelter, suggesting processing of the fruits or stems. Areoles are the areas on the stems or fruits of cacti from which glochids and spines emerge. Other notable perennial plant taxa included one occurrence each of banana yucca, raspberry, and prickly pear (suggesting preparation of the fruits), one carbonized acorn (possibly indicating consumption of the boiled or roasted nuts), and the recovery of possible piñon nutshell in three flotation samples (indicating the nuts could have been roasted and eaten).

Evidence for maize was found in 43 percent of samples from South Shelter, 24 percent of samples from North Shelter, and 13 and 8 percent of samples from South Talus and North Talus, respectively. Carbonized maize kernels were recovered from one macrobotanical sample and two flotation samples from South Shelter and one flotation sample and one macrobotanical sample from North Shelter. Two unburned kernels were recovered from Level 3 of in North Shelter deposits and could be associated with the historic use of the site. One specimen displays rodent damage and although it is difficult to imagine where a rodent would have had access to shelled maize, the two unburned kernels could have been deposited by rodents. Most of the maize remains recovered were cupules (the cup-shaped structures that hold two kernels on a cob). Normally, this distribution indicates that maize was grown nearby because shelled kernels, rather than whole cobs would be the less burdensome method of transporting maize on foot, but Coyote Canyon might have been a risky place for agricultural pursuits. While short-season Southwest maize cultivars exist that mature in as few as 75 days (Muenchrath and Salvador 1995), at 7,700 ft in elevation and with only 102 frost-free days (Williams and McAllister 1981:13), growing crops could have been extremely challenging. This evidence, considered with the balance of the artifact assemblage, the lack of features at the site, and the shallow depth of the shelters indicates the site was not used for habitation, but rather as a camp—one that was reused over a long period of time by hunter/gatherers. Pollen analysis results substantiate the conclusion that fresh maize was not introduced into the shelters. There were no pollen aggregates and maize pollen concentrations were low. "Rather, crops apparently were processed elsewhere and the reduced produce was brought to the site" (Chapter 14, Phillips, this report).

Maize kernel morphometrics of the three carbonized and two uncarbonized measurable specimens are presented in Table 13.5. The specimen from FS 308 is a very diminutive kernel, possibly from the tip of a cob where kernels are the smallest on an ear of maize. The other specimens fall within the normal range of maize kernels for the period of site occupation. A plant part that resembled *Cucurbita* rind was recovered from South Shelter and could represent either squash or wild gourd. The carbonized fragment was miniscule and measured less than 1 mm in thickness. As cited by King (1985:91), the average rind thickness of buffalo gourd is .7 mm, with a maximum thickness of 2.0 mm. King also states that the measurements of wild gourd and domestic squash overlap. This specimen falls within the overlap and a differentiation between wild gourd *(Cucurbita foetidissima)* and domesticated squash such as *Cucurbita pepo* cannot be made.

Taxa that were placed in the "other" category of plants because of variation in life cycles within a family or genus (e.g., annual/perennial) included: aster family, bean family, buckwheat family, groundcherry, mint family, morning glory family, scorpionweed, sedge family, vervain, and wild buckwheat. The aster family has numerous genera that have economic uses. Thistles (*Cirsium* spp.) are one of the examples of useful plants in this family. The young stems can be peeled and the inner part can be eaten raw or cooked and the young leaves can be eaten raw in salad (Harrington 1967:166–168). The bean family is also large and the uses of some of the many edible genera are described in Chapter 14 (Cummings and Varney). Curly dock *(Rumex crispus)* is an example of a genus in the buckwheat family, and indeed, two instances of dock were found in flotation samples. Dock is very high in vitamins A and C. The leaves can be boiled like spinach or eaten raw and the seeds can be ground into meal (Dunmire and Tierney 1995:170). Groundcherry fruits were boiled and crushed and then used as a condiment; at Zuni, the boiled fruits were ground and mixed with onions, chili, and coriander and made into what we would call salsa (Castetter 1935:39–40).

Seeds of the mint family (Lamiaceae) such as chia sage (*Salvia*) were dried or roasted and ground into a meal, or made into a mucilaginous beverage by the Papago, Pima, and Pomo as a refreshing drink, or as a stomach tonic if cold and to stimulate sweating and salivation if hot (Castetter and Underhill 1935; Russell 1908; Murphey 1959; Moore 2003). Bush morning glory is an example of

Table 13.5. Zea mays kernel morphometrics (mm).

FS No.	Provenience	Height (mm)	Width (mm)	Thickness (mm)	Weight (gm)	Comments
99	South Shelter 251N/143E,Level 2	6.5	6.6	5.1	0.07	–
308	South Shelter 246N/144E, Level 8	3.8	3.4	1.6	0.01	very diminutive, probably from cob tip
494	North Shelter 270N/141E, Level 2	7.4	8.6	5.7	0.08	missing embryo, swollen
546[u]	North Shelter 271N/140E, Level 3	–	8.6	3.9	0.21	missing embryo, rodent gnawing present at apex
		10.2	7.9	5.9	0.36	–

u = uncharred kernels.

the Convolvulaceae family. The giant root was used as an emergency food, but it was more important as a medicinal plant, which included use as a gastrointestinal aid and an analgesic (Row 2014). Scorpionweed can be used as cooked greens, but the prickly hairs on the surface of the leaves may deter this practice (Kirk 1975:74). The powdered root or leaves were used medicinally to reduce swelling (Dunmire and Tierney 1995:101). Members of the sedge family, such as bulrush, were used extensively by Native American groups. The shoots were gathered in spring and were eaten raw or cooked. The pollen was collected when the plants were in flower and mixed with meal to make bread; later on, its seeds were ground into a meal and used in a similar fashion as the pollen. Old stems were used to weave mats or baskets (Harrington 1967:212). Recovery of large quantities of sedge-family pollen suggested to analysts that sedge seeds were ground in or near South Shelter (Chapter 14, Cummings and Varney). The seeds of vervain can be roasted and ground into flour, although the flour is slightly bitter (Kirk 1975:78). One instance of a seed that compared favorably to wild buckwheat occurred in a sample from a Level 4 grid. Cummings and Varney state that wild buckwheat pollen occurs with regularity in samples, "indicating local growth in sufficient abundance that it might have been collected and the seeds ground into flour" (Chapter 14).

It is no surprise that the conifer wood assemblage from all types of samples is dominated by ponderosa pine; oak and alder were the most frequently encountered non-conifers. All three taxa are prominent tree or understory shrubs of the extant environment and the prehistoric composition of the forest was probably not drastically different than today. Douglas fir was most likely more abundant, considering the regularity in recovery of needles in flotation samples. Douglas fir wood was scarce in the record, but it is difficult to distinguish this species from other conifers without the benefit of a thin-section, something that is difficult if not impossible to cut from a carbonized specimen, so this identification challenge could be a contributing factor to its low-percent presence.

Summary and Conclusions

Flotation samples were analyzed from South and North Shelters and the adjacent talus slopes along with a Central Talus area in between the two shelters. Analysis resulted in the recovery of carbonized plant remains from 155 of the 162 flotation samples. Amaranth, cheno-ams, goosefoot, maize, grass family, Douglas fir, and ponderosa pine were the most common taxa encountered. Macrobotanical, pollen, and phytolith data point to the processing of seeds in the amaranth family as well as those of grasses. Maize was most likely brought to the site after being processed elsewhere. Douglas fir and ponderosa pine needles are probably residues of firewood use. The wood assemblage was dominated by ponderosa pine, oak, and alder, an unsurprising result as these three taxa are the most common species of the Petran and Madrean Montane Conifer Forest (Brown 1994), in which the site is located, and along the banks of Coyote Creek.

The wild plant assemblage indicates occupation of the site took place in late summer and into the fall; it consisted primarily of taxa whose seeds mature in late summer or fall, such as goosefoot, amaranth, and sunflower. Hedgehog cactus, chokecherry, banana yucca, and piñon have fruits or nuts that mature in the fall. Of course many of these seeds can be stored over winter, but with the absence of storage features, a reasonable conclusion is that plant resources were collected and processed during the time of occupation.

14 Pollen, Pollen/Starch, and Pollen/Phytolith Analyses

Bruce G. Phillips | Linda Scott Cummings and R. A. Varney

Pollen Analysis of Coyote Canyon Rockshelter (LA 139965)

Bruce G. Phillips | EcoPlan Associates, Inc.

In advance of improvements to NM 434, the Office of Archaeological Studies (OAS) conducted excavations at Coyote Canyon Rockshelter (LA 139965). Subsequently, 15 samples were submitted to EcoPlan Associates, Inc., Mesa, AZ, for pollen analysis (Table 14.1). Six samples were residues from ground stone washes, five were sediment samples from within the North and South Shelters, and four were sediment samples from the adjacent talus slope. While the wash samples yielded little information, the sediment samples contained evidence of limited farming, possibly along nearby Coyote Creek. A rich riparian zone also was reflected.

Coyote Canyon Rockshelter is on the west side of Coyote Creek, which runs along the eastern foot of the Rincon Mountains in northern New Mexico. Elevation is approximately 7800 ft above mean sea level. Vegetation of the area is categorized as Petran Montane Conifer Forest (Pase and Brown 1994), characterized by ponderosa pine (*Pinus ponderosa*) forest; Gamble Oak (*Quercus gambleii*) also is common. Grassland dominates areas where trees have been removed. A rich riparian habitat and diverse vegetation provided a wide variety of potentially useful plants (Akins and Boyer 2015:10).

Methods

Pollen washes were conducted at OAS laboratories in Santa Fe. The resulting residues, along with select sediment samples, were forwarded to EcoPlan. Following an inventory, all samples were sent to the Paleoecology Laboratory, Texas A&M University, for pollen extractions. Sediment sample bag contents were mixed thoroughly and 10 gm subsamples were taken. To estimate pollen concentrations, approximately 18,500 grains of *Lycopodium* were added to sediment samples. Because the amount of sediment removed during the washes could not be quantified, thus prohibiting calculations of pollen concentration values, no *Lycopodium* spores were added to wash samples.

All samples were then treated with 10 percent hydrochloric acid to reduce carbonates, followed by a swirl-and-decant step (Mehringer 1967:136–137) to reduce the heavier matrix fraction (greater than 180 µm). Silicates were reduced by a hydrofluoric acid treatment of approximately 20 hours. Heavy liquid flotation in zinc bromide (with a specific gravity of 1.9) was followed by acetolysis to further reduce organics. The remaining residues were washed with water and alcohol, stained with saffranin, and suspended in glycerol.

At EcoPlan, extracts were mounted and examined at a viewing power of 400X on an Olympus BHTU compound microscope. Subsequent percentage calculations were based on standard 100- or 200-grain counts, depending on pollen abundance. Identifications were aided by EcoPlan reference material and keys (Kapp 1969; Moore et al. 1991). Each fossil pollen grain was identified to the generic level when possible. If a grain could not be differentiated from similar genera, it was identified only to the family level. Pollen grains that were broken, corroded, or degraded beyond recognition were assigned to the "degraded" category.

Following standard examination, slides were scanned at 100X magnification to record cultigens and rare pollen types with possible cultural signif-

Table 14.1. Pollen recovered from site ground stone and sediment samples, counts by taxon and sample source.

Taxon	Common Name	Sediment pollen	Ground stone pollen	Ground stone pollen/starch	Present in vicinity
Number of samples		9	1	9	–
Arboreal Pollen					
Alnus	Alder	7	–	6	X
Juniperus	Juniper	–	4	4	X
Pinaceae:	Pine family	–	–	–	–
Abies	Fir	4	–	2	X
Picea	Spruce	2	–	1	X
Pinus	Pine	9	1	9	X
Acer	Maple	1	–	–	–
Quercus	Oak	5	1	7	X
Salix	Willow	3	–	1	X
Ulmus	Elm	–	–	1	X
Non-arboreal Pollen					
Amaranthaceae	Amaranth family (inc. Chenopodiaceae; combined based on genetic testing and pollen category "Cheno-ams").	9	1	9	X
Apiaceae	Umbel family	–	–	2	X
Asteraceae:	Sunflower family	–	–	–	X
Artemisia	Sagebrush	6	–	9	X
Low-spine	Ragweed, Cocklebur, Sumpweed	9	1	7	X
High-spine	Aster, Rabbitbrush, Snakeweed, Sunflower, etc.	9	1	9	X
Cirsium	Thistle	–	–	1	X
Boerhavia	Spiderling	1	–	–	–
Brassicaceae	Mustard or Cabbage family	8	1	1	X
Cyperaceae	Sedge family	–	–	1	X
Ephedra	Ephedra, Jointfir, Mormon tea	3	–	7	–
Eriogonum	Wild buckwheat	1	–	7	–
Euphorbia	Spurge	6	–	1	–
Fabaceae:	Bean or Legume family	9	1	2	X
Trifolium	Clover	–	–	1	X
Liliaceae	Lily family	4	–	–	X
Platyopuntia	Prickly pear cactus	1	–	–	X
Cylindropuntia	Cholla cactus	1	–	–	–
Poaceae:	Grass family	9	1	9	X
Agropyron	Wheatgrass	–	–	1	X
Rosaceae	Rose family	4	–	–	X
Sarcobatus	Greasewood	–	–	1	–
Sphaeralcea	Globemallow	1	–	–	–
Solanacea	Nightshade family	7	–	–	X
Thalictrum	Meadow-rue	–	–	3	–
Typha angustifolia -type	Narrowleaf cattail	7	1	2	–
Zea mays	Corn	4	–	–	–
Starches					
Lenticular starch	Typical of starches produced by grass seeds, inc. wheat grass (Agropyron), ryegrass (Elymus), barley grass (Hordeum).	–	–	2	–
Subangular starch	Typical of starches produced by grass.	–	–	1	–
Spores					
Monolete - smooth	Fern	–	–	4	–
Selaginella	Little clubmoss	–	–	**3**	X
Trilete - smooth	Fern	–	–	1	–
Other					
Muscle fiber	Muscle fiber	–	–	1	–

icance (such as cacti). Pollen aggregates (clumps) were recorded. Because aggregates are not efficiently transported by wind, they indicate either a source in the immediate sampling area (Fish 1995:661) or introduction to the site by humans (Gish 1991). Finally, the number of tracers per slide was determined. This allowed a concentration estimate for each category recorded in scanning.

For sediment samples, pollen concentrations were calculated with the following formula:

$$\text{Concentration} = \frac{\text{pollen grains counted}}{\text{tracers counted}} \times \frac{\text{tracer concentration}}{\text{sample volume}}$$

Pollen concentration values are estimates of the quantity of fossil pollen preserved in each gram of sediment. In natural settings, these values can indicate sedimentation rates, pollen production and dispersion rates, and the effects of differential preservation. In cultural settings, concentrations can indicate the intensity of site and/or feature use.

Degraded pollen assemblages are not uncommon in the Southwest (Hall 1981, 1985; Holloway 1981). Many factors cause pollen deterioration, and the process is not well understood. Mechanical factors can cause grains to be crushed or torn apart, whereas chemical agents can affect their structural integrity. Chief among chemical agents is the cycle of wetting and drying (Holloway 1989), which commonly affects open-air sites. Another factor is heat, which can oxidize and destroy pollen grains. Also affecting the number and distribution of pollen types is the amount of sporopollenin in grains of different plants. Sporopollenin is a highly resistant organic compound that allows pollen to be preserved in sediments and other settings. Because cheno-ams and Asteraceae often have large amounts of the compound and hence preserve well, they are often over-represented in the pollen record. Degraded grains were tracked in the analysis.

Results and Discussion

A single pollen-wash sample yielded a 100-grain count; the remaining wash samples contained no identifiable pollen or no pollen at all. All sediment samples contained sufficient pollen for 200-grain counts. Overall, 31 taxa were identified (Table 14.2), including maize. No introduced Old World types were found. Nomenclature and plant ecology follow Kearney and Peebles (1960); plants are discussed using their common names, except for cheno-ams, and High- and Low-spine Asteraceae.

Because taphonomic processes differ considerably between pollen deposited on ground stone versus in sediment, pollen-wash data are discussed separately from sediment-sample data.

Considerations of Pollen-Wash Data

Pollen washes typically involve rinsing the surface of a given artifact, collecting the solution, extracting fossil pollen in the laboratory, and microscopically analyzing the resulting residue. The assumption is that the data reflect the final activities associated with the artifact, such as grinding or storage of grains. Until recently, however, there have been few studies to show a direct connection between plant parts used, artifacts, and data. Geib and Smith (2008) conducted a series of experiments to understand how pollen from specific plants and plant parts is deposited during various processing stages and how this relates to the archaeological record. Focusing on grinding tools (ceramic containers were not investigated), more than 80 samples of wild seeds and 25 maize samples were washed at varying stages of food production. The "cleaned" produce was then ground on metates; manos and metates were then rinsed. Residues from plants and artifacts were processed and analyzed. A subset of tools from archaeological contexts also was analyzed, including sediment control samples of the immediately surrounding matrix.

The experiments demonstrated that pollen is progressively shed from plant resources throughout the food production process, that more pollen is recovered from roughly textured tools, and that control samples reflect the locations of food processing where plant materials accumulate. Only occasionally did data from pollen washes reflect the plant parts processed. In particular, maize pollen was more closely associated with archaeological sediment control samples than with artifact washes. As might be expected, maize pollen was most abundant on outer husks, and rapidly diminished as ears were shucked. Shelled kernels rarely yielded pollen. Similarly, washes from tools used to grind maize infrequently had maize pollen. The authors made the caveat that foods can be prepared in many

Table 14.2. Scientific names, common names, flowering seasons, and pollination modes, of pollen types identified at LA 139965.

Scientific name	Common name	Flowering season	Pollination Mode
Cultigen			
Zea mays	Maize	Summer	Wind
Cacti			
Cylindropuntia	Cholla	Spring-early summer	Insect
Platyopuntia	Prickly pear	Spring	Insect
Riparian types			
Typha	Cattail	Summer	Wind
Cyperaceae	Sedge family	Spring	
Salix	Willow	Spring	Wind
Trees			
Pinus ponderosa -type	Ponderosa pine-type	Late spring	Wind
Pinus edulis -type	Piñon pine-type	Summer	Wind
Abies -type	Fir	Late spring	Wind
Pseudotsuga menziesii	Douglas fir	Spring	Wind
Picea	Spruce	Spring	Wind
Juniperus	Juniper	Late winter-early spring	Wind
Quercus	Oak	Spring	Wind
Acer	Maple	Spring	Wind
Alnus	Alder	Spring	Insect
Herbs and Shrubs			
Poaceae	Grass family	Spring-fall	Wind
Cheno-Am	Includes goosefoot, pigweed, and others	Spring-fall	Wind/Insect
Low-spine Asteraceae	Includes ragweed and others	Summer-fall	Wind
High-spine Asteraceae	Includes sunflower and others	Spring-fall	Wind/Insect
Brassicaceae	Mustard family	Spring	Insect
Fabaceae	Pea family	Spring-fall	Insect
Euphorbia	Spurge	Spring-fall	Insect
Solanaceae	Nightshade family	Spring-fall	Insect
Rosaceae	Rose family	Spring-summer	Insect
Liliaceae	Lily family	Spring	Insect
Artemisia	Sagebrush	Summer	Wind
Boerhavia -type	Spiderling	Summer-fall	Insect
Ephedra	Mormon tea	Spring	Wind
Eriogonum	Wild buckwheat	Spring-summer	Insect
Liguliflorae	Asteraceae, Chickory tribe	Spring	Insect
Sphaeralcea -type	Globemallow	Spring-fall	Insect

ways and pollen can be introduced throughout the process (Geib and Smith 2008:2009).

Results of Pollen Washes

As mentioned previously, one wash sample contained enough pollen for a 100-grain count (Tables 14.3, 14.4). Of this sum, 33 percent of grains were too degraded to identify, indicating the assemblage was poorly preserved and likely incomplete. Identifiable pollen types were nearly all common to the local flora; a single piñon pine grain likely blew to the site from lower elevations to the south or beyond. No cultigens were identified. Nor were any pollen aggregates present. Therefore, no cultural use was detected.

The reasons for the extremely poor pollen recovery potentially are many, as discussed above. The near absence of pollen in most wash samples suggests that artifact material is a major influence. That is, if the artifacts washed are made of fine-grained rock (versus vesicular basalt, for example), then little or no pollen may have been adhering to the items when they were washed. Other mechanical factors might include crushing and tearing of pollen grains during use, and intentional washing after use by site inhabitants. Since sediment samples from

Table 14.3. Raw pollen data from standard 100- and 200-grain counts and scans.

FS	Area	100- and 200-Grain Counts																						Scans					
		Grains																						Grains				Agg.	
		Cattail	Ponderosa pine	Piñon pine	Juniper	Oak	Alder	Grass family	Cheno-Am	Low-spine Asteraceae	High-spine Asteraceae	Mustard family	Pea family	Spurge	Nightshade family	Rose family	Lily family	Sagebrush	Others	Degraded	Sum	Tracers	Tracers	Maize	Cholla	Prickly pear	Grass family	Spiderling
Wash Samples																													
100	South Shelter	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
166	South Talus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
281	North Talus	1	8	1	–	3	–	30	5	5	8	1	2	–	–	–	–	–	Liguliflorae 1	33	100	–	–	–	–	–	–	–
438	South Shelter	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
449	North Talus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
571	South Shelter	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sediment Samples																													
160	South Talus	3	20	–	–	1	–	61	37	7	19	9	9	2	1	2	3	6	Douglas fir 2; Spiderling 2	16	200	33	92	–	–	–	–	1
185	South Talus	2	32	3	1	2	4	65	18	14	7	3	6	3	1	–	5	1	Prickly Pear 2; Fir 4; Spruce 4; Wild buckwheat 1.	22	200	80	264	1	–	2	–	–
432	South Shelter	–	66	5	–	–	1	50	18	10	14	–	6	1	1	1	1	2	Maize 1; Mormon Tea 1	19	200	13	46	3	–	–	–	–
438	South Shelter	5	37	2	–	–	1	62	18	7	19	6	5	3	2	–	–	–	Willow 1	32	200	7	–	–	–	–	–	–
454	South Shelter	2	44	–	–	–	–	63	29	15	14	1	6	–	1	1	–	–	Mormon Tea 1	23	200	20	–	–	–	–	–	–
567	Central Talus	2	55	3	1	3	5	61	13	7	4	7	3	–	1	–	–	5	Sedge 2; Fir 1; Spruce 3	24	200	22	143	2	–	–	–	–
573	North Shelter	3	28	1	2	2	3	59	19	10	4	1	5	1	–	–	–	–	Willow 1; Liguliflorae 1; Globemallow 1; Mormon Tea 1	59	200	11	–	–	–	–	–	–
608	North Shelter	–	19	1	–	–	3	90	31	7	6	3	3	–	1	–	2	1	–	33	200	20	–	–	–	–	–	–
644	South Talus	2	47	1	3	10	4	68	10	6	5	1	7	1	–	2	–	6	Willow 2; Maple 3;	19	200	39	258	2	1	–	1	–

Agg. = aggregates.

Table 14.4. Transformed pollen data from standard 100- and 200-grain counts and scans.

FS	Area	100- and 200-Grain Counts																					Scans (per gram)				
		Percent																					Grains			Agg.	
		Cattail	Ponderosa pine	Piñon pine	Juniper	Oak	Alder	Grass family	Cheno-Am	Low-spine Asteraceae	High-spine Asteraceae	Mustard family	Pea family	Spurge	Nightshade family	Rose family	Lily family	Sagebrush	Others	Degraded	Types per sample	Concentration (grains per gram)	Maize	Cholla	Prickly pear	Grass family	Spiderling
Wash Samples (n = 6)																											
100	South Shelter	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
166	South Talus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
281	North Talus	1.0	8.0	1.0	–	3.0	–	30.0	5.0	5.0	8.0	1.0	2.0	–	–	–	–	–	Sedge 1.0; Fir 1.0; Spruce 1.5; Liguliflorae 1.0	33.0	13	–	–	–	–	–	–
438	South Shelter	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
449	North Talus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
571	South Shelter	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sediment Samples (n = 9)																											
160	South Talus	1.5	10.0	–	–	0.5	–	30.5	18.5	3.5	9.5	4.5	4.5	1.0	0.5	1.0	1.5	3.0	Douglas fir 1.0; Spiderling 1.0	8.0	16	11,212	–	–	–	–	20
185	South Talus	1.0	16.0	1.5	0.5	1.0	2.0	32.5	9.0	7.0	3.5	1.5	3.0	1.5	0.5	–	2.5	0.5	Prickly Pear 1.0; Fir 2.0; Spruce 2.0; Wild buckwheat 0.5	11.0	20	4,625	7	–	14	–	–
432	South Shelter	–	33.0	2.5	–	–	0.5	25.0	9.0	5.0	7.0	–	3.0	0.5	0.5	0.5	0.5	1.0	Maize 0.5; Spruce 1.5; Mormon Tea 0.5	9.5	16	28,462	121	–	–	–	–
438	South Shelter	2.5	18.5	1.0	–	–	0.5	31.0	9.0	3.5	9.5	3.0	2.5	1.5	1.0	–	–	–	Willow 0.5	16.0	13	52,857	–	–	–	–	–
454	South Shelter	1.0	22.0	–	–	–	–	31.5	14.5	7.5	7.0	0.5	3.0	–	0.5	0.5	–	–	Mormon Tea 0.5	11.5	11	18,500	–	–	–	–	–
567	Central Talus	1.0	27.5	1.5	0.5	1.5	2.5	30.5	6.5	3.5	2.0	3.5	1.5	–	0.5	–	–	2.5	Sedge 1.0; Fir 1.0; Spruce 1.5	12.0	17	16,818	26	–	–	–	–

Table 14.4 (continued)

FS	Area	100- and 200-Grain Counts: Percent: Cattail	Ponderosa pine	Piñon pine	Juniper	Oak	Alder	Grass family	Cheno-Am	Low-spine Asteraceae	High-spine Asteraceae	Mustard family	Pea family	Spurge	Nightshade family	Rose family	Lily family	Sagebrush	Others	Degraded	Types per sample	Concentration (grains per gram)	Scans (per gram): Grains: Maize	Cholla	Prickly pear	Agg.: Grass family	Spiderling
573	North Shelter	1.5	14.0	0.5	1.0	1.0	1.5	29.5	9.5	5.0	2.0	0.5	2.5	0.5	–	–	–	–	Willow 0.5; Liguliflorae 0.5; Globemallow 0.5; Mormon Tea 0.5	29.5	16	33,636	–	–	–	–	–
608	North Shelter	–	9.5	0.5	–	–	1.5	45.0	15.5	3.5	3.0	1.5	1.5	–	0.5	–	1.0	0.5	–	16.5	12	18,500	–	–	–	–	–
644	South Talus	1.0	23.5	0.5	1.5	5.0	2.0	34.0	5.0	3.0	2.5	0.5	3.5	0.5	–	1.0	–	3.0	Willow 0.5; Maple 1.5; Fir 1.0	9.5	19	9,487	14	7	–	7	–
Sample Average		1.1	19.3	0.9	0.4	1.0	1.2	32.2	10.7	4.6	5.1	1.7	2.8	0.6	0.4	0.3	0.6	1.2	–	13.7	15.6	21,566	–	–	–	–	–
Sample Ubiquity		77.8	100	77.8	44.4	55.6	77.8	100	100	100	100	88.9	100	66.7	77.8	44.4	44.4	66.7	–	–	–	–	–	–	–	–	–

Agg. = Aggregates.

comparable contexts yielded sufficient pollen for standard 200-grain counts, chemical deterioration is not indicated.

Results of Sediment Samples

All sediment samples contained sufficient pollen for 200-grain counts. Pollen concentrations were relatively high and the percentages of degraded grains generally were low, suggesting that the data were an accurate reflection of the original pollen assemblage. Grass-family pollen dominated the assemblage, having the highest frequencies in nearly all samples. Ponderosa pine and cheno-ams were subdominant. Other types with occasionally high percentages were High- and Low-spine Asteraceae, oak, mustard, and the pea family. Pollen signatures reflected aspects of both pine and grassland biomes. The riparian zone was represented by cattail, sedge, and willow pollen grains.

In scans, maize pollen was relatively common, found in four of nine (44 percent) samples. Along with macrobotanical specimens of maize (Akins and Boyer 2015:39), the pollen evidence suggests that the cultigen was routinely brought to the shelter. Low maize pollen concentrations and the lack of maize pollen aggregates suggest that fresh maize was not introduced. It is possible that the domesticate was grown on the nearby floodplain, harvested and processed in the same area, and then the reduced produce was brought to the site for consumption and storage. Traces of cacti pollen likely were incidental. Aggregates were nearly lacking, suggesting that fresh plant resources were rarely introduced to the investigated contexts. The dearth of pollen aggregates precluded a determination of seasonality of use.

Sediment samples were collected from Stratum 3, a deposit recognized as fill within the shelters and extending down the talus slope. While sediments in the shelters represent a combination of cultural fill, overbank sediments, and aeolian material, the talus deposits also include modern fill and pollen rain. In the field, however, no obvious differences between the two deposits were noted. In order to differentiate prehistoric cultural pollen in talus samples from natural and modern pollen, averages were calculated for select pollen types and for summary statistics. The distribution of abundant and common pollen types was comparable between shelter and talus samples, nearly identical between grasses and ponderosa pine, the two most abundant types (Table

Table 14.5. *Comparison of sediment sample averages from site Shelters versus Talus areas.*

Sediment Samples	Shelter (n = 5)	Talus (n = 4)
Concentration (grains per gram)	30,391	10,536
Types per sample	13.6	18.0
Percent		
Ponderosa pine	19.4	19.3
Grass family	32.4	31.9
Cheno-Am	11.5	9.8
Low-spine Asteraceae	4.9	4.3
High-spine Asteraceae	5.7	4.4
Pea family	2.5	3.1
Degraded	16.6	10.1

14.5). The average percentage of degraded grains was higher in shelter samples, though not substantially so. Because of such comparability, no distinct cultural signature was found within the major portion of the talus pollen assemblage. Differences in the assemblage (not shown in Table 14.5) include generally higher percentages of alder and sagebrush pollen in talus samples, possibly reflecting the open environment of the talus and greater inclusion of the natural pollen rain. Maize pollen was more common in talus samples, due to either debris intentionally discarded from the shelters and/or washing downslope following the occupation. It is also possible that some maize grains come from modern farms to the south.

Shelter samples had greater pollen concentrations than on the talus slope, possibly due to differences in the modes of deposition and sedimentary environments. Similarly, the greater numbers of types encountered on the talus slope likely reflect the open setting, allowing a higher proportion of the natural pollen rain to become incorporated into Stratum 3.

Summary and Conclusions

Fifteen samples were analyzed: six were from washes of artifacts and nine were sediment samples from within the shelters and on the talus slope. Only one of the wash samples had sufficient pollen for a 100-grain count. Myriad factors might account for the poor pollen recovery in wash samples, including the wash process, food preparation in the past, and mechanical factors, such as destruction during the grinding process. The single sample viable for analysis did not contain evidence of cultural use.

All sediment samples yielded 200-grain counts. As a whole, the pollen assemblage reflected the surrounding pine and oak forest and grasslands; a riparian zone was represented by cattail, sedge, and willow. No exceptional spikes in percentages of any type were found and pollen aggregates were lacking; economic use of wild resources was not indicated. Traces of maize were found in four of nine samples (44 percent), indicating the inhabitants routinely brought the cultigen to the site. Low maize pollen concentrations and a lack of maize pollen aggregates suggested that fresh produce was not introduced to the shelters. Rather, crops apparently were processed elsewhere and the reduced produce was brought to the site. No other economic plant resources were indicated in the pollen assemblage.

No major differences were found between the North and South Shelter samples, suggesting comparable activities in both locations. Few differences were found between shelter and talus assemblages. Slightly greater percentages of alder and sagebrush pollen, and a greater number of types in talus samples might reflect the open setting and greater incorporation of the natural pollen rain. Differences in pollen concentrations between the shelter and talus samples likely are due to edaphic (depositional) factors.

Pollen, Phytolith, and Starch Analysis of Artifact Washes from Coyote Canyon Rockshelter (LA 139965)

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Introduction

Two shelters and associated talus slopes at the Coyote Canyon Rockshelter (LA 139965), Mora County, NM, contained large quantities of artifacts and in situ archaeological sediments (Akins and Boyer 2015:10). While heavily affected by construction and bioturbation, the North and South Shelters and their talus slopes yielded nine pollen/starch and five phytolith/starch samples for analysis. These analyses aim to provide information regarding plant use at the site, which may indicate occupational season, site function, and provide more information about the identity of the site's inhabitants.

Methods

The use of ground stone tools in processing plants and animals can leave evidence on the artifact surface. Concentrations of pollen, phytoliths, and starches from the artifact surfaces may represent plants that were processed using the tools. Ground stone were washed at the Office of Archaeological Studies, after which the washes were submitted for pollen, phytolith, and starch analysis.

Pollen and Starch

The pollen and starch sample washes were first screened through 250-micron mesh, then centrifuged at 3,000 rpm to concentrate the organic fraction in the bottom of the tube. These pollen-rich organic fractions were rinsed with reverse osmosis de-ionized (RODI) water prior to receiving a short (25 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were acetylated for 10 minutes to remove extraneous organic matter, and then rinsed with RODI water to neutral. Following this a few drops of potassium hydroxide (KOH) and safranin stain were added to each sample. Due to the presence of large quantities of minute organic debris, the samples were centrifuged at high speeds for short intervals to remove this debris for better viewing.

A light microscope was used to count pollen at a magnification of 500X. Pollen preservation in these samples varied from good to poor. An extensive comparative reference housed at PaleoResearch Institute aided pollen identification to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent either pollen dispersal over short distances or the introduction of portions of the plant represented into an archaeological setting. The aggregates were included in the pollen counts as single grains, as is customary. An "A" next to the pollen frequency on the percentage pollen diagram notes the presence of aggregates. The percentage pollen diagram was produced using Tilia 2.0 and TGView 2.0.2. Total pollen concentrations were calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.

"Indeterminate" pollen includes pollen grains that are folded, mutilated, or otherwise distorted beyond recognition. These grains were included in the total pollen count since they are part of the pollen record. The microscopic charcoal frequency registers the relationship between pollen and charcoal. The total number of microscopic charcoal fragments was divided by the pollen sum, resulting in a charcoal frequency that reflects the quantity of microscopic charcoal fragments observed, normalized per 100 pollen grains.

Pollen extraction retains starch granules. Since starch analysis was requested for these samples, not only were starches recorded as part of the pollen count, an additional search for starches was conducted. Starch granules are a plant's mechanism for storing carbohydrates. Starches are found in numerous seeds, as well as in starchy roots and tubers. The primary categories of starches include the following: with or without visible hila, hilum centric or eccentric, hila patterns (dot, cracked, elongated), and shape of starch (angular, ellipse, circular, or lenticular). Some of these starch categories are typical of specific plants, while others are more common and tend to occur in many different types of plants.

Phytolith and Starch

The ground stone washes designated for phytolith and starch analysis were treated with a solution of three percent sodium hypochlorite (bleach) to destroy the organic fraction. After sitting overnight, the samples were rinsed several times to remove the bleach. Several RODI water rinses removed the bleach prior to freeze drying the samples. The dried material was mixed with sodium polytungstate (SPT) at a density of 2.1 g/ml and centrifuged to separate the phytoliths, which will float, from the other silica, which will not. After the phytolith-rich fraction was recovered the samples were rinsed with RODI water, and then alcohol to remove the water. After several alcohol rinses, the sample was mounted in immersion oil for counting with a light microscope at a magnification of 500x. Because starch analysis was requested, the phytolith slides also were scanned in search of starch. The phytolith diagram was produced using Tilia, a computer program developed by Dr. Eric Grimm of the Illinois State Museum for diagraming pollen.

Phytolith Review

Phytoliths are silica bodies produced by plants when soluble silica in the groundwater absorbed by the roots is carried up the plant's vascular system. Evaporation and metabolism of this water result in precipitation of the silica in and around the cellular walls. Opal phytoliths, which are distinct and decay-resistant plant remains, are deposited in the soil as the plant or plant parts die and break down. However, they are subject to mechanical breakage, erosion, and deterioration in high pH soils. Usually, phytoliths are introduced directly into the soils in which the plants decay. Phytolith transportation occurs primarily through animal consumption, human plant gathering, or wind, water, or ice soil erosion or transportation. Phytoliths produced in roots/tubers deteriorate at the level of those roots/tubers and are not represented on the growing surface. Therefore, roots/tubers phytolith recovery from stratigraphic sediments does not necessarily represent vegetation coeval with that represented by phytoliths produced in leaves or other aboveground vegetative parts.

The three major types of grass short-cell phytoliths include festucoid, chloridoid, and panicoid. Smooth elongate phytoliths provide no aid interpreting either paleoenvironmental conditions or the subsistence record, because all grasses, various other monocot plants, and several dicots produce them. Phytoliths tabulated to represent "total phytoliths" include the grass short-cells, bulliform, trichome, elongate, and dicot forms. All other silica and non-silica body recovery frequencies are calculated by dividing the number of each type recovered by the "total phytoliths."

The festucoid class of phytoliths is ascribed primarily to the subfamily Pooideae and occurs most abundantly in cool, moist climates. They grow well in shady areas and during the cooler spring and fall months. They are the first grasses to "green up" in the spring, going dormant in the summer, then growing again in the fall. Brown (1984) notes that festucoid phytoliths are produced in small quantity by nearly all grasses (mostly rondel-type phytoliths, which exhibit an approximately circular shape). Therefore, while these typical phytolith forms are produced by the subfamily Pooideae, they are not exclusive to this subfamily. Trapeziform phytoliths are tabular and may be thin or thick. Their outer margins may be smooth, slightly spiny, or sinuate.

Warm season or summer grasses are divided into the group that thrives in dry conditions (chloridoid) and those that grow best in humid conditions (panicoid) or that grow along sources of water. Chloridoid saddle phytoliths are produced by the subfamily Chloridoideae, a warm-season grass that grows in arid to semi-arid areas and requires less available soil moisture (Gould and Shaw 1983:120). They thrive in hot, dry conditions of summer. Twiss (1987:181) notes that some members of the subfamily Chloridoideae also produce both bilobate (panicoid) and festucoid phytoliths. Also, saddles may be produced in non-chloridoid grasses. Bilobates and polylobates (lobates) are produced mainly by panicoid (tall) grasses, although a few festucoid grasses also produce these forms. Panicoid or tall grasses prefer the warmth of summer and thrive in humid conditions or grow next to water such as creeks, rivers, and lakes. More than 97 percent of the native US grass species (1,026 of 1,053) are divided equally among three subfamilies: Pooideae, Chloridoideae, and Panicoideae (Gould and Shaw 1983:110).

Bulliform phytoliths are produced in grass leaf cells that control leaf rolling in response to drought. These cells often silicify under wet or moist conditions and increase in abundance as the grass leaves age. Trichomes represent silicified hairs, which may occur on the stems, leaves, and the glumes or bran surrounding grass seeds.

Terms applied to phytoliths in this study use the International Code for Phytolith Nomenclature (ICPN) (Madella et al. 2005). Phytolith reference samples prepared and curated at PaleoResearch Institute were consulted when identifying phytoliths recovered in this study.

Other Siliceous Microfossils

Diatoms and/or sponge spicules were noted. Pennate diatoms are cosmopolitan, occurring in many sediments, and indicate at least some soil moisture. Sponge spicules represent fresh water sponges. Diatoms are single-celled algae with a siliceous cell wall. They grow in a wide range of aerophilous habitats, including on wet plants and rocks, in damp soils, marshes, wetlands, mudflats, and various standing and flowing aquatic habitats. Often, their silica cells are preserved in sedimentary deposits. Individual taxa have specific growth requirements and preferences with respect to water chemistry. Thus, the presence (and subsequent identification to the species level) of diatoms in paleoenvironmental contexts can provide information about the nature of the local environment, including water chemistry, hydrologic conditions, and substrate characteristics. These data, coupled with input about local geology, hydrology, soil characteristics, pollen and phytoliths, provide evidence of the paleoenvironmental setting. In these phytolith samples, diatoms are noted, but not identified beyond the split of "pennate" and "centric" forms. Often, centric diatoms indicate wet conditions, while some of the pennate diatoms are cosmopolitan, occurring nearly everywhere. Both diatoms and sponge spicules can be transported with sediment. As an illustration, recovery of sponge spicules in upland soils is noted to accompany loess deposits derived from Illinois floodplains (Jones and Beavers 1963).

Ethnobotanic Review

Archaeological studies reference ethnographically documented plant uses as indicators of possible, or even probable, plant uses in pre-Columbian times. The ethnobotanic literature provides evidence for both broad and specific historic exploitation of numerous plants. Multiple ethnographic sources evidencing a plant's exploitation suggest its widespread historic use and an increased likelihood of the same or a similar plant's use in the past. We consulted a broad scope of ethnographic sources both inside and outside the study area to permit a more exhaustive review of potential plant uses. Ethnographic sources document historic use of some plants enduring from the past. Most likely medicinal plant use persisting into the historic period originated in pre-Columbian times. Unfortunately, due to changes in subsistence practices and European food introduction, a loss of plant knowledge likely occurred. The ethnobotanic literature serves only as a guide for potential uses in pre-Columbian times, not as conclusive proof of those uses. When compared with the material culture (artifacts and features) recovered by the archaeologists, pollen, phytoliths, starch, and macrofloral remains can become use indicators. We provide the following ethnobotanic background to discuss plants identified by pollen, phytoliths, and/or starch analyses.

Native Plants

Amaranthaceae (Amaranth Family)

Recent revision to botanical taxonomy, using gene-based APG (The Angiosperm Phylogeny Group 1998) and APG II (The Angiosperm Phylogeny Group 2003) systems, subsumes Chenopodiaceae under Amaranthaceae and places *Sarcobatus* as the single genus in its own family (Sarcobataceae). Cheno-am is a term derived from pollen analysis, although we have replaced it with Amaranthaceae according to the revised botanical taxonomy. Cheno-am or Amaranthaceae refers to a group that includes the genus *Amaranthus* (amaranth, pigweed) and members of the Chenopodiaceae (goosefoot family) such as *Atriplex* (saltbush), *Chenopodium* (goosefoot), *Monolepis* (povertyweed), and *Suaeda* (seepweed). These plants, which produce large quantities of seeds, are weedy annuals or perennials, often growing in ecologically disturbed habitats such as cultivated fields and the vicinity of habitation sites (Castetter and Bell 1942:61; Curtin 1984:47–71; Kearney and Peebles 1960; Kirk 1975).

Species of *Amaranthus* (amaranth, pigweed) and *Chenopodium* (goosefoot), weedy annuals and/or perennials that grow in disturbed areas, are the source of valuable greens and seeds that provide food. Sometimes eaten raw, the nutritious seeds often were parched, ground into meal, and made into mushes and cakes (Harrington 1967:55–62, 69–71; Kirk 1975:57–65). While *Chenopodium* seeds contain calories roughly equivalent to corn, they provide significantly more protein and fat (Asch 1978:307, cited in Kindscher 1987:82). Leaves, which are most tender during young spring growth, were eaten fresh or cooked, but could be eaten throughout the growing season (Harrington 1967:55–62, 69–71; Kirk 1975:57–65). *Amaranthus* leaves provided iron and vitamin C, while young *Amaranthus* leaves contain significant amounts of protein, calcium, phosphorus, potassium, vitamin A, and vitamin C (Watt and Merrill 1963:6, cited in Kindscher 1987:22). Amaranthaceae plants were gathered from early spring through fall (Harrington 1967:55–62, 69-71; Kirk 1975:57–65). *Amaranthus* poultices were used to reduce swellings and to soothe aching teeth. Leaf tea was used to stop bleeding, as well as to treat dysentery, ulcers, diarrhea, mouth sores, sore throats, and hoarseness. *Chenopodium* leaves are rich in vitamin C and were eaten to treat stomach aches and to prevent scurvy. Leaf poultices were applied to burns, and tea made from the whole plant was used to treat diarrhea (Angier 1978:33–35; Foster and Duke 1990:216; Harris 1972:58; Krochmal and Krochmal 1973:34–35, 66–67; Moore 1990:12).

Atriplex (saltbush) occurs as an annual herb or perennial shrub, exploited for both its greens and seeds. Leaves and young shoots have a salty taste and were cooked alone as greens or used as seasoning. Silverscale saltbush (*A. argentea*) fruits were eaten at Acoma and Laguna (Castetter 1935:18; Whiting 1939:18). *Atriplex* seeds are very nutritious and can be ground into meal, mixed with water and drunk as a beverage, or mixed with some other meal and used as flour. The seeds do not ripen until mid-fall and can remain on the shrubs throughout the winter into the next growing season (Kirk 1975:59). *Atriplex* wood was one of four shrubs prescribed for kiva fuel at Hopi, and its ashes were used by several Puebloan groups in making bread to fix the color in blue cornmeal (Castetter 1935:17–18; Robbins et al. 1916:54; Whiting 1939:73). *Atriplex* leaves, twigs, and blossoms yielded a bright yellow dye (Bryan and Young 1940:32). The dried tops of *A. canescens* were used to make tea used for treating nausea and vomiting caused by the flu. A hot infusion of *Atriplex* was taken to break fevers, while a cold tea was used to treat stomachaches (Moore 1990:29). Native and introduced *Atriplex* species grow widely throughout the western United States in waste places and fields, growing in arid alkaline or saline soils (Kearney and Peebles 1960:225; Muenscher 1980:180).

Apiaceae (Umbel or Parsley Family)

Members of the Apiaceae family are annual or perennial herbaceous plants, commonly with hollow stems. The roots, stems, and/or leaves of several members of this family were used by native groups for food, seasoning, and medicine. Usually when roots of plants in the Apiaceae family are collected, the entire plant is pulled up. Roots are dug in the spring when the plants are flowering and easily recognized. Hence, processing usually introduces pollen into work spaces and the food that is consumed. *Cymopterus* (springparsley) produces an edible root that can be eaten raw or cooked. Hopi children enjoyed the sweet roots of *C. newberryi* (corkwing, wafer parsnip) in the spring. The parsnip-like root of *C. purpurascens* (widewing springparsley, gamote) was much used by Southwestern groups. *Daucus pusillus*, a relative of the cultivated carrot, roots were consumed both raw and cooked by the Navajo. Although best when cooked, young stems of *Heracleum lanatum* (cowparsnip) can be peeled and eaten raw. The cooked roots are noted to taste like rutabaga. *Hydrocotyle* (marsh pennywort) plants were eaten as greens. *Lomatium* (biscuitroot, Indianroot) have large edible roots that were eaten raw, roasted, or ground into flour. The Paiute made an "Indian bread" from peeled, mashed roots that were formed into cakes and allowed to dry. *Osmorhiza* (sweetroot, sweet cicely) roots are anise-flavored and have been used as a seasoning. The tuberous roots of *Perideridia* (yampa, wild caraway) have a nutty flavor. Roots were cooked or dried and ground into a flour. The small seeds were used as a seasoning, and they were parched and ground into a flour. *Sium* (waterparsnip) roots and leaves are both reported to be eaten (Colton 1974:305; French 1971:385–412; Kearney and Peebles 1960:606–620; Kirk 1975:117–125, 270–271; Whiting 1939:86).

A poultice of boiled *Angelica* (angelica) roots was applied to sores and swellings, especially venereal, by Paiute groups. *Berula erecta* (cutleaf waterparsnip) leaves and blossoms were used for food and medicine. Cowparsnip roots have some stimulative and carminative properties, and have been used in treating epilepsy. Paiute groups applied a poultice of the mashed root for rheumatism and a salve for wounds and sores. A root decoction was taken for colds. *Lomatium* root poultice was applied for rheumatism, sores, cuts, swellings, sprains, rashes, and smallpox. A root decoction was used to treat colds, hay fever, bronchitis, influenza, and pneumonia. Sweet cicely (*Osmorhiza*) root decoction was taken by Paiute groups for stomachaches, indigestion, gas pains, colds, influenza, pneumonia, fever, pulmonary disorders, as a physic, as a wash for venereal sores, skin rashes, and head lice, and as an eyewash. A root poultice was applied to cuts, swellings, bruises, and snakebites. The roots also were chewed to treat sore throats. *Sium* (waterparsnip) has been used medicinally as a diuretic, antiscorbutic, and aperitive (Albee et al. 1988:7–22;

Kirk 1975:117–125, 270–271; Moerman 1998:75, 122, 189–190, 261, 270, 313–314, 371–372).

Cyperaceae (Sedge Family)

The Cyperaceae (sedge family) are grasslike or rushlike herbaceous plants commonly found in moist ground and riparian habitats, on open, dry ground, in disturbed areas, and often growing with grasses (Britton and Brown 1970:295–441; Harrington 1967:174; Kirk 1975:176). An edible, sugary juice fills *Carex* (sedge) stems, and the tuberous stem base was eaten (Yanovsky 1936:9).

Cyperus (flatsedge, nutgrass) tubers were eaten raw, boiled, dried and ground into flour, or fire-baked. When roasted to dark brown and ground, the roots produced a coffee-like beverage. The Pima ate small *Cyperus ferax* tubers. *Cyperus esculentus* tubers have been eaten since ancient Egyptian times. Fresh or dried *Cyperus esculentus* tubers were chewed by the Pima to treat coughs (Harrington 1967:174; Kearney and Peebles 1960:98–99, 149–150; Kirk 1975:176; Peterson 1977:230).

Young perennial *Scirpus* syn. *Schoenoplectus* (bulrush) shoots and older base stems and rootstalks were eaten raw or cooked, while pollen or rootstalk flour was added to cakes. Crushed and boiled rootstalks made a sweet syrup. The seeds were eaten whole or parched and ground into flour. In addition, woven baskets and mats incorporated the long stems, and the plant was used as a ceremonial emetic (Duke 1986:141; Harrington 1967:210–213; Kirk 1975:175–176; Moerman 1986:446; Peterson 1977:230).

Scirpus-type (bulrush, tule) plants are mostly perennial herbs with triangular or circular stems. Recent studies by taxonomists have created several new genera including *Amphiscirpus*, *Bolboshoenus*, *Isolepis*, *Shoenoplectus*, and others. At one point, the *Scirpus* genus held almost 300 species, many of which have now been reassigned to new genera, leaving *Scirpus* with an estimated 120 species. In general, bulrushes have cylindrical, bullwhip-like stems, while threesquares have triangular stalks. Young shoots were gathered in the spring and eaten raw or cooked. Old stems were woven into mats and baskets. Pollen was collected and mixed with other meal to make breads, mush, and cakes. Seeds also were parched and ground into flour. The starchy roots are edible and were eaten raw, roasted, or dried and ground into a flour for cooking. Young rootstocks were crushed and boiled to make sweet syrup. Plants also were used ceremonially as an emetic. *Scirpus*-type plants grow in woods, thickets, meadows, pastures, ricefields, ditches, swamps, bogs, marshes, and in other low, wet places (Britton and Brown 1970:326; Duke 1986:141; Kearney and Peebles 1960:151; Kirk 1975:175–176; Martin 1972:31; Moerman 1986:446; Muenscher 1980:151; Peterson 1977:230).

Commelina (Dayflower)

Commelina (dayflower) is an herbaceous, perennial monocot with mostly blue flowers. Several species are introduced and grown as ornamentals. The Navajo list the dayflower as an aphrodisiac to be used by older men, women, or stud animals (Wyman and Bailey 1943:61). Native species of *Commelina* found in New Mexico include *C. erecta* (slender dayflower, whitemouth dayflower) and *C. dianthifolia* (birdbill dayflower). Like many of the *Commelina*, *C. erecta* is considered a weed that thrives under disturbance. It can be found in rocky woods and hillsides, scrub oak woods, pine woods and barrens, sand dunes, hummocks, shale barrens, rock outcrops, roadsides, railroad rights-of-way, fields, and occasionally as a weed in cultivated ground (Bailey and Bailey 1976:300–301; Grimm 1993:39). In some areas *Commelina* seeds are eaten by quail during the winter (Kamees et al. 2008:3, 15).

Ephedra (Mormon tea, Jointfir, Ephedra)

Ephedra (ephedra, jointfir, Mormon tea) is a shrub with jointed stems measuring 2 to 12 inches long. The stems were used to make tea, and the seeds were parched and ground into meal. *Ephedra* tea, a very useful medicine, was consumed as a diuretic, for mild kidney inflammations, weak kidneys, weak lungs, as a decongestant, for head colds and hay fever, and as a mild tonic. Also, the tea was used to treat syphilis and painful urination caused by gonorrhea. The Navajo are reported to have boiled the tops of *E. viridis* (green ephedra) into a beverage used as a cough medicine (Elmore 1976:92). *Ephedra* grows in arid parts of the western United States, including desert scrub, grassland, chaparral, or brush, and piñon/juniper woodland (Kirk 1975:21; Moore 1990:26–27; Shields 1984:64; Sweet 1976:22).

Ephedra pollen is divided into *E. torreyana* and *E. nevadensis* types, named after two common types of Mormon tea in the American Southwest (Martin 1970:51). *Ephedra torreyana*-type includes *E. trifurca* and *E. antisyphilitica*, while *Ephedra nevadensis*-type includes *E. clokeyi*, *E. coryi*, *E. funera*, *E. viridis*, *E. californica*, and *E. aspera*. *Ephedra torreyana*-type is dominant in southern Arizona, New Mexico, northern Mexico, and west Texas. In contrast, *Ephedra nevadensis*-type Mormon tea is dominant in northern Arizona, southern Utah, and southern Colorado. This results in a clear-cut distribution with *Ephedra torreyana*-type pollen abundant along the Mexican border and *Ephedra nevadensis*-type pollen abundant in the Four Corners region, Great Basin, and Mojave Desert. This distribution mirrors the distinction between summer-dominant and winter-dominant precipitation, with *Ephedra nevadensis*-type growing in areas of winter-dominant precipitation and *Ephedra torreyana*-type occupying areas of summer-dominant precipitation (Martin 1970:51). Modern distribution along precipitation lines suggests that prehistoric distribution should be an indicator of summer- or winter-dominant precipitation and that changes in frequencies of these two types of *Ephedra* pollen relative to one another act as indicators of changes in precipitation patterns.

***Eriogonum* (Wild Buckwheat)**

Eriogonum (wild buckwheat) are perennial or annual herbs or shrubs. The stems can be eaten raw or boiled before the plant flowers. The water in which leaves of *Eriogonum corymbosum* (crispleaf buckwheat) were boiled was mixed with corn meal by Hopi people and baked into bread. An infusion of the entire *Eriogonum* plant was used by Hopi women to help stop postpartum bleeding. The Navajo used a cold root infusion to treat diarrhea, as a ceremonial medicine, as a mouthwash for sore gums, and for bad coughs. A lotion was used for rashes, dog and bear bites, and for infants' sore navels. A poultice of chewed leaves was applied to red ant bites, and the dried plant was smoked to cure snake bites. The root of *E. jamesii* (James' buckwheat, antelope sage) was an important medicine. The Navajo people used a root decoction in medicine ceremonies, to ease labor pains, and as a contraceptive. The Zuni also used antelope sage root to cure many illnesses. Powdered wild buckwheat root was applied to cuts and arrow wounds, and a root decoction was taken after childbirth to heal lacerations. *Eriogonum* can be found from the foothills to subalpine on mesas, dry, rocky, hillsides, rocky meadows, and plains (Castetter 1935:29; Kirk 1975:231; Moerman 1986:171–176; Weber 1976:261–263; Weiner 1972:34, 41).

Fabaceae (Pea or Bean Family)

Fabaceae (pea or bean) is a large family of flowering plants and contains trees, shrubs, herbs, water plants, xerophytes, and climbers. All members of this family have a one-chambered fruit, termed a legume fruit, that splits along two sides when mature (Hickey and King 1981:196; Zomlefer 1994:160). Fabaceae form a symbiotic relationship with nitrogen-fixing bacteria that form nodules on the roots and take gaseous (or other) nitrogen from the sediment, making it available to the plants. Nitrogen is released back to the soil when the plants decay. This supply of nitrogen contributes to the relatively high protein values for leaves and seeds of legumes (USDA 1998). Legumes such as alfalfa often are grown as rotation crops to restore nitrogen to poor soils. *Medicago sativa* (alfalfa), a deep-rooted herbaceous plant that commonly grows to a height of two to three feet, is one of the oldest known forage legumes (McGee 1984:228; Phillips Petroleum Company 1963:93, 111).

Plants in the Fabaceae are important to human diet. Legume seeds contain, on average, about twice as much protein as do cereal grains, and are rich in iron and B vitamins (McGee 1984:249). Many wild or native legumes in the greater Southwest are known to have been eaten. Seeds of *Dalea* (prairie clover) and *Astragalus* (milkvetch) were ground and made into bread. *Astragalus* pods were eaten raw or cooked, or dried for winter use. Fleshy *Astragalus* roots were eaten fresh by the Acoma, Laguna, and Hopi. *Astragalus* also was used as a ceremonial emetic (Castetter 1935:17; Cushing 1920:246; Moerman 1998:113–114). Acoma and Laguna people ate the seeds and pods of *Vicia americana* (American vetch) and *Lathyrus polymorphus* syn. *Lathyrus decaphyllus* (manystem peavine, wild pea) (Castetter 1935:32; Moerman 1998:298–299, 596). The entire *Trifolium* (clover) plant is edible and nutritious with a high protein content. The leaves were eaten raw or cooked as greens. Seeds also were used as food. Dried blossoms were used to make tea (Kirk 1975:100–101; Tilford 1997:124). Large clusters of pink *Robinia neomexicana* (New Mexico locust) flowers were eaten by the Jemez. Branches were used to make bows and arrow shafts (Castetter 1935:49; Dunmire and Tierney 1995:66; Moerman 1986:481).

The roots of *Hoffmannseggia glauca* syn. *Hoffmannseggia densiflora* (Indian rushpea) were eaten roasted or boiled like potatoes by Pueblo groups (Kirk 1975:256; Moerman 1998:267). The sweet roots of *Sophora nuttalliana* syn. *Sophora sericea* (silky sophora) were chewed by the Acoma and Laguna (Moerman 1998:538). The roots of *Dalea lanata* syn. *Dalea terminalis* (woolly prairie clover) are very sweet and were eaten raw by the Hopi, while roots of *Dalea lasiathera* (purple prairie clover) were eaten by the Zuni, especially by children (Kirk 1975:256; Moerman 1998:192–193). *Glycyrrhiza lepidota* (wild licorice) roots contain somewhat sweet-tasting glycyrrhizin. They were chewed raw or added to other foods as a flavoring. *Glycyrrhiza* sticks were given to teething infants to chew and suck on. Glycyrrhizin has properties that make it useful against allergies, convulsions, bacterial infections, and muscle spasms. Wild licorice root was used to treat inflammatory conditions of the stomach, mild constipation, and dry coughs. It was eaten before meals to control indigestion and to stimulate the appetite (Kane 2006:207–208; Kearney and Peebles 1960:471; Kirk 1975:101; Moore 1990:15–16; Tilford 1997:90). Powdered root of *Calliandra humilis* (dwarf stickpea) was used by the Zuni to treat rashes (Moerman 1998:131).

Poaceae (Grass Family)

A large, widely distributed family, Poaceae (grass family) thrive in many different climates and biomes. The family includes many diverse, economically important species. Grasses on the landscape provide fodder for game animals. Grass caryopses (seeds) have been used extensively for food and some have been cultivated and/or domesticated. Native grasses in this area including *Achnatherum* (ricegrass), *Agropyron* (wheatgrass), *Agrostis* (bentgrass), *Bromus* (brome grass), *Elymus* (ryegrass), *Festuca* (fescue), *Hordeum* (wild barley), *Muhlenbergia* (muhly grass), *Poa* (bluegrass), and *Sporobolus* (dropseed) were collected and processed as food. Often, parched grass grains were ground into meal to make mushes and cakes. When present, grass awns (hairs) were singed off by exposing the seeds to flame. Depending on species, grass seeds ripen from spring to fall, providing a long-term available food source. In addition, roots, edible raw, roasted, or dried, were ground into flour. Grass leaves and stems provided raw materials for building, weaving, and making cordage. For example, bedding, baskets, mats, twine, thatch, clothing, and sandals all were made from grasses. Grass functioned as a floor covering, tinder, and to make brushes and brooms (Chamberlin 1964 [1911]:372; Cushing 1920:219, 253–254; Fowler 1986:76–77; Harrington 1967:322; James 1901:72–85; Kindscher 1987:228–237; Kirk 1975:177–190; Liljeblad and Fowler 1986:416–417; Rogers 1980:32–40).

Thalictrum (Meadow-rue)

Thalictrum (meadow-rue) is a delicately flowered perennial herb that grows throughout the United States. Navajo used the plant in a ceremonial medicinal decoction, as a black dye, and a ceremonial tea for drinking and bathing (Moerman 1998:554–555). Historically, a preparation of the root was used experimentally by physicians to treat piles. Meadow-rue is easily cultivated and grows best in well-drained, loamy soil (Bailey and Bailey 1976:1104; Foster and Duke 1990:48).

Typha (Cattail)

Typha (cattail) are perennial marsh or semi-aquatic plants with creeping rhizomes that grow in or near wetlands, ponds, and sloughs, and on the edges of rivers and streams (Britton and Brown 1970:68–69; Kirk 1975:171). The Hopi transplanted cattails to washes near habitations areas (Adams 2004:190), a practice that others also might have adopted. This plant is a rich source of nutrients. Native Americans used various parts of the cattail plant throughout the year for food, medicine, utilitarian items, and ceremonial purposes.

In early spring, stem bases were eaten raw or cooked with other foods by the Apache (Castetter and Opler 1936:47). During the summer, young flower stalks were taken out of their sheaths and cooked. Flower stalks were eaten alone or were added as a flavoring or thickening for other foods. Pollen-producing flowers and pollen itself were collected and used as flour, either alone or mixed with other meal (Tilford 1997:28–29). In the fall, the root stalks were collected, the outer peel was removed, and the white inner cores of almost pure starch were eaten raw, cooked with meat, or baked, or were dried and ground into flour. Cattail roots are richer in starch during the fall than at other times of the year. Cattail starch flour is similar in quantities of fats, proteins, and carbohydrates to flour from rice and corn (Harrington 1967:223; Sweet 1962:5). The seed-like fruits also were collected and eaten in the fall. Native Americans processed these "seeds" by burning off the bristles, after which the seeds were parched and could be more easily rubbed off the spike. The slightly astringent flower heads were used medicinally to relieve diarrhea and other digestive disorders (Moerman 1998:573–576; Tilford 1997:29).

Cattail down was used as dressing for wounds, on infants to prevent chafing, and as padding in cradleboards. The leaves and stems were used for weaving mats, baskets, and thatching, and to adorn costumes. Apaches used the leaves for lodge floor coverings (Moerman 1998:573–576).

Also, cattail pollen was used in ceremonies by several Apache groups. During the Apache Sunrise Dance girls are sprayed with cattail pollen as part of the ceremony (Lamphere 1983:Figure 4; Rea 1997:109).

Discussion

Excavations at the Coyote Canyon Rockshelter (LA 139965), Mora County, New Mexico, identified in situ archaeological sediments, disturbed by bioturbation. Located on the west side of Coyote Creek, the shelters are situated within a ponderosa pine (*Pinus ponderosa*) and Gambel's oak (*Quercus gambelii*) woodland. In deforested areas grasses were abundant (Akins and Boyer 2015:10). Two rockshelters, North Shelter (smaller) and South Shelter, each exhibited an associated talus slope, North Talus and South Talus. Nine pollen/starch and five phytolith/starch samples were submitted for analysis from the North and South Shelters and associated talus slopes.

South Shelter and South Talus

Excavations in South Shelter revealed rodent burrowing and some bioturbation. Artifact concentrations included ceramics, bone, chipped stone, ground stone, and historic artifacts, as well as several projectile points and awls (Akins and Boyer 2015:18–19). South Shelter displayed the highest artifact counts, including ceramics, bone, chipped stone, ground stone, and historic artifacts (Chapter 8). South Shelter and accompanying talus are represented by a single smooth abrader, basin metate, slab metate, and two one-hand manos examined for pollen and starch analysis. In addition, a mano fragment and flaked abrader were examined for phytoliths and starch (Table 14.6).

A one-hand mano (FS 86, represented by sample 2), recovered from the surface in the South Shelter, yielded moderate quantities of *Juniperus* and Cyperaceae pollen, representing juniper and sedges and small quantities of *Picea,* and *Ulmus* pollen, representing spruce and elm. This signature differs from that of other ground stone examined from the site, suggesting that quantities of juniper visible on the landscape today were not typical during the period of occupation represented by the subsurface ground stone. In addition, wind transport of *Picea* pollen today is different from that of the past. Elm trees appear to be a recent addition to the vegetation community. Recovery of a moderate quantity of Poaceae pollen accompanied by aggregates including a single large grass pollen attributed to *Agropyron* (wheatgrass) and the large quantity of Cyperaceae polllen suggests grinding grass and sedge seeds into flour. No starches were observed, nor were fern spores evident in this sample. Total pollen concentration was larger than that observed in other samples, as might be expected in a tool recovered from the modern surface.

Pollen analysis of a smooth abrader (FS 623, represented by sample 8), a basin-shaped metate (FS 670, represented by sample 9), and a slab metate (FS 506, represented by sample 7) from the shelter provides a basic environmental signature. Moderate quantities of *Pinus* and *Artemisia* pollen reflect pine and sagebrush growing locally (Fig. 14.1, Table 14.1). High-spine Asteraceae pollen, representing plants in the sunflower family such as rabbitbrush, was present in small to moderate quantities. Small quantities of Amaranthaceae pollen likely reflect local saltbush. Small quantities of *Alnus*, *Juniperus*, and *Quercus* pollen noted in sample 8, indicate local growth of alder, along the creek, and juniper and oak in the uplands. The presence of a small quantity of *Abies* pollen is the result of long distance wind transport of pollen from fir trees growing at higher elevation. *Ephedra* pollen reflects local ephedra or Mormon tea. The elevated quantity of *Ephedra torreyana*-type pollen observed on the basin metate might reflect grinding ephedra in preparation for medicinal use. Small quantities of Low-spine Asteraceae, *Cirsium*, *Eriogonum*, Fabaceae, and *Trifolium* pollen reflect local growth of marshelder or a re-

Table 14.6. Pollen samples summary, by site area and provenience.

Sample No.	FS No.	Grid Unit	Stratum	Level	Elevation (m)	Description	Analysis
South Shelter							
2	FS 86	250.02N/143.67E	–	Surface	12.75	One-hand mano	Pollen and starch
8	FS 623	241N/144E	3	2–3	12.36-12.26	Smooth abrader	Pollen and starch
9	FS 670	241.80N/144.65E	3	3	11.8	Basin metate	Pollen and starch
7	FS 506	243.90N/145.10E	3	13	11.66	Slab metate	Pollen and starch
10	FS 575	242.75N/144.85E	–	Surface	12.66	Mano fragment	Phytolith and starch
12	FS 713	241N/144	3	11	11.92-11.87	Flaked abrader	Phytolith and starch
South Talus							
1	FS 65	244N/145E	3	4	11.83–11.74	One-hand mano	Pollen and starch
North Shelter							
13	FS 747	272.78N/141.24E	3	8	11.58	One-hand mano	Phytolith and starch
11	FS 587	273N/141E	3	8	11.50-11.48	One-hand mano	Phytolith and starch
North Talus							
4	FS 416	270N/142E	3	3	10.82-10.77	Metate fragment	Pollen and starch
5	FS 417	273.7N/142.40E	3	2	11.4	Basin metate	Pollen and starch
6	FS 392	274.80N/142.80E	–	Surface	11.72	One-hand mano	Pollen and starch
14	FS 773	267.15N/141.80E	8	1	11.83	Flaked abrader	Phytolith and starch
3	FS 251	271N/143E	3	3	10.97-10.79	One-hand mano	Pollen and starch

lated plant, thistle, wild buckwheat, legumes, and clover. Recovery of Brassicaceae pollen from the slab metate suggests grinding seeds of a member of the mustard family. Poaceae pollen was noted in moderate to large quantities, accompanied by aggregates in the smooth abrader and basin metate samples. It is likely that grass seeds were ground using all three of these implements. Lenticular starch, typically produced by cool season grass seeds such as wheatgrass, ryegrass, and barley grass, was observed in the basin metate wash, documenting grinding grass seeds. Indeterminate pollen was elevated in the smooth abrader sample, indicating the presence of damaged pollen. Only a small quantity of microscopic charcoal was noted in that sample. The basin and slab metate washes exhibited larger quantities of microscopic charcoal, which might derive from grinding parched seeds.

A few monolete smooth spores indicate local growth of ferns, probably in a shady, protected area around the shelter. Recovery of probable muscle fibers suggests grinding meat with this abrader. Total pollen concentration was low in each of these washes, calculated at between 12 and 53 pollen per sq cm of washed ground surface. A few *Selaginella* moss spores were recovered, likely representing club moss growing on rocks in the vicinity.

The phytolith record from a mano fragment (FS 575, represented by sample 10) and a flaked abrader (FS 713, represented by sample 12) recovered from South Shelter was dominated by elongate smooth forms typical of grasses (Fig. 14.2). Grass short cells are diagnostic for distinguishing between cool season and warm season (short and tall) grasses. Cool season or Festucoid grasses are indicated by several forms. Elongate dendritic forms, noted only in sample 12, originate in the bract material (lemmas, paleas and glumes) that surrounds the seed (caryopsis) of some wild and domesticated grasses. They are very common in the bract material of Pooideae (Festucoid) grasses native to North America (and also common in domesticated Old World cereals, which is irrelevant here). The presence of these dendriforms, particularly when they occur as sheet elements, has the potential to suggest that grass seeds were ground when recovered from ground stone washes. This is because the dendriform-bearing plant material that encapsulates the grass seed is never entirely removed from all of the grains during the parching and winnowing steps. Whether noted as sheet elements or individually, these dendriforms can then be left on grinding equipment, cooked, digested, and incorporated into the archaeological record. Disarticulated dendriforms cannot be reliably ascribed to a particular grass (i.e., *Hordeum pusillum*),

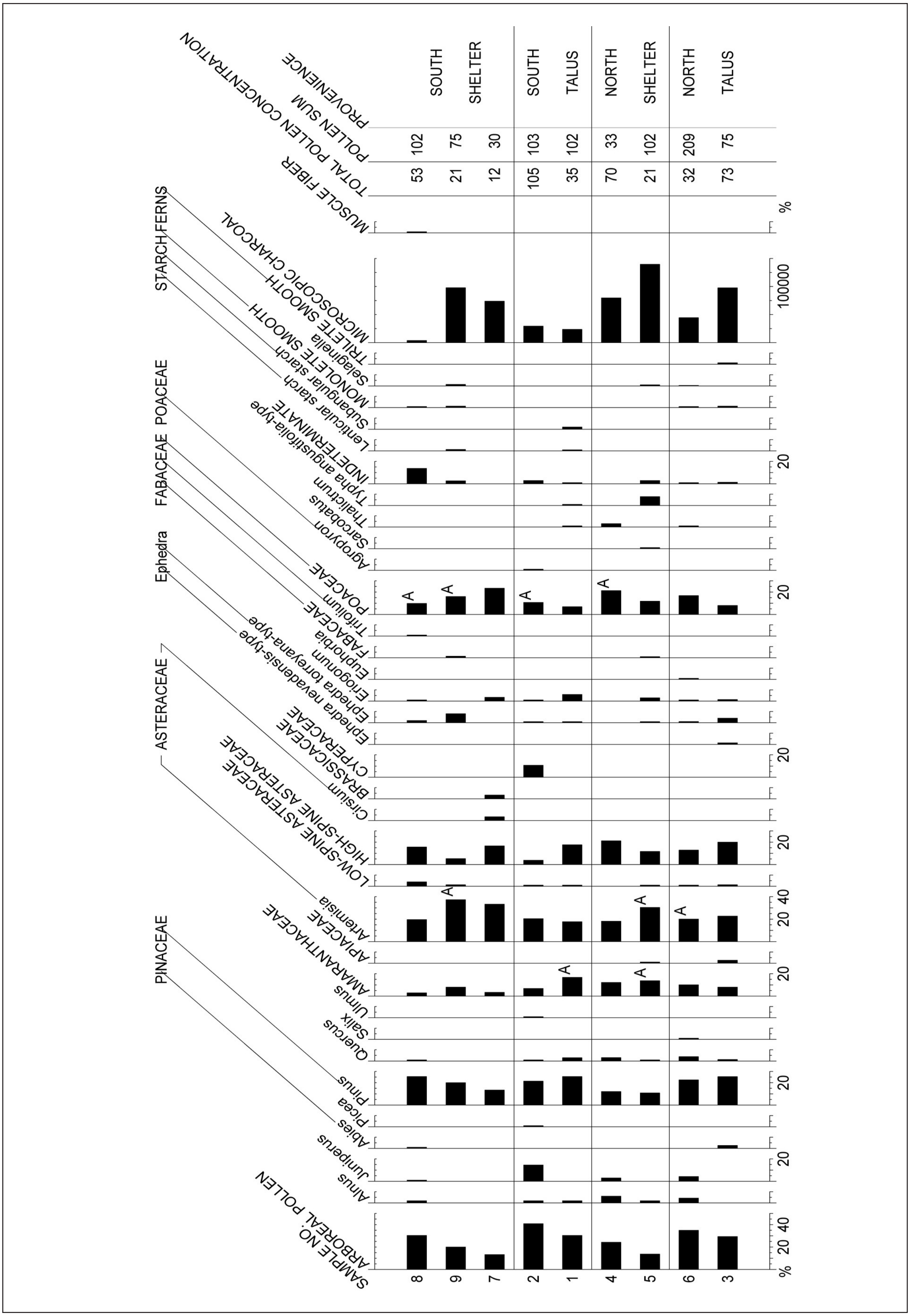


Figure 14.1. LA 139965, pollen diagram.

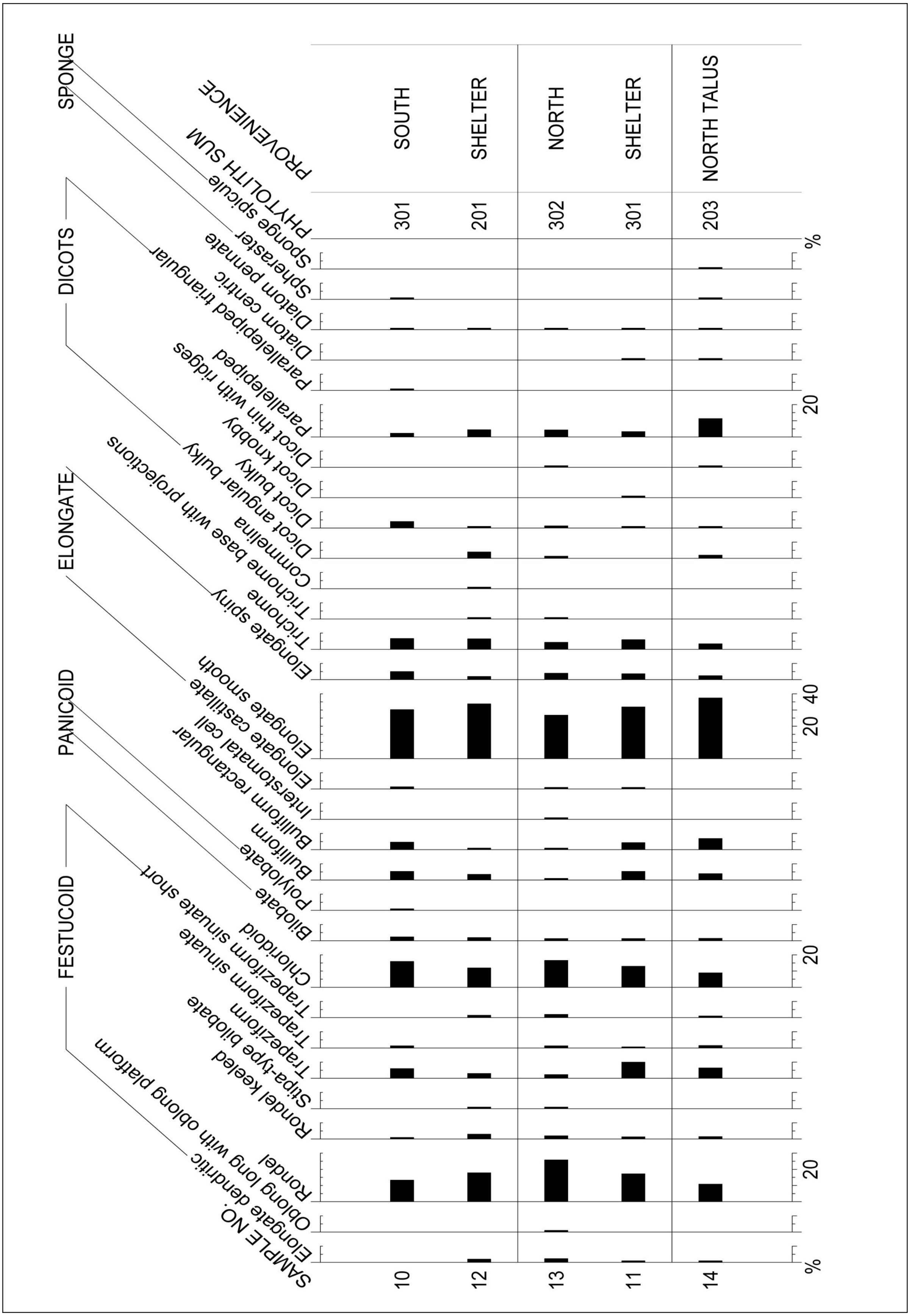


Figure 14.1. LA 139965, phytolith diagram.

however, and are instead broadly representative of local growth of, and occasionally processing of, wild grasses. When observed in small quantities, individual dendriforms recovered in this context are deemed to likely represent part of the local environmental signal because we find an average of three dendriforms per 200 "grain" count (more than 1.5 percent) of phytoliths in many sediments. A signature of grass processing should rise above this frequency. Sample 12 exhibits 2 percent elongate dendritic forms, suggesting grass-seed grinding.

Rondels were moderately abundant, representing cool season (Festucoid) grasses. *Stipa*-type bilobates represent the presence of needle grasses. Trapeziform phytoliths of various shapes are typical of many festucoid or cool season grasses. Chloridoid saddles are moderately abundant, indicating warm-season short grasses on the landscape. Bilobates and polylobates, representing warm-season tall grasses that prefer moist habitats are rare. Other phytoliths observed include bulliforms, representing cells that control leaf-rolling in grasses in response to drought. Elongate forms broken down into castillate, smooth, and spiny categories are general forms found in grasses. Unfortunately, they have no ability to inform concerning which group of grasses are represented. Trichomes and trichome bases, representing hairs on grasses and possibly sedges were observed in moderate frequencies. A single *Commelina* seed phytolith was noted in sample 12, representing a flaked abrader recovered from South Shelter. This is the only phytolith of this type recorded in this study. Dicots are represented by forms that are not sufficiently specific to identify the plants to the family level. Pennate diatoms were observed in both samples, while sponge spherasters were noted only in sample 10. The phytolith records from the mano fragment and flaked abrader appear to be largely environmental. No specific economic signature was observed, and no starches were recovered either while counting or scanning the samples.

The pollen record from a one-hand mano recovered from South Talus was similar to the records from South Shelter. Sample 1 yielded an elevated Amaranthaceae pollen frequency accompanied by aggregates, elevated High-spine Asteraceae and *Eriogonum* frequencies, and small quantities of *Thalictrum* and *Typha angustifolia*-type pollen. This signature suggests grinding goosefoot or related seeds and possibly seeds from a member of the sunflower family, wild buckwheat, and cattail. Recovery of *Thalictrum* pollen likely derives from plants growing in the same wetlands as the cattails. Fabaceae and Brassicaceae pollen, representing legumes and plants in the mustard family, were observed in South Shelter samples, but not South Talus samples. Lenticular and sub-angular grass seed-type starch were observed in sample 1, suggesting grinding two types of grass seeds. No fern spores were noted in this sample.

North Shelter and North Talus

North Shelter, estimated to be approximately 8 sq m and containing a mass of branches and large rocks in the center of the opening, was excavated completely. Rodent burrows were common and no features were observed. Large numbers of ceramics, bone, chipped stone, ground stone, and historic artifacts were recorded (Chapter 8, this report). Two manos recovered from the shelter were studied for phytoliths and starch.

The associated North Talus yielded ceramics, bone, chipped stone, ground stone, and historic artifacts, some of which were relocated by construction activities (Chapter 8, this report). Two metates and two one-hand manos were washed, and the resulting samples were submitted to the PaleoResearch Institute for pollen/starch analysis. A flaked abrader was washed, and that wash sample was submitted for phytolith/starch analysis.

The pollen record from the two metate washes (samples 4 and 5) from North Talus yielded moderate quantities of *Artemisia*, High-spine Asteraceae, and Poaceae pollen representing sagebrush, plants in the sunflower family such as rabbitbrush and snakeweed, and grasses. The elevated frequency of Poaceae pollen, accompanied by aggregates, observed in sample 4 suggests grinding grass seeds with this tool. Moderate quantities of Amaranthaceae pollen were noted in both samples and aggregates were observed in sample 5, suggesting grinding goosefoot or related seeds. Small quantities of *Alnus*, *Juniperus*, *Pinus*, and *Quercus* pollen indicate growth of alder in the drainage and juniper, pine, and oak on the surrounding slopes. Recovery of a small quantity of *Thalictrum* pollen from sample 4 indicates local growth of meadow-rue. Sample 5 yielded small quantities of Apiaceae, Low-spine Asteraceae, *Ephedra torreyana*-type, *Eriogonum*, Fabaceae, and *Sarcobatus* pollen, reflecting a member of the umbel family, marshelder or a similar plant in the sunflower family, ephedra or Mormon tea, wild buckwheat, a legume, and greasewood. An elevated *Typha angustifolia*-type pollen frequency suggests processing cattail with this metate. Both samples yielded large quantities of microscopic charcoal suggesting that the food ground had been parched or that the metates had been exposed to fire. The pollen observed did not appear to have been burned and the records were sufficiently diverse to suggest that they represent the period of use. No starches were observed either in the count or scan. *Selaginella* spores indicate local growth of club moss on rocky or in rocky areas. The pollen records from these two metates indicates that occupants of North Shelter processed resources from the uplands and the riparian zone in the drainage bottom.

Two one-hand manos from the North Talus were washed (samples 3 and 6) to recover pollen and starch. The pollen records from these tools was similar to that of the one-hand manos from the South Shelter and associated talus (samples 2 and 1, respectively). Differences included recovery of a small quantity of *Abies* pollen from sample 3, representing long distance wind transport from fir trees living at higher elevation. Sample 6 is the only one in this project to exhibit *Salix* pollen, indicating local growth of willow in a riparian habitat. The Amaranthaceae pollen frequencies were moderately small and no aggregates were recorded. Like sample 5 from the North Talus, sample 3 yielded a small quantity of Apiaceae pollen. This recovery, in a quantity slightly larger than that for sample 5, suggests the possibility that a plant from the umbel family was processed in or near the North Talus using the basin metate and one of the one-hand manos. Sample 3 is the only one to exhibit both *Ephedra nevadensis*-type and *Ephedra torreyana*-type pollen. Quantities are consistent with wind transport from local vegetation, although processing cannot be ruled out. The quantity of Poaceae pollen is larger in sample 6 than sample 3 suggesting grinding grass seeds by at least one of these one-hand manos. *Thalictrum* pollen was noted in sample 6, indicating meadow-rue growing in the wetland. Small quantities of fern spores were observed in both samples, recording local growth of ferns in one of the shady habitats nearby.

The phytolith record from two one-hand manos recovered from North Shelter was dominated by elongate smooth forms, generally indicative of grasses. Grass short cells represent both cool season (Festucoid) and warm season short (Chloridoid) and tall (Panicoid) grasses indicating a diverse local grass community. Diversity in the Festucoid grass short cells suggests local growth of cool season grasses. Recovery of a few *Stipa*-type bilobates in sample 13 indicates that needle grass was part of the local grass population. Elongate dendritic forms, typically produced by glumes surrounding cool season grasses, were noted as 2.3 percent of the record, suggesting grass seed grinding using the mano represented by sample 13. Other phytoliths (bulliform, interstomatal cells, elongate castillate, elongate smooth, elongate spiny, trichome, and trichome base with projections) do not inform concerning the type or group of grass represented. Dicots are represented primarily by parallelepiped and bulky forms, none of which are diagnostic at the family level. A few diatoms were noted in each of the samples, which are attributed to the environmental signature.

Sample 14, representing a flaked abrader from the North Talus, yielded a phytolith record similar to that from the two one-hand manos. Once again, elongate smooth forms, representing grasses in general, dominated the record. Grass short cells represent both cool season (Festucoid) and warm season (Chloridoid and Panicoid) grasses. Again, bulliform, elongate smooth, elongate spiny, and trichome are general forms that do not contribute to an interpretation of the types of grasses represented. Dicots also are represented by undiagnostic forms (dicot angular bulky, dicot bulky, dicot thin with ridges, and parallelepiped). A few diatoms were recovered that appear to be part of the environmental signature. As with other phytolith records from Coyote Canyon Rockshelter, this one appears to derive primarily from the sediments, representing the environment.

Summary and Conclusions

Pollen, phytolith, and starch analyses on artifacts from the Coyote Canyon Rockshelter (LA 139965) sought to inform concerning plant use at the site, contributing to discussions regarding site use, both season and function, as well as general activities at the site that may help indicate the identity of the inhabitants. Results from these analyses indicate exploitation of native resources from both the uplands and riparian vegetation communities. Seed processing and grinding included at least small seeds from plants such as goosefoot and/or amaranth. At least two types of grass seeds also were ground. Mustard family and sedge family seeds also likely were ground in or near South Shelter. Quantities of *Ephedra* pollen vary, suggesting the possibility that ephedra was ground, likely for its medicinal properties. *Erigonum* pollen was a regular part of the record indicating local growth in sufficient abundance that it might have been collected and the seeds ground into flour. Recovery of *Thalictrum* pollen, representing meadow-rue, from tools recovered from the North Talus and South Talus was surprising. This pollen does not travel on the wind, so its presence here represents either collection and processing of meadow-rue or perhaps transport of meadow-rue pollen when other wetland or riparian resources, such as cattails, were collected. Cattails appear to have been processed using a basin metate (FS 417 represented by sample 5) at North Talus.

Pollen records provided more specific information concerning plant processing than did phytolith signatures. Starch, indicating both seeds from cool season grass such as wheatgrass, and grass in general, were observed in washes of the basin metate (FS 670 represented by sample 9) and one of the one-hand manos (FS 65 represented by sample 1) examined from South Shelter and its associated talus. Evidence of grinding grass seeds was obtained from pollen, phytoliths, and starches recovered from most of the pollen samples (8, 9, 7, 2, 4, and 6 and possibly also 5), two of the phytolith samples (12 and 13), and starches noted in pollen samples 9 and 1. The combined pollen and starch records implicate eight of the nine tools examined for grinding grass seeds, while the phytolith record implicates two of the five tools examined for grinding grass seeds.

No signatures exclusive to one season were obtained from these tools. In general, pollen and phytolith records represent accumulation of signatures over much of the life of the tool and at least the life after the last resurfacing if the grinding surface was pecked sufficiently to remove earlier signatures. Tree pollen represents spring and includes pollen from wetland trees such as alder and willow. Upland woodland trees, including juniper, pine, and oak also are represented. Elm pollen is restricted to the mano recovered from the surface and is interpreted as a recent addition to a local vegetation community. Trees growing at higher elevations reflected by at least a few pollen include fir and spruce. Sagebrush and rabbitbrush pollinate during the late summer and fall. Their pollen is usually well represented in signatures from much of the western United States, as they are in this record. Grasses and many other plants represented in these records pollinate throughout the summer. Therefore, the pollen record reflects the entire growing season of spring through autumn. The phytolith record of cool season grasses, which grow during the cooler months of the spring and fall, and warm grasses, which grow only during the hot summer, is a mixture of plants from the entire growing season. In fact, both the pollen and phytolith records are very similar to that expected from sediments, a normal phenomenon. Not only do ground stone accumulate pollen and phytoliths during their use life, they also may be the recipients of phytoliths from the surrounding sediments after they are discarded. When broken pollen is observed it is interpreted to be a clear indication that those pollen were present during the use life of the tool, as they were likely broken by grinding.

15 Euroamerican Artifact Analysis

Susan M. Moga

Euroamerican artifacts (n = 111) were recovered from four excavation areas at LA 139965. (Table 15.1). The site was probably a seasonal hunting campsite for Native Americans, Hispanic sheepherders, and Anglo hunters. A variety of Euroamerican artifacts were collected, including fragments of cans, bottles, and ammunition. Modern bottle glass—predominantly brown and clear beer-bottle glass—and other modern beverage containers, cans, nails, and pieces of recent vehicles were generally not collected.

The Office of Archaeological Studies' *Historic Artifact Analysis Standardized Variable and Attribute Codes* (Boyer et al. 1994) were applied during analysis. It defines and determines a detailed, descriptive set of attributes that are recorded for each artifact, including: category, type, function, fragment, material type, aging, dates, manufacturing techniques, brand names, color, type of finish, ceramic paste and wares, and decorative motifs. The data recovered from the artifacts was entered into an electronic database (SPSS).

Analytical Results

The 111 Euroamerican artifacts recovered from the site came from eight functional categories. The artifacts are discussed by functional categories to reveal the artifact type, their frequencies, and their use and discard patterns.

Unassignable Items. Artifacts that could not be assigned to a category because they lack specific attributes were classified as unassignable (n = 60). Most of the artifacts in this category are glass bottle fragments (n = 26) that could be assigned to several categories, including food, indulgences, chemicals, cleaning products, toiletries, or other personal hygiene products. Cans (n = 24) have the second-highest frequency of unassignable items. With only body fragments and occasional tops or bottoms, the cans could have contained food, hardware oils, turpentine, gasoline, lubricants, furniture waxes, caulking materials, or vehicle fluids. These are just a few examples of how cans and bottles could be

Table 15.1. Euroamerican artifacts, counts by site area.

Artifact Types	North Shelter	North Talus	South Shelter	South Talus	Total
Unassignable	1	3	37	19	**60**
Food	2	5	15	2	**24**
Indulgences	–	3	–	2	**5**
Domestic	1	1	–	–	**2**
Construction/ Maintenance	–	–	11	1	**12**
Personal Effects	2	–	–	1	**3**
Transportation	–	–	1	1	**2**
Military/Arms	1	1	–	1	**3**
Total	**7**	**13**	**64**	**27**	**111**

categorized if more attributes were present to distinguish them. Other unassignable items in the assemblage were unknown fragments (n = 3), metal scraps (n = 3), flat glass (n = 2), and unknown vessel fragments (n = 2).

Food. Food items (n = 24) consist mostly of fruit or vegetable cans (n = 14), with lesser amounts of sardine cans (n = 4) (Fig. 15.1), sauce cans (n = 2), and unknown bottled goods (n = 4). One of the unknown bottled goods is probably a piece of a small stoneware crock for jam or marmalade (Fig. 15.2). This small body fragment was wheel-thrown and had a black alphabetic transfer print; only the characters "orld's" could be deciphered. A specific brand name could not be associated with the fragment.

These more recently dated items were probably tossed into the shelter from the nearby highway, since they were recovered from the surface and from Levels 1–3. The food cans were all machine-made sanitary cans that dated post-1904. They were highly fragmented, heavily rusted, and were opened with a knife (Fig. 15.1).

Sardine cans are frequently found at historic sites. Sardines are a nutritious, protein-packed food item that travels well and have a reasonably long shelf life. Sardines were initially packed in Nantes, France, in 1834 and found a market in the United States by 1860. The key strip, which tore open the top panel of the can, was invented in 1866. After many re-inventions, double-seamed sardine cans were successfully machine produced by 1918 (Jarvis 1950:184; Rock 1981:8).

In 1875, Julius Wolff started the first American sardine cannery in Eastport, Maine. Soon afterward—between 1875 and 1880—19 more sardine canneries opened in Eastport. During the two World Wars, the demand for sardines created a "boom" in the industry. But by 1941, mechanical refrigeration revolutionized the fish industry. The ability to store fresh and frozen fish brought a rapid decline to the canned sardine industry (Jarvis 1950:184, McDermott 2011:209). After a 135-year history, the shrinking demand for sardines and the competition of lower labor costs in China and Thailand, the last sardine factory in America closed. Stinson Seafood was a 100-year-old cannery in Prospect Harbor, Maine. It was owned by Bumble Bee Foods, who printed the last sardine cans with "Made in the United States" in April 2010 (*Stinson Seafood, the Last Sardine Cannery in the U.S. Is Closing;* www.VillageVoice.com, accessed February 2015).

Indulgences. Indulgences (n = 5) are a luxury items consumed for pleasure and recreation and are not a necessity for human existence. It was surprising that so few indulgences were found, especially with the site location directly off the highway with an overhang. But shattered beer, wine, or liquor bottles were probably categorized as "unassignable" instead, since specific attributes were absent, and pieces of recent bottle glass were generally not collected.

Figure 15.1. Knife-opened fruit or vegetable (FS 115) and sardine cans (FS 117).

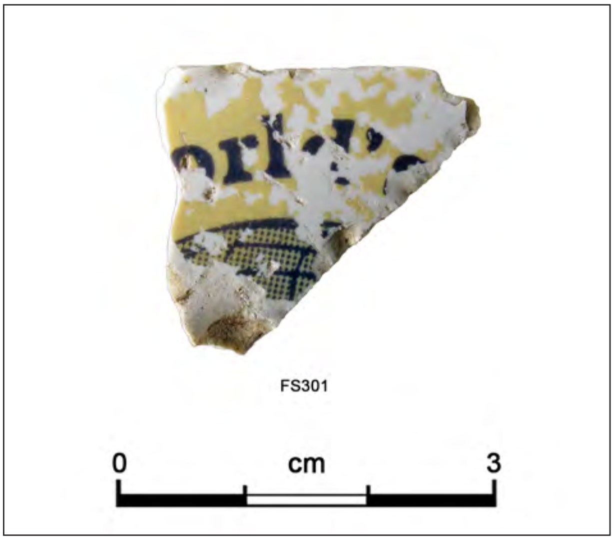


Figure 15.2. Stoneware crock for jam or marmalade (FS 301).

The few metal crown caps (n = 2) with plastic liners date from 1956 to the present day. These caps were used on both soda and beer bottles. The original crown caps were also metal, but had a cork lining and dated from 1892.

One amber glass-bottle fragment could be identified as a beer bottle crown finish. Another amber bottle finish could not be classified as beer or liquor, because it was shattered and recorded as an unknown indulgence. Both bottles were dated post-1880, based on the glass color. If side seams were present on the finish, they would date post-1904, when bottle manufacture became automated.

The base and body of a clear glass liquor flask was collected. The lower portion of the external body was embossed with "one pint" and the base was embossed with an "A" in a circle, representing the American Glass Works, Virginia, who manufactured beer and liquor bottles between 1908 and 1935 (Toulouse 1971:22–23).

Domestic. Domestic items (n = 2) include a piece of a molded clear-glass decorative object with geometric lines. The fragment is too small to further identify. A sewing item, an intact metal safety pin (Fig. 15.3) was also collected. Safety pins were invented in 1849 by Walter Hunt. Sitting at his desk, twisting a piece of wire and contemplating on how to pay back a $15.00 debt, the safety pin came into existence. The man to whom Walter owed the money gave him $400.00 for the rights to the safety pin. Walter paid his debt and the rest is history (Safety pin, http://www.sjmv.org/Campus/Class/scinventors/safetypin/SafetyPin.html, accessed February 4, 2014).

Construction and Maintenance. Most of the Construction and Maintenance (n = 12) artifacts are small hardware objects. The function of some of these items is not known. They include: fragments of rusted, flat sheet metal (n = 4); a metal strap or band (n = 2); and a flat, corroded copper disc (n = 1). One of the metal straps was originally thought to be a metal projectile point. After re-examination by several archaeologists, it was determined to be a metal strap, cut and punched and used as a fastener (Fig. 15.4).

Other hardware items are a common square nail, a fence staple, small sections of wire (n = 2), and a wire weight with a rock attached to the wire. Baling and barbed wire were the most commonly used wire. The first barbed wire in the United States was patented in 1867; 600 other wire types were available by 1897. It was important for Americans during the westward movement to fence in their

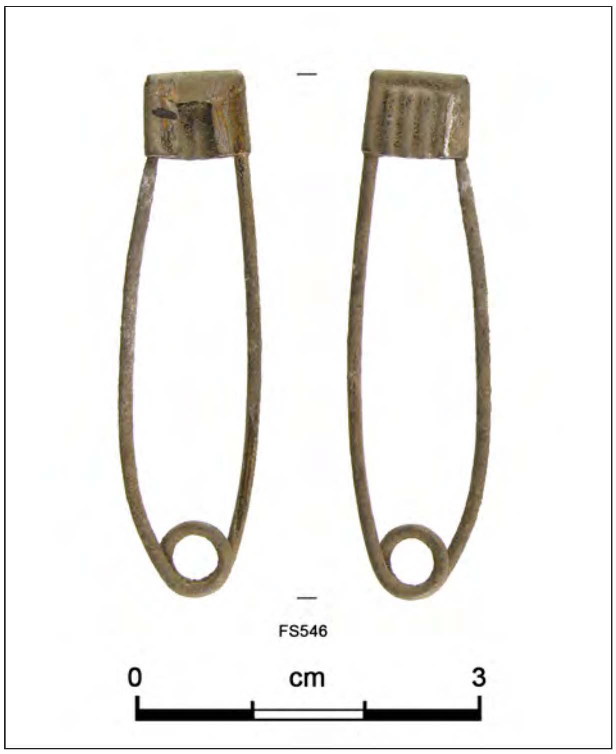


Figure 15.3. Safety pin (FS 546).

Figure 15.4. Metal strap fastener (FS 120).

land and the defensive barbed point was preferred to other types of fencing (Munsey 1970:292).

Personal Effects. Personal Effects (n = 3) are items owned by individuals who lived, worked at, or visited the site. These items could include clothing, footwear, personal hygiene, medicine, money, or religious objects. Two four-holed metal buttons (Fig. 15.5) were found at the site. Made of iron, the buttons were inexpensive and stamp produced. They were most popular between 1800 and 1870 (Marcel 1995:4). The other personal item was a copper frog fastener (Fig. 15.5). Braided frogs were used as ornamental garment closures on military uniforms since the seventeenth century (http://en.wikipedia.org/wiki/Frog, accessed February 5, 2015).

Transportation. The Transportation category (n = 2) includes items used in travel by humans for the transportation of goods and other items to a designated location. The category includes animal power, wagons and buggies, cars and trucks, and the railroad. The items in the assemblage include a tiny, red molded-plastic fragment of a tail light. In 1920 national and international regulations were enforced on rear vehicle lighting. Prior to this standardization, a kerosene lamp was used to illuminate the rear license plate, but it was also a signal to other individuals sharing the same roadway (Moore and Rumar 1999:3).

The other transportation item is an iron rivet (Fig. 15.6). This may be part of a Mexican bridle like those found on nineteenth-century sites (Adams et al. 2000a:56–57). Adams's crew recovered a rivet from an 1869 Apache/Cavalry site in the Lincoln National Forest that is very similar to the rivet found at Coyote Canyon Rockshelter.

Military & Arms. The Military and Arms category (n = 3) includes small and large arms, explosives, military-issued clothing, insignia, and equipment. Several cartridges (n = 3) were collected at the site. Two cartridges were brass center-fires. One was a .44 caliber Winchester, dating to 1873 and after. It was both a rifle and handgun caliber and the standard cartridge for the Winchester 1873 Model rifle that became so popular it was known as "The gun that won the West." Today, .44 caliber is the

Figure 15.5. Metal buttons (FS 524 and 736) and copper frog fastener (FS 146).

Figure 15.6. Iron rivet, possibly from a Mexican bridle (FS 124).

most popular cartridge in the United States, both for hunting and law enforcement and has a reputation of killing the most deer (http://en.wikipedia.org/wiki/.44-40, accessed January 26, 2015). The other center-fire is a .300 Weatherby Magnum, which is a .30 caliber rifle cartridge. It was designed by Roy Weatherby in 1944 and is commonly used by big game hunters all over the world (http://en.wikipedia.org/wiki/.300_Weatherby_Magnum, accessed January 26, 2015).

One .22 caliber copper rim-fire cartridge was stamped on the base with the letter "U," which represents Union Metallic Cartridge Company, a division of Remington Arms. It dates between 1867 and 1912 (www.acronymfinder.com/Union-Metallic-Cartridge-Co-, accessed January 26, 2015).

Results of Archaeological Investigations

The artifacts collected during the excavation of four designated areas at the Coyote Canyon Rockshelter can be used to date the deposits, possibly reveal the ethnicity of individuals, and identify various activities that may have taken place within the shelter (Table 15.2). The areas investigated are: North Shelter, North Talus, South Shelter, and South Talus. Each area will be addressed individually.

North Shelter

The fewest Euroamerican artifacts from the site were recovered from North Shelter (n = 7). A broken amber glass bottle finish from Level 1 was unassignable, since it could have come from a liquor flask, a medicine bottle, or a chemical bottle. Food items included two rusted sardine cans, and an intact safety pin from the Domestic Category. Personal items are two four-hole metal buttons from Levels 2 and 6. One .22 caliber rim-fire cartridge was recovered from Level 1. The mean date for the Euroamerican artifacts from North Shelter is 1862.

North Talus

North Talus (n = 13) had slightly more Euroamerican artifacts than North Shelter. A few are unidentifiable ceramic objects (n = 3), and the Food category (n = 5) includes a sauce can and some unknown food bottles made of stoneware. The Indulgence category includes crown caps from either soda or beer bottles (n = 2), and a broken pint-size liquor bottle. A clear glass decorative object was classified as Domestic. A center-fire .30 caliber cartridge in the Military and Arms category and was found in

Table 15.2. Euroamerican artifacts, counts by level.

Artifact Type	Surface	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Total
Unassignable	–	33	8	9	4	2	1	2	1	**60**
Food	2	19	2	1	–	–	–	–	–	**24**
Indulgences	–	2	2	1	–	–	–	–	–	**5**
Domestic	–	2	–	–	–	–	–	–	–	**2**
Construction/ Maintenance	–	1	4	2	5	–	–	–	–	**12**
Personal Effects	–	–	2	–	–	–	1	–	–	**3**
Transportation	–	–	1	–	1	–	–	–	–	**2**
Military/Arms	–	2	–	1	–	–	–	–	–	**3**
Totals	**2**	**59**	**19**	**14**	**10**	**2**	**2**	**2**	**1**	**111**

Level 1. The mean date for the Euroamerican artifacts from North Talus is 1931.

South Shelter

South Shelter had the greatest variety and the highest frequency of Euroamerican artifacts within the Coyote Canyon Rockshelter assemblage (n = 64). Most of these items were smashed bottle fragments (n = 16) and rusted tin can fragments (n = 21). Due to their high fragmentation, they could not be assigned to a specific category, but only as unidentifiable. Some sauce, sardine, and fruit or vegetable cans were identifiable and were recorded within the Food category (n = 15).

Construction and Maintenance (n = 11) items include metal straps, sections of wire, flat sheet metal fragments, and a fence staple. One section of baling wire was wrapped around a rock and used as a weight, probably on a wire fence. Whether this section of South Shelter was fenced in at one time is not known. A Transportation item—an iron rivet possibly from a Mexican saddle or harness dating to approximately 1900—was recovered from about the middle level of fill (Level 4) of grid unit 244N/143E, which had rodent disturbance throughout.

The greater artifact counts at South Shelter may reflect heavier use due to it being a larger environment that was probably warmer during the winter months, or simply because of the larger area involved. The mean date for the Euroamerican artifacts from South Shelter is 1881.

South Talus

South Talus (n = 27) had artifacts from six different categories. Most of the artifacts are unidentifiable broken glass bottles (n = 11), a flat glass fragment, and a few unidentifiable objects (n = 2). The Food category has one sardine can and one fruit or vegetable can. Indulgences are limited, with a broken beer bottle finish and a piece of an unidentifiable liquor bottle.

One item was recorded in the Construction and Maintenance category. It is a round, common wire nail with a pennyweight of 7d; it was found in Level 1 of grid unit 244N/148E. A Personal item is a copper frog fastener, used as a decorative garment closure. A Transportation item is a piece of a red plastic tail light dating post-1920s. One item is present in the Military and Arms category. A Winchester .44 caliber center-fire cartridge came from Level 3 of grid unit 247N/145E. The mean date for the Euroamerican artifacts from South Talus is 1890.

Conclusions

Many of the Euroamerican artifacts from the Coyote Canyon Rockshelter were highly fragmented and most of the bottles could only be dated by glass color. Only one liquor bottle has a maker's mark and all of the cartridges were assigned either a brand or manufacturer. The artifacts are varied and came from eight of the 12 designated categories, but most were unidentifiable.

Most likely, Anglos, Hispanics, and Native Americans used the rockshelters at various time periods. The rivet may have come from a Mexican saddle or harness. Fencing items were probably Anglo-oriented, as would be likely for the sardine cans as well. But, the remaining objects could be cross-cultural, indicating a mean date of 1890 for the site.

16 Site Dating

Jeffrey L. Boyer | Eric Blinman and Nancy J. Akins

Analyzing Radiocarbon Dates from LA 139965

Jeffrey L. Boyer

Twenty samples from LA 139965 were submitted to Beta Analytic, Inc., for accelerator mass spectrometry (AMS) radiocarbon analysis and dating (Fig. 16.1, Table 16.1; Apps. 5.1, 5.2). They included six samples of the Stratum 3 sediment and 14 samples of charcoal from what were identified as archaeological contexts. Six archaeological charcoal samples and two sediment samples came from the North Shelter, one sediment sample came from the Central Talus area between the North and South Shelters, seven archaeological samples and three sediment samples were collected from the South Shelter, and one archaeological sample came from the South Talus area immediately south of the South Shelter. Figure 16.1 shows the collection locations of the samples on the site map; Table 16.1 synthesizes the resulting Beta Analytic data; Appendix 5.1 provides the full Beta Analytic reports for the sediment samples across the site; Appendix 5.2 provides their full charcoal sample reports.

Methodological Background

Radiocarbon Date Calibrations

Beta Analytic analysis results for each sample include the measured radiocarbon age in years BP (before AD 1950), which is corrected for $\delta^{13}C$—the ratio of ^{13}C to ^{12}C in ‰ ("isotopic fractionation")—in the sample, producing the conventional radiocarbon age, also in years BP. Inherent variability in the presence of carbon isotopes in each sample as well as in detection and counting procedures produces an error factor that is represented in the results as a single standard deviation (1 sigma) value before and after the mean age. Beta Analytic also provides dates calibrated to calendar years as 1-sigma and 2-sigma "calibrated results" (in this case, atmospheric curve IntCal13). The Beta Analytic calibration process uses the conventional radiocarbon age (BP) as a single value—the mean age without its 1-sigma range—and follows that single value as it intercepts the calendar-year curve, or, more accurately, one or more points comprising the curve, and assigns one or more calendar–year values to the conventional age. Those values are presented as "intercept dates." The calibration process then provides 1-sigma and 2-sigma ranges of calibrated dates that account for the intercept date(s) and the range of the conventional age about its mean as it intercepts the calibration curve. The calibrated results are presented as BP and calendar-year date ranges and can include, for a single sample, multiple 1-sigma and 2-sigma ranges derived from the slope of the calibration curve and its interception with the conventional age. Key Beta Analytic result details are presented by site area and field specimen/sample number in Table 16.1; the individual full Beta Analytic reports may be found in Appendix 5.

For each sample, the conventional age (BP) and its 1-sigma error value calculated by Beta Analytic were then used with two applications, OxCal (v. 4.2.4 (90); https://c14.arch.ox.ac.uk/oxcal/OxCal.html, first accessed August 18, 2015; atmospheric curve IntCal13) and Calib (v. 7.1; http://calib.qub.ac.uk/calib, first accessed August 19, 2015; atmospheric curve IntCal13) for additional calendar-year recalibrations. OxCal and Calib recalibrations are also presented in Table 16.1, which shows that calendar-year calibrations produced by Beta Analytic,

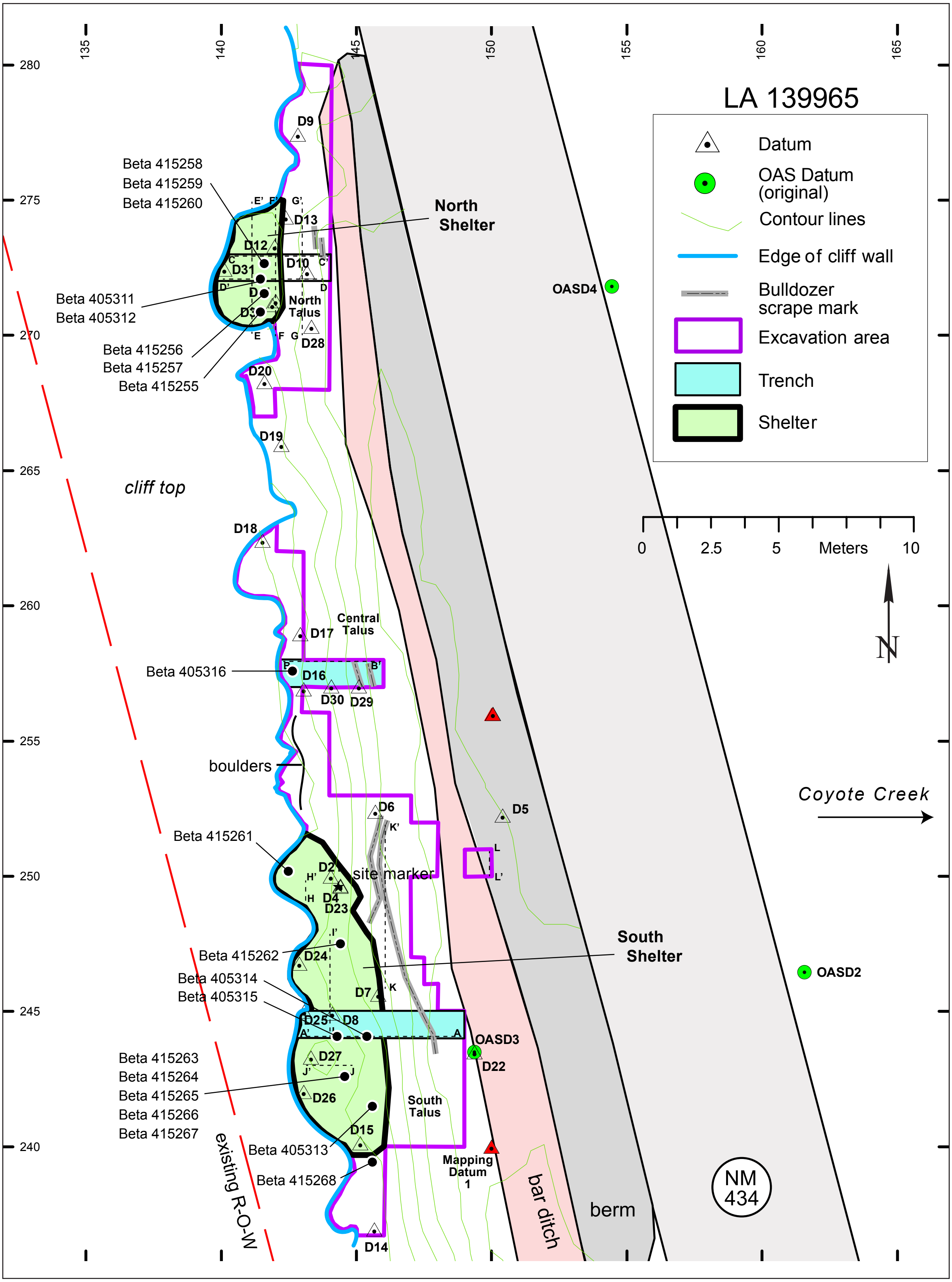


Figure 16.1. LA 139965, site map showing locations of radiocarbon samples.

Table 16.1. LA 139965, radiocarbon dates, sample summary; by site area and feature.

FS No.	Beta Analytic Sample No.	Sample Material/ Condition	Weight (gms)	Beta-Analytic Data					OXCAL* Calibration Data**					CALIB Calibration Data		
				13C/ 12C Ratio	Conven. Radiocarbon Age (BP)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Calib. Curve Inter. Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Mean Date (AD)	1-Sigma Mean Date Range (AD)	Median Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Median Date (AD)
North Shelter																
532	415257	ponderosa pine charcoal and oak charcoal	0.72 and 0.19	-23.7	1470 ± 30	545-645	570-620	600	**545-645 (95.4%)**	**567-630 (68.2%)**	594	30 (564-624)	596	**546-644 (100.0%)**	**567-623 (100.0%)**	595
494	415255	ponderosa pine charcoal	3.87	-22.3	1280 ± 30	665-775	675-725; 740-770	690 750 760	**662-774 (95.4%)**	**681-721 (40.8%)** 741-767 (27.4%)	724	36 (688-760)	720	**664-773 (100.0%)**	**682-720 (59.2%)** 741-767 (40.8%)	719
750	415260	ponderosa pine charcoal	6.20	-21.8	1080 ± 30	895-1020	905-920; 965-995	980	894-930 (27.2%) **938-1018 (68.2%)**	901-921 (20.1%) **951-996 (48.1%)**	958	37 (921-995)	966	894-930 (28.4%) **937-1018 (71.6%)**	901-921 (27.9%) **950-996 (68.9%)**	965
622	405311	bulk sediment	200.00	-23.3	850 ± 30	1155-1255	1165-1220	1210	1052-1080 (5.2%) **1152-1260 (90.2%)**	**1163-1221 (68.2%)**	1189	42 (1147–1231)	1194	1053-1079 (5.1%) **1152-1260 (94.9%)**	**1163-1220 (100.0%)**	1193
719	415258	ponderosa pine charcoal	3.75	-24.2	850 ± 30	1155-1255	1165-1220	1210	1052-1080 (5.2%) **1152-1260 (90.2%)**	**1163-1221 (68.2%)**	1189	42 (1147-1231)	1194	1053-1079 (5.1%) **1152-1260 (94.9%)**	**1163-1220 (100.0%)**	1193

Table 16.1 (continued)

FS No.	Beta Analytic Sample No.	Sample Material/ Condition	Weight (gms)	Beta-Analytic Data					OXCAL* Calibration Data**					CALIB Calibration Data		
				13C/ 12C Ratio	Conven. Radiocarbon Age (BP)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Calib. Curve Inter. Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Mean Date (AD)	1-Sigma Mean Date Range (AD)	Median Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Median Date (AD)
736	415259	ponderosa pine charcoal	5.31	-22.8	760 ± 30	1220-1285	1255-1275	1265	**1219-1284 (95.4%)**	**1246-1279 (68.2%)**	1256	19 (1237–1275)	1260	**1221-1283 (100.0%)**	1229-1230 (1.7%) **1246-1279 (98.3%)**	1259
621	405312	bulk sediment	165.00	-23.3	710 ± 30	1265-1295; 1370-1380	1275-1290	1280	**1256-1306 (85.0%)** 1363-1385 (10.4%)	**1268-1294 (68.2%)**	1291	32 (1259–1323)	1282	**1257-1305 (89.5%)** 1364-1384 (10.5%)	**1269-1292 (100.0%)**	1281
503	415256	ponderosa pine charcoal	7.29	-22.3	630 ± 30	1285-1400	1295-1320; 1350-1390	1305 1365 1385	**1287-1399 (95.4%)**	1296-1319 (25.4%) **1351-1391 (42.8%)**	1344	34 (1310-1378)	1352	1287-1332 (40.8%) **1337-1398 (59.2%)**	1296-1318 (37.5%) **1352-1390 (62.5%)**	1350
Central Talus																
567	405316	bulk sediment	195.00	-23.0	1680 ± 30	260-280; 325-420	340-400	385	258-296 (10.2%) **321-422 (85.2%)**	**339-401 (68.2%)**	360	41 (319-401)	366	258-284 (9.4%) 289-295 (1.1%) **321-421 (89.5%)**	**339-400 (100.0%)**	365
South Shelter																
578	415263	ponderosa pine charcoal	1.84	-23.0	1320 ± 30	650-720; 740-765	660-685	670	**652-723 (73.0%)** 740-768 (22.4%)	**658-693 (52.3%)** 747-763 (15.9%)	700	35 (665-735)	687	**653-722 (77.0%)** 740-767 (23.0%)	**658-693 (77.3%)** 747-762 (22.7%)	686

Table 16.1 (continued)

FS No.	Beta Analytic Sample No.	Sample Material/ Condition	Weight (gms)	Beta-Analytic Data					OXCAL* Calibration Data**					CALIB Calibration Data		
				13C/ 12C Ratio	Conven. Radiocarbon Age (BP)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Calib. Curve Inter. Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Mean Date (AD)	1-Sigma Mean Date Range (AD)	Median Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Median Date (AD)
382	405315	bulk sediment	160.00	-23.0	1170 ± 30	770-905; 920-965	775-790; 800-895	885	**771-903 (80.8%)** 918-965 (14.6%)	777-793 (11.1%) **801-893 (57.1%)**	853	53 (800-906)	850	**771-903 (84.9%)** 918-964 (15.1%)	777-793 (17.0%) 801-847 (41.8%) 853-893 (41.2%)	849
113	415261	ponderosa pine charcoal	2.97	-21.8	1080 ± 30	895-1020	905-920; 965-995	980	894-930 (27.2%) **938-1018 (68.2%)**	901-921 (20.1%) **951-996 (48.1%)**	958	37 (921-995)	966	894-930 (28.4%) **937-1018 (71.6%)**	901-921 (27.9%) **950-996 (68.9%)** 1008-1011 (3.2%)	965
639	415267	ponderosa pine charcoal	2.73	-22.8	960 ± 30	1020–1155	1025-1050; 1085-1125; 1140-1150	1035	**1020-1155 (95.4%)**	1024-1049 (22.7%) **1085-1124 (34.7%)** 1137-1150 (10.9%)	1088	42 (1046-1130)	1095	1021-1059 (31.5%) **1063-1154 (68.5%)**	1024-1048 (34.0%) **1085-1124 (51.0%)** 1137-1150 (15%)	1094
627	415266	ponderosa pine charcoal	3.57	-22.7	900 ± 30	1035-1215	1050-1085; 1125-1140; 1150-1165	1155	**1039-1210 (95.4%)**	1048-1092 (33.0%) 1121-1140 (11.8%) 1147-1185 (23.5%)	1119	51 (1068-1170)	1123	1039-1110 (46.0%) **1115-1210 (54.0%)**	1046-1090 (49.4%) 1121-1139 (17.3%) 1148-1183 (33.3%)	1122

Table 16.1 (continued)

FS No.	Beta Analytic Sample No.	Sample Material/ Condition	Weight (gms)	Beta-Analytic Data					OXCAL* Calibration Data**					CALIB Calibration Data		
				13C/ 12C Ratio	Conven. Radiocarbon Age (BP)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Calib. Curve Inter. Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Mean Date (AD)	1-Sigma Mean Date Range (AD)	Median Date (AD)	2-Sigma Calib. Age (AD)	1-Sigma Calib. Age (AD)	Median Date (AD)
614	415265	ponderosa pine charcoal	7.39	-21.4	810 ± 30	1165-1270	1215-1260	1225	**1169-1270 (95.4%)**	**1215-1261 (68.2%)**	1228	27 (1201-1255)	1232	1169-1177 (2.9%) **1180-1269 (97.1%)**	**1215-1260 (100.0%)**	1231
603	415264	ponderosa pine charcoal	4.61	-23.0	750 ± 30	1225-1285	1260-1280	1270	**1222-1287 (95.4%)**	**1252-1283 (68.2%)**	1261	19 (1242-1280)	1266	**1223-1286 (100.0%)**	**1254-1282 (100.0%)**	1264
387	405314	bulk sediment	200.00	-23.5	720 ± 30	1260-1295	1270-1285	1280	**1246-1302 (90.5%)** 1367-1383 (4.9%)	**1265-1290 (68.2%)**	1282	26 (1256-1308)	1278	**1246-1302 (95.0%)** 1367-1382 (5.0%)	**1267-1288 (100.0%)**	1277
258	415262	ponderosa pine charcoal	2.92	-23.3	710 ± 30	1265-1295; 1370-1380	1275-1290	1280	**1256-1306 (85.0%)** 1363-1385 (10.4%)	**1268-1294 (68.2%)**	1291	32 (1259-1323)	1282	**1257-1305 (89.5%)** 1364-1384 (10.5%)	**1269-1292 (100.0%)**	1281
657	405313	bulk sediment	195.00	-23.5	550 ± 30	1315-1355; 1390-1430	1330-1340; 1395-1415	1410	1311-1359 (40.5%) **1387-1434 (54.9%)**	1326-1344 (24.3%) **1394-1421 (43.9%)**	1377	38 (1339-1415)	1396	1312-1358 (42.0%) **1387-1432 (58.0%)**	1326-1343 (35.5%) **1394-1420 (64.5%)**	1395
South Talus																
649	415268	ponderosa pine charcoal	3.68	-22.1	1070 ± 30	895-925; 940-1020	970-1015	985	895-928 (20.9%) **940-1021 (74.5%)**	905-916 (9.4%) **968-1016 (58.8%)**	967	37 (930-1004)	977	896-927 (21.5%) **941-1021 (78.5%)**	905-916 (14.1%) **967-1016 (85.9%)**	976

OxCal, Calib applications are usually very similar and often identical. Differences are related to variations in calculation algorithms and in ways that the three processes present their results. Recalibrations using OxCal and Calib provide results that allow estimations of probability of accuracy and, depending largely on the slope of the calibration curve in relation to specific conventional radiocarbon ages, precision. The Beta Analytic process uses the conventional radiocarbon age as a point with a 1-sigma standard deviation error that creates a range of dates within which any single date has the same probability of accuracy as any other single date. Precision is based on the width of the 1-sigma range. Beta Analytic calibration involves the "interception" of the range of conventional ages with the calibration curve (Fig. 16.2). "Intercept dates" are the points at which the mean conventional age intersects the calibration curve. Ranges of calibrated dates result from the interception of the range of conventional ages with the calibration curve, which is constructed as a best-fit line following multiple data points. Since every conventional age within a range has equal probability of accuracy, every range of calibrated dates also has equal probability of accuracy. Consequently, the Beta Analytic calibration process cannot assign differential probabilities of accuracy to multiple ranges of calibrated dates for a single sample.

For each conventional radiocarbon age with its 1-sigma error, on the other hand, OxCal provides one or more 1-sigma and 2-sigma calendar date ranges with percentage numbers (Table 16. 1) that represent the portions of overall 1-sigma and 2-sigma ranges comprised of smaller ranges. The conventional radiocarbon age is used, not as a single point with a standard deviation, but as a normal probability distribution curve (Fig. 16.3). Additionally, any location on the calibration curve is identified as a range of values rather than a single value. The curve, therefore, is not a single best-fit line; visually, the curve resembles a ribbon rather than a single line:

> The OxCal plot…displays a thick blue line. A similar thick line, in grey, is displayed in [a] Calib plot. The thick line is the "calibration curve." The calibration curve represents the tree-ring ^{14}C concentrations used in the calibration procedure. There are at least two issues here. First, the calibration "curve" is not a curve in the common sense; rather, each point on the curve has a potential error, which is usually specified by the standard deviation of the measurement: …the top of the thick line indicates the upper 1σ bound, and the bottom of the thick line indicates the lower 1σ bound. Second, both OxCal and Calib treat the curve as continuous; doing so requires interpolation, because we do not have ^{14}C measurements in continuous time, only for each tree ring, i.e., for each calendar year. (Keenan 2012:346, brackets added)

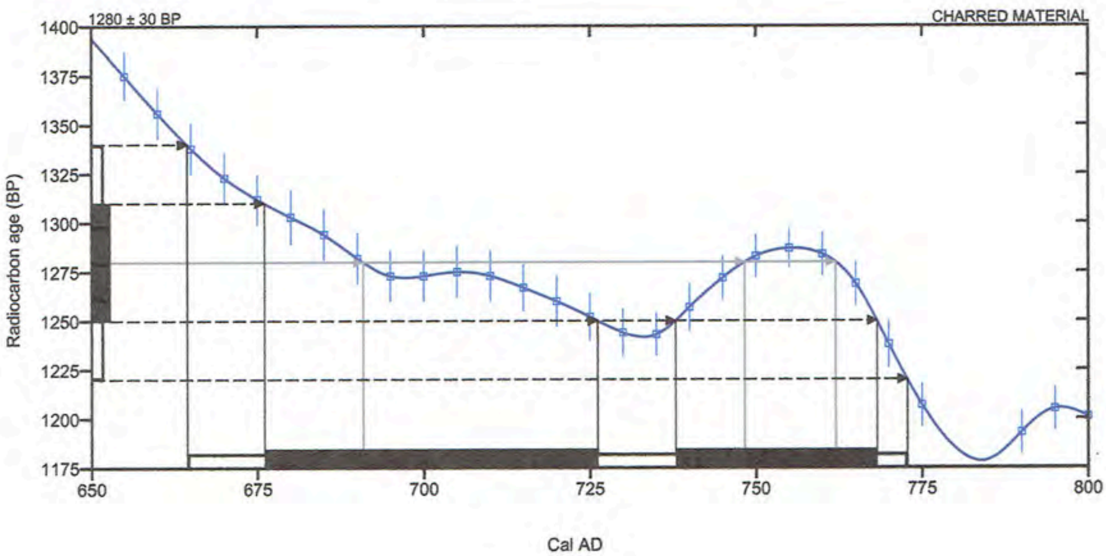
Thus, there is no single point or set of single points at which the mean conventional age intercepts the calibration curve. Rather, the conventional age distribution curve intersects the "ribbon" of calibration curve values and the OxCal calibration process determines ranges of calendar-year values that result from that intersection. In doing so, OxCal determines how much of the conventional age distribution curve intersects the calibration curve at one or more locations along the latter, and presents those data as 1-sigma and 2-sigma calendar-year ranges with percentages of the distribution curve intersecting the calibration curve. This is what Keenan (2012:346) calls, "the main output of the calibration process," whether of OxCal, Calib, other calibration applications, or Keenan's own process. Because it determines the portions of overall 1-sigma and 2-sigma date ranges that are made up of smaller ranges, the OxCal percentage values for 1-sigma ranges add up to 68.2 percent, while the percentage values for 2-sigma ranges add up to 95.4 percent (Table 16.1). The OxCal percentages can be interpreted as probabilities of accuracy and, depending on the shape of the calibration curve, as the precision of date ranges because higher percentage values represent date ranges within which a sample's actual age is more likely to fall.

OxCal analyses also provide mean and median calendar dates, as well as the 1-sigma standard deviation value for each mean date (Table 16.1). Telford and others (2004) point out problems with single-year calibration-curve intercept dates such as those provided by Beta Analytic (Table 16.1). The problems focus on difficulties determining single points at which dates, expressed as ranges of values within confidence limits, intersect a cal-

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-415255**
Conventional radiocarbon age	**1280 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 665 to 775 (Cal BP 1285 to 1175)**
Intercept of radiocarbon age with calibration curve	Cal AD 690 (Cal BP 1260) Cal AD 750 (Cal BP 1200) Cal AD 760 (Cal BP 1190)
Calibrated Result (68% Probability)	Cal AD 675 to 725 (Cal BP 1275 to 1225) Cal AD 740 to 770 (Cal BP 1210 to 1180)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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Figure 16.2. Beta 415255: Beta Analytic calibration curve plot.

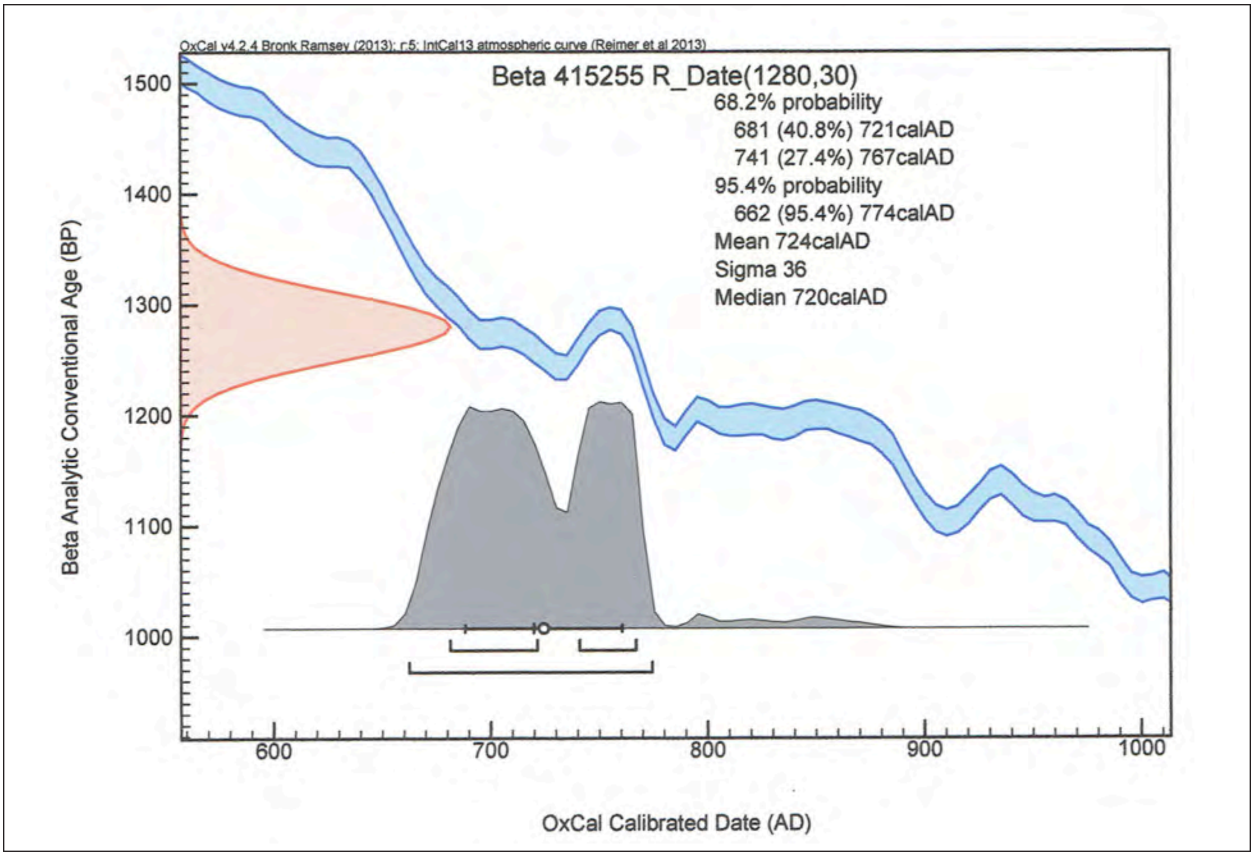

Figure 16.3. Beta 415255: OxCal calibration curve plot.

ibration curve also made up of ranges of values. Further, because the calibration curve is subject to revision as new atmospheric data are acquired, intercept dates are directly related to the version of the curve in use at the time of analysis. Consequently, Telford and others (2004) conclude that mean and median dates, calculated as they are from ranges of dates representing the intersection(s) of conventional age curves and calibration curves, are more accurate single-year values than intercept dates. It is important to remember, however, that inherent variation in samples and in calibration processes mean that single-year values represent specific dates within ranges of dates and that, excepting the precision provided by percentage values, no one year within those ranges is more likely than any other to be "the" year. That is, single-year precision is not possible. Still, because analytical results from Beta Analytic include intercept dates, they are reported here.

Like OxCal, Calib also provides one or more 1-sigma and 2-sigma calendar date ranges representing the intersection(s) of a conventional age-distribution curve with the calendar-year calibration curve, and provides percentage values for each range. Unlike the OxCal percentages, though, Calib percentages represent the proportions of total 1-sigma and 2-sigma ranges comprised of smaller ranges. Consequently, the Calib percentages associated with each range, whether 1-sigma or 2-sigma, add up to 100.0 percent (Table 16.1). Like OxCal percentage values, Calib percentage values can be interpreted as probabilities of accuracy and, potentially, as the precision of date ranges, also because higher percentage values represent date ranges within which a sample's actual age is most likely to fall. Differences between OxCal and Calib calibration dates are usually minimal and are likely related to equational differences between the applications.

Most Accurate and Most Precise Dates

For each sample, a "most accurate" and "most precise" date is determined by comparing the OxCal and Calib 2- and 1-sigma calibrated ranges, respectively, taking into account the Beta Analytic intercept dates, the OxCal and Calib mean dates, and the OxCal median dates. "Most accurate" refers to the range of calibrated dates with the highest probability—expressed as a percent value—of including the actual age of the sample. Calibrated 2-sigma ranges frequently do not include multiple individual ranges resulting from multiple, discontinuous intersections of the conventional age range with the calibration curve but that is dependent on the slope and shape of the curve. If there are multiple individual ranges within the overall oldest–youngest calibrated, 2-sigma range for a sample, focus is placed first on the individual range or ranges with probabilities greater than 50 percent of the overall 2-sigma probability. That is, focus is first placed on the individual range or ranges with probabilities greater than 47.70 percent for OxCal dates and 50.00 percent for Calib dates.

If the overall range comprises multiple smaller, individual ranges, the temporal distances between those ranges are then examined. If ranges are separated by more than 10 years, they are considered to be discontinuous, whereas if they are separated by less than 10 years, the apparent discontinuity is considered not to be real and the ranges are added together. This increases the length of the greater-than-50-percent range and its probability of accuracy. The most accurate date for a sample might not be the entire calibrated, 2-sigma range but the nature of calculating a range of 95.4 percent or greater probability means that it will likely be very close to the entire range.

"Most precise" refers to the range of calibrated, 1-sigma dates with the highest probability of including the actual age of the sample, also obtained from OxCal and Calib calibration results. Because 1-sigma dates are usually shorter than 2-sigma ranges (but not always, depending on the slope and shape of the calibration curve), they are considered potentially more precise because they further limit the range within which the actual date is probably present. Increased precision comes with the considerable risk of decreased security (68.2 versus 95.4 percent probability), however, a variety of factors are assessed to determine whether recommending a more precise date is warranted.

1-sigma results more often comprise multiple, individual ranges than do 2-sigma results. Again, focus is first directed on the individual range or ranges that make up more than 50 percent of the overall oldest-to-youngest 1-sigma range. That means greater than 47.70 percent for OxCal dates and 50.00 percent for Calib dates. Length of temporal separation between individual ranges is also checked, using the same greater-than or less-than 10-year standard used for 2-sigma dates. The results are checked against the OxCal and Calib mean dates and the OxCal median date and, frequently but with less weight against the Beta Analytic intercept dates. If there is good correspondence between the date range making up most or all of the overall 1-sigma range and the sample's mean, median, and intercept dates, a "most precise" date is warranted.

The "most accurate" date for a sample is the 2-sigma range with probability percentage greater than 50 percent of the total range for that sample. The "most precise" range for the same sample is the 1-sigma range with probability percentages greater than 50 percent of its total 1-sigma range. "Most accurate" and "most precise" dates with approximate confidence levels for the archaeological samples from LA 139965 are presented in Table 16.2. Only most accurate dates are presented for the sediment samples because, since they were collected and submitted as large, bulk samples ranging from 160 to 200 gm of sediment, they are presumed to contain a higher amount of datable material from a potentially much longer time frame than small samples of charcoal from specific archaeological contexts. Their results reflect a 95.4 percent confidence average of all the datable material found in each large sample. Most accurate dates with approximate confidence levels for the sediment samples are also presented in Table 16.2. For both archaeological and sediment samples, if the confidence level for a 2- or 1-sigma date is less than 75 percent, the next most accurate or precise date is also listed. Lower confidence levels are usually associated with changes in the slope of the calibration curve.

Identifying Statistical Groups of Dates

To determine whether statistical groups of dates are present in the assemblage, I use Grubbs' test to determine whether the assemblage contains dates that are statistical outliers. For this test, I use the Beta Analytic conventional radiocarbon age for each sample because this value is the common basis

Table 16.2. LA 139965, most accurate and most precise calibrated radiocarbon dates for each sample, by site area.

Grid Unit	Level	Elevation	FS No.	Beta Analytic Sample No.	Most Accurate Date (2-sigma, AD)	Most Precise Date (1-sigma, AD)
North Shelter						
271N/141E	6	11.42-11.37	FS 532	415257	545-645 (100.0%)	567-630 (100.0%)
270N/141E	2	11.88-11.79	FS 494	415255	662-774 (100.0%)	681-721 (100.0%)
272N/141E	8	11.52-11.27	FS 750	415260	894-1018 (100.0%)	901-921 (31.1%) 950-996 (68.9%)
272.9N/141.3E		11.65-11.45	FS 622	405311	1152-1260 (94.9%)	NA; sediment
272/N141E	3	11.81-11.71	FS 719	415258	1152-1260 (94.9%)	1163-1221 (100.0%)
272N/141E	6	11.60-11.53	FS 736	415259	1219-1284 (100.0%)	1246-1279 (98.3%)
272.9N/140.9		11.75-11.60	FS 621	405312	1256-1306 (89.5%)	NA; sediment
271N/141E	2	11.70-11.62	FS 503	415256	1287-1399 (100.0%)	1296-1319 (37.3%) 1351-1391 (62.7%)
Central Talus						
256N/142E	1	12.60-12.40	FS 567	405316	312-422 (89.4%)	NA; sediment
South Shelter						
242N/144E	1	12.64-12.46	FS 578	415263	652-723 (76.5%)	658-693 (77.0%)
243.9N/143.7E		11.95-11.70	FS 382	405315	771-903 (84.8%)	NA; sediment
250N/143E	4	12.52-12.24	FS 113	415261	894-1018 (100.0%)	901-921 (30.3%) 950-996 (69.7%)
242N/144E	16	11.76-11.68	FS 639	415267	1020-1155 (100.0%)	1024-1049 (49.0%) 1085-1124 (51.0%)
242N/144E	13	11.91-11.86	FS 627	415266	1039-1210 (100.0%)	NA; no range had more than 50 percent of total
242N/144E	10	12.06-12.01	FS 614	415265	1169-1270 (100.0%)	1215-1260 (100.0%)
242N/144E	7	12.21-12.16	FS 603	415264	1222-1287 (100.0%)	1252-1283 (100.0%)
243.95/144.9E		12.10-11.80	FS 387	405314	1246-1302 (95.0%)	NA; sediment
247N/144E	3	12.11-12.06	FS 258	415262	1256-1306 (89.3%)	1268-1294 (100.0%)
241N/145E	1	12.39-12.34	FS 657	405313	1311-1359 (42.2%) 1387-1434 (57.8%)	NA; sediment
South Talus						
239N/145E	2	12.35-1220	FS 640	415268	940-1021 (78.3%)	967-1016 (86.1%)

for Beta Analytic, OxCal, and Calib calibrations. Because no dates are determined by Grubbs' test, it is not necessary to use calibrated ages. Grubbs' test assigns a standardized Z value to each conventional radiocarbon age that represents the distance of each age from the group mean; it then compares each individual Z value to a critical Z value determined by the number of ages in the group. Ages whose Z values exceed the critical Z value are statistical outliers. For each group, the test also identifies the conventional age that is furthest from the group mean but is not a statistical outlier.

The protocol for identified outliers is to remove the outlier age from the group and re-run the Grubbs' test. If the second test identifies another outlier, that age is then removed and the test run again, and so on until all outliers are identified and removed. Outliers are grouped together and tested to determine whether they are a cohesive set of dates. Identification of statistical outliers does not, in itself, tell us why they are outliers, which can only be determined in light of archaeological context, material integrity, and material suitability for radiocarbon dating, as well as comparison with other dates from related samples and proveniences.

The protocol for those mean conventional ages that are identified by Grubbs' test as furthest from their group means, but are not statistical outliers, is the same as for outliers—realizing that those ages were not actually statistically different from the others in their groups. The results, therefore, cannot be used to securely identify different groups of dates within a site assemblage; they are, however, used to suggest intra-site groups of dates that can be examined with other tests. In part, this is because the group mean and standard deviation calculated for any group of ages by the Grubbs' test reflect both the number of individual ages and their range or span of years.

In addition to calendar-year calibrations, Calib is used to calculate mean pooled conventional radiocarbon ages, including 1-sigma standard deviations (Table 16.3). Calib is then used to convert mean pooled conventional ages to calibrated radiocarbon ages to make them more comparable with other calibrated ages (Table 16.3). Mean pooled calibrated ages are not, however, accorded the same weight in this analysis as comparing 1-sigma and 2-sigma dates from site features because the process of combining (pooling) any series of mean dates and their standard deviation values and calculating a mean value and mean standard deviation value for that pooled group necessarily minimizes differences within the group and, therefore, results in smaller standard deviation values and shorter ranges of dates than are evident when simply comparing the values within the group. Further, the process of calibrating the pooled mean conventional ages produces both 1- and 2-sigma standard deviation ranges that represent proportions of 1-sigma ranges for the conventional ages, that is 68.2 and 95.4 percents, respectively, of a 68.2 percent range. In other words, calibrating pooled mean conventional ages produces confidence levels within the 1-sigma, 68.2 percent confidence level. Consequently, I am not confident of the apparently increased precision provided by pooled mean ages. Therefore, when assessing the dates from features and sites, emphasis is placed on comparison of the calibrated 1- and 2-sigma radiocarbon ages; the results are compared with pooled mean ages and their similarities are observed but the latter are not given the same weight when identifying most accurate and most precise dates.

Additionally, Calib calculated Student's t-test values (Table 16.3). The results of these tests show whether the dates make up a single group, that is, whether they are statistically the same at a 95.4 percent confidence level. If they are not the same, however, these tests do not necessarily confirm whether more than one group of dates are present or whether the dates are all different from each other. They do, however, provide information important for identifying the strength of group identities. Thus, intra-site groups identified or suggested by outlier testing were examined by calculating mean pooled ages and standard deviations and, with Student's t-tests, to determine whether the groups could be confirmed. It was, therefore, the interplay of outlier testing with t-testing and mean pooled ages that identified and confirmed or denied groups of site dates.

LA 139965 Radiocarbon Dates

Tables 16.1 and 16.2 show that 2-sigma calibrated radiocarbon ages from LA 139965 range from AD 312 to 1434. Those dates are shown in an OxCal multiple plot in Figure 16.4, ordered from oldest to youngest. Showing all of them in a single curve plot is needlessly difficult to read. Curve plots are presented during discussions of different groups of dates. This discussion begins by examining radiocarbon dates from different excavation areas at LA 139965, from north to south.

North Shelter

Two sediment samples and six archaeological samples were collected from the North Shelter area (Fig. 16.1). Their 2-sigma calibrated dates, which range from AD 545 to 1399, are shown in Figures 16.5 and 16.6. Visual inspection of those graphs shows that most of the samples (n = 5) date between about AD 1150 and 1400, while the other three sample dates are spread between AD 545 and 1018. To determine whether those samples constitute a single statistically significant group or if such a group is present within the North Shelter dates, Student's t-test and Grubbs' outlier test were performed, using the procedures detailed earlier. Table 16.3 presents the results, which show that the only statistically significant group of samples from the North Shelter are two with the same conventional (AD 1105; 850 BP) and calibrated dates (AD 1152 to 1260). One of those, Beta-405311, was a sediment sample, while the other, Beta-415258, was an archaeological sample, both from the same grid unit and with between a 6 and 36 cm difference in elevation (Fig. 16.7; Tables 16.1; 16.2).

The archaeological and sediment samples from the North Shelter show a general trend in which older dates came from lower elevations and

Table 16.3. North Shelter, radiocarbon dates: Students T and Grubbs Outlier results.

1. All conventional date values				
Students T Test				
Mean pooled date	953.75 BP	AD 996.25		
Square root of variance	10.6066	8 samples		
Students T	680.2083			
Chi square	14.1			
Degrees of freedom	7			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	953.75 BP	AD 996.25		
Standard deviation	295.73			
Critical Z value	2.1266			
Conclusion	1470 BP value is furthest from the group mean but not an outlier. Z = 1.75			
2. Remove 1470 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	880.00 BP	AD 1070.00		
Square root of variance	11.3389	7 samples		
Students T	341.7778			
Chi square	12.6			
Degrees of freedom	6			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	880.00 BP	AD 1070.00		
Standard deviation	226.42			
Critical Z value	2.0199			
Conclusion	1280 BP value is furthest from the group mean but not an outlier. Z = 1.77			
3. Remove 1280 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	813.33 BP	AD 1136.67		
Square root of variance	12.2472	6 samples		
Students T	134.3704			
Chi square	11.1			
Degrees of freedom	5			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	813.33 BP	AD 1136.67		
Standard deviation	155.52			
Critical Z value	1.8871			
Conclusion	1080 BP value is furthest from the group mean but not an outlier. Z = 1.71			
4. Remove 1080 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	760.00 BP	AD 1190.00		
Square root of variance	13.4164	5 samples		
Students T	39.5555			
Chi square	9.49			
Degrees of freedom	4			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	760.00 BP	AD 1190.00		
Standard deviation	94.34			
Critical Z value	1.7150			
Conclusion	630 BP value is furthest from the group mean but not an outlier. Z = 1.38			

Table 16.3 (continued)

5. Remove 630 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	792.50 BP	AD 1157.50		
Square root of variance	15.0000	4 samples		
Students T	16.0833			
Chi square	7.81			
Degrees of freedom	3			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	792.50 BP	AD 1157.50		
Standard deviation	69.46			
Critical Z value	1.4812			
Conclusion	710 BP value is furthest from the group mean but not an outlier. Z = 1.19			
6. Remove 710 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	820.00 BP	AD 1130.00		
Square root of variance	17.3205	3 samples		
Students T	6.0000			
Chi square	5.99			
Degrees of freedom	2			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	820.00 BP	AD 1130.00		
Standard deviation	51.96			
Critical Z value	1.1543			
Conclusion	760 BP value is an outlier. Z = 1.15; the reason is that there are only three values and two of them are the same (850.00 BP).			

The only significantly confirmed group of dates from the North Shelter, at the 95.4 percent confidence level, consists of two samples with the same conventional date values.

younger dates came from higher elevations. While the alluvial strata at LA 139965 was recognizably disturbed by bioturbation from several sources—worms, rodents, and humans—as well as, presumably, continual aggrading alluviation until construction of the highway cut the site off from the flood plain, the trend of older to younger dates supports a conclusion that the natural sediment was not so mixed that no chronological patterning can be observed; Figure 16.8 graphically shows the lower, older and higher, younger dates from the two sediment samples at the 273 N grid line. That said, however, the sequences in the North Shelter samples are considerably different. That from the 270N/141E grid unit is in the seventh through eighth centuries AD, while one from the 271N/141E unit (Fig. 16.9) is later, from the fourteenth century AD. Interestingly, the latter is, generally, slighty lower in elevation than the former. So, while the general elevational trend within grid-unit sequences is older to younger dates, the older sequence in one unit both overlaps with, and is higher in elevation, overall, than the younger sequences in the nearby unit (Fig. 16.10).

Further, as seen in Figure 16.7, in the three-date elevational sequences from 272N/141E grid unit, the date in the middle is younger than the two bracketing it. The middle date should be, if the sequence were intact, at the top of that sequence, overlapping with the younger of the two sediment samples. Indeed, the upper date from unit 271N/141E, AD 1351 to 1391 (1-sigma calibrated), fits well with the 272N/141E sequence, as it would overlap with the dates in the 272N/141E sequence and is from a comparable elevation. This apparent correspondence was checked for statistical significance but the dates do not make up a significantly similar group. Nonetheless, they indicate that bioturbation and other

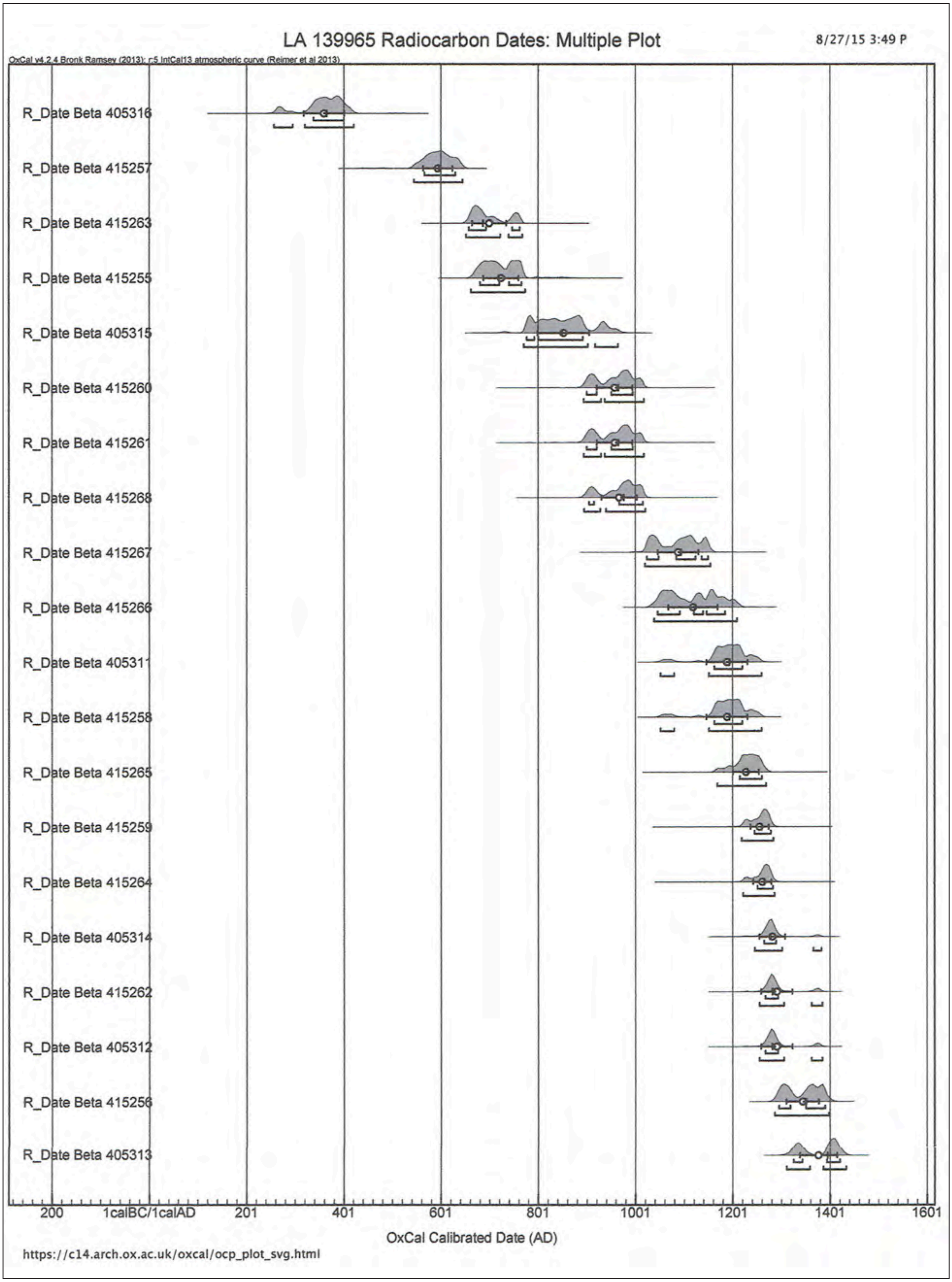

Figure 16.4. OxCal multiple plot of all radiocarbon dates.

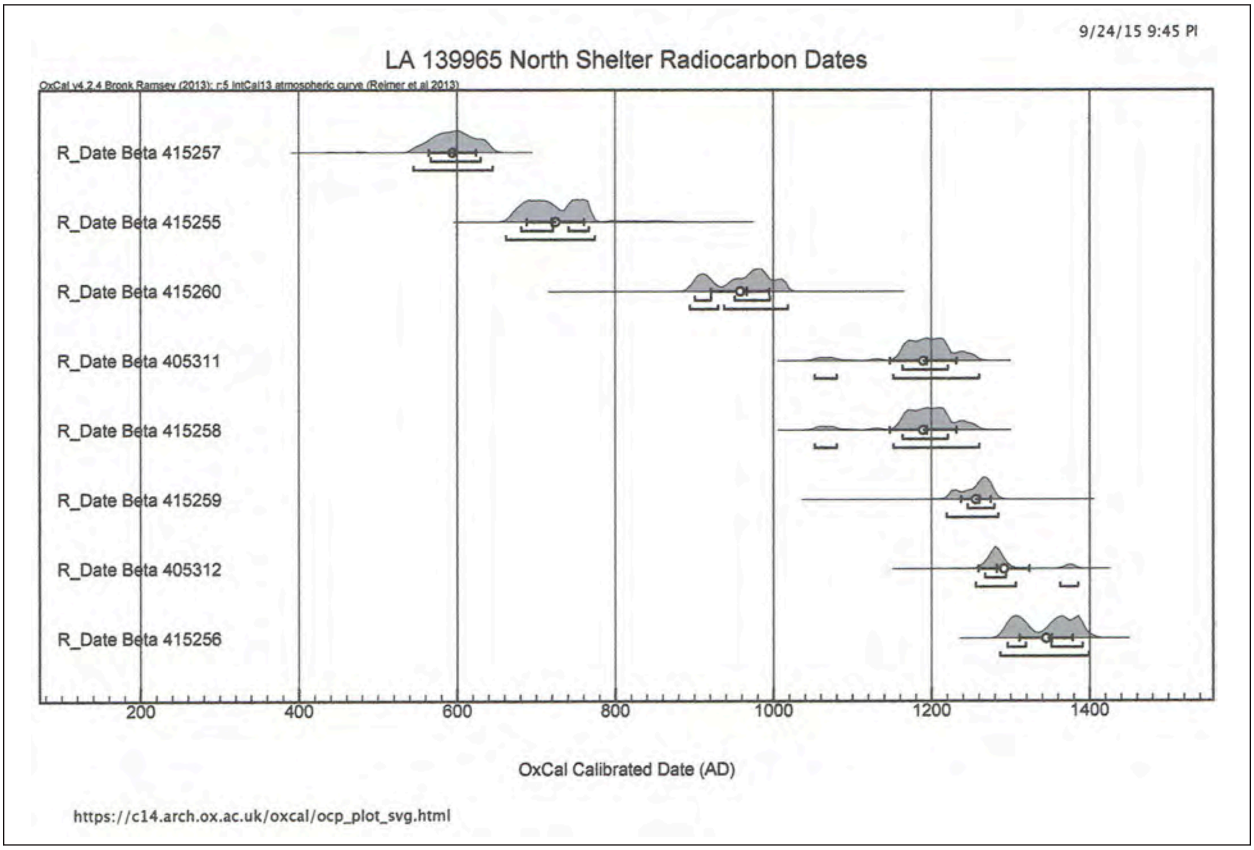

Figure 16.5. North Shelter, calibrated radiocarbon dates: multiple plot.

sources of disturbance have not thoroughly mixed the thick alluvial deposit.

Central Talus

A single sample of sediment, Beta-405316, was submitted from the Central Talus excavation area (Fig. 16.1). Its most accurate calibrated date is AD 321 to 422 (Fig. 16.11; Table 16.2). This is the oldest date from LA 139965 and, along with sample Beta-415263 from the South Shelter, also an older date, came from the highest elevation at the site, ca. 12.40 to 12.60 m above main datum (Fig. 16.7), from the top of the talus slope near the cliff face.

South Shelter

Two sediment samples and eight archaeological samples were collected from the South Shelter area (Fig. 16.1). Their 2-sigma calibrated dates, which range from AD 652 to 1434, are shown in Figures 16.12 and 16.13. Visual inspection of those graphs shows a more gradual trend in those dates than seen in the North Shelter graphs; still, five archaeological samples and two sediment samples have most accurate (2-sigma calibrated) dates between about AD 1020 and 1434. In order to determine whether those samples constitute a single statistically significant group or if such a group is present within the South Shelter dates, Student's t-test and Grubbs' outlier test were performed, using the procedures detailed earlier. Table 16.4 presents the results, which show that the only statistically identified group of samples from the South Shelter are four with conventional ages between about AD 1145 and 1245 (710 to 810 BP) at the center of the South Shelter range. While no further tests were done after that group was identified, the next sample furthest from the group mean is the one with the AD 1145 (810 BP) conventional date, leaving three conventional dates in the thirteenth century AD. This is the same result as from the North Shelter samples, in which the only statistically identifiable group of dates is in the thirteenth century AD. One of these South Shelter

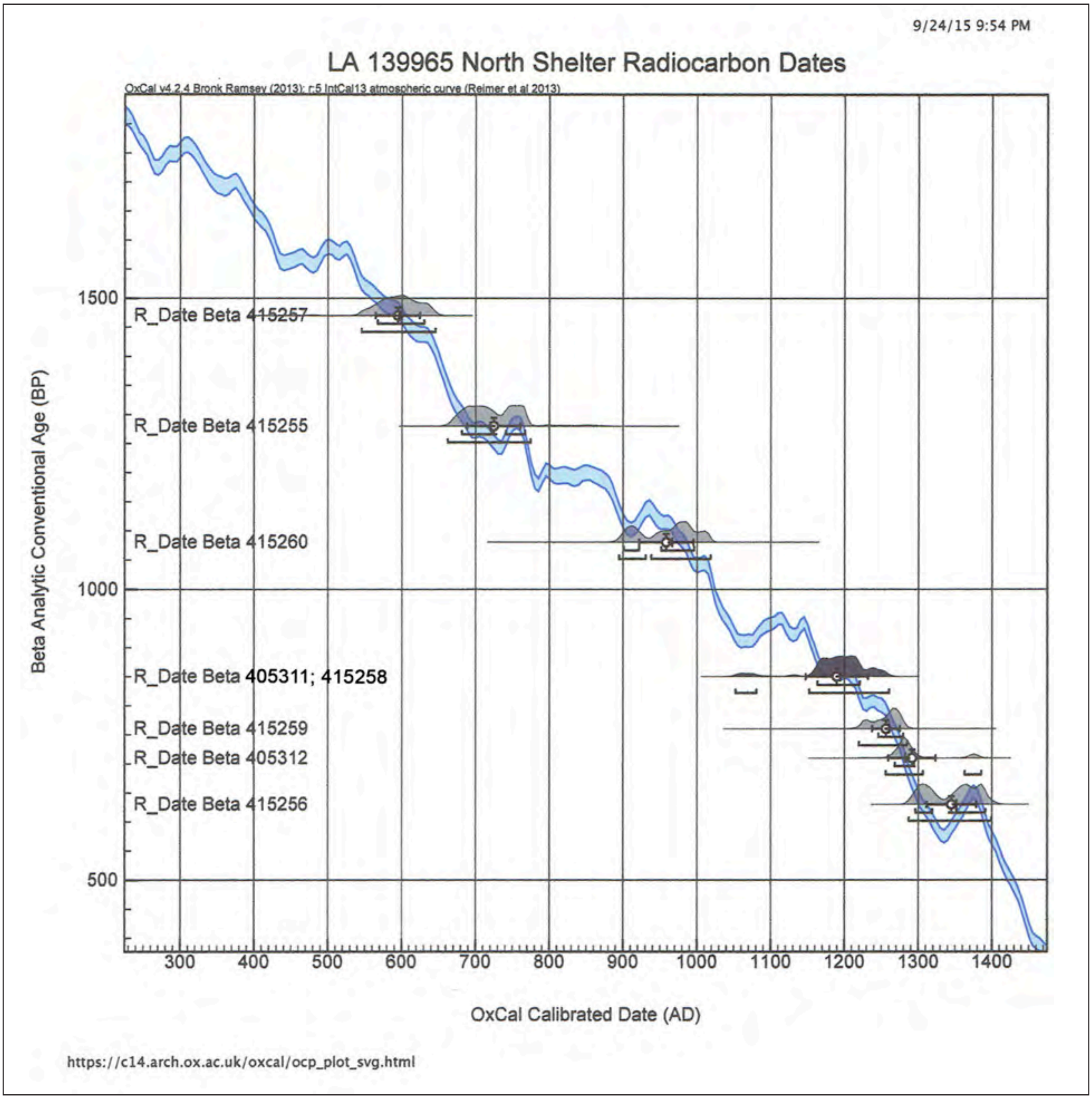

Figure 16.6. North Shelter, calibrated radiocarbon dates: curve plot.

samples, Beta-405314, was a sediment sample from grid unit 243N/143–144E (along the 244N grid line; Fig. 16.14) whose date represents a sort of average for datable material in the large sample. Two others, Beta-415265 and 415264, were archaeological samples from a sequence in adjacent grid unit 242N/144E, and the fourth, Beta-415262, was an archaeological sample from unit 247N/144E. All were from similar elevations between 11.80 and 12.21 m (Fig. 16.15**;** Tables 16.1, 16.2; **).** It is interesting, then, that the sediment sample yielded a date very similar to archaeological samples at approximately the same elevation, a point to which we will return later.

Only one grid unit in the South Shelter, 242N/144E, provided an elevational sequence of archaeological samples (Fig. 16.15). Four samples yielded a 200-year sequence of overlapping, precise dates between AD 1024 and 1283. That sequence

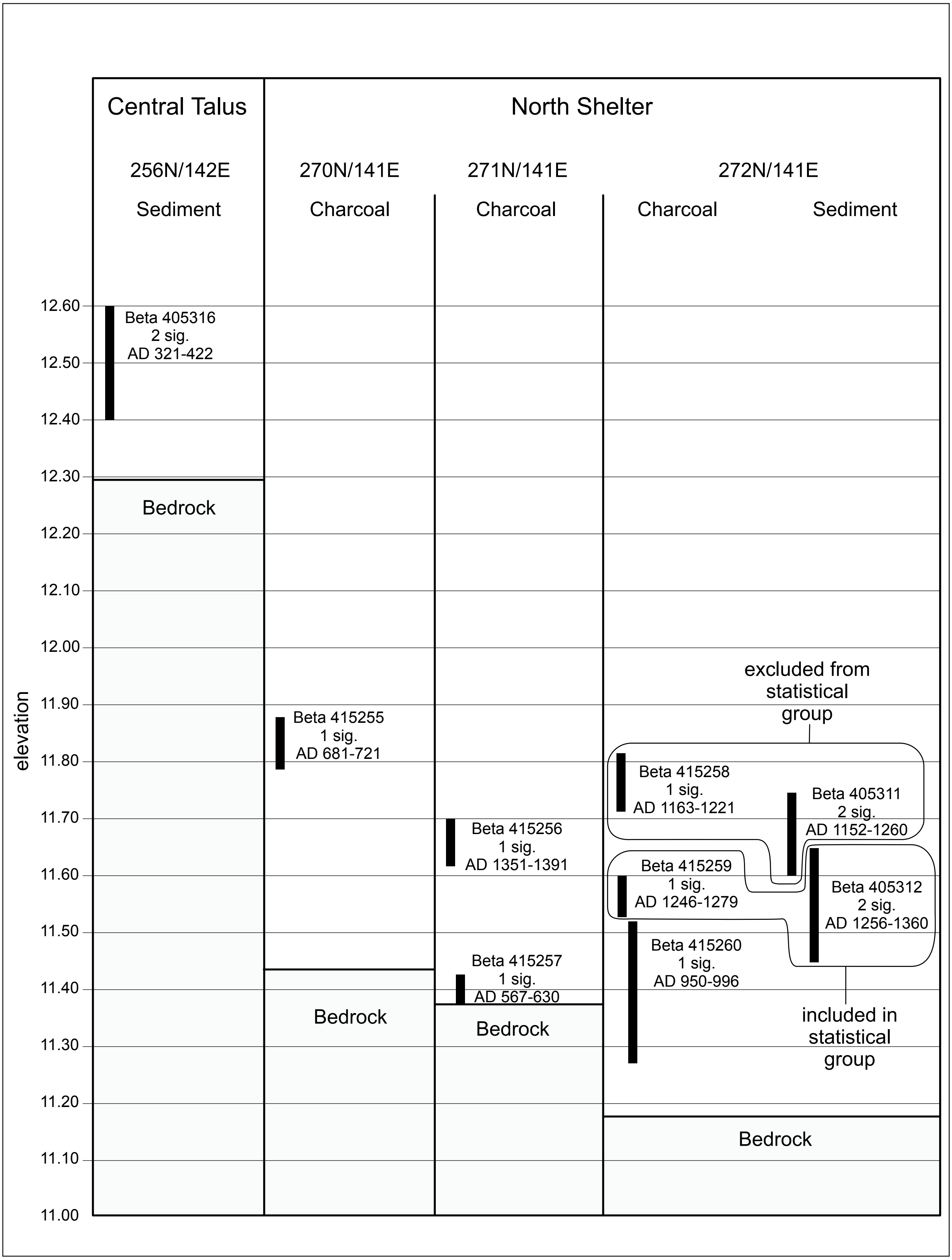

Figure 16.7. Central Talus and North Shelter, radiocarbon dates by grid unit and elevation showing samples included in and excluded from statistical group in North Shelter–South Shelter corresponding elevational ranges.

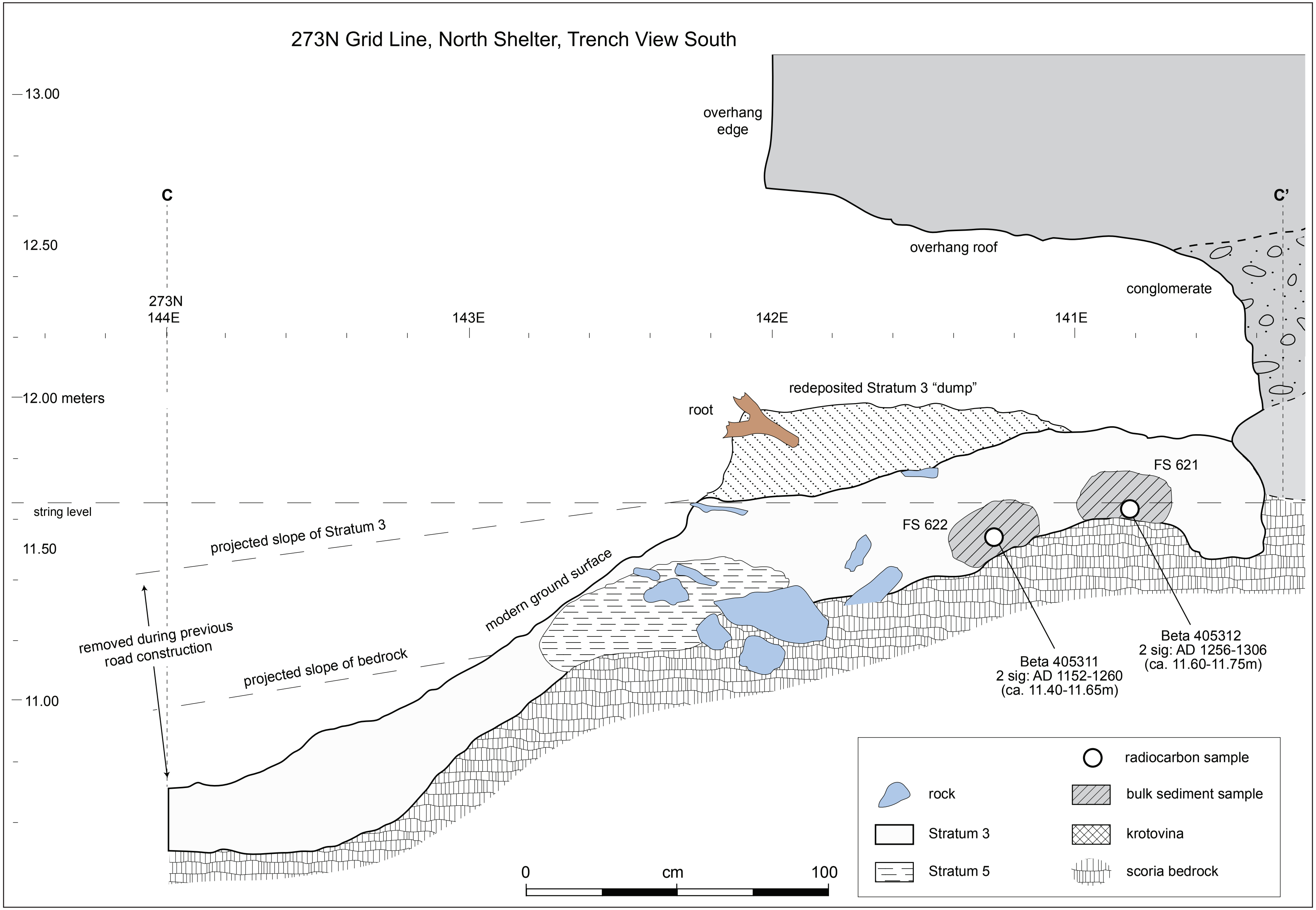

Figure 16.8. North Shelter, 273N grid line profile showing dates of sediment samples. View to south.

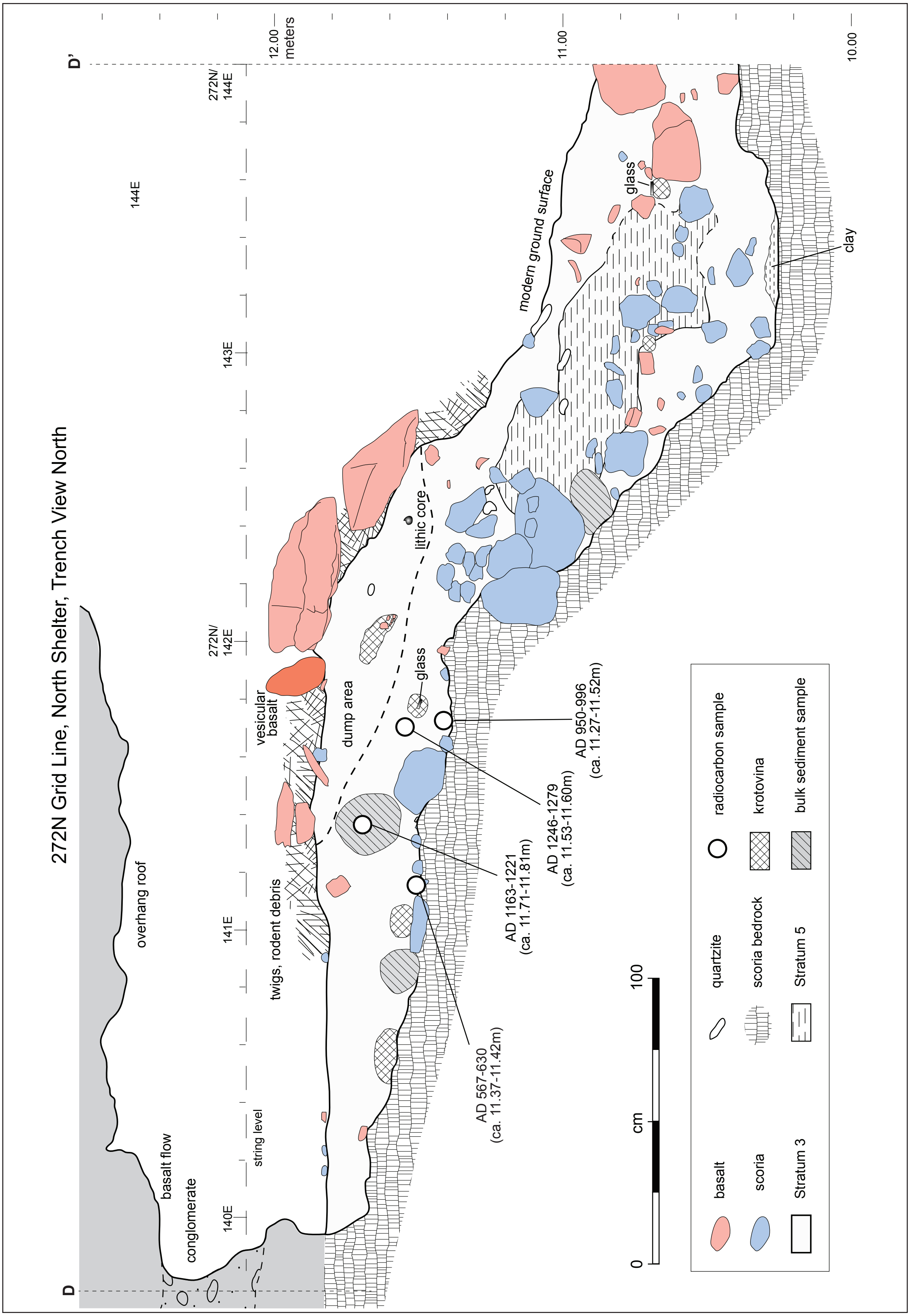

Figure 16.9. North Shelter, 272N grid line profile showing approximate locations of radiocarbon dates.

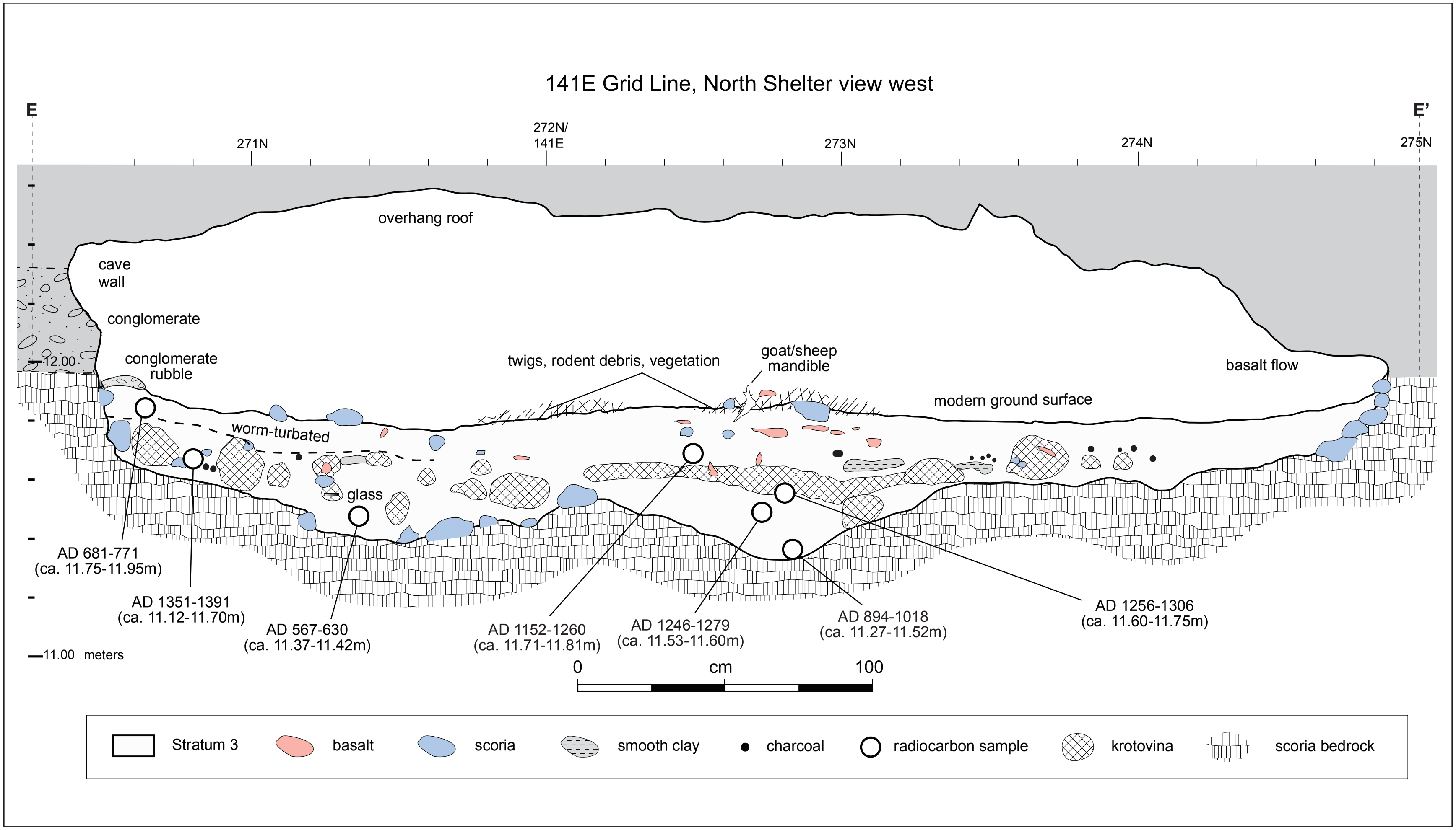

Figure 16.10. North Shelter, 141E grid line profile showing approximate locations of radiocarbon dates.

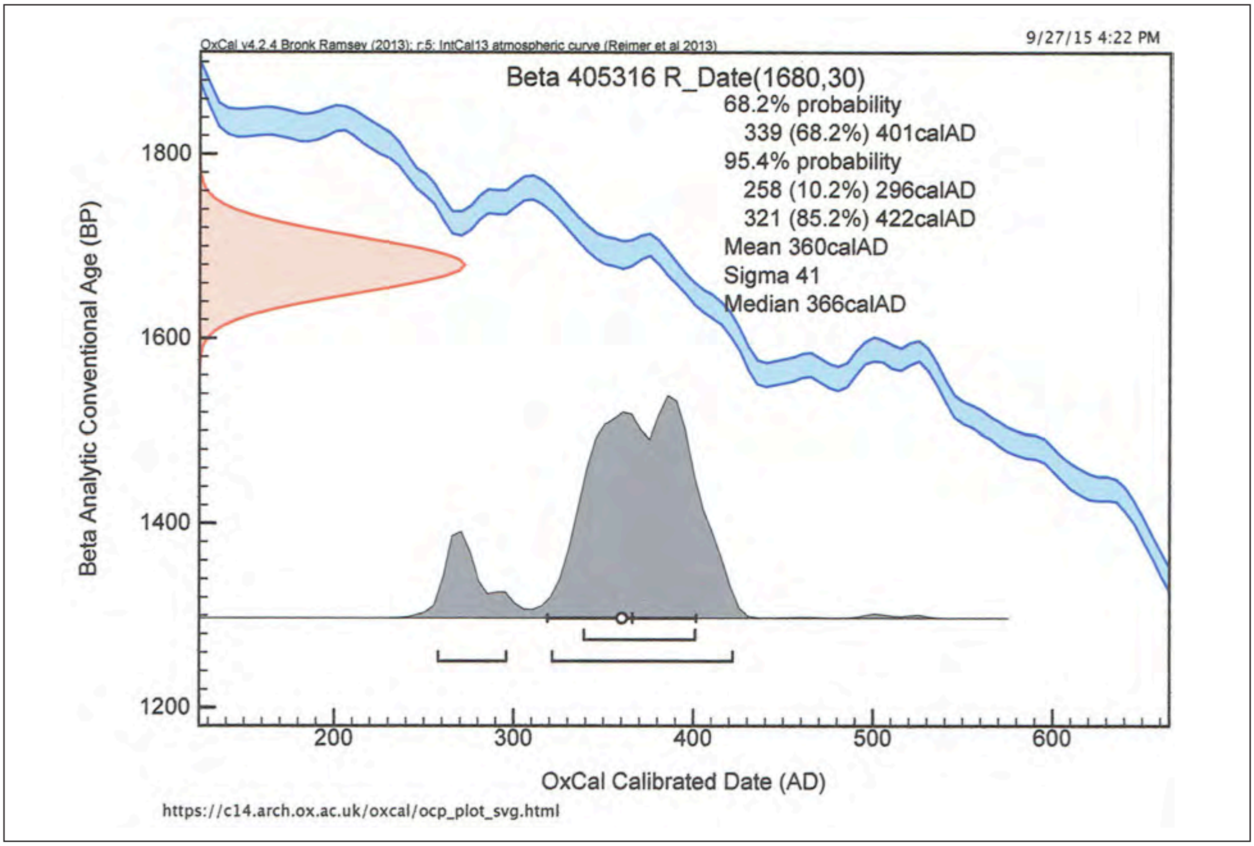

Figure 16.11. Central Talus, calibrated radiocarbon date: curve plot.

supports the observation from the North Shelter dates that chronological patterning in the Stratum 3 alluvial deposit was not significantly disturbed by bioturbation and other causes. Nonetheless, like the North Shelter sequences, this South Shelter sequence contains a date that is out of sequence: the date from Beta-415266 appears younger than the sample below it, a point to which we will also return later. Still, the general older–younger sequence is also supported by the two sediment samples from unit 243N/143–144E; the lower sample yielded an older date, AD 771–903, than the upper sample, AD 1246–1302 (Fig. 16.15). Although the dates are separated by nearly three centuries, they are in appropriate chronological order.

South Talus

A single archaeological sample, Beta-415268, was submitted from the South Talus excavation area (Fig. 16.1). Its most precise date is AD 967 to 1016 (Table 16.2; Fig. 16.16), which is similar to that obtained from sample Beta-415261 (AD 950–996), collected from the same elevation in a South Shelter grid unit 11 m north of the South Talus unit. Like the Central Talus sample, the South Talus sample was from a relatively high elevation (Fig. 16.15) but, since neither was within a shelter, Stratum 3 was about 30 cm thick in the talus excavation grid where it was collected.

Discussion: What Do the Radiocarbon Dates, Date?

As we have observed, although the alluvial sediments constituting Stratum 3 at LA 139965 were recognizably disturbed by a variety of bioturbation and other events and processes, elevational sequences of radiocarbon dates in North Shelter and South Shelter indicate that the deposit was not so mixed that chronological patterns are not evident. That is, older dates are regularly found below younger dates, as we would expect if mixing were

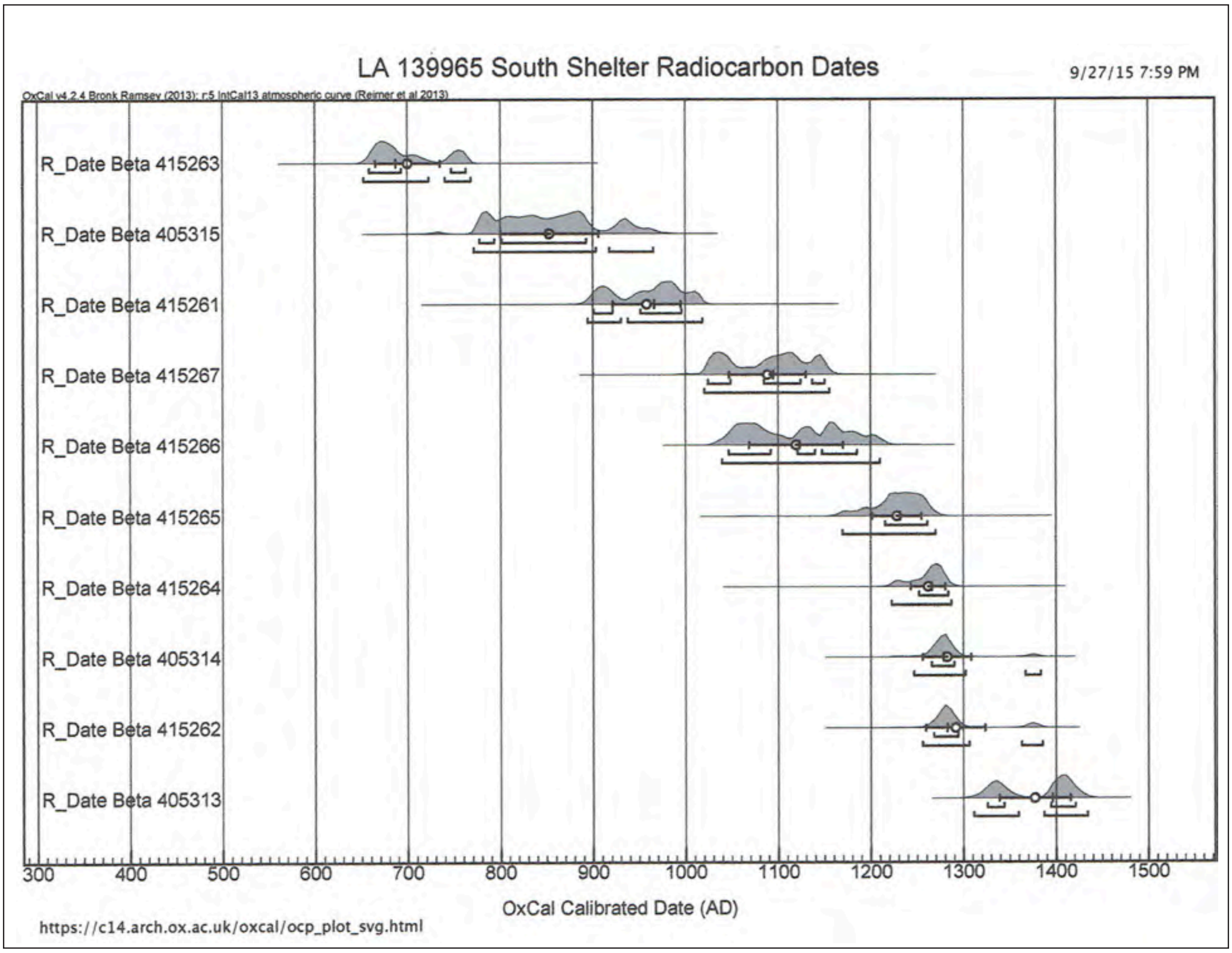

Figure 16.12. South Shelter, calibrated radiocarbon dates: multiple plot.

not significant. Those patterns are not, however, without complications that require clarification before we can assess the relevance of the dates to site occupation.

Out-of-Order Dates within Sequences

The archaeological sequence from the North Shelter is interrupted by an "out-of-order" date, specifically by a date that should be at the top of the sequence if it was in strict chronological order. In the North Shelter sequence from grid unit 272N/141E, the out-of-order date (AD 1246–1279) is 25–116 years younger than the youngest date at the top of the sequence (AD 1163–1221). The archaeological sequence from the South Shelter is also interrupted by an out-of-order date that should have been at the bottom of the sequence. Additionally, the South Shelter sequence is capped at the top by a date that is about four centuries older than the youngest date in the sequence (Table 16.2).

Elevational Date Groups

Four overlapping archaeological and sediment samples from grid unit 272N/141E in the North Shelter, from elevations between about 11.53 and 11.81 m, yielded dates between AD 1152 and 1306 (Fig. 16.7). As we noted earlier, these four samples do not constitute a statistically significant group; the only such group from the North Shelter comprises two samples with the same date, AD 1152 to 1260. The 11.53 to 11.81 m elevation range is 11 cm above the range of (11.37–11.42 m) the oldest date in the other North Shelter sequence (271N/141E), which is at least 500 years older, also using accurate dates.

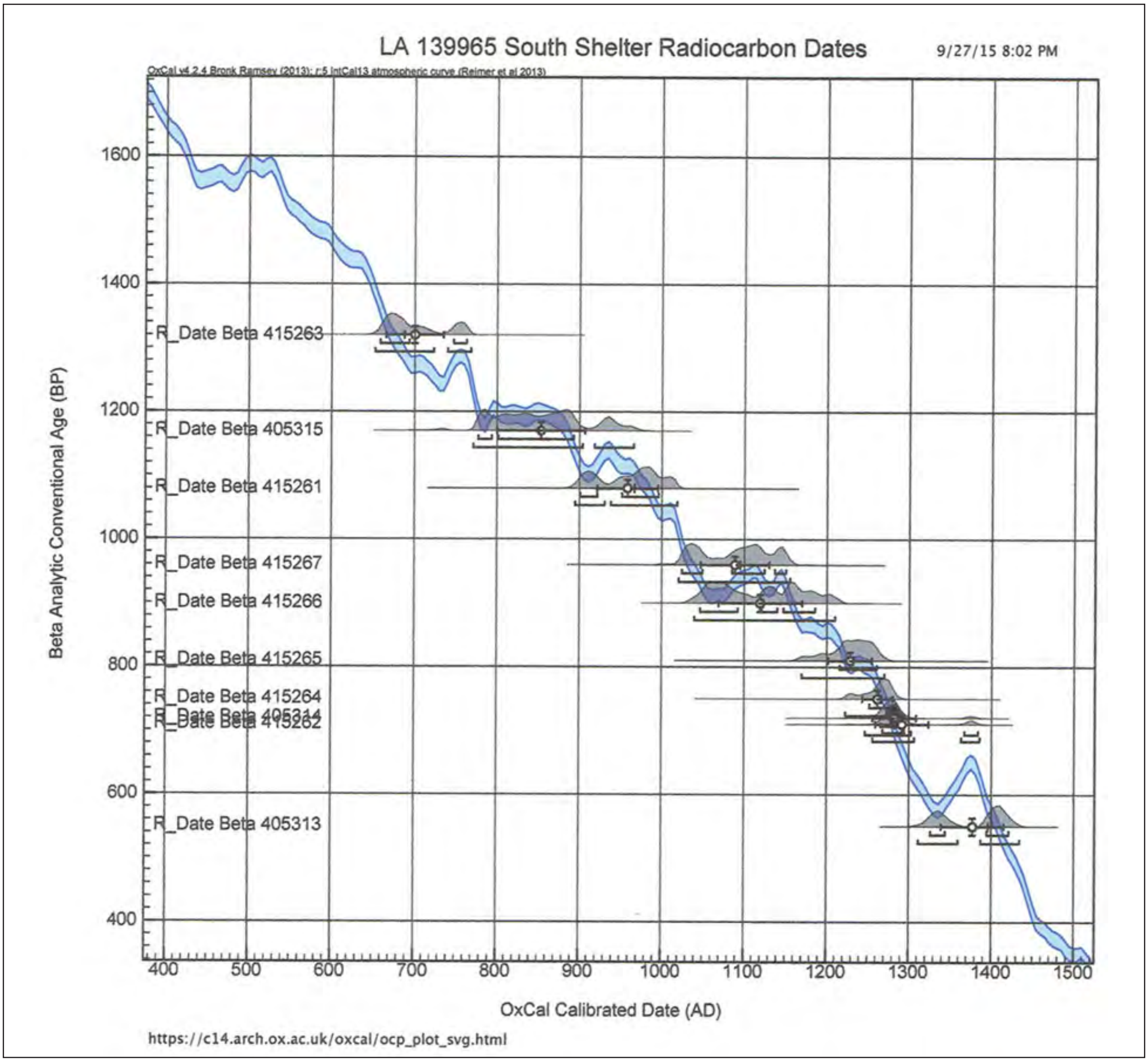

Figure 16.13. South Shelter, calibrated radiocarbon dates: curve plot.

From the South Shelter at elevations between about 11.80 and 12.20 m, there are five archaeological and sediment samples with overlapping dates between AD 1039 and 1302, using accurate dates. These samples are not a statistically significant group, although four samples within the group are statistically the same; they range from AD 1169 to 1302. This date range is very similar to the group of dates from the North Shelter. We should observe that the elevation of the floor of the South Shelter is higher than that of the North Shelter.

To determine whether the groups of similar dates from North Shelter and South Shelter are statistically related, Student's t-test and Grubbs' outlier test were performed by combining the four North Shelter samples and the six South Shelter samples into a single group. The results are presented in Table 16.5. Two samples from the North Shelter—Beta-415259 (archaeological charcoal) and Beta-405312 (sediment)—and four samples from the South Shelter—Beta-415265, 415264, and 415262 (archaeological charcoal) and Beta-405314 (sediment)—make up a group whose dates are statistically the same (95.4 percent confidence). Their mean pooled

Table 16.4. South Shelter, radiocarbon dates: Students T and Grubbs Outlier results.

1. All conventional date values				
Students T Test				
Mean pooled date	897.00 BP	AD 1053.00		
Square root of variance	9.4868	10 samples		
Students T	563.1222			
Chi square	16.9			
Degrees of freedom	9			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	897.00 BP	AD 1053.00		
Standard deviation	237.30			
Critical Z value	2.2899			
Conclusion	1320 BP value is furthest from the group mean but an not outlier. Z = 1.78			
2. Remove 1320 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	850.00 BP	AD 1100.00		
Square root of variance	10.0000	9 samples		
Students T	342.2222			
Chi square	15.5			
Degrees of freedom	8			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	850.00 BP	AD 1100.00		
Standard deviation	196.21			
Critical Z value	2.215			
Conclusion	1170 BP value is furthest from the group mean but not an outlier. Z = 1.63			
3. Remove 1170 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	810.00 BP	AD 1140.00		
Square root of variance	10.6666	8 samples		
Students T	214.2222			
Chi square	14.1			
Degrees of freedom	7			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	810.00 BP	AD 1140.00		
Standard deviation	165.96			
Critical Z value	2.1266			
Conclusion	1080 BP value is furthest from the group mean but not an outlier. Z = 1.63			
4. Remove 1080 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	771.42 BP	AD 1178.58		
Square root of variance	11.3389	7 samples		
Students T	121.6508			
Chi square	12.6			
Degrees of freedom	6			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	771.42 BP	AD 1158.58		
Standard deviation	135.08			
Critical Z value	2.0199			
Conclusion	550 BP value is furthest from the group mean but not an outlier. Z = 1.64			

Table 16.4 (continued)

5. Remove 550 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	808.33 BP	AD 1141.67		
Square root of variance	12.2474	6 samples		
Students T	58.0926			
Chi square	11.1			
Degrees of freedom	5			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	808.33 BP	AD 1141.67		
Standard deviation	102.26			
Critical Z value	1.8871			
Conclusion	960 BP value is furthest from the group mean but not an outlier. Z = 1.48			
6. Remove 960 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	778.00 BP	AD 1172.00		
Square root of variance	13.4164	5 samples		
Students T	27.4222			
Chi square	9.49			
Degrees of freedom	4			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	778.00 BP	AD 1172.00		
Standard deviation	78.55			
Critical Z value	1.7150			
Conclusion	900 BP value is furthest from the group mean but not an outlier. Z = 1.55			
7. Remove 900 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	747.50 BP	AD 1202.50		
Square root of variance	15.0000	4 samples		
Students T	6.7500			
Chi square	7.81			
Degrees of freedom	3			
Conclusion	Samples are significantly the same at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	747.50 BP	AD 1202.50		
Standard deviation	45			
Critical Z value	1.4812			
Conclusion	810 BP value is furthest from the group mean but not an outlier. Z = 1.39			

The only significantly confirmed group of dates from the South Shelter, at the 95.4 percent confidence level, consists of four samples with the conventional date values of 810, 750, 720, and 710 BP (AD 1140, 1200, 1230, and 1240).

calibrated age is AD 1238.33; their accurate (2-sigma calibrated) dates range from AD 1169 to 1306 and their precise (1-sigma calibrated) dates range from AD 1215 to 1294 (Table 16.2). The fact that the group of six samples includes two sediment samples is important because they confirm that datable organic materials from that time period, at least in these elevation ranges, dominate the Stratum 3 deposit. In turn, they also show that dates in that range from the archaeological charcoal samples are not unusual, affirming the statistical definition of the group.

Figures 16.7 and 16.15 identify the North Shelter and South Shelter samples, respectively, that are included in and excluded from the statis-

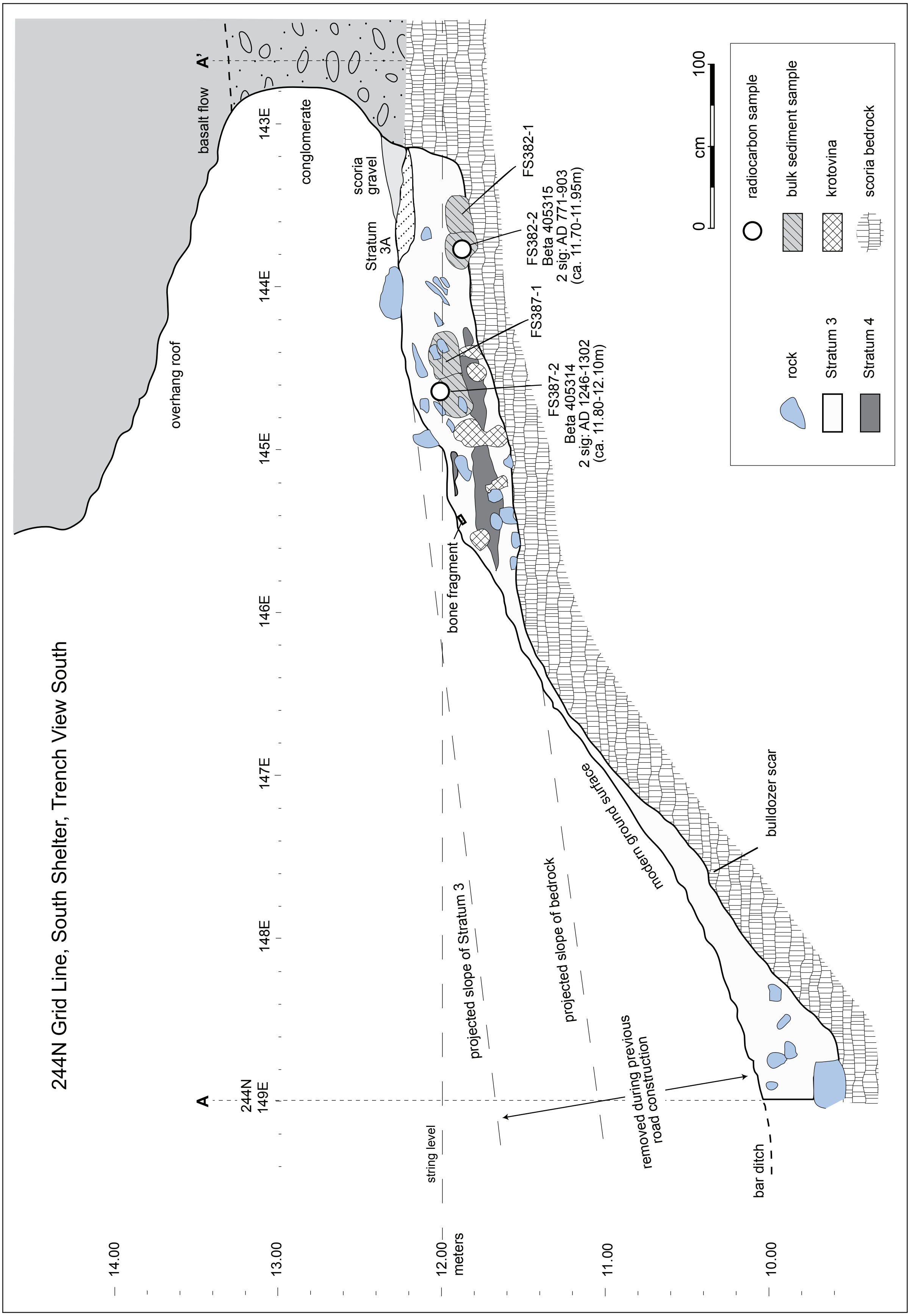

Figure 16.14. South Shelter, 244N grid line profile showing dates of sediment samples. View to south.

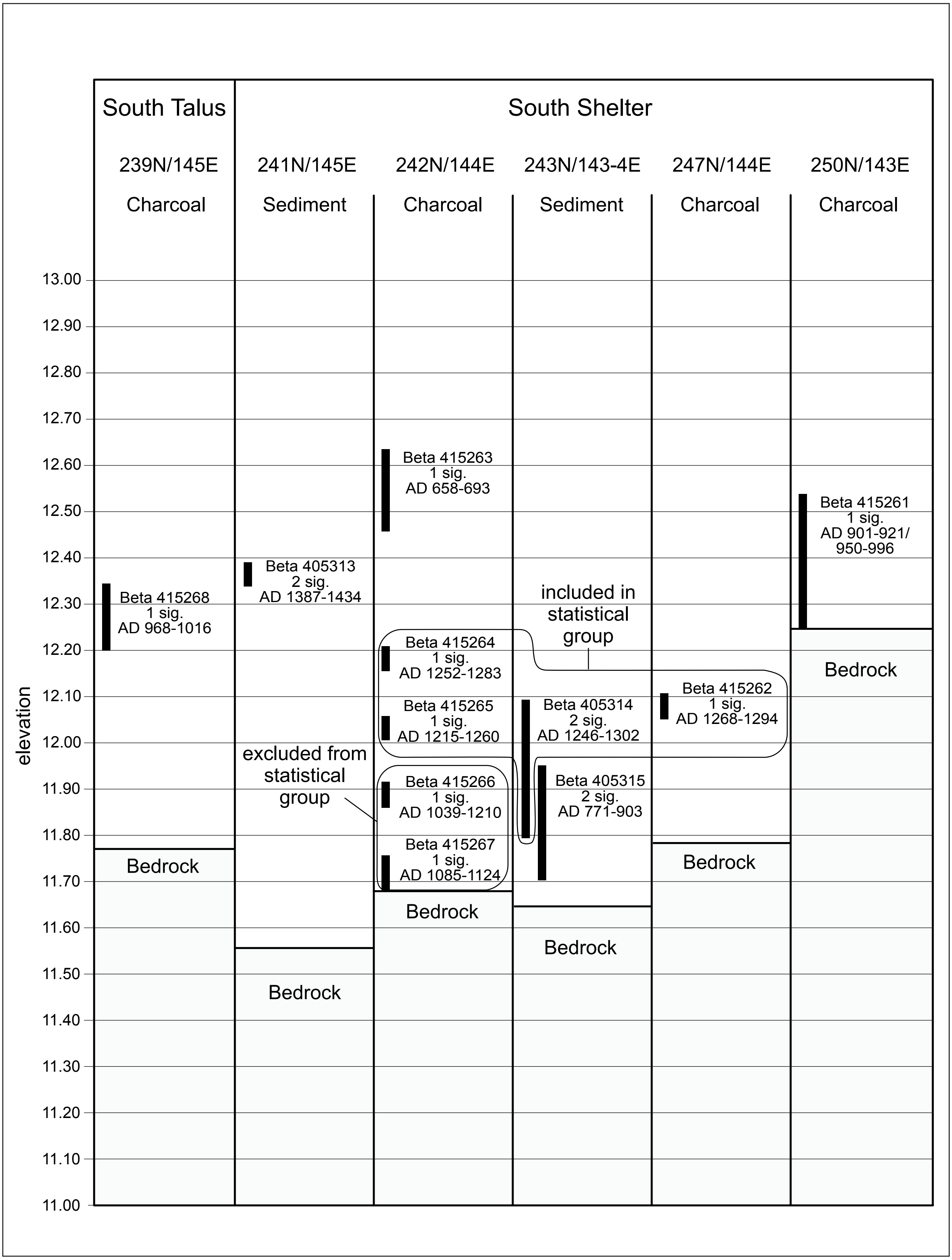

Figure 16.15. South Talus and South Shelter, radiocarbon dates by grid unit and elevation showing samples included in and excluded from statistical group in North Shelter–South Shelter corresponding elevational ranges.

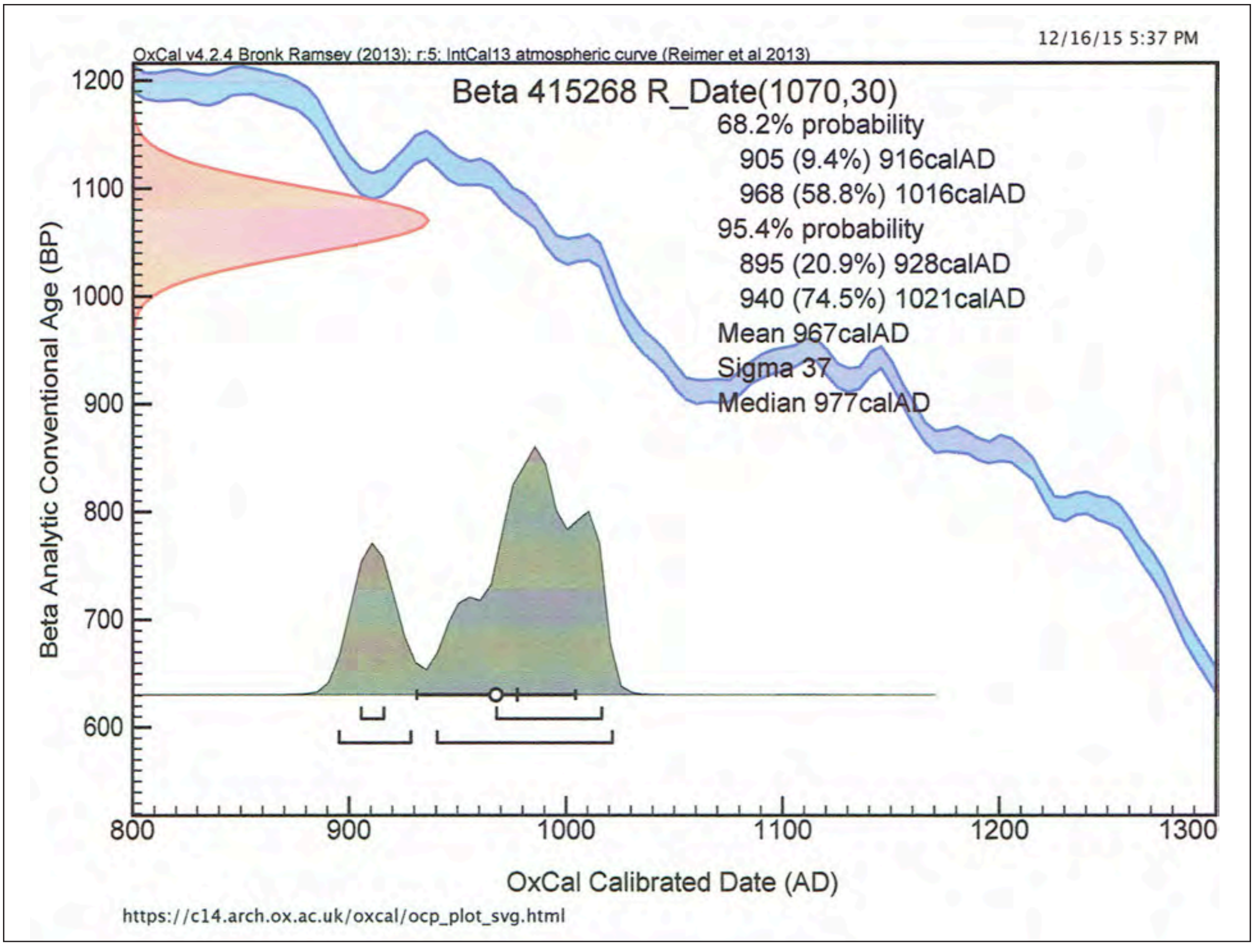

Figure 16.16. South Talus, calibrated radiocarbon date: curve plot.

tically identified group from the corresponding elevational ranges. Figure 16.15 shows that, among the South Shelter samples, the excluded samples include the two oldest samples in the 242N/144E archaeological sequence; their mean conventional date is AD 1065 (930 BP), 187 years older than the mean date of the statistical group from North and South Shelters (743 BP, AD 1207) and 183 years older than the mean of the four South Shelter dates in the group at AD 1203 (747 BP). Figure 16.15 also reinforces that the two older, excluded dates are switched chronologically: the younger of the two samples is from a lower elevation than the older. The four South Shelter samples in the group came from a narrow elevation range between about 11.80 and 12.20 m, while the two older samples excluded from the group came from between 11.70 and 11.90 m elevation. This observation again confirms the general older to younger order of dates with increasing elevation.

Among the North Shelter samples, on the other hand, the included and excluded samples overlap each other in elevational depth (Fig. 16.7). This is because the two post-1100 dates from the 272N/141E archaeological sequence are chronologically switched, with the younger date from below the sample that provided the older date. Had they not been out of order, the younger dates (mean conventional date: AD 1220, 735 BP), which are included in the statistical group, would be from higher elevations than the older dates (mean conventional date: AD 1105, 850 BP) that were excluded. Again, accounting for the switched date order, older dates would be from lower elevations than younger dates. The mean of the two excluded dates (950 BP, AD 1100) is 207 years older than that of the statistical

Table 16.5. North Shelter and South Shelter, radiocarbon dates assessed by corresponding elevational ranges: Students T and Grubbs Outlier results.

1. All conventional date values				
Students T Test				
Mean pooled date	773.00 BP	AD 1177.00		
Square root of variance	9.4868	10 samples		
Students T	75.7333			
Chi square	16.9			
Degrees of freedom	9			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	773.00 BP	AD 1177.00		
Standard deviation	8.02			
Critical Z value	2.2899			
Conclusion	960 BP value is furthest from the group mean but an not outlier. Z = 1.63			
2. Remove 960 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	757.22 BP	AD 1192.78		
Square root of variance	10.0000	9 samples		
Students T	50.8395			
Chi square	15.5			
Degrees of freedom	8			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	757.22 BP	AD 1192.78		
Standard deviation	75.63			
Critical Z value	2.2150			
Conclusion	900 BP value is furthest from the group mean but not an outlier. Z = 1.29			
3. Remove 900 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	745.00 BP	AD 1205.00		
Square root of variance	10.6666	8 samples		
Students T	38.8889			
Chi square	14.1			
Degrees of freedom	7			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	745.00 BP	AD 1205.00		
Standard deviation	70.71			
Critical Z value	2.1266			
Conclusion	850 BP value is furthest from the group mean but not an outlier. Z = 1.41			
4. Remove 850 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	730.71 BP	AD 1219.29		
Square root of variance	11.3389	7 samples		
Students T	26.1901			
Chi square	12.6			
Degrees of freedom	6			
Conclusion	Samples are significantly different at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	735.71 BP	AD 1219.29		
Standard deviation	62.68			
Critical Z value	2.0199			

Table 16.5 (continued)

Conclusion	850 BP value is furthest from the group mean but not an outlier. Z = 1.82			
5. Remove 850 BP value from group, based on Grubbs result				
Students T Test				
Mean pooled date	711.67 BP	AD 1238.33		
Square root of variance	12.2474	6 samples		
Students T	9.2593			
Chi square	11.1			
Degrees of freedom	5			
Conclusion	Samples are significantly the same at 95.4 percent confidence level.			
Grubbs Outlier Test				
Mean date	711.67 BP	AD 1238.33		
Standard deviation	40.82			
Critical Z value	1.8871			
Conclusion	960 BP value is furthest from the group mean but not an outlier. Z = 1.31			

The significantly confirmed group of dates from the North and South Shelter corresponding elevational ranges, at the 95.4 percent confidence level, consists of six samples with the conventional date values of 810, 760, 750, 720, 710, and 710 BP (AD 1140, 1190, 1200, 1230, 1240, and 1240).

group and 215 years older than the mean of the two included North Shelter dates.

Differences between the means of the excluded dates from the North Shelter, AD 1105, and from the South Shelter, AD 1065, show why they do not, themselves, form a statistically defined group.

In addition to the group of dates between the mid-twelfth and late-fourteenth centuries AD, two samples from 11 m apart in the southern part of the site, one from the South Talus excavation area and the other from the northern end of the South Shelter, have identical dates: AD 967 to 1016 (1-sigma calibrated). They are also from the same elevations: ca. 12.20 to 12.35 m and 12.24 to 12.5 m, respectively, higher than the ca. AD 1150 to 1300 date group in the South Shelter.

Alternative Explanations

We have observed that although there are exceptions, the general trend of older dates coming from lower elevations than younger dates is reiterated by archaeological and sediment sample sequences from both shelters and by statistically identified groups of dates. Two possible scenarios present themselves. In the first, the Stratum 3 alluvium contained a relatively large amount of naturally occurring burned wood; based on the charcoal, that wood was predominantly ponderosa pine. Most, although perhaps not all, the charcoal came from trees dating to or after the twelfth century AD at the time they burned. Some may have dated during or after the fourteenth century AD, based on date ranges extending into the AD 1300s. If this were the case, the charcoal specifically selected for dating—in contrast to the bulk sediment samples—was either not actually archaeological in the sense that it resulted from human activities, or we cannot distinguish between natural and archaeological charcoal in the deposit. This scenario relates the LA 139965 radiocarbon data to what were likely natural geological and geomorphological events and processes, perhaps associated with climatic events and processes. Human presence at the site, then, took place within those natural contexts and, without evidence that specifically links human activities to physical aspects of the site, we cannot know the extent to which human presence impacted the site's natural characteristics.

In the second scenario, the 1-sigma calibrated date range from both shelters in the thirteenth century AD, combined with the immediately older range in the second half of the twelfth century AD from the North Shelter, reflects a time of relatively persistent, if consistently short-term, human use of the shelters. That time period could be as long as about AD 1150 to 1400 and perhaps later, again based on date ranges extending through the AD 1300s, a possibility that could be supported by the presence of Classic-period sherds in the South Shelter and South Talus. During that time, numerous human-caused burning events resulted in a considerable amount of wood charcoal left in what was probably aggrading sediment. In this case, the absence of readily recognizable archaeological features at the site implies that those burning events were informal, befitting short-term, non-residential use of the shelters, and that the people consistently selected ponderosa pine, with smaller amounts of oak. Alternatively, and even more likely, more formal features were present in the area now occupied by the road and some of the shelter charcoal was deposited as trash or carried there by the wind and flooding of Coyote Creek.

Plasma Dating

Eric Blinman and Nancy J. Akins

In conjunction with testing the capabilities of the new low-energy plasma radiocarbon sampling laboratory at the Center for New Mexico Archaeology (CNMA), samples of corn, animal bone, and a charred deposit from the roof of South Shelter were processed for radiocarbon dating (Table 16.6; App. 5.3). The goals were to explore the potential of this sampling method while providing additional dates for the site. All of the charred corn kernel samples were submitted to refine the periods when corn was brought to the shelters. Other samples, such as a sawn cattle rib, were more a test of the method. The pairing of the deer and bison tooth (FS 102) samples was to test whether the two species (and a bone versus a tooth) from the same level would provide similar dates. Sheep or goat specimens were submitted to inform on the historic component of the site.

Traditional AMS radiocarbon dating typically involves chemical pre-treatment to remove carbonate, oxalate, and humate contamination, followed by conversion of the sample into a measurable form of carbon, usually by combustion. Traditional acid-base-acid pre-treatment results in destruction of a considerable portion of the sample prior to carbon isotope measurement, requiring at best milligrams of an object for dating samples and at worst tens of grams of sample material. Traditional sample pre-treatment and dating is wholly destructive of the object or the portion of the object selected for dating.

Plasma oxidation with low-pressure energized oxygen gas is a radiocarbon sample-preparation technique that has been used since the 1990s (Rowe

Table 16.6. North Shelter and South Shelter, plasma date samples and results.

Sample No.	FS No.	Area	Grid Unit	Level	Material	Calibrated Date	Probability (%)
151230–2b	308	South Shelter	246N/144E	8	burned corn kernel	AD 1255	95.4
160120–1b–1	102	South Shelter	244N/144E	7	unburned deer metacarpal fragment	AD 1575 AD 1590 AD 1710 AD 1890 AD 1910	6.0 0.3 27.1 46.9 15.1
160122–1d–1	559	North Shelter	271N/140E	2	unburned cattle rib	AD 1904	95.4
160126–1–1	503	North Shelter	274N/141E	3	unburned artiodactyl tooth	AD 1093 AD 1140 AD 1286	7.7 2.5 85.2
160203–2	99	South Shelter	251N/143E	2	burned corn kernel	AD 1019	95.4
160204–3	494	North Shelter	270N/141E	2	burned corn kernel	AD 1017	95.4
160315–1	102	South Shelter	244N/144E	7	burned bison tooth	AD 493 AD 656	12.8 82.6
160712 b-1	183	South Shelter	ceiling		charcoal soot deposit	AD 1405	95.4
160824 b-1	565	North Shelter	273N/141E	7	burned sheep/goat mandibular condyle	AD 341	95.4

et al. 2017). It selectively oxidizes carbon from molecules at the surface of an object at low temperatures (Steelman et al. 2004:741). Because of the low temperatures used, carbonate and oxalate molecules are not oxidized, so acid pre-treatment is not required. Humic-acid contaminates can be removed by rinsing in a pH8 phosphate buffer solution that is extremely mild and can be considered non-destructive for most materials. Following pre-treatment, samples are placed in a vacuum chamber which is evacuated to a high vacuum (10-6 torr). The vacuum removes most atmospheric carbon dioxide (CO_2) that was present in the chamber or that was absorbed by the object. After the vacuum stabilizes (after off-gassing is complete), the surfaces of the object and the interior of the chamber are cleaned by exposure to a low energy argon plasma. Plasma temperatures can be regulated by controlling the power of radio frequency energy used to create the plasma, and for delicate objects, the temperature can be maintained below 40° Celsius (104° Fahrenheit). When argon plasma exposure yields no significant CO_2, all potential contaminants that would impact dating have been removed.

After argon plasma treatment is complete, low-pressure oxygen is introduced to the chamber, and an oxidation plasma is initiated. Oxidation can be for a little as 5 minutes or as long as 2 hours, depending on the sample surface area and the density of organic molecules on that surface. Low temperatures (40° Celsius or less) can be maintained through the oxidation process, or plasma energies can be increased if there is no need to maintain "non-destructive" conditions. Oxidation products for cellulose, sugars, and lipids are dominated by CO_2 and water, while various nitrous oxides are also formed during the oxidation of proteins. Liquid nitrogen and ethanol slush cold traps are used to segregate water, CO_2, and some other combustion products from the gasses in the sample chamber. The traps are manipulated so that the CO_2 (with perhaps some nitrous oxides) are captured in a glass tube, the glass tube is flame sealed, and the radiocarbon sample is complete as an ampoule of 40–100 millionths of a gram (micrograms) of CO_2. All of the carbon is derived from the object, and the radiocarbon sampling process is complete.

Ampoules are sent to the ETH Zurich AMS laboratory for direct AMS dating. When transmitted to the ETH laboratory, the plasma-derived samples are no different than any other radiocarbon samples in terms of measurement, accuracy, interpretation, or other constraints on radiocarbon dating interpretation. The advantages to the low energy plasma sampling process are that it makes acid pre-treatments unnecessary, it allows non-destructive sampling of rare, fragile, or valuable materials, and it does not preclude other types of analyses of individual artifacts (such as residue analysis). The CNMA plasma laboratory has collected samples from international standards, and the combination of CNMA plasma sampling and ETH Zurich AMS measurement has produced results that document accurate dates for the standards (Rowe et al. 2017).

Results of the Coyote Creek Rockshelter plasma dating are mixed (Chapter 8, this report). Some are plausible in comparison with other radiocarbon dates and chronologically sensitive artifacts found in the vicinity, while other dates differ significantly, but given the amount of rodent disturbance are not impossible. The best example of this is the two samples from Level 7 of grid unit 244N/144E in South Shelter. An unburned fragment of deer metacarpal could date as early as AD 1575 and as late as AD 1910 but the AD 1890 intercept has the highest probability. Given the amount of rodent disturbance in this grid unit (see Fig. 7.5) as well as the mechanical movement of boulders in an adjacent grid unit (Fig. 8.21), a relatively modern piece of deer bone could have found its way deep into the shelter fill. A piece of burned bison tooth from the same level could date as early as AD 493 but is more likely to date around AD 656. The depth of the deposit and other bison tooth fragments found deeply buried in nearby grid units makes the early date on the tooth plausible. Two other South Shelter dates are on corn, and both have dates that fall within the range of traditional radiocarbon dates and dated ceramic types.

Samples from North Shelter include corn with essentially the same date as one of the samples from South Shelter and three faunal samples. A deeply buried burned mandibular condyle that was originally identified as possible sheep or goat returned one of the earliest dates for the site—AD 341. If the date is correct, it was probably from a mountain sheep. Another specimen, tentatively identified as a domestic sheep or goat tooth, returned a most likely date of AD 1286, suggesting that it was actually from a closely related species such as pronghorn or bighorn sheep. The final example is a modern commercial cut—a beef sparerib that dated around AD 1904. Short rib cuts have been found in nineteenth- and early twentieth-century contexts in Santa Fe (personal observation from OAS excavations at the Executive Office building), so this date is plausible.

Additional LA 139965 samples will be processed in the future and the lab will continue to experiment with bone and tooth dating.

17 Discussion

Coyote Canyon Rockshelter (LA 139965) is unique in a number of ways, starting with the fact it was excavated. Few sites east of the Sangre de Christo Mountains have been excavated and even fewer sites in Mora County have been excavated.

Archaeological Resources East of the Sangre de Christo Mountains

More is known about areas to the north (Boyer et al. 1994a, 1994b), northeast (Glassow 1980; Winter 1988), and west (Adler and Dick 1999) than the eastern flank of the Sangre de Cristo Mountains. To better understand how the eastern area was used, a search for reports on sites east of the Sangre de Cristo Mountains was conducted—it soon revealed that very little is known about the area. To learn more about the known non-Anglo site distribution, Ann Stodder did a NMCRIS search (accessed July 2015); Figure 17.1. The northwest corner of the study area includes Eagle Nest Lake and the northern edge follows Highway 58 past Cimarron, about halfway to Springer. The area extends due south to Tecolote Pueblo and the eastern plains in San Miguel County. The southwest corner of the area is near where NM 3 crosses the Pecos River; the western border extends up the east side of the Sangre de Cristo Mountains to Eagle Nest (Fig. 17.1). Some of the boundary areas were drawn using site location information on NMCRIS GIS maps. The area encompasses approximately 7,688 sq km (2,968 sq mi). Areas to the northeast that had more intensive study, such as the Vermejo River drainage and associated canyons, Dawson, and the Park Plateau area were not included in the NMCRIS search because there are publications on the large projects in this area (Biella and Dorshow 1997; Glassow 1980; Winter 1988).

NMCRIS has information on nine sites assigned to the Paleoindian period. One site has Clovis, Folsom, and Plainview components, three have Folsom/Midland components—and one of these also has a Cody component; the rest are unspecified. Glassow (1980:71) reports Folsom points in private collections but no definite sites in the Cimarron area. Winter's (1988:73) slightly later summary for the Dry Cimarron Valley notes two Clovis points in a small lithic scatter located on a bluff that could represent a Paleoindian site; or, the points could have been left there by later groups. The situation is similar for the Folsom period even though the Folsom type site lies just outside the study-area boundary. Folsom points have been recovered by collectors throughout the Dry Cimarron Valley, but the sites they were associated with may be like the Folsom type site and deeply buried (Winter 1988:73). As with the other Paleoindian components, the Dry Cimarron had isolated occurrences and collections by local collectors (Winter 1988:74). These observations suggest that Paleoindians used the east flank of the Sangre de Cristo Mountains, but any substantial sites are probably buried under alluvium.

Archaic sites are more common (n = 51) in NMCRIS, especially those with Late Archaic components. Three date to the Early Archaic and one also has a Middle Archaic component. Two were recorded as structural. One of these sites is located southeast of Coyote Canyon in a restricted canyon and also has a Pueblo and an historic component (NMCRIS, accessed September 21, 2015). Four are recorded as Middle Archaic; these sites also have Late Archaic components. Late Archaic sites are the most common (n = 32). Another 12 are unspecified Archaic. Only six are at elevations over 7,000 ft (four Late Archaic and one each Early and Middle Ar-

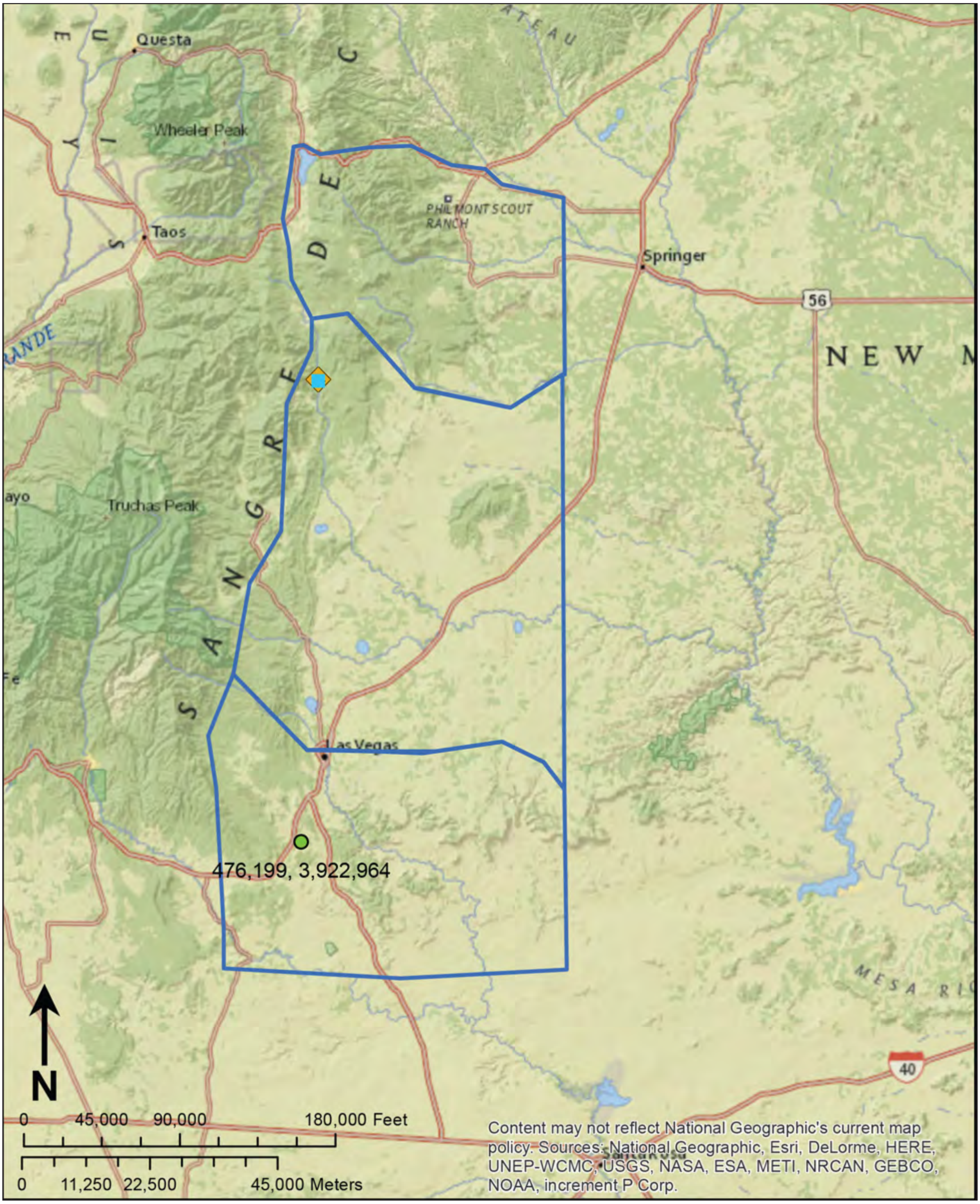

Figure 17.1. 2015 NMCRIS search result for sites east of the Sangre de Cristo Mountains.

chaic). No Early or Middle Archaic sites or projectile points have been reported for the Dry Cimarron Valley. Three rockshelters and an open site have absolute dates in the Late Archaic and a number of sites have Late Archaic projectile points, suggesting greater use of that area, probably by Plains Archaic groups (Winter 1988:74–75). This suggests an Archaic-period presence east of the Sangre de Cristo Mountains that increased in the Late Archaic. High-elevation sites such as these suggest that the En Medio points found during the Coyote Canyon Rockshelter excavations could represent a Late Archaic component not documented by means other than the projectile points.

Pueblo sites are much more common in the NMCRIS area (n = 123) examined. Almost all are multicomponent and are recorded in either the Pecos Classification or Rio Grande sequence. Just over half are non-structural with components listed as: unspecified (n = 3), Basketmaker II (n = 4), Pueblo I (n = 7), Pueblo II (n = 19), Pueblo III (n = 11), Pueblo IV (n = 4), Developmental (n = 6), Coalition (n = 2), Post-Pueblo Revolt (n = 1), and Spanish Contact/Colonial (n = 1). The distribution of sites recorded as structural is similar: unspecified (n = 6), Pueblo I (n = 3), Pueblo II (n = 17), Pueblo III (n = 23), Pueblo IV (n = 5), Developmental (n = 4), Coalition (n = 1), Spanish Contact/Colonial (n = 1), and Recent Historic (n = 1). One main difference is that Pueblo III structural site numbers increase while non-structural sites decrease. Coyote Canyon Rockshelter is at the highest elevation for sites in this NMCRIS data base (7700 ft). Non-structural sites have a mean elevation of 6477 ft (6456 ft without Coyote Canyon Rockshelter). Structural sites tend to be at lower elevations (mean 6238 ft) with only one over 7000 ft. While still small, the numbers suggest a greater presence of Pueblo groups in the area during the time that Coyote Canyon Rockshelter site was occupied—but these were much more common in lower elevation settings.

Other sites, especially to the north, were recorded as Plains Woodland (ca. AD 250–450 to AD 950) (n = 32). Most are unspecified Plains Village (n = 8) and a few are Plains Woodland (n = 4), Panhandle Aspect (ca. AD 1000–1350) (n = 5), or Unspecified Other Prehistoric (n = 1). Only nine are recorded as nonstructural, but as Winter (1988:75) points out, structural sites are more visible and more likely to be recorded. In the Dry Cimarron Plains Woodland sites have cord-marked and plain ceramics, manos, metates, bedrock mortars, rock art, dart and arrow points, and in that area were occupied from about AD 250–450 until AD 950–1000. These groups were probably foragers who utilized parts of northeastern New Mexico, southeastern Colorado, and adjacent parts of Texas and Oklahoma while living in rockshelters, brush and hide shelters with rock foundations, or in open camps. Panhandle Aspect sites have upright-slab walls and fortified sites in defensive locations, but are relatively rare (Winter 1988:75–76).

Information on Protohistoric and early Historic non-Pueblo groups was not collected. None of the dates or artifacts from Coyote Canyon Rockshelter indicate occupation during this period. However, the presence of sheep/goat bones and a few historic artifacts with early dates suggest that herders from the Guadalupita or Mora Land Grants could have grazed flocks in the area. A NMCRIS search for Hispanic sites found 24 sites dating from Spanish Contact/Colonial to New Mexico Statehood–WW II periods. Only five were recorded as non-structural, with one each for the Spanish Contact/Colonial and Post-Pueblo Revolt periods, and three for the U.S. Territorial period.

Research Questions

Three research questions were proposed in the data recovery plan (Akins et al. 2014). As noted in Chapter 5 of this report, the focus of Question 2 (ethnicity) shifted when analyses did not find evidence of a suggested Jicarilla Apache component at the site.

Question 1: Chronology

Artifacts and radiocarbon dates document use of LA 139965 over a long period of time. The occupation was intermittent and extended from at least the Late Archaic period into the nineteenth century.

Archaic Period

The earliest evidence of site use is the presence of four En Medio points, which date to the Late Archaic period, ca. 800 BC–AD 400. One was found in each of the primary site areas, but no other cultural material could be assigned to this period. All of the points are base fragments and unlikely to have been salvaged from earlier sites for reuse (Chapter 10, this report). The earliest radiocarbon date for the site falls at the end of the Late Archaic (most accurate AD 312–422; Chapter 16, this report). It is on organic material from a sediment sample taken from against the cliff in the Central Talus area—the only site area without an En Medio point. This early date in an area of the site that has few cultural remains documents Coyote Creek flooding and overbank deposits up to the cliff. It indicates that alluvial deposition took place during this period and that a human presence was possible even if not preserved intact. An AD 341 plasma date from deep in North Shelter also falls in the Late Archaic period (Chapter 16, this report).

Early Developmental Period

The next group of dates is from the early Developmental period (ca. AD 600–900). A charcoal sample from one of the shallower grids in the south corner of North Shelter has a most accurate date of AD 681–721 while a most accurate date of AD 567–630 came from the base of an adjacent grid unit. South Shelter radiocarbon dates include one from sediment at the back of the shelter just above bedrock (AD 771–903), a charcoal date from disturbed fill on top of a boulder in the main area of the shelter (most precise AD 658–693), and a plasma date from a bison tooth (cal AD 656) (Chapter 16, this report).

The presence of wide neckbanded ceramics provides additional evidence for use of the site during this period (Chapter 9). Wide neckbanded (n = 31) and wide neckbanded wiped (n = 2) sherds were found in all four of the main site areas. Two of those from the North Shelter were in the same level as the AD 681–721 radiocarbon sample. Others were found in adjacent grids in Levels 1 and 2 and the rest in deeper levels of a grid unit to the north. In South Shelter, most wide neckbanded sherds were found in grid units at the south end (242–243N) (n = 9 of 11) in both upper and lower levels of fill.

Stemmed projectile points were most popular in the early Developmental period (Chapter 10, this report). These were more common in the northern area of the site, where they were found in both upper and lower levels. One from North Shelter was in the same grid unit as two wide neckbanded ceramics, as was one from North Talus. The two from South Shelter were found in deeper levels. One wide neckbanded sherd was in the level above where a stemmed point was recovered. Small corner-notched points were also more common in the early Developmental period than later (Chapter 10, this report). These were fairly common and found in the upper two levels in North Shelter, the upper five levels of North Talus, and throughout South Shelter and South Talus.

Late Developmental Period

Radiocarbon samples dating to, or mostly to, the late Developmental period (ca. AD 900–1200) were from both shelters and South Talus (Chapter 16, this report). The South Talus sample was from the far southern end of the site in the second level of fill against the cliff; it returned a most precise date of AD 967–1016. A date from the north end of South Shelter (Level 4) also dates to this period (most accurate AD 894–1018, most precise AD 901–921 or 950–996). Two other South Shelter dates have overlapping ranges (most accurate AD 1020–1155 and 1039–1210) from Levels 13 and 16 respectively). In addition, a plasma date on burned corn is from this period (cal AD 1019). The only North Shelter dates that fall completely in the late Developmental period are a charcoal sample from a deep level (Level 8) (most accurate AD 894–1018) and a plasma date from a corn kernel dated to cal. AD 1017. Two sediment samples and a charcoal sample from Level 3 of an adjacent grid returned most accurate dates of AD 1152–1260.

Most of the ceramics recovered from the site date to the period between AD 1050 and 1225 (Chapter 9). This conclusion was based on the large number of Plain Gray sherds as well as the presence of Taos Incised Gray and Taos Black-on-white ceramics. All of the Taos Black-on-white (n = 1 from North Shelter; n = 6 from North Talus) and more of the Taos Incised Gray were found in the northern area (n = 24 of 39). All but one of the Taos Black-on-white ceramics was recovered from the first level of fill. Incised gray sherds came from most levels within North Shelter (n = 12) but tended to be in the upper levels in North Talus (n = 12). In South Shelter, only one came from an upper level and the rest were in mid- to lower levels (n = 10). All of those from South Talus (n = 4) were in the upper two levels.

In some areas side-notched projectile points appear in the late Developmental period and are most common in that period (Chapter 10, this report). This form is much more common in South Shelter, where they are more often found in Levels 3–8; they are the most frequent projectile point type in South Talus Levels 3–6.

Coalition Period

Several radiocarbon dates fall within, or mostly within, the Coalition period (ca. AD 1200–1325). In North Shelter a charcoal sample from 272N/141E, Level 6, returned a most precise date of AD 1246–1279, while a sediment date from an adjacent grid unit farther back in the shelter had a most accurate date of AD 1256–1306. In South Shelter, the earliest of the Coalition dates came from a charcoal sample from the southern part of the shelter in 242N/144E, Level 7, and was most precisely dated at AD 1252–1283. A sediment date from a meter north has a range that encompasses most of the Coalition-period date range (most accurate AD 1246–1302). North of the main part of South Shelter, in 247N/144E, Level 3, a charcoal sample dated most precisely at AD 1268–1294 (Chapter 16, this report). Plasma samples dating to this period include burned corn from Level 8 of South Shelter and a burned artiodactyl tooth from Level 3 in North Shelter.

Ceramic evidence for a Coalition-period occupation is seen in the presence of corrugated pottery—both Indented Corrugated and Smeared Corrugated. Both types occur earlier but higher frequencies are more typical of the Coalition period. No painted wares from this period were found. Two Indented Corrugated sherds were found in Level 3 of a North Talus grid unit. The rest came from the southern area of the site. Five were fairly deep (Levels 8–9) in a grid unit at the back of South Shelter (241N/144E) and adjacent to a grid unit that had a Coalition-period date in Level 7. The two from South Talus are from widely separated grid units and different depths (243N/147E, Level 1, and 245N/145E, Level 7). Smeared Corrugated sherds were most common in South Shelter and North Talus. But they were also found in North Shelter (n = 9), in Level 1 (n = 2), Level 3 (n = 6), and Level 4 (n = 1), while those from North Talus (n = 14) were scattered throughout nine grid units and from Levels 1–8. The main section of South Shelter (244–246N) had the most Smeared Corrugated sherds (n = 17); they were more concentrated in 245N/143–144E (n = 12), where they were found in Levels 2–10. Only four were found south of the main section of South Shelter and these were on the surface, in Level 1 (n = 2), and in Level 3. Two were found north of the main section of South Shelter, in 247N/144E, Level 7, considerably below the Coalition-period radiocarbon date from the same grid unit. All of the South Talus Smeared Indented ceramics (n = 7) came from the first two levels of fill and most were north of the main shelter area (n = 4).

Classic Period

A sediment date on a sample from south of the main section of South Shelter (AD 1311–1359 or AD 1387–1434) and a charcoal sample from North Shelter 271N/141E, Level 2, most accurately dated at AD 1351–1399 (Chapter 16, this report) are the only radiocarbon dates that fall within or mostly within the Classic period (ca. 1325–1600). An occupation during this period is also indicated by Cieneguilla Glaze-on-yellow and glaze-on-yellow ceramics produced between the fourteenth and early fifteenth centuries (Chapter 9, this report). South Shelter held 15 of the glaze-on-yellow sherds. Two were found in Levels 5 and 8 in the south section of the shelter. The rest were from the main section of the shelter and were found in Levels 1–10 in 12 grid units. South Talus had a similar distribution except these tended to be in the upper two levels (n = 5, of 8).

Protohistoric Period

The only possible indication of use during this period is a plasma date of AD 1405 from soot scraped from the ceiling in South Shelter. Otherwise, no radiocarbon dates and none of the artifacts indicate definite use of the site between AD 1400 and the arrival of the Spanish. No micaceous wares were found but a few polished utility (n = 3) and Smudged Utility (n = 5) sherds that could have been produced during the historic period were found. Given the similarities to prehistoric wares from the site, it is more likely that these ceramics were produced during the prehistoric period (Chapter 9, this report).

Historic Era

Evidence for historic use of the site comes mainly from domestic animal bones and Euroamerican artifacts. Domestic ungulates were introduced to Northern New Mexico by the Spanish as early as 1598, when Oñate arrived at San Juan de los Caballeros at the juncture of the Rio Grande and Chama River with sheep, goats, cattle, and horses (Baxter 1987:4–5). The 67 specimens from domestic animals recovered from LA 139965 (n = 2 cattle; n = 64 sheep or goat; n = 1 goat) were spread throughout the site, with the largest frequencies in the North Talus and South Shelter (n = 21 each), slightly less (n = 20) from North Shelter, and few (n = 5) from South Talus. The cattle specimens were found in the two shelters and that from North Shelter was a modern commercial cut (short rib). The sheep/goat and goat were mainly from the first three levels in North Shelter (n = 16 of 19) with two in Level 4 and a cf. sheep/goat fragment in Level 7. All of the sheep/goat from North Talus were in the first two levels of fill. Most of the South Shelter sheep/goat were also in the first three levels of fill (n = 16 of 20) with two each in Levels 4 and 5. South Talus had single sheep/goat specimens from the surface through Level 4. Other than the modern cattle specimen and an unburned deer specimen, none of these can be assigned to a specific part of the historic era. A piece of deer metacarpal from South Shelter grid unit 244N/144E returned a date of AD 1890 (46.9 percent probability). A sawn beef short-rib from North Shelter grid unit 271N/140E, Level 2, returned a date of AD 1904 (cal, 95.4 percent probability).

Strike-a-light flints also indicate site use after the arrival of the Spanish. The only other chipped stone object that could date to this period is a Spanish side-notched projectile point (Chapter 10, this report) that was found in the same grid unit as several sheep or goat specimens. Neither the strike-a-light flints nor domestic animal bones are exclusive to any one early group.

It is theoretically possible that Jicarilla Apaches used the site area without leaving diagnostic evidence, most likely in the period between about 1720–1730 and 1835. Historic records document their presence in Mora and San Miguel counties and along the foothills of the Sangre de Cristo Mountains, with seasonal movement onto the plains (Tiller 1992:13).

Hispanic settlers could have used the general area for grazing sheep as early as the 1830s. Although, farming was the primary occupation into the late 1880s (Ebright 2010:3), the 1880 census has 31 herders in the greater Guadalupita area. The Coyote Canyon Rockshelter sheep/goat specimens could date from this period and as late as 1915 when the grant heirs lost their rights to the common lands in that area (Chapter 3, this report).

Some of the Euromerican artifacts have beginning dates in the 1800s (10.2 percent before 1850 and 45.9 percent between 1850 and 1900), but none have ending dates before 1900 and only four have end dates at all (Chapter 14, this report). Workers and visitors to a lumber camp—actually a small community dating from the 1920s—located a few miles to the north along Coyote Creek (Chapter 3, this report)—could have passed by the rockshelters and left some of the more modern material behind. By 1930, a gravel road from Lucero to Black Lake passed by the site; once it was improved hunters and travelers would have had increased access to the shelters (Chapter 1, this report).

Question 2: Ethnicity of the Site Occupants

The prehistoric groups occupying the site were most likely Ancestral Pueblos. Ceramics and chipped stone artifacts indicate links with the Taos area to the north (ceramics, Chapter 9, this report), the Chama Valley to the west (Pedernal chert; Chapter 10, this report), Rio Grande gravels to the west (Pedernal chert, Madera chert, obsidian; Chapter 10, this report), the Jemez Mountains and Valle Grande to the northwest (obsidian; Chapter 10 and Appendix 2, this report), to the south or southeast (Tecovas chert; Chapter 10, this report), and to the Galisteo Basin (ceramics; Chapter 9, this report). Rare items, such as a single Cibola white ware sherd and Narbona Pass and Zuni spotted cherts, also point to ties to the west. Items associated with Woodlands or Plains groups (paddle and anvil or cord-marked ceramics, some bone and stone tool types like beveled knives, and tool material such as Alibates chert) are absent or virtually absent. The only possible link to a Plains tradition is a single sherd that has surface treatment resembling the paddle and anvil finishing technique, but the temper and paste in this sherd are similar to those of Taos gray ware types (Chapter 9, this report).

Assessing the dating, much less the ethnicity, of the historic component(s) is more difficult. Other than sheep or goat bones and plasma dates from the late nineteenth and early twentieth centuries, few artifacts indicate an early historic occupation. Likely definitive historic objects for LA 139965 include: strike-a-light flints; the possibly Spanish side-notch projectile point (Chapter 10, this report); an iron rivet that could be part of a Mexican bridle; and an ambiguous piece of metal that was originally thought to be a projectile point, but was determined to be a metal strap that was cut and punched for use as a fastener (Chapter 15, this report).

By the time census records document herders among the residents of Guadalupita (1880), the peak of the sheep industry had passed. Sheep were no longer driven long distances to be sold for their meat, but the introduction of new breeds and crossbreeds increased wool production (Baxter 1987:147–150; Dunmire 2013:68, 89). It was the era of the land and livestock barons, such as T. B. Catron (Chapter 2, this report), who used the *partida* system of leasing flocks to landless herders in return for payments in lambs or wool. However, most sheep owners were Hispanics, Pueblos, and Anglos with relatively small flocks. In 1890, Mora County had about 200,000 sheep and 25,000 goats, but only 65,000 cattle (Dunmire 2013:50, 94–95). Sheep and goat remains, and possibly the knife-opened early canned goods and strike-a-light flints, are the most likely artifacts to have been left by local Hispanic ranchers who moved their small flocks to the mountains during spring and summer.

The chipped stone and historic artifacts recovered from the site do not tell us who left them. Strike-a-light flints work with metal and could have been used by Pueblos, Apaches, Hispanics, or even Anglos before matches became readily available. Nor is it clear that the sheep or goat specimens (n = 65, including 31 cf. sheep or goat) can clarify who was grazing flocks in the area and occasionally losing or butchering a sheep or goat. All but one specimen came from juvenile or mature sheep and could represent as few as four animals (three full-sized and one fetal or neonate). The fetal or neonate cranial fragment indicates a presence in early spring while the others could occur through the year. Foot, skull, and rib fragments make up most of the body parts, with very few vertebra, pelvis, or rear leg parts. This distribution suggests the animals were butchered at the site and some of the prime parts may have been removed or simply were processed to the extent that they could not be distinguished from the native artiodactyls. Unlike the native artiodactyl bones, few are burned (7.7 percent) or have evidence of processing (n = 5 cuts; n = 4 defleshing). Knife-opened canned goods could have been left by Hispanic herders, Anglo travelers, or hunters.

Question 3: Why Was the Site Occupied and How Did It Function in Its Settlement System?

LA 139965 is located on a strip of land between an olivine basalt cliff and Coyote Creek. The cliff and the rockshelters at the base of the cliff face east; the sun warms the shelter in the morning and provides shade in the afternoon. Proximity to the creek and a grassy or lightly wooded area between the creek and cliff made this an ideal place to camp, whether for a few nights or a more extended period. Seasonal flooding, demonstrated by alluvial fill within the shelters, was probably more frequent during the wet period between AD 260 and 1000 (Hall, Chapter 7, this report) and may have discouraged use during some seasons and especially wet years. However, sudden or unexpected rises in the creek could be escaped by climbing the more broken rock just north of the shelters.

A variety of small and large mammals and plants live near the shelters and would have supplied a range of wild foods as well as abundant fuel wood. Charred and uncharred amaranth and goosefoot were found in more of the flotation samples than any other plant. Grass parts were also common, as were various corn parts (Chapter 13, this report). Traces of corn pollen were found in several pollen samples but none were in the aggregates that would suggest it was grown on the site (Phillips, Chapter 14, this report). The site occupants exploited both upland and riparian plant resources, grinding seeds from amaranth, goosefoot, and grass (Cummings and Varney, Chapter 14, this report). Plant remains from the site indicate occupation from at least spring into the fall. Charred piñon and acorn shell document some presence into fall (Chapter 13, this report).

Ground stone morphology, wear, and associated botanical remains indicate the tools were multifunctional and used to process a wide variety of wild seeds, corn, and meat. Tool design suggests hulling, husking, and cracking activities rather than high-volume flour production, consistent with the long-term use of the site as a hunting campsite (Chapter 11, this report).

Fauna recovered from Coyote Canyon Rockshelter indicates a focus on hunting deer while also utilizing a range of small mammals, occasional birds, and larger artiodactyls. Smaller animals such as the squirrels, rodents, rabbits, beaver, and birds could have been trapped or hunted by women and children who remained at the base processing animals and plants while others sought out larger game. Deer tend to be dispersed during most of the year, inhabiting high-elevation forests from April until the start of winter snows. Bones from deer recovered at the site indicate all ages were hunted. Fetal artiodactyl specimens (n = 6, deer; n = 81, small to medium and medium artiodactyl—most of which are probably deer) indicate that does were killed as early as March, while immature specimens (n = 62, deer) indicate that does and fawns were taken after the birthing season in late May and early June when they tend to be isolated (Chapter 12, this report). Juvenile deer are eventually allowed back into the family group as does, and fawns from adjacent ranges band together while foraging. Group size increases slowly through late summer and autumn and into winter (Mackie et al. 1982:868). Shed and unshed antler from bucks (n = 35, deer; n = 21, deer or elk), as well as a good number of juvenile specimens (n = 146, deer), were also found. Thus, it appears that the human strategy was not just to harvest the largest and healthiest animals during their peak condition, but deer in general throughout the warmer seasons. The best strategy for hunting deer from the site might require small hunting groups to leave the camp and move throughout the area, but not so far that complete deer could not be brought back to the site for processing. The body-part distribution for deer at LA 139965 is similar to that found in residential sites to the west, suggesting that rather than performing initial processing tasks and transporting the higher utility parts back to the camp and eventually to a residential site, deer were processed at the site (Chapter 12, this report).

Over 200 projectile points and preforms were recovered from the site. These provide evidence for intensive hunting and related activities, including projectile-point manufacture, shaft refurbishing, and the return of carcasses to the site. In addition to preforms broken during manufacture, proximal portions of points with haft or impact fractures were returned on shafts and replaced by new points. Others are medial or distal fragments with haft snaps that were probably embedded in carcasses and discarded when the meat was processed. Other types of chipped stone tools—formal (n = 72), informal (n = 58), and utilized debitage (n = 35)—also relate to hunting and processing animal products. Hammerstones could be used for flint knapping or breaking up bone; scrapers, knives, and debitage for butchering and processing hides; and drills and gravers were likely used for working bone or wood (Chapter 10, this report).

The evidence indicates that the primary use for the site during the prehistoric era was as a hunting camp for groups focusing on deer during the warm season and this use continued from as early as AD 300–400 through at least the Coalition period. However, questions of who these groups were and whether they comprised specialized hunters or family groups remain, as does the question of whether they were primarily hunting and gathering groups or logistically organized hunters based in permanent residential sites (e.g., Chapter 10, this report).

Hunting—and for that matter gathering—involves a number of tasks. Lithic material must be gathered for making points, wood for shafts and bows, and feathers for fletching arrows. Snares, traps, and nets can also be part of the tool kit. Hunting also involves knowledge of the area, coordination of hunters, killing, cleaning, and returning the game to the base. Once there, hides must be processed and butchering completed. Meat must be cooked or dried and bones processed for marrow and grease (Szuter 2000:198). Hunting small animals is generally a simple task requiring expedient technology (sticks, clubs, stones, traps, snares, nets) and could be accomplished by women and children. Large mammal hunting was often restricted to men (Szuter 2000:200–204).

It is generally accepted that women did most of the gathering, processing of plant foods, and the cooking (e.g., Crown 2000:221–225; Fish 2000:173; Szuter 2000:198–199). Consistent finding of tiny seeds and the tools that ground them into meal are an indication that women and probably children were part of the groups who stayed at Coyote Canyon Rockshelter. The same can be said for the small mammal and bird bones found there and for the extensive processing indicated by burning and breaking of large animal bones. Bone awls and spatulate tools are also consistent with tasks that were probably done by women (preparing hides and working leather), while beads and other ornaments may also suggest a range of age and sexes were present.

Mixed group composition differs from the Pueblo ethnographic view of hunting large animals, where hunting parties were generally small and restricted to older males, sometimes accompanied by younger apprentices, and often entailed elaborate ceremonies, rituals, and magic (Szuter 2000:204). Hunting has decreased in importance and changed in historic times, making it even more difficult to evaluate past practices. Santa Clara non-ceremonial deer hunting took place in the fall when deer were in the best condition and it did not conflict with other economic activities. Hunting parties consisted of two to four males who left early in the morning on horseback. They stopped at a campsite and hunted on foot. Parts not consumed at the camp were packed back to the pueblo. If a surplus of meat was acquired, it was jerked and stored. Jerked meat was pounded or ground and used in stews and pies (Hill 1982:45, 47, 49–50). At Taos, deer were hunted in the mountains in collective drives led by war captains; treatment followed a sequence of ritual practices. Deer are associated with cold (Gnabisk1981:48), which suggests they were hunted during the cool season when it did not conflict with other economic activities. Neither of these practices would result in the kinds of deposits found at Coyote Canyon Rockshelter, but modern transportation, firearms, and additional sources of meat (e.g., cattle and sheep) have altered many aspects of hunting.

Researchers have long suggested that sites east of the Sangre de Cristo Mountains were left by hunting and gathering people who were in the area before AD 900 (Lutes 1959:67). More recently, Cordell notes that high-elevation areas in the Jemez and Sangre de Cristo Mountains were sparsely inhabited, providing a large area for highly mobile hunting and gathering groups who may have practiced some horticulture. An abundance and diversity of plants and animals allowed this mobile settlement and subsistence strategy to persist until at least AD 1000–1050 (Cordell 2006:307–308, 314).

The NMCRIS database for the area east of the Sangre de Cristo Mountains indicates that the population was sparse during the Archaic and Pueblo periods and that most sites at higher elevations were non-structural. Coyote Canyon Rockshelter is an example of a site that was probably a seasonal base camp for the kind of groups suggested by Cordell (2006). Another is Red Bow Shelter (described in Chapter 12, this report), which was also intermittently occupied between 900 BC and AD 1200. No structures were found in the portion excavated, but it had numerous fire pits and a large artifact assemblage. As at Coyote Canyon Rockshelter, most of the chipped stone material at Red Bow was locally available with some non-local material, such as obsidian and chalcedony, occurring. Projectile points were not as common, and the fauna had a greater proportion of rabbits but also had considerable deer and unidentifiable specimens from medium to large mammals that are probably mainly artiodactyl and deer. A variety of plants were used and corn may have been planted during at least the later part of the occupation. A second north-facing shelter excavated as part of the same project had a similar pattern (Campbell 1984, Kershner 1984).

Lutes reports several smaller rockshelters on the Philmont Scout Ranch (Lutes 1958, 1959). An example of a more lightly used shelter is Lizard Cave at Philmont Scout Ranch, which was excavated by Boy Scouts and Explorers who were directed by Lutes in 1956 (Lutes 1958, 1959) and Skinner in 1962 (Skinner 1964). Located on the east side of a canyon fairly high above the canyon bottom (22.9 m [75 ft]), the shelter was 13.7 by 3.4 m and 1.7 m high with a masonry wall, a room with a hearth, and a cache of perishable items. Ceramics—including Taos Gray—indicate use around AD 1000–1300 and possible reuse around AD 1700 (Skinner 1964:22, 28). Lutes also excavated a small, three room slab-lined structure on a terrace above Ponil Creek. It had a few Taos Black-on-white and Kwahe'e Black-on-white sherds along with three complete metates, bone awls, bone beads—some strung with olivella shell beads, numerous projectile points, drills, knives, and more scrapers than any other tool. Tests in the trash area and beneath the floor of the large room found evidence of an earlier jacal structure. He concluded that the Philmont Ranch sites were left by an unspecialized "Plains" hunting and gathering people who had intermittent contacts with the Rio Grande area (Kirkpatrick 1976:80–81; Lutes 1958: 10, 1959:59–64). With possible storage in the two smaller rooms and considerable trash, the slab-house site may represent a slightly different aspect of mobile hunting and gathering groups, perhaps some who planted corn. Several years later Glassow excavated a slightly earlier (Escritores phase—AD 900–1100) pithouse in the same area; it had a four-post roof, collared hearth, and ventilator shaft. It also had up to a meter of midden deposit and therefore was interpreted as a sedentary occupation (Glassow 1980:73). Even during the densest occupation (Cimarron phase, AD 1200–1300) structures were small (Glassow 1980:74–75) and unlikely to have housed the kinds of "sedentary" populations who would need to engage in distant logistic hunts.

Since the area in front of Coyote Canyon Rockshelter was scraped away, we cannot know whether there were shelters or features that would imply more prolonged occupations. Certainly the amount of animal bone and chipped stone and the seasons of use indicated by the deer bones suggest substantial occupation that could have included jacal or small pit rooms. This, the other rockshelter sites, and small structural sites found east of the Sangre De Cristo Mountains fit better with a mobile hunter and gatherer economy than with our expectations for logistic hunting camps of more sedentary agricultural groups. As noted in Chapter 10 of this report, logistic hunting camps would be specialized extractive locations where activities would be limited. Hunting tools would be mended and replaced with points or materials brought for that purpose, and food gathered and cooked. This contrasts with hunter and gatherers, where a wider range and more generalized activities related to extraction, processing, maintenance, and consumption should be represented—which is the pattern that is seen at Coyote Canyon Rockshelter and other sites east of the Sangre de Cristo Mountains.

Coyote Canyon Rockshelter and the other sites east of the Sangre de Cristo Mountains seem to represent an area that was sparsely occupied by hunting and gathering groups through the Coalition period, with little evidence of use after about AD 1300. Whether these mobile groups were eventually absorbed by agriculturalists or forced farther north and east (e.g., Vierra and Ford 2007:125) is a question for further research. For now, it appears that Coyote Canyon Rockshelter and similar sites indicate that mobile hunters and gatherers occupied the area in a manner generally attributed to the Archaic period into at least the Coalition period. Hunting was possibly the most important aspect of subsistence, followed by gathering. That all or most of the sites have corn is an indication of interaction with more sedentary groups—either as trade for commodities, such as dried meat, or acquisition of the seed and knowledge for planting small gardens in favorable locations.

Conclusions

Multiple lines of evidence indicate that Coyote Canyon Rockshelter was occupied from at least the Late Archaic into the Classic period. Evidence also suggests that these were highly mobile hunter-gatherers who repeatedly stayed at this location during the warm season. While the main resource focus was deer, a wide variety of other animals and plants were utilized. Ceramic evidence indicates that they were part of what is considered the greater Taos District or Tradition with few ties to Plains groups. Chipped stone materials indicate the same—either these groups also utilized areas to the west or traded raw materials with groups who did.

The variety of stone and bone tool types indicate that more than hunting and processing took place at the site. Examining the body-part distribution for deer, pronghorn, and the indeterminate artiodactyl specimens provides a different perspective on animal use, not only at this site but others. Strong resemblances between assemblages from an Archaic rockshelter, Coyote Canyon Rockshelter, and more sedentary groups finds that differences are relatively slight and calls into question our conceptions about the logistic hunting practices of agricultural groups.

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Appendix 1 ⩡ Petrographic Analysis

PETROGRAPHIC ANALYSIS OF CERAMICS FROM LA 139965

David V. Hill Ph.D.

INTRODUCTION

Ten ceramic samples and one clay sample were submitted for petrographic analysis. The goal of this study is to compare the current samples with previous petrographic studies of prehistoric ceramics from the Taos area.

Background to the Petrographic Analysis

Petrographic analysis is an analytical technique derived from geology and has been widely adopted for the analysis of archeological ceramics (Kidder and Shepard 1936; Whitbread 1995). In this method, samples for analysis samples of pottery sherds are impregnated with epoxy, mounted on glass slides and ground to a standard thickness of thirty microns. The resulting samples known as "thin-sections" are then analyzed using a petrographic microscope. In a petrographic microscope, light is passed through a polarizing filter that polarizes the light so that it vibrates in a single plane. The polarized light passes through the thin section, through an objective lens like that of a standard light microscope, and then through a second polarizing filter. The second polarizing filter is oriented at 90 degrees relative to the lower polarizing filter. The light then passes on to the objective lens. The behavior of polarized light passing through mineral crystals is used to determine the type of mineral present, though the examination of various properties of the mineral such as the distinctive crystalline structure of the mineral, color and texture. In general, petrographic microscopes are used to characterize anisotropic (optically transparent) minerals (Phillips 1971). Optical properties such as crystalline structure of minerals, shape of the inclusions or other physical characteristics are also used to identify inclusions that are present in the thin-section. The use of petrographic analysis for the study of archaeological ceramics has lead to the techniques use to identify human-caused additions such as the identification of crushed pot sherds to ceramic pastes (Whitbread 1986).

Methodology

The ceramics and clay sample were analyzed by the author using a Nikon Optiphot-2 petrographic microscope working between 20X and 200X examining each thin section using both plain and cross-polarized light. The sizes of the inclusions present in the paste are presented in terms of the Wentworth Scale, a standard method of characterizing particle sizes in sedimentology and the range of actual measurements (Table 1). The sizes of the isolated mineral grains and rock fragments were measured using a graduated reticle built into one of the microscopes optics and compared with standardized charts. The percentages of inclusions observed in the paste of the sherds were estimated using a comparative charts (Matthew et al. 1991; Terry and Chilingar1955). Given the diversity of the inclusions that are often present in archaeological fired clay materials, the comparative method for assessing the amount and size of materials observed in fired materials has been found as useful for archaeological petrography as point counting (Mason 1995). Standard comparative charts were also used to classify the distribution of particles sizes and the shape of the mineral grains and rock fragments that are present in the ceramic pastes of the ceramics.

The analysis was conducted by examining the entirety of the eleven thin-sections and generating a brief description for each of the samples. The ceramic and clay samples were also assigned to preliminary composition groups. The sherds and clay samples assigned to the composition groups were then compared to one another to confirm assignment to each group. Rather than reliance on the identification of a single type of unusual mineral or rock fragment or statistically derived composition groups that rely on sampling an unidentified range of variation the current study relies on the direct comparison between samples for the classification of compositional groups using a combination of attributes that included the types of minerals and rock fragments present and their size, shape and percentage in the clay. Additional material used to classify the sandstone samples is derived from Folk (1974).

DESCRIPTION OF THE PETROGRAPHIC SAMPLE

Sample 1. F.S. 194 Smeared Corrugated

The paste of this sherd is dark brown in color. The paste contains sediments derived from a granite source. The minerals present in the paste occur as isolated grains and as aggregate rock fragments composed of two or more different minerals. The aggregate grains are composed of quartz and untwinned or microcline-twinned alkali feldspar or plagioclase. The mineral grains and rock fragments range in size from very fine to very coarse. The ubiquity of the amount of the inclusions decreases with an increase in their overall size. The mineral inclusions and rock fragments account for about twenty percent of the ceramic paste. Approximately ten percent of the alkali feldspar grains display microcline-twinning. The feldspars range from having a fresh appearance to being partially or completely altered to sericite. Plagioclase is present making up about fifteen percent of the minerals present in the paste and rock fragments. Brown biotite is also present accounting for an additional five percent of the minerals present in the ceramic paste.

Sample 2. F.S. 206 Smeared Corrugated

The paste of this sherd is dark brown in color. The paste contains sediments derived from a granite source. The minerals present in the paste display a bimodal distribution in size. The paste contains about ten percent silt-sized to very fine sands and a trace of brown biotite. Sub-angular shaped medium to very coarse sized mineral grains and fragments of granite account for an additional five percent of the ceramic paste. The bimodal distribution of the inclusions in the ceramic paste indicate that the larger mineral grains represent an added tempering agent.

The smallest mineral inclusions in the ceramic paste are too small to identify accurately through optical means alone. Consequently only a rough estimate can be made of the amounts of the minerals that make up to fine mineral fraction in the ceramic paste. The most common mineral found among the smaller inclusions is quartz. The next most common mineral untwinned and microcline twinned alkali feldspar. The appearance of the feldspar grains in the fine and coarse fractions in the paste ranges from fresh to highly altered to sericite. In both isolated grains and in a few of the multi-mineral grains and isolated grains of alkali feldspar have been altered to the point of opacity. Plagioclase is present in a trace amount among the larger grains. Brown biotite is also present in the paste in a trace amount.

The coarse sized rock fragments are primarily composed of granite. The granite is composed of quartz, untwinned or microcline twinned alkali feldspar, plagioclase and brown biotite. Aggregates of quartz and alkali feldspar are also present in the coarse sized fraction of the paste. Also present are isolated grains of quartz, unweathered untwinned and microcline twinned (one only) alkali feldspar and plagioclase. One medium sized grain of brown biotite is also present in the paste as is one coarse sized fragment of monzonite.

Sample 3. F. S. 284 Coiled Gray

The paste of this sherd is black and opaque. The paste of this sherd contains sediments from a granite source that display a bimodal size distribution. The fine fraction accounts for about fifteen percent of the ceramic paste. The coarse fraction accounts for an additional five percent. The isolated minerals present in the silt-sized to fine size fraction consist of primarily quartz with a lesser amounts of untwinned and rarely microcline twinned alkali feldspar, plagioclase. Brown biotite is present only in the fine-sized fraction of the inclusions. The alkali feldspar grains range in appearance from fresh and unweathered to alteration to sericite obscuring the optical characteristics of the mineral grains.

The coarse fraction consists primarily of quartz with lesser amounts of untwinned alkali feldspar and plagioclase. Fragments of granite are composed of quartz, untwinned or microcline twinned alkali feldspar, plagioclase. Like the alkali feldspars present as isolated grains this mineral in the fragments of granite range from fresh in appearance to weathered through alteration to sericite. A single coarse-sized fragment of caliche is also present in the paste of this sherd.

It is possible that the coarse sized fraction is an added material but without comparative clay samples, the origin of the inclusions cannot be determined.

Sample 4. F. S. 311 Taos Black-on-white?

The paste of this sherd is light brownish gray. The paste contains twenty percent sub-angular mineral grains from a plutonic source. The mineral grains range continuously from silt-sized to fine on the Wentworth Scale. Many of the mineral grains are too small to identify through optical means alone. Among the identifiable minerals the most common is quartz, followed by untwinned alkali feldspar (orthoclase). Trace amounts of microcline, plagioclase and brown biotite are also present in the ceramic paste.
Based on the presence of a trace amount of plutonic rock fragments and the angular to sub-angular appearance of the mineral grains, the source of the sediments is from fine-textured plutonic rock. One fine sized fragment composed of quartz and biotite could be from biotite schist. No additional types of rock fragments or minerals were observed in the paste of this sherd. It is likely that the mineral inclusions in this sherd are naturally present in the ceramic clay.

Sample 5. F.S. 321 Smeared Corrugated

The paste of this sherd is dark brown in color. The paste contains a mix of isolated mineral grains along with fragments of sandstone. Approximately three percent of the ceramic paste contains rounded silt-sized to very fine isolated mineral grains. The silt-sized grains are too small to identify accurately by optical means alone. Where possible quartz untwinned and microcline twinned alkali feldspar, plagioclase and brown biotite. The fine-sized grains likely represent natural inclusions in the ceramic paste.

Five percent of the ceramic paste is composed of fragments of micaceous sandstone. Two types of sandstone are present in the ceramic paste. One type of sandstone is fine grained moderately well sorted, immature texture and has a brown or black colored clay cement. Quartz, untwinned alkali feldspar and a trace amount of brown biotite make up the minerals found in the sandstone. The sandstone fragments range from medium to coarse sized. The other type of sandstone is well sorted, more mature (has 90% or more quartz) and has a calcium cement that contains biotite mica.

Trace amounts of medium to coarse sized fragments of very fine textured biotite mica schist are also present in the paste of the sherd. Also present are medium to coarse sized angular fragments of quartz. One medium sized fragment of caliche is also present in the sherd. The distinctive sandstone is likely an additive to the ceramic paste. However, without comparative samples of clay from potential sources areas the source of the sandstone cannot be determined.

Sample 6. F.S. 503 Taos? Incised

The paste of this sherd is medium brown in color. The paste contains isolated mineral grains and fragments of quartzite, granite, coarse textured biotite schist, biotite gneiss and monzonite porphyry. The inclusions range continuously from silt-sized to very coarse in size and account for about fifteen percent of the ceramic paste. The inclusions present in the ceramic paste decrease in their amount in a direct relationship to an increase in the size of the particles. The most common mineral in the ceramic paste is quartz. Quartz is present as isolated mineral grains, as quartzite, granite, biotite schist and biotite gneiss and accounts for about seventy-five percent of the minerals present in the sherd. Untwinned alkali feldspar (orthoclase) is the next most common mineral present in the sherd accounting for about fifteen percent of the minerals in the rock fragments and isolated mineral grains. Untwinned alkali feldspar is present in granite, and monzonite porphyry. Brown biotite is present primarily as isolated inclusions and in the schist and gneiss grains. Plagioclase feldspar is present in a trace amount in the fragments of granite and monzonite.

The variety of plutonic and metamorphic rock fragments and the wide range of sizes of the mineral grains and rock fragments indicates that the source of the clay for this sherd was derived either from a conglomerate or sediments associated with an alluvial clay.

Sample 7, F. S. 558 Plain Rim

The paste of this sherd is highly micaceous with brown clay of the body grading into books of brown biotite mica. Quartz occurs in the biotite schist and as isolated grains. The quartz grains range in size from medium sized to very coarse and account for about fifteen percent of the ceramic paste. It is clear that this sample was made using a highly micaceous clay.

Sample 8, F.S. 546 Plain Gray

The paste of this sherd is a medium yellowish brown and is highly micaceous. The paste contains isolated mineral grains and fragments of plutonic, metamorphic and igneous rock. The mineral grains and rock fragments display a bimodal distribution based on their size. Silt-sized to very fine sized mineral grains account for about five percent of the ceramic paste. The smallest sized mineral grains are too tiny to identify accurately by optical means alone. The minerals that can be identified in the fine fraction of the inclusions in the ceramic paste consist predominately of quartz, followed by untwinned alkali feldspar and brown biotite. The untwinned alkali feldspar and the trace amount of feldspar that show microcline twinning range in appearance from fresh to altered to sericite. This includes the isolated alkali feldspar gains and those in the fragments of granite discussed below. Due to the similarity in color of the paste to the biotite and the birefringent (optically active) appearance of the clay an accurate estimate of the amount fo biotite mica in the paste cannot be made.

An additional three percent of the paste consists of medium to very coarse mineral grains and rock fragments. The most common type of rock in this size class is granite. The granite composed of quartz, untwinned alkali feldspar, plagioclase and brown biotite. Epidote is present in one fragment of granite. The biotite also ranges from optically active to being weathered to black opaque inclusions.

Three coarse sized fragments of a immature moderately well sorted sub-arkosic sandstone is are present in the paste. The intergranular spaces in the sandstone contain dark brown to black colored clay cement and grains of brown biotite.

One very coarse sized fragment of monzonite porphyry is present in the ceramic paste. The groundmass is microcrystalline in texture with untwinned alkali feldspar appearing as the porphyritic mineral.

One coarse-sized metamorphic rock fragment is composed of sillimanite, untwinned alkali feldspar and brown biotite.

A single coarse-sized fragment of fine-textured basalt is also present in the paste of this sherd. The groundmass of the basalt is composed of dark brown glass. The plagioclase display a distinct trachyitic texture. A single olivine is also present in the basalt grain.

The limited amount of mineral grains both fine and course indicates that the minerals and rock fragments are natural constituents in the clay.

Sample 9. F.S. 625, Plain Gray

The paste of this sherd is dark brown in color. The isolated mineral grains and rocks fragments of sedimentary, plutonic and metamorphic rock account for about ten percent of the ceramic paste. The mineral grains and rock fragments range continuously from silt-sized to very coarse. The isolated mineral grains consist of in order of abundance; brown biotite, quartz, and untwinned alkali feldspar. The most common type of rock is sandstone. Like Sample F.S. 321 two types of sandstone are present in the paste of this sherd. One type of sandstone is immature, poorly to moderately well sorted, intergranular biotite and has dark brown to black cement. The other type of sandstone is finer grained, more well sorted and mature. This type of sandstone also contains intergranular biotite and has calcium cement.

A trace amount of granite is also present in the paste of this sherd. The granite is composed of quartz, untwinned or rarely microcline twinned alkali feldspar, plagioclase and brown biotite. The feldspars in the granite generally appears fresh and unweathered. Two coarse sized fragments of fine-textured biotite gneiss are also present in the paste of this sherd.

A single very coarse sized fragment of caliche is also present in the paste of this sherd.

It is likely that the minerals and rock fragments present in the paste of this sherd are natural inclusions in the ceramic clay.

Sample 10. F. S. 635 Plain Gray

The paste of this sherd is nearly identical to that of F.S. 206 in both color and the types and amount of mineral grains present. Moreover the mineral grains and fragments of granite in this sherd show the same bimodal distribution in terms of the size of the inclusions.

Unlike F. S. 206, the paste of this sherd contains three coarse sized fragments of monzonite porphyry and two very coarse sized fragments of quartzite.

Sample 11. Fired Clay Sample

The clay sample fired a medium brownish red. Three types of materials make up the bulk of the inclusions present in the paste. These inclusions are; fine-sized rounded grains of quartz, fine-to medium sized books of brown biotite and coarse to very coarse sized rounded grains of fine-textured basalt. The basalt grains are stained with hematite from the weathering of some of the minerals that were present originally. In two cases the weathering has left angular hematite stained pores in the basalt once occupied by minerals.

Trace amounts of weathered brown volcanic tuff, a single medium-sized fragment of granite, a coarse-sized fragment of quartzite and a medium-sized highly weathered fragment of monzonite are also present in the clay sample.

DISCUSSION

Extensive petrographic study of prehistoric primarily decorated ceramics has been conducted in the vicinity of Taos, New Mexico (Fowles et al. 2007; Hill 1994, 1997). These studies serve as a baseline for comparison with the ceramics in the current sample.

Samples F.S 206, Smeared Corrugated and F.S. 635 Plain Gray share a common paste composition with a bimodal distribution of very fine and coarse sized mineral grains and inclusions of granite along with a trace amount of monzonite. As only two prehistoric utilityware ceramics from the Taos are have been examined there is little to compare these sherds with (Hill 1997). Formations that contain weathered sediments in the Taos area tend to contain plutonic and volcanic rocks (Chaplin 1981; Hill 1994).

Sample F.S. 311 is a possible sherd of Taos Black-on-white. The paste of this sherd contains silt-sized to fine sized rounded sand grains composed of quartz, untwinned alkali feldspar, plagioclase and biotite that account for about twenty percent of the ceramic paste. This sherd also contains on aggregate mass of quartz and brown biotite that is likely from biotite schist. The amount of fine mineral grains possibly derived from a plutonic source and the possible fragment of biotite schist is very similar to Mineral Composition Group 3 (Fowles et al. 2007: 142). This composition group is composed of sherds of Kwahe'e Black-on-white believed to have been made in the Rancho drainage

(Fowles et al. 2007: 143). This composition group lacks the volcanic rock fragments that are present in other groups of decorated sherds from this site.

The paste of Samples F.S. 194, F.S. 284 and F.S. 503 also contains abundant sediments and rock fragments derived from a source of granite. It is possible that these sherds originated near the source of F.S. 311. The sediments in these three sherds likely originated in the Sangre de Cristo Mountains.

Sample 10 F.S. 635 Plain Gray and F.S. 321 Smeared Corrugated contain sediments that contain two types of sandstone, One type of sandstone is immature, moderately to poorly sorted and has a dark brown to black cement containing biotite. The other type of sandstone is fine-textured, mature, and moderately well sorted. This sandstone has a calcium cement that contains brown biotite. The variation in the amount of sediments derived from granite may be indicative of variation in the source clay. Arkosic sandstones are present within the Madera formation and a likely the source of the sandstone and granite in the paste of these sherds. (Kues 1984).

In addition to a variety of plutonic and metamorphic rocks present in F.S. 625, Plain Gray, the paste of this sherd contains a single coarse-sized grain of basalt. Previous petrographic studies of decorated whiteware from the Taos area found that mixes of plutonic and volcanic rock are common in the Rio Grande del Rancho and in the vicinity of the Taos Pueblo (Fowles 2007; Hill 1994; 1997).

The mixed sediments in Sample 546 Plain Gray also contains basalt in addition to fragments of plutonic rock. It is possible that this sherd and F.S. 625 represent variation in the same source of clay used to make the original ceramic vessels.

Sample F.S. 558 has a highly micaceous ceramic paste that is likely derived from a source of weathered quartz biotite schist. The paste of this sherd closely resembles micaceous pottery that were made using clays from previously identified sources of micaceous clay at either the Molo nan na or Picuris locations (Eiselt and Ford 2007; Hill 2013). The sherd was most likely made using one of these two clay sources.

The fired clay sample recovered from the excavation contains abundant rounded grains of basalt. Basalt is confined to individual fragments in two sherds. It is unlikely that the clay sample represents the source material of any of the sherds.

The ceramics that were analyzed during the current study indicate that all of the sherds originated in the Taos area. The exception to this is the micaceous sherd F.S. 558 which was made using clay from near Picuris.

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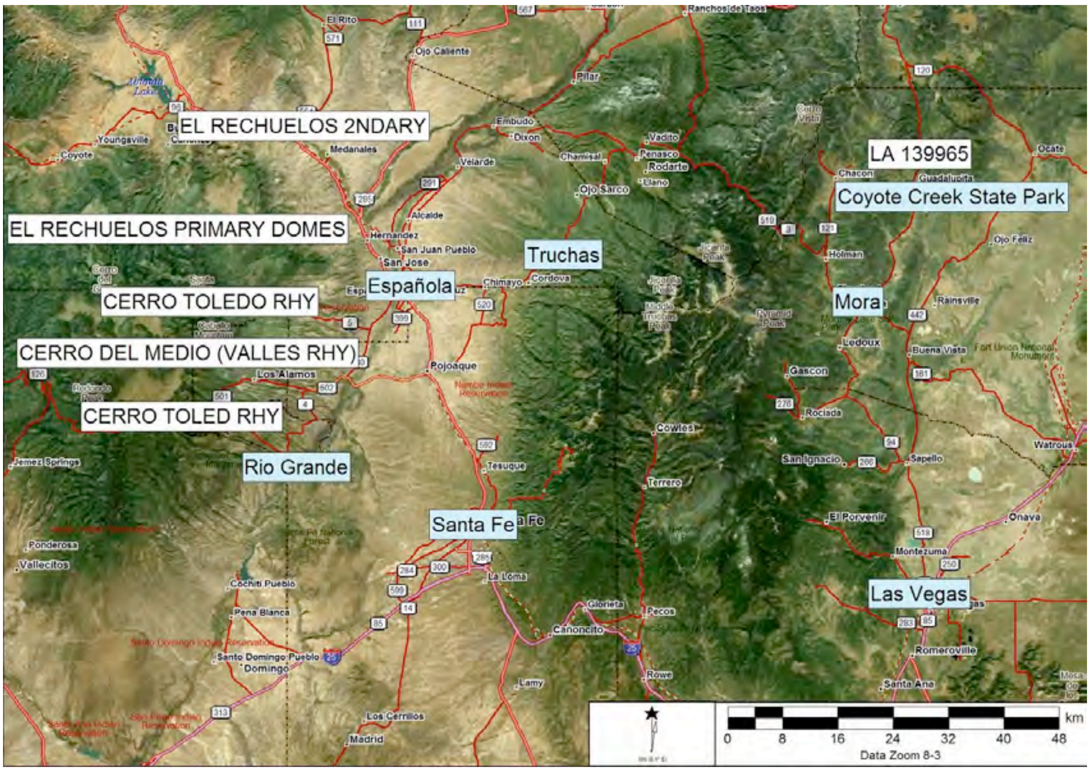
Appendix 2 ⩡ Obsidian Analysis

GEOARCHAEOLOGICAL XRF LAB

GEOARCHAEOLOGICAL X-RAY FLUORESCENCE SPECTROMETRY LABORATORY
8100 Wyoming Blvd., Ste M4-158 | Albuquerque, NM 87113 USA

SOURCE PROVENANCE OF OBSIDIAN ARTIFACTS FROM LA 139965 ROCKSHELTERS, NORTH CENTRAL NEW MEXICO



Digital elevation image of site location, relevant sources in the Jemez Mountains, and prominent features

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Report Prepared for

James Moore
Office of Archaeological Studies
Museum of New Mexico
Santa Fe, New Mexico

10 May 2015

INTRODUCTION

The analysis here of 98 artifacts from four localities at LA 139965 along Coyote Creek north of Mora, New Mexico indicates procurement of obsidian from three major sources in the Jemez Mountains (Cerro del Medio/Valles Rhyolite, Cerro Toledo Rhyolite, and El Rechuelos; see Tables 2.1 and 2.2, and Figure 2.1). At least some of the raw material could have been procured from secondary sources in the Rio Chama (El Rechuelos) or Rio Grande Alluvium (El Rechuelos and Cerro Toledo Rhyolite) west of the site approximately 100 km, but the Cerro del Medio (Valles Rhyolite) obsidian had to be originally procured in Valles Caldera proper (Shackley 2005, 2013; see cover image).

LABORATORY SAMPLING, ANALYSIS AND INSTRUMENTATION

All archaeological samples are analyzed whole. The results presented here are quantitative in that they are derived from "filtered" intensity values ratioed to the appropriate x-ray continuum regions through a least squares fitting formula rather than plotting the proportions of the net intensities in a ternary system (McCarthy and Schamber 1981; Schamber 1977). Or more essentially, these data through the analysis of international rock standards, allow for inter-instrument comparison with a predictable degree of certainty (Hampel 1984; Shackley 2011).

All analyses for this study were conducted on a ThermoScientific *Quant'X* EDXRF spectrometer, located at the Geoarchaeological XRF Laboratory, Albuquerque, New Mexico. It is equipped with a thermoelectrically Peltier cooled solid-state Si(Li) X-ray detector, with a 50 kV, 50 W, ultra-high-flux end window bremsstrahlung, Rh target X-ray tube and a 76 µm (3 mil) beryllium (Be) window (air cooled), that runs on a power supply operating 4-50 kV/0.02-1.0 mA at 0.02 increments. The spectrometer is equipped with a 200 l min^{-1} Edwards vacuum pump, allowing for the analysis of lower-atomic-weight elements between sodium (Na) and titanium (Ti). Data acquisition is accomplished with a pulse processor and an analogue-to-digital converter. Elemental composition is identified with digital filter background removal, least squares empirical peak deconvolution, gross peak intensities and net peak intensities above background.

The analysis for mid Zb condition elements Ti-Nb, Pb, Th, the x-ray tube is operated at 30 kV, using a 0.05 mm (medium) Pd primary beam filter in an air path at 200 seconds livetime to generate x-ray intensity Ka-line data for elements titanium (Ti), manganese (Mn), iron (as $Fe_2O_3^T$), cobalt (Co), nickel (Ni), copper, (Cu), zinc, (Zn), gallium (Ga), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), niobium (Nb), lead (Pb), and thorium (Th). Not all these elements are reported since their values in many volcanic rocks are very low. Trace element intensities were converted to concentration estimates by employing a linear calibration line ratioed to the Compton scatter established for each element from the analysis of international rock standards certified by the National Institute of Standards and Technology (NIST), the US. Geological Survey (USGS), Canadian Centre for Mineral and Energy Technology, and the Centre de Recherches Pétrographiques et Géochimiques in France (Govindaraju 1994). Line fitting is linear (XML) for all elements. When barium (Ba) is analyzed in the High Zb condition, the Rh tube is operated at 50 kV and up to 1.0 mA, ratioed to the bremsstrahlung region (see Davis 2011; Shackley 2011). Further details concerning the petrological choice of these elements in Southwest obsidians is available in Shackley (1988, 1995, 2005; also Mahood and Stimac 1991; and Hughes and Smith 1993). Nineteen specific pressed powder standards are used for the best fit regression calibration for elements Ti-Nb, Pb, Th, and Ba, and include G-2 (basalt), AGV-2 (andesite), GSP-2 (granodiorite), SY-2 (syenite), BHVO-2 (hawaiite), STM-1 (syenite), QLO-1 (quartz latite), RGM-1 (obsidian), W-2 (diabase), BIR-1 (basalt), SDC-1 (mica schist), TLM-1 (tonalite), SCO-1 (shale), NOD-A-1 and NOD-P-1 (manganese) all US Geological Survey standards, NIST-278 (obsidian), U.S. National Institute of Standards and Technology, BE-N (basalt) from the Centre de Recherches Pétrographiques et Géochimiques in France, and JR-1 and JR-2 (obsidian) from the Geological Survey of Japan (Govindaraju 1994).

The data from the WinTrace™ software were translated directly into Excel for Windows software for manipulation and on into SPSS for Windows for statistical analyses. In order to evaluate these quantitative determinations, machine data were compared to measurements of known standards during each run. RGM-1 a USGS obsidian standard is analyzed during each sample run of 20 for obsidian artifacts to check machine calibration (Table 2.1).

Source assignments were made by reference to the laboratory data base (see Shackley 1995, 2005). Further information on the laboratory instrumentation and source data can be found at: http://www.swxrflab.net/ (see Table 2.1 for all data). Trace element data exhibited in Table 2.1 and Figure 1 are reported in parts per million (ppm), a quantitative measure by weight.

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Table 2.1. Elemental concentrations for the artifacts and USGS RGM-1 obsidian standard. All measurements in parts per million (ppm).

Sample	Locality	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source
480-1	N. Shelter	610	320	9521	125	12	22	64	36	El Rechuelos
500-1	N. Shelter	657	520	12298	214	8	66	180	99	Cerro Toledo Rhy
500-2	N. Shelter	697	606	13284	246	9	71	191	98	Cerro Toledo Rhy
512-1	N. Shelter	606	396	10193	148	15	23	68	43	El Rechuelos
512-3	N. Shelter	591	423	10397	169	13	27	71	51	El Rechuelos
512-4	N. Shelter	741	389	11880	154	12	42	151	50	Cerro del Medio (Valles Rhy)
521-1	N. Shelter	814	399	12205	161	12	43	167	56	Cerro del Medio (Valles Rhy)
524-1	N. Shelter	648	368	10012	147	11	23	66	45	El Rechuelos
531-1	N. Shelter	680	408	12360	174	13	50	164	55	Cerro del Medio (Valles Rhy)
541-1	N. Shelter	727	473	10506	170	14	24	70	45	El Rechuelos
541-2	N. Shelter	703	412	12271	174	14	44	171	50	Cerro del Medio (Valles Rhy)
546-1	N. Shelter	532	464	11637	199	8	60	169	99	Cerro Toledo Rhy
554-1	N. Shelter	843	412	10327	162	13	19	66	40	El Rechuelos
565-1	N. Shelter	738	661	13550	230	9	62	159	84	Cerro Toledo Rhy
569-1	N. Shelter	692	418	12074	170	9	48	164	52	Cerro del Medio (Valles Rhy)
569-4	N. Shelter	597	513	12260	215	8	64	181	97	Cerro Toledo Rhy
579-1	N. Shelter	519	487	12044	218	9	66	179	97	Cerro Toledo Rhy
586-1	N. Shelter	811	435	10415	158	11	21	64	39	El Rechuelos
587-1	N. Shelter	481	415	11386	190	11	61	169	92	Cerro Toledo Rhy
591-1	N. Shelter	669	471	10595	179	14	24	72	48	El Rechuelos
608-1	N. Shelter	613	415	10118	158	12	22	69	48	El Rechuelos
716-1	N. Shelter	760	411	10287	151	12	21	66	41	El Rechuelos
719-1	N. Shelter	718	420	12233	176	12	43	174	57	Cerro del Medio (Valles Rhy)
724-1	N. Shelter	777	444	10389	164	16	23	67	45	El Rechuelos
728-1	N. Shelter	719	462	12762	187	9	48	176	55	Cerro del Medio (Valles Rhy)
735-1	N. Shelter	740	597	13131	215	9	56	150	78	Cerro Toledo Rhy
736-1	N. Shelter	629	592	12788	222	12	67	175	94	Cerro Toledo Rhy
736-2	N. Shelter	766	463	12698	176	12	47	170	58	Cerro del Medio (Valles Rhy)
748-1	N. Shelter	971	482	13019	159	11	36	143	41	Cerro del Medio (Valles Rhy)
748-2	N. Shelter	715	406	11859	161	8	42	137	47	Cerro del Medio (Valles Rhy)
750-1	N. Shelter	622	388	11947	168	12	45	165	54	Cerro del Medio (Valles Rhy)
760-1	N. Shelter	625	412	11830	169	12	46	170	53	Cerro del Medio (Valles Rhy)
763-1	N. Shelter	629	470	10461	176	13	26	76	52	El Rechuelos
765-1	N. Shelter	988	478	10598	155	16	21	63	39	El Rechuelos
13-1	S. Shelter talus	733	433	10392	153	13	20	66	45	El Rechuelos
13-2	S. Shelter	709	431	10533	161	16	24	70	44	El Rechuelos

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	talus									
63-1	S. Shelter talus	650	376	10151	143	12	24	70	42	El Rechuelos
64-1	S. Shelter talus	710	461	10399	166	12	24	69	45	El Rechuelos
70-1	S. Shelter talus	617	589	12889	236	9	70	183	91	Cerro Toledo Rhy
96-1	S. Shelter talus	701	436	10327	153	12	22	70	44	El Rechuelos
147-2	S. Shelter talus	596	412	10083	155	14	24	71	46	El Rechuelos
150-1	S. Shelter talus	674	478	10493	175	11	22	77	48	El Rechuelos
153-1	S. Shelter talus	552	377	11726	164	11	44	162	52	Cerro del Medio (Valles Rhy)
154-2	S. Shelter talus	610	427	10185	145	10	25	67	42	El Rechuelos
176-1	S. Shelter talus	739	411	11804	172	15	44	159	57	Cerro del Medio (Valles Rhy)
179-1	S. Shelter talus	741	452	10531	156	12	19	69	47	El Rechuelos
Sample	Locality	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source
180-1	S. Shelter talus	636	395	10164	154	15	23	63	40	El Rechuelos
230-1	S. Shelter talus	661	487	10562	156	14	19	64	39	El Rechuelos
300-1	N. Talus	584	451	11862	180	17	46	171	55	Cerro del Medio (Valles Rhy)
314-1	N. Talus	629	396	11999	170	12	43	169	57	Cerro del Medio (Valles Rhy)
330-1	N. Talus	559	376	11556	149	10	42	153	47	Cerro del Medio (Valles Rhy)
350-1	N. Talus	551	358	11365	148	9	42	156	48	Cerro del Medio (Valles Rhy)
371-1	N. Talus	568	364	11471	161	11	46	159	51	Cerro del Medio (Valles Rhy)
379-1	N. Talus	671	426	12225	181	13	45	174	53	Cerro del Medio (Valles Rhy)
379-2	N. Talus	606	408	11881	173	14	45	161	55	Cerro del Medio (Valles Rhy)
405-1	N. Talus	715	444	10409	160	15	23	70	47	El Rechuelos
408-1	N. Talus	567	418	10287	169	16	25	69	48	El Rechuelos
427-1	N. Talus	648	453	10539	169	14	24	70	48	El Rechuelos
427-2	N. Talus	779	470	10558	168	14	21	65	44	El Rechuelos
440-1	N. Talus	557	482	12059	208	8	66	172	93	Cerro Toledo Rhy
449-1	N. Talus	628	535	12433	219	9	69	181	99	Cerro Toledo Rhy
455-2	N. Talus	640	407	10240	149	15	24	66	42	El Rechuelos
666-2	N. Talus	787	407	12201	169	12	44	161	59	Cerro del Medio (Valles Rhy)
69-1	South Shelter	1518	596	12865	200	10	50	143	76	too small (probably Cerro Toledo)
78-6	South Shelter	639	398	10087	148	11	24	68	46	El Rechuelos
79-3	South Shelter	633	442	10317	161	13	23	68	47	El Rechuelos
83-9	South Shelter	771	510	12006	205	8	57	161	88	Cerro Toledo Rhy
100-1	South Shelter	664	413	12167	174	13	46	161	59	Cerro del Medio (Valles Rhy)

101-2	South Shelter	569	384	10054	145	14	24	62	39	El Rechuelos
103-2	South Shelter	840	414	10249	150	12	24	65	44	El Rechuelos
105-1	South Shelter	658	451	10169	152	14	25	72	48	El Rechuelos
106-1	South Shelter	773	492	10631	169	14	23	72	47	El Rechuelos
111-1	South Shelter	827	516	10910	182	14	25	72	48	El Rechuelos
111-2	South Shelter	823	480	13126	193	15	46	169	52	Cerro del Medio (Valles Rhy)
134-5	South Shelter	573	403	10157	159	11	26	66	50	El Rechuelos
181-1	South Shelter	1214	456	10566	163	14	24	62	39	El Rechuelos
190-1	South Shelter	602	397	11870	164	14	47	167	57	Cerro del Medio (Valles Rhy)
191-1	South Shelter	624	417	10159	158	14	23	73	43	El Rechuelos
192-1	South Shelter	648	391	11969	169	10	44	170	55	Cerro del Medio (Valles Rhy)
198-14	South Shelter	685	402	12288	170	10	44	168	56	Cerro del Medio (Valles Rhy)
202-1	South Shelter	627	403	10236	155	14	25	74	43	El Rechuelos
210-1	South Shelter	666	430	10352	161	12	23	70	40	El Rechuelos
211-1	South Shelter	761	479	10647	180	16	27	75	48	El Rechuelos
212-11	South Shelter	636	446	10419	168	12	23	71	50	El Rechuelos
218-2	South Shelter	599	404	10097	151	14	25	73	46	El Rechuelos
229-2	South Shelter	677	457	10376	165	14	23	65	42	El Rechuelos
238-4	South Shelter	709	551	12460	229	20	64	168	93	Cerro Toledo Rhy
292-3	South Shelter	658	425	10238	156	16	25	70	46	El Rechuelos
304-1	South Shelter	585	437	11748	196	9	63	172	103	Cerro Toledo Rhy
307-1	South Shelter	735	504	10666	175	13	24	72	48	El Rechuelos
316-1	South Shelter	627	434	10188	162	14	23	71	49	El Rechuelos
331-1	South Shelter	820	446	12628	177	11	41	156	57	Cerro del Medio (Valles Rhy)
331-2	South Shelter	937	471	10945	176	15	22	72	46	El Rechuelos
335-2	South Shelter	605	386	11834	158	12	46	156	54	Cerro del Medio (Valles Rhy)
337-1	South Shelter	555	424	10270	156	12	24	69	46	El Rechuelos
Sample	Locality	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source
342-5	South Shelter	767	473	10450	164	10	22	69	40	El Rechuelos
347-1	South Shelter	749	413	10229	157	12	21	66	47	El Rechuelos
356-2	South Shelter	797	413	12296	172	12	44	162	48	Cerro del Medio (Valles Rhy)
RGM1-S4		1568	288	13734	149	109	24	216	7	standard
RGM1-S4		1526	293	13702	146	104	25	216	10	standard
RGM1-S4		1634	279	13713	150	110	25	217	8	standard
RGM1-S4		1534	275	13720	149	108	24	218	9	standard
RGM1-S4		1536	255	13700	147	107	23	216	12	standard
RGM1-S4		1632	294	13748	147	108	27	218	13	standard

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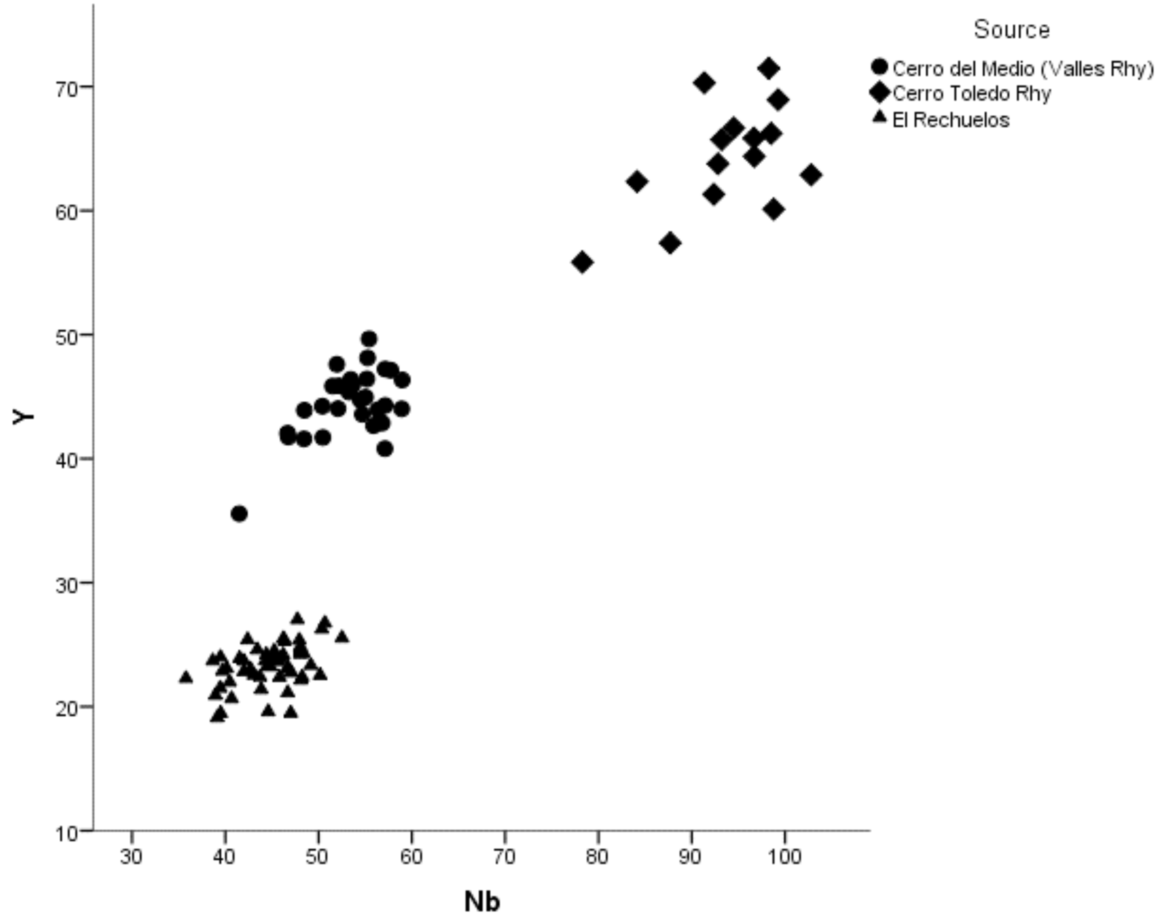
Table 2.2. Crosstabulation of source by locality.

			Source			
			Cerro del Medio (Valles Rhy)	Cerro Toledo Rhy	El Rechuelos	Total
Locality	N. Shelter	Count	12	9	13	34
		% within Locality	35.3%	26.5%	38.2%	100.0%
		% within Source	40.0%	60.0%	25.0%	35.1%
		% of Total	12.4%	9.3%	13.4%	35.1%
	N. Talus	Count	8	2	5	15
		% within Locality	53.3%	13.3%	33.3%	100.0%
		% within Source	26.7%	13.3%	9.6%	15.5%
		% of Total	8.2%	2.1%	5.2%	15.5%
	S. Shelter talus	Count	2	1	11	14
		% within Locality	14.3%	7.1%	78.6%	100.0%
		% within Source	6.7%	6.7%	21.2%	14.4%
		% of Total	2.1%	1.0%	11.3%	14.4%
	South Shelter	Count	8	3	23	34
		% within Locality	23.5%	8.8%	67.6%	100.0%
		% within Source	26.7%	20.0%	44.2%	35.1%
		% of Total	8.2%	3.1%	23.7%	35.1%
Total		Count	30	15	52	97
		% within Locality	30.9%	15.5%	53.6%	100.0%
		% within Source	100.0%	100.0%	100.0%	100.0%
		% of Total	30.9%	15.5%	53.6%	100.0%

Figure 2.1. Nb versus Y bivariate plot of all archaeological samples. These two transition metals (Nb and Y) are particularly useful in discriminating Jemez Lineament volcanics including the Jemez Mountain obsidian sources (Shackley 2005).



Appendix 3 Protein Residue Analysis

Protein Residue Analysis of 40 Artifacts from Site LA139965

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(LAS-363)

Introduction

The use of chemical and molecular biological techniques in the analysis of archaeological materials can provide significant new information for the interpretation of their use. The identification of organic residue from lithic and ceramics artifacts, coprolites and soils have provided archaeologists with specific data regarding prehistoric exploitation of animals and plants. Although ancient protein residues may not be preserved in their original form, linear epitopes are generally conserved which can be identified by immunological methods (Abbas et al. 1994).

Immunological methods have been used to identify plant and animal residues on flaked and groundstone lithic artifacts (Allen et al. 1995; Gerlach et al. 1996; Henrikson et al. 1998; Hyland et al. 1990; Kooyman et al. 1992; Newman 1990, 1995; Petraglia et al. 1996; Shanks et al.1999; Yohe et al. 1991) and in Chumash paint pigment (Scott et al. 1996). Plant remains on artifacts also been identified through chemical (opal phytoliths), and morphological (use-wear), studies (Hardy and Garufi 1998; Jahren et al. 1997, Sobolik 1996). Plant and animal residues on ceramic artifacts have been identified through the use of gas-liquid chromatography, high performance liquid chromatography and mass spectrometry (Bonfield and Heron 1995; Evershed et al. 1992; Evershed and Tuross, 1996; Heron et al. 1991, Patrick et al. 1985). Serological methods have been used to determine blood groups in skeletal and soft tissue remains (Heglar 1972; Lee et al. 1989) and in the detection of hemoglobin from 4500-year-old bones (Ascenzi et al. 1985). Human leukocyte antigen (HLA) and deoxyribonucleic acid (DNA) determinations made on human and animal skeletal and soft tissue remains have demonstrated genetic relationships and molecular evolutionary distances (Hänni et al. 1995; Hansen and Gurtler 1983; Lowenstein 1985, 1986; Pääbo 1985, 1986, 1989; Pääbo et al. 1989). Successful identification of residues on stone tools, dated between 35-60,000 B.P., has been made by DNA analysis (Hardy et al. 1997), while recently, residues on surgical implements from the American Civil War were identified by immunological and DNA analysis (Newman et al. 1998). A recent study demonstrated the viability of identifiable immunoglobulin G in 1.6 million-year-old fossil bones from Venta Micena, Spain, (Torres et al. 2002). Horse exploitation was identified by immunological analysis of residues retained on Clovis points dated to ca. 11,200 B.P. (Kooyman et al. 2001).

The use of forensic techniques in the investigation of archaeological materials is appropriate as both disciplines deal with residues that have undergone changes, either deliberate or natural. Criminals habitually endeavor to remove bloodstains by such means as laundering, scrubbing with bleach, etc. yet; such degraded samples are still identified by immunological methods (Lee and De Forest 1976; Milgrom and Campbell 1970; Shinomiya et al. 1978, among others). Similarly it has been shown that immunological methods can be successfully applied to ancient human cremations (Cattaneo et al. 1992). Forensic wildlife laboratories use immunological techniques in their investigation of hunting violations and illegal trade, often from contaminated evidence (Bartlett and Davidson 1992; Guglich et al. 1993; Mardini 1984; McClymont et al. 1982). Immunological methods are also used to test the purity of food products such as canned luncheon meat and sausage, products which have undergone considerable degradation (Ashoor et al. 1988; Berger et al. 1988; King 1984). Thus the age and degradation of protein does not preclude detection (Gaensslen 1983:225).

Materials and Methods

The method of analysis used in this study of archaeological residues is cross-over immunoelectrophoresis (CIEP). Prior to the introduction of DNA fingerprinting this test was used by forensic laboratories to identify trace residues from crime scenes. Minor adaptations to the original method were made following procedures used by the Royal Canadian Mounted Police Serology Laboratory, Ottawa (1983). The solution used to remove possible residues is five percent ammonium hydroxide which is the most effective extractant for old and denatured proteins without interfering with subsequent testing (Dorrill and Whitehead 1979; Kind and Cleevely 1969). Artifacts are placed in shallow plastic dishes and 0.5 ml of five percent ammonia solution applied directly to each. Initial disaggregation is carried out by floating the dish and contents in an ultrasonic cleaning bath for five minutes. Extraction is continued by placing the dish and contents on a rotating mixer for thirty minutes. For large ground stone items, such as metates, stone bowls, etc., the ammonium hydroxide is applied directly to the worked surface, agitated periodically with a sterile orangewood stick, and allowed to sit for one half hour. The resulting solution is drawn off, placed in a numbered, sterile plastic vial and stored at -20ºC prior to testing. In the case of soil samples, one gram is placed in a vial and 0.5 ml of 1 M Tris buffer solution ($H_2NC[CH_2OH]_3$) is used instead of ammonium hydroxide. The vial is placed in a rotating mixer overnight. The resulting solution is drawn off, placed in a numbered, vial and stored at -20ºC prior to testing.

A series of paired wells is punched into an agarose gel. Approximately 2 µl. of antiserum is placed into one well and the same amount of the unknown sample extract is placed in the other. An electric current is then passed through the gel. The antiserum and unknown sample migrate through the gel and come into contact. If there is protein in the unknown which corresponds with the antiserum, an antigen-antibody reaction occurs and the protein precipitates out in a specific pattern. The precipitant is detected when the gel is pressed, dried and stained. Control positives are run simultaneously with all the unknown samples. Sterile equipment and techniques are used throughout the analysis.

The Samples

Forty «Number_of_Artifacts»«Types_of_artifacts_tested»artifacts were submitted for immunological analysis by the Museum of New Mexico«Company_Name»«Client_City_»«Client_State». Residue was removed from the artifacts as discussed above. The residue was tested against a suite of plant and animal antisera (Table 3.1). Animal antisera provided by Cappel Research, Lampire Biomedical, and Cedarlane Laboraties and plant antisera produced at the University of Calgary and Cedarlane Laboratories, provide family level identification only. The relationship of antisera to some of the possible species identified is shown in Table 3.2.

Results

Eleven«Number_of_positive_hits» positive reactions were registered on 10 of the submitted artifacts (see Table 3.3 below). No other positive reactions were registered (Table 3.3). The absence of identifiable proteins on an artifact may be due to poor preservation of protein, insufficient protein, or that they were not in contact with any of the organisms included in the available antisera.

TABLE 3.1: ANTISERA USED IN ANALYSIS

Animal Antiserum	Source	Plant Antiserum	Source
Pronghorn	Cedarlane Laboratories	Agave	Cedarlane Laboratories
Ursine	MP Biomedical	Amaranthaceae	University of Calgary
Bovine	“	Asteraceae	“
Camelidae	Lampire Biomedical	Camas	“
Feline	Cappel Research	Capparaceae	“
Phasianinae	“	Chenopodiaceae	“
Cervinae	“	Cupressaceae	“
Elephantine	Lampire Biomedical	Lessoniaceae	Cedarlane Laboratories
Cavinnae	“	Lomatium	“
Equine	“	Malvaceae	University of Calgary
Hominini	Cappel Research	Mesquite	“
Leporidae	“	Portulacaceae	Cedarlane Laboratories
Murinae	“	Pinaceae	“
Caprinae	“	Acorn	“
Porcine	“	Buckeye	“
Triopsidae	“		
Salmoninae	Lampire		

TABLE 3.2: POSSIBLE SPECIES IDENTIFIED

Antiserum to:	**Reacts with:**
Pronghorn	Pronghorn
Bear	black, grizzly, etc
Bovine	bison, cow, musk ox
Camel	all camelids (New & Old world)
Cat	bobcat, cougar, lynx, etc.
Chicken	quail, grouse, & other gallinaceous fowl
Deer	deer, elk, moose
Elephantidae	elephant, mammoth
Guinea-pig	beaver, guinea-pig, porcupine, squirrel
Horse	horse, donkey, kiang, etc.
Human	human
Rabbit	rabbit, hare, pika
Rat	all rat & mouse species
Sheep	bighorn & other sheep
Triops	triops
Trout	trout and salmon species
Acorn	Oak species
Agave	yucca, agave
Amaranthaceae	amaranth, pigweed, *quelite*, etc.
Asteraceae	rabbitbrush, sagebrush, sunflower, thistle
Buckeye	Buckeye species
Camas	camas, wild hyacinth
Capparaceae	beeplant, bladderpod, stinkweed, etc.
Chenopodiaceae	goosefoot, greasewood, pickleweed, saltbush, etc
Cupressaceae	cedar, cypress, juniper
Lessoniaceae	kelp, possibly algae
Lomatium	*Lomatium sp.*
Malvaceae	mallows
Mesquite	mesquite, palo verde, other legumes
Portulacaceae	bitterroot
Pinaceae	fir, hemlock, pine, spruce

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TABLE 3.3: RESULTS

LAS #	Site	FS Number	Artifact	Results
1	LA139965	526	Eccentric Point	Negative
2	LA139965	505	Pueblo Corner	Negative
3	LA139965	490	Pueblo Corner	Negative
4	LA139965	454	Pueblo Stemmed	Human
5	LA139965	448	Pueblo Side	Rabbit
6	LA139965	428	Small Projectile Point	Negative
7	LA139965	335	Pueblo Side	Rabbit
8	LA139965	310	Pueblo Corner	Negative
9	LA139965	270-2	En Medio Point	Negative
10	LA139965	270-1	Pueblo Corner	Negative
11	LA139965	251	Pueblo Side	Negative
12	LA139965	243	Pueblo Side	Deer
13	LA139965	232	Pueblo Side	Negative
14	LA139965	219	Pueblo Side	Negative
15	LA139965	218	Pueblo Stemmed	Negative
16	LA139965	214	Pueblo Corner	Negative
17	LA139965	165	Small Projectile Point	Negative
18	LA139965	153-3	Pueblo Side	Deer
19	LA139965	153-2	Side, Basal Notched	Negative
20	LA139965	133	Pueblo Side	Deer, Human
21	LA139965	85	Pueblo Corner	Negative
22	LA139965	100	Pueblo Corner	Negative
23	LA139965	35	Eccentric Point	Negative
24	LA139965	27	Large Side Notched	Pronghorn
25	LA139965	763-3	Pueblo Corner	Rabbit
26	LA139965	769	Pueblo Corner	Negative
27	LA139965	763-1	Pueblo Side	Negative
28	LA139965	750	Pueblo Stemmed	Negative
29	LA139965	742	Pueblo Corner	Negative
30	LA139965	736-2	En Medio Point	Negative
31	LA139965	736-1	Pueblo Corner	Negative
32	LA139965	724	Eccentric Point	Negative
33	LA139965	716	Pueblo Corner	Negative
34	LA139965	694	Pueblo Corner	Deer
35	LA139965	665	Pueblo Corner	Negative
36	LA139965	664	Pueblo Corner	Deer
37	LA139965	659	Pueblo Corner	Negative
38	LA139965	643	Pueblo Corner	Negative
39	LA139965	634	Eccentric Point	Negative
40	LA139965	607	Pueblo Corner	Negative

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Appendix 4 ⩡ Paleobotanical Data Tables

Table App4.1a. Summary, South Shelter flotation samples.

FS No.	North	East	Level	Volume (l)	Weight (gm)	Roots	Insects	Bone	Rodent Pellets
73	244	144	2	1.70	19.49	Y	Y	Y	Y
76	244	144	3	1.55	19.15	Y	Y	N	N
79	244	144	4	1.85	20.05	Y	N	N	Y
83	244	144	5	1.48	15.35	Y	Y	Y	Y
87	251	143	1	1.40	6.70	Y	Y	N	Y*
99	251	143	2	1.00	3.88	Y	Y	Y	Y*
100	244	144	6	1.84	11.27	Y	N	Y	N
102	244	144	7	1.43	13.50	Y	Y	N	N
105	244	144	8	1.75	14.89	Y	Y	Y	N
110	244	144	9	1.40	9.70	Y	Y	N	N
111	244	144	9	1.34	10.10	Y	Y	Y	Y
120	244	143	2	1.55	6.90	Y	Y	N	Y
123	244	143	3	1.93	21.43	Y	Y	N	Y
125	244	143	4	1.67	19.98	Y	Y	N	Y
129	244	143	5	1.41	25.70	Y	N	N	Y*
131	244	143	6	1.89	11.04	Y	Y	N	Y*
134	244	143	7	1.44	13.43	Y	Y	N	Y*
136	244	143	8	2.11	15.17	Y	Y	N	N
187	245	144	1	1.32	16.30	Y	Y	N	Y
189	245	144	2	1.09	20.90	Y	Y	N	Y
190	245	144	2	0.84	13.20	Y	Y	N	Y*
191	245	144	3	1.20	19.69	Y	Y	N	Y
195	245	144	4	1.14	16.17	Y	Y	Y	N
198	245	144	5	1.00	8.89	Y	Y	Y	N
202	245	144	6	2.00	17.56	Y	Y	Y	Y*
207	245	144	7	1.00	8.61	Y	Y	N	N
209	245	144	8	1.77	19.60	Y	Y	N	Y*
212	245	144	9	1.17	9.65	Y	Y	Y	N
218	245	144	10	1.97	12.23	Y	Y	Y	N
227	245	143	4	0.95	10.77	Y	N	Y	Y
229	245	143	5	1.75	17.70	Y	Y	Y	N
235-A	245	143	6	0.48	2.80	Y	N	N	N
235-B	245	143	6	0.99	11.90	Y	Y	N	Y*
240	245	143	8	0.93	7.00	Y	Y	Y	Y*
244	245	143	9	2.22	15.00	Y	Y	Y	N
245	245	143	10	1.10	7.90	Y	Y	N	N
258	247	144	3	0.98	23.88	Y	Y	N	Y*
263	247	144	4	1.00	11.12	Y	Y	N	Y*
271	247	144	6	1.38	8.19	Y	Y	N	Y*
274	247	144	7	2.13	13.04	Y	Y	N	Y*
290	246	144	3	0.99	21.93	Y	Y	N	Y
292	246	144	4	1.53	28.17	Y	Y	N	Y
294	246	144	5	0.93	11.57	Y	Y	N	Y*
297	246	144	6	1.70	16.15	Y	Y	Y	Y*
305	246	144	7	1.00	11.65	Y	Y	Y	Y*
308	246	144	8	1.68	15.50	Y	Y	Y	Y*
313	246	144	9	0.95	6.60	Y	N	N	Y*
318	246	144	11	0.88	7.82	Y	Y	N	Y*
323	246	144	12	1.76	13.18	Y	Y	N	Y*
332	246	144	13	1.10	5.40	Y	N	Y	N
337	246	143	3	1.47	25.70	Y	Y	N	Y
343	246	143	5	1.40	17.86	Y	Y	N	Y
347	246	143	6	2.25	13.20	Y	Y	Y	Y
357	246	143	9	1.10	16.22	Y	Y	Y	Y

Table App 4.1a (continued)

FS No.	North	East	Level	Volume (l)	Weight (gm)	Roots	Insects	Bone	Rodent Pellets
363	247	143	4	1.20	56.52	Y	Y	N	Y
369	247	143	6	1.55	14.66	Y	Y	N	Y*
443	243	145	4	1.44	14.69	Y	Y	Y*	Y*
447	243	145	5	1.19	8.80	Y	Y	Y	N
448	243	145	6	0.78	6.10	Y	Y	Y	N
470	243	144	6	1.50	15.11	Y	Y	Y	Y
489	243	144	11	1.25	13.86	Y	Y	Y	Y*
496	243	144	12	1.10	9.30	Y	Y	N	Y*
514	243	144	13	0.97	7.87	Y	Y	N	N
518	243	145	8	1.15	4.57	Y	Y	Y	N
539	243	143	9	1.13	11.80	Y	Y	Y	Y*
564	242	145	6	1.00	8.50	Y	Y	N	Y
570	242	145	7	1.96	9.41	Y	Y	N	Y
632	242	144	14	1.19	13.00	Y	Y	N	Y*
634	242	144	15	1.13	15.40	Y	Y	N	Y
642	242	145	9	1.11	26.10	Y	Y	N	N
675	241	145	6	1.26	9.30	Y	Y	N	Y*
682	241	145	8	0.93	21.30	Y	Y	Y	N
708-A	241	144	9	1.28	17.48	Y	N	Y	N
708-B	241	144	9	1.21	9.85	Y	Y	N	Y
720	240	145	2	0.85	9.47	Y	Y	N	Y
722	241	144	12	1.08	12.38	Y	Y	Y	Y

Y = present; N = absent; * = charred.

Table App4.1b. Summary, North Shelter flotation samples.

FS No.	North	East	Level	Volume (l)	Weight (gm)	Roots	Insects	Bone	Rodent Pellets
476	274	141	1	1.60	11.91	Y	Y	Y	Y*
479	271	141	1	1.19	34.25	Y	Y	Y	Y
480	270	141	1	0.83	12.77	Y	Y	N	Y
486	274	141	2	1.45	14.10	Y	Y	Y	Y*
491	271	141	2	0.60	20.20	Y	Y	N	Y
494	270	141	2	0.77	8.61	Y	Y	N	Y
499	270	141	3	1.30	15.81	Y	Y	N	Y
500	274	141	3	1.27	12.61	Y	Y	Y	Y*
503	271	141	3	1.05	18.75	Y	Y	Y	Y
512	271	141	4	0.96	10.44	Y	Y	Y	Y*
515	274	141	4	1.20	14.93	Y	Y	Y	Y*
530	273	141	3	1.13	11.54	Y	Y	N	Y*
532	271	141	6	1.10	8.66	Y	Y	Y	Y
540	273	141	4	1.02	9.07	Y	Y	N	Y*
542	273	141	5	1.44	10.03	Y	Y	Y	Y*
546	271	140	1	0.93	88.32	Y	Y	Y	Y
548	270	140	1	0.96	10.50	Y	Y	N	Y
554	273	141	6	2.55	20.20	Y	Y	Y	Y*
559	271	140	2	0.70	18.95	Y	Y	N	Y
566	273	141	7	1.30	14.84	Y	Y	N	Y*
569	271	140	3	0.85	6.25	N	N	Y	N
573	270	140	3	1.04	6.87	Y	Y	Y	N
580	271	140	4	0.80	6.20	N	N	Y	Y
582	270	140	4	0.81	4.62	Y	Y	Y	N
586	273	141	8	1.35	5.90	Y	Y	N	Y
598	273	140	1	1.29	13.23	Y	Y	N	Y
601	271	140	6	1.05	7.02	Y	Y	N	N
608-A	273	140	2	1.20	10.80	Y	Y	N	Y*
608-B	273	140	2	1.48	18.70	Y	N	N	Y*
611	273	140	3	1.82	14.46	Y	Y	N	Y
716	272	141	2	0.80	19.92	Y	Y	Y	Y
719	272	141	3	0.65	6.52	Y	Y	N	Y
724	272	141	4	0.80	8.36	Y	Y	Y	N
728	272	141	5	0.80	8.09	N	N	Y	Y
736	272	141	6	1.00	12.77	Y	Y	Y	Y
742	272	141	7	0.60	4.21	Y	Y	N	Y*
750	272	141	8	0.77	7.38	Y	Y	N	N
755	272	140	2	0.83	7.26	Y	Y	Y	Y
758	272	140	3	0.63	5.65	N	Y	Y	Y
760	272	140	4	0.90	5.10	Y	Y	N	N
763	272	140	5	0.80	5.21	N	Y	N	N
766	272	140	6	0.97	8.00	Y	Y	Y	N

Y = present; N = absent; * = charred.

Table App4.1c. Summary, South Talus, North Talus, and Central Talus flotation samples.

FS No.	North	East	Level	Volume (l)	Weight (gm)	Roots	Insects	Bone	Rodent Pellets
South Talus									
6	250	146	2	0.80	3.78	Y	Y	N	N
8	251	146	1	1.55	14.47	Y	Y	N	N
12	251	146	3	1.03	5.73	Y	Y	N	N
13	247	146	1	1.00	11.06	Y	Y	N	Y
19	246	146	1	0.95	10.24	Y	Y	N	Y
26	244	148	2	1.30	7.45	Y	Y	Y	N
27	250	147	1	0.79	6.79	Y	Y	N	N
45	244	147	2	1.08	21.04	Y	Y	Y	Y
46	244	147	3	0.71	4.85	Y	Y	N	N
65	244	145	4	0.85	8.88	Y	Y	Y	Y
66	245	147	1	0.66	22.48	Y	Y	Y	Y
72	250	144	1	0.92	8.69	Y	Y	N	Y
85	244	145	5	1.95	23.19	Y	Y	N	N
90	244	145	6	1.41	10.48	Y	Y	Y	N
96	244	145	8	1.45	12.18	Y	Y	Y	N
143	246	145	1	1.43	21.75	Y	Y	Y	Y*
145	246	145	2	1.49	16.28	Y	Y	N	Y*
147	246	145	3	1.42	15.20	Y	Y	Y	Y*
159	246	145	7	1.34	5.50	Y	Y	N	N
185	252	143	1	1.55	12.30	Y	Y	N	Y
197	252	143	2	1.22	12.60	Y	Y	Y	Y
208	252	143	3	0.92	4.91	Y	Y	N	Y*
216	252	143	4	1.09	5.24	Y	Y	N	Y*
389	243	147	2	0.49	10.94	Y	Y	N	Y*
412	242	147	2	1.80	14.97	Y	Y	N	N
421	242	146	1	1.15	18.30	Y	Y	N	Y
426	242	146	2	1.62	15.40	Y	Y	N	Y
697	237	144	1	0.63	2.70	Y	Y	N	N
North Talus									
251	271	143	3	0.65	4.00	Y	Y	N	Y
262	271	143	5	0.92	5.60	Y	Y	N	N
296	271	143	9	1.00	1.20	Y	N	N	N
303	270	143	2	0.83	8.99	Y	Y	N	N
310	274	143	1	1.44	22.00	Y	Y	N	Y
379	271	142	3	1.00	8.00	Y	Y	N	Y*
380	273	143	3	1.48	6.63	Y	Y	N	N
393	274	142	1	0.77	19.70	Y	Y	N	Y*
405	270	142	1	0.73	15.29	Y	Y	N	Y
436	270	142	7	1.40	4.36	Y	Y	N	Y*
630	269	143	2	0.89	2.83	Y	N	N	N
666	272	143	2	0.96	6.40	Y	Y	Y	N
691	272	142	1	0.97	3.70	Y	Y	N	N
Central Talus									
592	254	142	1	1.15	10.80	Y	Y	N	N
607	253	142	1	0.40	12.90	Y	Y	N	Y
618	253	143	1	0.73	4.90	Y	Y	N	N

Y = present; N = absent; * = charred.

Table App4.2a. South Shelter, 240N/145E–242N/145E, flotation sample plant remains

Category	Taxon	240N/145E	241N/144E			241N/145E		242N/144E		242N/145E		
		FS 720 Level 2	FS 708-A Level 9	FS 708-B Level 9	FS 722 Level 12	FS 675 Level 6	FS 682 Level 8	FS 632 Level 14	FS 634 Level 15	FS 564 Level 6	FS 570 Level 7	FS 642 Level 9
Charred												
Annuals	Amaranth	–	–	–	0.9	0.8	–	–	–	–	–	–
	Cheno-am	2.4	–	1.7	0.9	–	–	0.8	–	1.0	–	–
	Goosefoot	1.2	3.9	–	–	–	2.2	1.7	1.8	3.0	1.0	0.9
Cultivars	Maize	–	–	–	–	–	+ c	–	–	+ c, poss. 1.0 k frag.	+ c	+ cf. c
Grasses	Grass family	–	1.6 frag., cf. 0.8	0.8	–	–	2.2	–	–	cf. 1.0 frag.	–	–
Other	Buckwheat family	–	–	–	–	–	1.1	–	–	–	–	–
	Possible Sedge family	–	–	–	–	–	2.2	–	–	–	–	–
	Unidentifiable seed	–	0.8 frag.	–	0.9	0.8	–	0.8	–	–	0.5	0.9
	Unknown part	–	–	–	–	–	–	–	–	1.0 frag.	–	1.8 frag.
Perennials	cf. Chokecherry	–	–	–	–	–	–	–	1.8 frag.	–	–	–
	Douglas fir	–	+ needle	+ needle	+ needle	+ needle	+++ needle	+ needle	+ needle	+ needle	+ needle	–
	Pine	+ bark	–	+ bark	–	+ bark	+ bark	–	–	–	+ bark	–
	Ponderosa pine	+ needle	+ needle	+ fascicle, + needle	–	+ needle	+ needle	–	–	+ needle	+ needle	+ needle
Uncharred												
Annuals	Amaranth	+	–	+	+	+	–	+	–	–	+	+
	Goosefoot	+	–	+	+	–	+	++	+++	+	+	+
	Purslane	+	–	+	–	+	–	–	–	–	–	–
	Spurge	+	–	+	+	–	–	+++	++++	–	+	–
	Stickleaf	+	–	–	+	–	–	–	–	–	–	–
	Strawberry blite	+	–	–	+	–	–	+	–	–	+	+
Grasses	Dropseed grass	+	–	–	–	–	–	–	–	–	–	–
	Grass family	++	–	+	+	+	+	+	+	–	+	+
Other	Aster family	+	–	–	+	+	+	+	+	–	–	+
	Groundcherry	+	–	–	–	–	–	–	–	–	–	–
	Mullein	+	–	–	–	–	+	–	–	–	–	–
	Unidentifiable seed	–	+	–	–	–	+	–	–	–	–	–
	Vervain	–	–	+	–	–	+	–	–	–	–	–
	Alder	–	+	–	–	–	–	–	–	–	–	–
Perennials	Chokecherry	+	–	–	–	–	–	–	–	–	–	–
	Hedgehog cactus	–	+	+	–	+	–	–	–	+	–	+
Perennials	Oak	–	–	–	+ nutshell	+ nutshell	–	+ nutshell	+ nutshell	–	+ nutshell	–
	Ponderosa pine	+ needle	–	–	–	+ needle	–	–	–	–	–	–
	Strawberry	–	–	–	–	+	–	–	–	–	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample.
c = cupule; cf. = compares favorably.

Table App4.2b. South Shelter, 243N/143E–244N/143E, flotation sample plant remains.

Category	Taxon	243N/143E	243N/144E				243N/145E				244N/143E	
		FS 539 Level 9	FS 470 Level 6	FS 489 Level 11	FS 496 Level 12	FS 514 Level 13	FS 443 Level 4	FS 447 Level 5	FS 448 Level 6	FS 518 Level 8	FS 120 Level 2	FS 123 Level 3
Charred												
Annuals	Amaranth	–	–	–	–	–	0.7	0.8	–	–	0.6	2.6
	Cheno-am	0.9	–	1.6	0.9	1.0	–	0.8	–	–	0.6	12.4
	Goosefoot	5.3	–	2.4	2.7	2.1	5.6	3.4	2.6	0.9	–	1.0
	Sunflower	–	–	–	–	–	–	0.8	–	–	–	cf. 1.0
Cultivars	Maize	–	–	+ c	–	+ c	+ cf. c	+ c	–	+ poss c	–	–
Grasses	Grass family	–	–	–	–	–	cf. 0.7	cf. 1.7	1.3 frag.	cf. 0.9	–	cf. 1.0
Other	Groundcherry	–	–	cf. 0.8	–	–	–	–	–	–	–	0.5
	Sedge family	–	0.7	–	–	–	–	–	–	–	–	–
	Unidentifiable seed	–	–	–	1.8	–	0.7	–	–	0.9	–	–
	Unknown plant part	–	–	–	0.9 frag.	1.0	–	–	1.3 frag.	–	+ twig w/ buds	0.5 frag.
Perennials	cf. Chokecherry	–	0.7, 0.7[pc]	–	–	–	–	–	–	–	–	–
	Douglas fir	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	–	+ needle
	Pine	–	+ bark, + bark pc	–	–	–	–	–	–	–	–	+ bark
	possible Piñon pine	–	–	–	–	–	–	–	–	–	–	+ nutshell
	Ponderosa pine	–	+ needle	–	+ needle	+ needle	+ needle	+ needle	+ needle	–	+ needle	+ needle
Uncharred												
Annuals	Amaranth	+	++	–	–	+	–	+	–	–	++	–
	Goosefoot	–	+	–	–	–	++	+	+	+	+	+
	Purslane	–	++	–	–	–	+	+	+	–	+	+
	Spurge	–	+	–	–	–	–	–	–	–	–	–
	Strawberry blite	–	++	–	–	–	+	+	+	–	++	–
	Sunflower	–	–	–	–	–	–	–	–	–	+	+
Grasses	Dropseed grass	–	+	–	–	–	–	–	–	–	–	–
	Grass family	–	+	–	–	–	+	+	–	+	–	–
Other	Aster family	–	+	–	–	–	–	–	–	–	+	–
	Buckwheat family	–	–	–	–	–	–	–	–	–	+	–
	Groundcherry	–	+	–	–	–	–	+	+	–	+	–
	Mint family	–	+	–	–	–	–	–	–	–	–	–
	Mullein	–	+	–	–	–	+	+	–	–	–	–
	cf. Sedge family	–	–	–	–	–	–	–	+	–	–	–
Other	Vervain	–	+	–	–	–	–	–	–	–	–	–
	Wild lettuce	–	+	–	–	–	–	–	–	–	–	–
Perennials	Alder	–	–	–	–	–	–	–	–	–	+	–
	Chokecherry	–	cf. +	–	–	–	–	+	–	–	–	–
	Douglas fir	–	–	–	–	–	+ needle	–	–	–	–	–
	Hedgehog cactus	+	++	–	–	–	–	–	–	–	+	+
	Juniper	–	–	–	–	–	–	–	–	–	+ twig	–
	Oak	–	–	–	–	–	–	+ nutshell	–	–	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample.
c = cupule; cf. = compares favorably.

Table App4.2c. South Shelter, 244N/143E (continued)–244N/144E, flotation sample plant remains.

Category	Taxon	244N/143E					244N/144E					
		FS 125 Level 4	FS 129 Level 5	FS 131 Level 6	FS 134 Level 7	FS 136 Level 8	FS 73 Level 2	FS 76 Level 3	FS 79 Level 4	FS 83 Level 5	FS 100 Level 6	FS 102 Level 7
Charred												
Annuals	Amaranth	6.0	–	0.5	–	0.5	–	–	0.5	–	0.5	–
	Cheno-am	9.6	–	3.2	1.4	1.4	2.9	4.5	0.5	2.0	0.5	0.7
	Goosefoot	2.4	–	1.0	1.4	2.8	0.6	0.6	2.2	–	0.5	0.7
	cf. Sunflower	1.2	–	–	–	–	–	–	–	–	–	–
Cultivars	Maize	–	–	+ c	+ c	–	–	+ cf. c	+ c	–	cf. + c	cf. + c
Grasses	Grass family	3.0	–	0.5	–	0.5	1.2	1.9	–	–	0.5	–
Other	cf. Aster family	–	–	–	–	–	–	1.3	–	–	–	–
	cf. Bufflalo gourd/squash	–	–	–	–	–	+ rind	–	–	–	–	–
	Monocot stem	+	–	–	–	–	–	–	–	+	–	–
	cf. Morning glory family	–	1.4	–	–	–	–	–	–	–	–	–
	Sedge family	0.6	cf. 0.7	–	–	–	0.6	0.6	–	–	–	–
	Unidentifiable seed	–	–	0.5	–	–	1.2	–	–	–	–	–
	Unknown plant part	–	–	0.5 frag.	–	–	–	1.3	1.1	2.7	1.1	–
	cf. Wild buckwheat	0.6	–	–	–	–	–	–	–	–	–	–
Perennials	cf. Dock	–	–	–	–	–	–	0.6	–	–	–	–
	Douglas fir	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle
	Pine	+ bark	+ bark, cf. + conescale	–	+ bark	+ bark	–	–	+ bark	+ bark	–	+ bark
	Ponderosa pine	+ needle	+ needle	+ needle	+ needle	–	+ needle	+ needle	+ needle	+ needle	–	+ needle
Uncharred												
Annuals	Amaranth	+	+	+	+	–	++	+	+	+	–	+
	Goosefoot	+	–	+	+	–	++	+	+	+	+	+
	Purslane	+	–	+	+	+	+	+	+	+	–	–
	Sunflower	–	–	–	+	–	+	–	–	–	–	–
	Tumbleweed	–	–	–	–	–	–	0.6*	–	–	–	–
Grasses	Grass family	–	–	–	–	–	–	+	–	–	–	–
Other	Aster family	–	–	–	–	–	+	–	–	–	–	–
	Groundcherry	–	–	–	–	–	+	+	–	–	–	–
	Mullein	–	–	–	–	–	+	+	–	–	–	–
Other	Nightshade family	+	–	–	–	–	–	–	–	–	–	–
	Unknown plant part	–	–	–	++ node	–	–	–	–	–	–	–
	Vervain	–	–	–	+	–	+	–	–	–	–	–
Perennials	Chokecherry	+	–	–	–	–	–	–	–	–	–	–
	Hedgehog cactus	+	–	+	–	–	–	+	–	–	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample.
c = cupule; cf. = compares favorably.

Table App4.2d. South Shelter, 244N/144E (continued)–245N/144E, flotation sample plant remains.

Category	Taxon	244N/144E			245N/143E							245N/144E
		FS 105 Level 8	FS 110 Level 9	FS 111 Level 10	FS 227 Level 4	FS 229 Level 5	FS 235-A Level 6 Ash Layer	FS 235-B Level 6	FS 240 Level 8	FS 244 Level 9	FS 245 Level 10	FS 187 Level 1
Charred												
Annuals	Amaranth	–	–	3.0	3.2	2.3	–	–	–	0.5	–	0.8
	Cheno-am	1.7	1.4	0.7	12.6	–	–	3.0	3.2	1.4	1.8	2.3
	Goosefoot	6.3	1.4	14.2	2.1	1.1	2.1	1.0	2.2	2.3	5.5	–
Cultivars	Maize	poss. + c fragment	poss. + c	cf. + c	–	+ c	–	poss. + c	–	–	–	–
Grasses	cf. Dropseed grass	–	–	–	–	–	–	–	1.1	–	–	–
	Grass family	–	–	cf. 2.2	1.1	–	2.1	–	–	–	–	–
Other	Cactus family	–	–	–	–	cf. + areole	–	–	–	cf. + areole	–	–
	cf. Groundcherry	–	–	0.7	–	–	–	–	–	–	–	–
	Unidentifiable seed	–	–	–	1.1 frag.	0.6	–	–	–	–	–	0.8
	Unknown plant part	–	–	–	1.1	–	–	–	–	–	–	–
Perennials	Douglas fir	+ needle	+ needle	+ needle	+ needle	–	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle
	Hedgehog cactus	–	0.7	–	–	–	–	–	–	–	–	–
	Pine	+ bark	–	–	+ bark	+ bark	–	–	–	–	–	–
	Ponderosa pine	–	–	–	+ needle	+ needle	–	+ needle	+ needle	+ needle	–	–
Uncharred												
Annuals	Amaranth	–	–	–	+	–	–	+	+	+	+	+++
	Goosefoot	–	–	–	+	+	–	+	+	+	+	+++
	Purslane	–	–	+	+	+	–	+	–	+	–	++
	Spurge	–	–	–	+	–	–	–	–	–	–	+
	Stickleaf	–	–	–	–	–	–	–	–	–	–	+
	Sunflower	–	–	–	+	–	–	–	–	–	–	–
Grasses	Brome	–	–	–	–	–	–	–	–	–	–	+ floret
	Grass family	–	–	+	–	+	–	–	–	–	–	–
Other	Aster family	–	–	+	–	–	–	–	–	–	+	+
	Groundcherry	–	–	–	–	–	–	–	–	+	–	+
	Mint family	–	–	–	–	–	–	–	–	–	–	+
	Mullein	–	–	–	–	–	–	–	–	–	–	+
	cf. Sedge family	–	–	–	–	–	–	–	–	–	+	–
Other	Vervain	–	–	–	+	–	–	–	–	–	–	–
Perennials	cf. Chokecherry	–	–	–	–	–	–	–	–	–	–	+ fruit
	Hedgehog cactus	–	–	–	+	–	–	–	–	+	–	–
	Oak	–	–	–	–	–	–	–	+ nutshell	–	+ nutshell	+ cup
	cf. Strawberry	–	–	–	–	–	–	–	–	+	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample.
c = cupule; cf. = compares favorably.

Table App4.2e. South Shelter, 245N/144E (continued)–246N/143E, flotation sample plant remains.

Category	Taxon	245N/144E									246N/143E	
		FS 190 Level 2	FS 191 Level 3	FS 195 Level 4	FS 198 Level 5	FS 202 Level 6	FS 207 Level 7	FS 209 Level 8	FS 212 Level 9	FS 218 Level 10	FS 337 Level 3	FS 343 Level 5
Charred												
Annuals	Amaranth	–	–	–	1.0	–	–	0.6	–	1.5	–	–
	cf. Caltrop	–	–	–	2.0	–	–	–	–	–	–	–
	Cheno-am	3.6	3.3	3.5	1.0	2.0	3.0	2.3	0.9	5.6	13.6	6.4
	Goosefoot	4.8	1.7	6.1	3.0	3.5	3.0	5.6	9.4	19.8	–	1.4
Cultivars	Maize	–	+ c	+ c	–	–	+ c	+ c	–	–	–	cf. + c
Grasses	Grass family	–	–	0.9	1.0	–	1.0	–	–	–	1.4	0.7
Other	Cactus family	–	–	–	poss. 1.0 areole	–	–	–	–	–	–	–
	Unidentifiable seed	–	2.5	2.6	1.0	0.5 frag.	–	1.1	–	1.0	1.4	0.7
	Unknown plant part	1.2 frag.	4.2	0.9	2.0, cf. 1.0 peduncle	–	–	–	–	–	0.7	–
	Vervain	–	–	–	–	–	–	–	–	–	0.7	–
Perennials	Banana yucca	–	–	–	–	–	–	–	–	0.5 frag.	–	–
	Chokecherry	–	–	2.6 frags.	–	0.5 frag.	1.0 frag.	–	–	–	–	–
	Douglas fir	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle
	Hedgehog cactus	–	–	1.8	–	–	–	–	–	–	–	–
	Pine	–	+ bark	+ bark	+ bark	+ bark	+ bark	–	+ bark	+ bark	–	+ needle
	Piñon pine	–	–	–	–	+ needle	–	–	–	–	+ needle	+ needle
	Ponderosa pine	+ needle	+ needle	–	–	–	–	+ needle	+ needle	+ needle	–	–
	possible Yucca	–	–	–	–	–	–	–	–	+ caudex	–	–
Uncharred												
Annuals	Amaranth	–	+	+	–	+	–	–	–	–	++	+
	Goosefoot	–	+	+	+	+	–	+	–	+	+++	+
	Purslane	–	+	+	+	+	–	+	+	–	+	+
	Spurge	–	–	+	–	–	–	–	–	–	–	–
	Stickleaf	–	–	–	–	–	–	–	–	+	+	–
	Strawberry blite	–	–	–	–	–	–	–	–	–	++	++
Grasses	Grass family	+	cf. +	–	+	–	–	–	cf. +	–	+, + floret	cf. +
Other	Aster family	–	–	–	–	–	–	–	–	–	+	–
	Cactus family	–	–	cf. + spine	–	–	–	–	–	–	–	–
	Groundcherry	+	+	+	–	–	–	–	–	–	+	+
	Spiderling	–	–	–	–	–	–	–	–	–	+	–
	Unidentifiable seed	+	–	–	–	–	–	–	–	–	–	–
	Wild lettuce	–	–	–	–	–	–	–	–	–	+	–
Perennials	Chokecherry	–	–	–	–	–	–	–	–	–	–	+
	Hedgehog cactus	–	–	–	+	–	–	–	–	–	+	+
	Juniper	–	–	–	–	–	–	–	–	–	+, + twig	–
	Oak	–	–	–	–	–	–	–	–	+ nutshell	+ nutshell	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample.
c = cupule; cf. = compares favorably.

Table App4.2f. South Shelter, 246N/143E (continued)–246N/144E, flotation sample plant remains.

Category	Taxon	246N/143E		246N/144E								
		FS 347 Level 6	FS 357 Level 9	FS 290 Level 3	FS 292 Level 4	FS 294 Level 5	FS 297 Level 6	FS 305 Level 7	FS 308 Level 8	FS 313 Level 9	FS 318 Level 11	FS 323 Level 12
Charred												
Annuals	Amaranth	–	0.9	4.0	3.9	1.1	–	–	0.6	–	–	0.9
	Cheno-am	1.3	0.9	10.0	9.2	4.3	0.6	–	3.0	2.1	3.4	8.2
	Goosefoot	2.2	2.7	5.0	2.6	2.2	1.8	–	5.4	5.3	8.0	16.4
Cultivars	Maize	+ c	+ c	–	–	cf. + c	+ c	–	+ c, 0.6 k	–	–	–
Grasses	Grass family	–	–	6.0	cf. 1.3	cf. 2.2	–	–	0.6cp	–	1.1	cf. 1.8
Other	Scorpionweed	–	–	–	–	–	–	–	1.2	–	–	–
	Sedge family	0.4	–	cf. 1.0	0.7	–	–	–	–	–	–	–
	Unidentifiable seed	0.4	–	4.0	0.7	–	1.8 frags., 0.6	1.0	1.2	–	1.1	–
	Unknown plant part	–	–	3.0	–	–	1.2	–	0.6	–	–	–
	Vervain	–	–	–	–	–	0.6	–	–	–	–	–
Perennials	Douglas fir	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle
	Hedgehog cactus	–	–	1.0	–	–	–	1.0	–	–	–	–
	Piñon pine	–	–	–	–	–	+ needle	–	–	–	–	–
	Ponderosa pine	+ needle	–	+fascicle, +needle	+ needle	+ needle	+ needle	+ needle	–	–	+ needle	–
Uncharred												
Annuals	Amaranth	+	+	+	+	+	+	+	+	–	+	+
	Goosefoot	+	+	+	+	+	+	+	+	–	+	–
	Purslane	+	+	+	+	+	–	+	+	–	–	+
	Spurge	–	+	–	–	–	–	–	–	–	–	–
	Strawberry blite	+	–	+	+	–	+	+	–	–	–	+
Grasses	Grass family	–	–	+	–	–	–	–	–	–	–	–
	cf. Grass family	+	+	–	+	–	–	+	–	–	–	–
Other	Aster family	+	–	–	+	–	+	–	–	+	–	–
	Buckwheat family	–	+	–	–	–	–	–	–	–	–	–
	Groundcherry	–	–	+	+	–	–	–	+	–	–	–
	Mint family	+	–	–	–	–	–	–	–	–	–	–
	Mullein	–	+	–	+	–	–	–	+	–	–	+
	cf. Sedge family	–	–	+	–	–	–	–	+	–	+	–
Perennials	cf. Chokecherry	–	+	–	–	–	–	+	–	–	–	–
	Dock	–	–	–	+	–	–	–	–	–	–	–
	Hedgehog cactus	–	–	+	+	–	–	–	–	–	–	–
Perennials	Juniper	–	–	+	–	–	–	–	–	–	–	–
	Oak	+ nutshell	++ nutshell	–	–	–	–	+ nutshell	–	+ nutshell	+ nutshell	+ nutshell

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample.
c = cupule; cf. = compares favorably; k = kernel; pc = partially charred.

Table App4.2g. South Shelter, 246N/144E–251N/143E, charred flotation sample plant remains.

Category	Taxon	246N/144E	247N/143E		247N/144E				249N/143E	251N/143E	
		FS 332 Level 13	FS 363 Level 4	FS 369 Level 6	FS 258 Level 3	FS 263 Level 4	FS 271 Level 6	FS 274 Level 7	FS 189 Level 1	FS 87 Level 1	FS 99 Level 2
Annuals	Amaranth	–	–	–	2.0	–	–	–	–	–	–
	Cheno-am	3.6	8.3	1.3	7.1	4.0	2.9	3.3	–	2.1	3.0
	Goosefoot	10.0	2.5	1.9	11.2	7.0	1.4	4.2	–	0.7	2
	Purslane	–	–	–	–	–	–	–	–	1.4	–
	Sunflower	–	–	–	–	–	0.7	–	–	–	–
	Tobacco	–	–	0.6	–	–	–	–	–	–	–
Cultivars	Maize	–	–	+ c	–	+ c	–	+ poss. g	–	–	–
Grasses	Grass family	–	–	2.6	3.1	cf. 1.0	0.7	–	–	–	–
Other	cf. Aster family	–	–	–	–	–	–	–	–	–	1.0
	cf. Morning glory family	–	–	–	–	1.0	–	–	–	–	–
	Scorpionweed	–	–	0.6	–	–	–	–	–	0.7	–
	cf. Sedge family	–	–	–	–	–	0.7	–	–	0.7	–
	Unidentifiable seed	0.9	2.5	–	–	1.0	–	–	0.9	–	–
	Unknown plant part	–	0.8 fruit, 2.5	1.3	3.1 frags.	1.0	2.2	–	0.9	2.1	–
	Vervain	–	–	–	–	–	–	–	–	0.7	–
Perennials	Chokecherry	–	–	–	cf. 1.0 frag.	–	–	cf. 0.5 frag.	–	–	–
	Douglas fir	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	–	–	cf. + needle
	Hedgehog cactus	–	–	–	–	1.0	0.7	–	–	–	–
	Pine	–	cf. 0.8	–	+ bark	+ umbo	+ bark	+ bark	+ bark	+ bark	+ bark
	Ponderosa pine	–	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle	+ needle
	Prickly pear cactus	–	–	–	–	–	0.7 embryo	–	–	–	–
	Raspberry	–	–	–	–	–	–	0.5	–	–	–
	cf. Willow	–	–	–	–	–	–	–	–	0.7 bud, + poss. node	–

Plant parts are seeds unless indicated otherwise.
Cultural plant material is charred.
+ = 1-10/sample.
c = cupule; cf. = compares favorably; g = glume.

Table App4.2h. South Shelter, 247N/143E–251N/143E, uncharred flotation sample plant remains.

Category	Taxon	247N/143E		247N/144E				249N/143E	251N/143E	
		FS 363 Level 4	**FS 369 Level 6**	**FS 258 Level 3**	**FS 263 Level 4**	**FS 271 Level 6**	**FS 274 Level 7**	**FS 189 Level 1**	**FS 87 Level 1**	**FS 99 Level 2**
Annuals	Amaranth	+	++	++	+	+	++	+++	++	++
	Goosefoot	+	+	+	+	+	+	+++	++	++
	Purslane	+	–	+	–	+	+	+	++	+
	Spurge	+	–	–	–	–	–	–	–	–
	Stickleaf	+	–	–	–	–	–	+	+	–
	Strawberry blite	+	+	+	+	–	+	–	–	–
	Sunflower	+	–	–	–	–	–	–	+	–
Grasses	Brome	–	–	–	–	–	–	+	–	–
	Dropseed grass	–	–	–	–	–	–	–	+	–
	Grass family	+	–	cf. +	+	+	+	–	+ floret	+
Other	Aster family	+	+	+	+	–	+	+	+	+
	Groundcherry	–	+	–	–	–	–	–	+	–
	Mint family	+	–	–	–	–	–	+	–	–
	Mullein	–	–	–	+	–	–	–	–	+
	Scorpionweed	–	+	–	–	–	–	–	+	–
	Sedge family	–	–	+	–	+	–	–	+	+
	Unidentifiable seed	–	–	–	–	–	–	+	–	–
	Vervain	–	–	–	–	–	+	+	+	–
	Wild lettuce	–	–	–	–	–	–	+	–	–
Perennials	Alder	+	–	–	–	–	–	+	+	–
	Chokecherry	–	+	–	–	–	cf. +	+	–	+
	Dock	+ fruit, +	+	–	–	–	–	+	–	–
	Hedgehog cactus	+	+	–	+	–	–	+	+	+
	cf. Juniper	–	–	–	–	–	–	–	+	–
	Oak	+ nutshell	+ nutshell	–	–	–	–	–	–	–
	cf. Pine	+	+	–	–	–	+	+	–	–
	Ponderosa pine	+ needle	–	–	+ needle	–	+ needle	+ needle	–	–

Plant parts are seeds unless indicated otherwise.
Non-cultural plant material is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample.
cf. = compares favorably.

Table App4.2i. South Shelter, 240N/145E–243N/143E, flotation sample wood taxa.

Category	Taxon	240N/145E	241N/144E		241N/145E		242N/144E		242N/145E			243N/143E
		FS 720 Level 2	FS 708-A Level 9	FS 722 Level 12	FS 675 Level 6	FS 682 Level 8	FS 632 Level 14	FS 634 Level 15	FS 564 Level 6	FS 570 Level 7	FS 642 Level 9	FS 539 Level 9
Conifers	Ponderosa pine	11/.30	6/.26	16/.42	13/.20	15/.55	8/.70	10/1.0	11/.37	12/.20	14/.30	13/.53
	Unknown Conifer	–	–	–	–	–	1/.02	1/.01	–	–	–	–
Non-Conifers	cf. Alder	1/.01	3/.04	1/.01	2/.03	1/.01	7/.10	2/.03	2/.02	4/.02	–	–
	cf. Cottonwood/ Willow	–	1/.01	–	–	–	–	–	1/.02	–	4/.05	1/.03
	Oak	1/.09	10/.29	3/.05	4/.05	3/.05	3/.06	7/.20	6/.12	4/.07	2/.03	5/.12
	Sagebrush	–	–	–	–	–	–	–	–	–	–	1/.02
	Unknown Non-conifer	–	–	–	1/.04	1/.09	1/.10	–	–	–	–	–
Total		**13/.40**	**20/.60**	**20/.48**	**20/.32**	**20/.70**	**20/.98**	**20/1.24**	**20/.53**	**20/.29**	**20/.38**	**20/.70**

Count/weight in grams.
cf. = compares favorably.

Table App4.2j. South Shelter, 243N/144E–244N/143E, flotation sample wood taxa.

Category	Taxon	243N/144E				243N/145E				244N/143E		
		FS 470 Level 6	FS 489 Level 11	FS 496 Level 12	FS 514 Level 13	FS 443 Level 4	FS 447 Level 5	FS 448 Level 6	FS 518 Level 8	FS 120 Level 2	FS 123 Level 3	FS 125 Level 4
Conifers	cf. Juniper	–	–	3/.09	–	–	–	–	–	–	–	–
	Pine	–	–	–	–	–	1/.02	–	–	–	–	–
	cf. Piñon pine	–	–	–	–	–	–	–	–	1/.06	–	–
	Ponderosa pine	12/.67	13/.64	8/.23	9/.24	12/.39	10/.40	17/.50	13/.17	3/.10	12/.36	4/.11
	Unknown Conifer	–	–	–	1/.05	–	–	–	–	–	–	–
Non-Conifers	cf. Alder	5/.07	3/.07	–	3/.08	–	1/.01	1/.02	1/.01	–	–	–
	cf. Chokecherry	–	–	–	–	–	–	–	–	3/.20	–	–
	cf. Cottonwood/ Willow	–	–	–	1/.01	–	4/.03	–	–	2/.10	7/.16	14/.41
	Oak	3/.05	4/.09	9/.22	6/.09	8/.16	4/.04	2/.01	6/.06	2/.02	1/.03	2/.11
	Unknown Non-conifer	–	–	–	–	–	–	–	–	2/.03	–	–
Total		**20/.79**	**20/.80**	**20/.54**	**20/.47**	**20/.55**	**20/.50**	**20/.53**	**20/.24**	**13/.51**	**20/.55**	**20/.63**

Count/weight in grams.
cf. = compares favorably.

Table App4.2k. South Shelter, 244N/143E (continued)–244N/144E, flotation sample wood taxa.

Category	Taxon	244N/143E				244N/144E						
		FS 129 Level 5	**FS 131 Level 6**	**FS 134 Level 7**	**FS 136 Level 8**	**FS 73 Level 2**	**FS 76 Level 3**	**FS 79 Level 4**	**FS 83 Level 5**	**FS 100 Level 6**	**FS 102 Level 7**	**FS 105 Level 8**
Conifers	Pine	–	–	–	–	3/.19	–	–	–	–	–	–
	cf. Piñon pine	–	–	–	–	–	4/.29	–	–	–	–	–
	Ponderosa pine	12/1.4	7/.30	10/.33	15/.44	6/.27	12/.31	11/.54	14/.71	16/.65	14/.97	12/.33
Non-Conifers	cf. Alder	3/.02	3/.05	1/.02	–	2/.02	–	–	–	1/.02	3/.02	2/.28
	cf. Chokecherry	–	–	–	–	3/.13	–	–	–	1/.07	–	–
	cf. Cottonwood/ Willow	2/.02	1/.01	6/.14	–	2/.03	1/.02	4/.06	3/.07	–	–	1/.01
	Oak	3/.10	9/.37	3/.07	5/.06	3/.07	3/.06	5/.08	3/.07	2/.09	3/.03	5/.13
	Unknown Non-conifer	–	–	–	–	1/.07	–	–	–	–	–	–
Total		**20/1.54**	**20/.73**	**20/.56**	**20/.50**	**20/.78**	**20/.68**	**20/.68**	**20/.85**	**20/.83**	**20/1.02**	**20/.75**

Count/weight in grams.
cf. = compares favorably.

Table App4.2l. South Shelter, 244N/144E (continued)–245N/144E, flotation sample wood taxa.

Category	Taxon	244N/144E		245N/143E							245N/144E	
		FS 110 Level 9	**FS 111 Level 10**	**FS 227 Level 4**	**FS 229 Level 5**	**FS 235-A Level 6 Ash Layer**	**FS 235-B Level 6**	**FS 240 Level 8**	**FS 244 Level 9**	**FS 245 Level 10**	**FS 187 Level 1**	**FS 190 Level 2**
Conifers	Ponderosa pine	10/.20	11/.20	9/.28	11/.50	6/.10	17/.60	14/.30	10/.40	13/.24	8/.50	8/.30
	Unknown Conifer	–	–	–	–	–	–	–	–	3/.05	–	–
Non-Conifers	cf. Alder	2/.03	1/.01	4/.06	–	5/.07	2/.01	–	–	3/.04	–	2/.04
	cf. Chokecherry	–	–	–	1/.03	–	–	–	–	–	2/.11	–
	cf. Cottonwood/ Willow	–	2/.01	1/.01	3/.03	–	–	–	4/.05	–	5/.10	5/.10
	Oak	8/.10	5/.10	6/.09	5/.10	2/.01	1/.01	6/.04	6/.20	1/.01	3/.10	5/.10
	Possible Sagebrush	–	–	–	–	–	–	–	–	–	1/.07	–
	Unknown Non-conifer	–	–	–	–	–	–	–	–	–	1/.02	–
Total		**20/.33**	**19/.32**	**20/.44**	**20/.66**	**13/.18**	**20/.62**	**20/.34**	**20/.65**	**20/.34**	**20/.90**	**20/.54**

Count/weight in grams.
cf. = compares favorably.

Table App4.2m. South Shelter, 245N/144E (continued)–246N/143E, flotation sample wood taxa.

Category	Taxon	245N/144E								246N/143E		
		FS 191 Level 3	FS 195 Level 4	FS 198 Level 5	FS 202 Level 6	FS 207 Level 7	FS 209 Level 8	FS 212 Level 9	FS 218 Level 10	FS 337 Level 3	FS 343 Level 5	FS 347 Level 6
Conifers	cf. Juniper	–	4/.08	–	–	–	–	6/.07	–	–	–	–
	Pine	–	–	–	1/.09	–	4/.30	–	2/.06	–	–	–
	Ponderosa pine	10/.32	11/.41	14/.35	12/.55	11/.24	12/.39	8/.17	13/.38	13/2.73	9/.47	11/.36
	Unknown Conifer	–	–	–	–	1/.02	–	–	–	–	–	–
Non-Conifers	cf. Alder	–	1/.01	3/.04	–	–	–	2/.01	–	2/.02	–	–
	cf. Chokecherry	1/.01	–	–	1/.01	–	–	–	–	–	–	1/.17
	cf. Cottonwood/Willow	5/.10	–	–	1/.03	1/.01	–	–	–	–	3/.04	3/.05
	Oak	3/.14	3/.07	3/.03	5/.07	7/.11	4/.08	4/.07	5/.05	4/.11	8/.27	4/.07
	cf. Sagebrush	–	–	–	–	–	–	–	–	1/.01	–	–
	Unknown Non-conifer	1/.01	–	–	–	–	–	–	–	–	–	1/.01
Total		**20/.58**	**19/.57**	**20/.42**	**20/.75**	**20/.38**	**20/.77**	**20/.32**	**20/.49**	**20/2.87**	**20/.78**	**20/.66**

Count/weight in grams.
cf. = compares favorably.

Table App4.2n. South Shelter, 246N/143E (continued)–246N/144E, flotation sample wood taxa.

Category	Taxon	246N/143E	246N/144E									
		FS 357 Level 9	FS 290 Level 3	FS 292 Level 4	FS 294 Level 5	FS 297 Level 6	FS 305 Level 7	FS 308 Level 8	FS 313 Level 9	FS 318 Level 11	FS 323 Level 12	FS 332 Level 13
Conifers	cf. Douglas fir	–	–	–	–	1/.03	–	–	–	–	–	–
	Pine	–	–	–	1/.12	–	–	1/.06	–	–	2/.06	–
	Ponderosa pine	11/.39	8/.38	11/.42	14/.47	9/.59	12/.21	14/.40	15/.25	15/.36	13/.71	9/.12
	Unknown Conifer	–	–	–	–	–	1/.01	–	–	–	–	–
Non-Conifers	cf. Alder	–	1/.03	3/.05	1/.03	–	3/.24	1/.01	–	2/.01	–	3/.13
	cf. Cottonwood/Willow	2/.03	–	2/.05	1/.01	5/.07	1/.03	3/.10	3/.02	–	2/.02	–
	Possible Currant	–	3/.03	–	–	–	–	–	–	–	–	–
	Oak	4/.06	8/.26	4/.11	3/.07	5/.11	2/.02	1/.01	1/.01	3/.02	3/.03	8/.06
	Unknown Non-conifer	3/.05	–	–	–	–	1/.01	–	1/.01	–	–	–
Total		**20/.53**	**20/.70**	**20/.63**	**20/.70**	**20/.80**	**20/.52**	**20/.58**	**20/.29**	**20/.39**	**20/.82**	**20/.31**

Count/weight in grams.
cf. = compares favorably.

Table App4.2o. South Shelter, 247N/143E–251N/143E, flotation sample wood taxa.

Category	Taxon	247N/143E		247N/144E				249N/143E	251N/143E		Totals	
		FS 363 Level 4	**FS 369 Level 6**	**FS 258 Level 3**	**FS 263 Level 4**	**FS 271 Level 6**	**FS 274 Level 7**	**FS 189 Level 1**	**FS 87 Level 1**	**FS 99 Level 2**	**Weight**	**%**
Conifers	cf. Douglas fir	–	–	–	1/.03	–	–	–	–	–	**0.06**	**<1**
	cf. Juniper	–	–	–	–	–	–	–	–	–	**0.24**	**1**
	Pine	–	–	–	–	–	2/.07	–	–	–	**0.97**	**2**
	cf. Piñon pine	–	–	–	–	–	–	–	–	–	**0.35**	**1**
	Ponderosa pine	9/.36	16/.50	16/.64	12/.38	13/.67	7/.19	9/.20	4/.03	3/.05	**32.2**	**70**
	Unknown Conifer	–	–	–	–	–	–	1/.01	–	–	**0.17**	**<1**
Non-Conifers	cf. Alder	2/.03	–	–	3/.03	–	3/.01	–	–	2/.04	**1.91**	**4**
	cf. Chokecherry	2/.05	–	–	–	–	–	1/.02	6/.04	–	**0.84**	**2**
	cf. Cottonwood/ Willow	3/.08	2/.02	1/.01	2/.01	3/.03	–	4/.01	2/.02	–	**2.22**	**5**
	Possible Currant	–	–	–	–	–	–	–	–	–	**0.03**	**<1**
	Oak	4/.19	2/.01	3/.08	2/.03	4/.05	7/.09	–	2/.01	–	**6.29**	**14**
	Sagebrush	–	–	–	–	–	1/.03	–	–	–	**0.13**	**<1**
	Unknown Non-conifer	–	–	–	–	–	–	–	–	–	**0.44**	**1**
Total		**20/.71**	**20/.53**	**20/.73**	**20/.48**	**20/.75**	**20/.39**	**15/.24**	**14/.10**	**5/.09**	**45.85**	**100**

Count/weight in grams.
cf. = compares favorably.

Table App4.2p. South Shelter, wood sample taxa.

Category	Taxon	241N/144E	242N/144E					244N/144E		244N/148E			245N/143E	246N/144E	247N/144E		250N/143E	
		FS 687 Level 2	**FS 578 Level 1**	**FS 603 Level 8**	**FS 614 Level 10**	**FS 627 Level 13**	**FS 639 Level 16**	**FS 79 Level 4**	**FS 100 Level 6**	**FS 26 Level 2**	**FS 30 Level 4**	**Level 8**	**FS 240 Level 8**	**FS 308 Level 8**	**FS 258 Level 3**	**FS 274 Level 7**	**FS 88 Level 3**	**FS 113 Level 4**
Conifers	Possible Douglas fir	–	–	–	–	–	–	–	–	–	–	–	2/.25	–	–	–	–	–
	Juniper	–	–	–	–	–	–	–	–	–	–	–	–	2/.21	–	–	–	–
	Pine	–	–	–	–	–	1/.28	–	1^pc^/.46	–	–	1/.04	–	–	–	–	–	–
	Ponderosa pine	1^u^/158.03	5/1.84	20/4.61	14/7.39	13/3.57	10/2.73	2^pc^/9.90	–	2/.06	–	–	21/2.85	27/4.17	21/2.92	12/2.08	16/2.66	14/2.97
	Unknown conifer	–	–	–	–	–	–	–	–	–	1^u^/.34	–	–	1^pc^/8.88	–	–	–	1/.05
Non-Conifers	cf. Alder	–	–	4/.68	3/.29	2/.19	–	–	–	–	–	–	–	1/.05	4/.22	1/.07	8/.57	8/.54
	cf. Chokecherry	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7/.29	–
	cf. Cholla	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1/.09	–
	cf. Cottonwood/Willow	–	–	1/.12	1/.21	–	–	–	–	–	–	–	–	–	1/.06	–	4/.15	6/.28
	Oak	–	–	–	1/.16	3/.70	–	–	–	–	–	–	1/.14	1/.17	5/.51	5/.77	5/.71	2/.49
	Unknown non-conifer	–	2/.27	–	–	–	–	–	–	–	–	–	1/.20	–	–	–	6/.44	2/.11
Total		**1/158.03**	**7/2.11**	**25/5.41**	**19/8.05**	**18/4.46**	**11/3.01**	**2/9.90**	**1/.46**	**2/.06**	**1/.34**	**1/.04**	**25/3.44**	**32/13.48**	**31/3.71**	**18/2.92**	**47/4.91**	**33/4.44**

Count/weight in grams.
cf. = compares favorablyl; pc = partially charred; u = uncharred.

Table App4.2q. LA 139965, dendro sample plant taxa.

Category	Taxon	South Shelter			South Talus
		246N/143E	250N/142E	250N/143E	249N/144E
		FS 337 Level 3	FS 118 Level 1	FS 95 Level 2	FS 165 Level 2
Wood Conifers	Ponderosa pine	–	1^{pc}/.40	1/11.63	–
	Unknown conifer	–	1^{pc}/.30	–	–
Non-Conifers	cf. Alder	–	1^{u}/.72	–	–
	cf. Chokecherry	1^{pc}/4.87	–	–	–
Other	Oak acorn?	–	–	–	1/.17
Total		**1/4.87**	**3/1.42**	**1/11.63**	**1/.17**

Count/weight in grams.
cf. = compares favorably; pc = partially charred.

Table App4.2r. South Shelter, 241N/144E–245N/143E, macrobotanical sample taxa.

Category	Taxon	241N/144E	242N/144E	243N/143E	243N/144E	243N/144E	244N/144E	245N/143E
		FS 623 Level 0-2	FS 589 Level 4	FS 534 Level 5	FS 469 Level 6	FS 472 Level 7	FS 76 Level 3	FS 225 Level 3
Wood Conifers	Pine	1^{pc}/.84	–	–	–	–	4/.84	–
	Ponderosa pine	–	–	cf. 1^{pc}/.39	cf. 1^{pc}/.56	1^{pc}/1.13	17/4.64	1^{pc}/.65
	Unknown Conifer	–	1^{pc}/1.56	–	–	–	2/.75	1^{u}/.10
Non-Conifers	cf. Alder	–	–	–	–	–	2/.18	–
	Cottonwood/Willow	–	–	–	–	–	2/.10	–
Total		**1/.84**	**1/1.56**	**1/.39**	**1/.56**	**1/1.13**	**27/6.51**	**2/.75**

Count/weight in grams.
pc = partially charred; u = uncharred.

Table App4.2s. South Shelter, 245N/143E (continued)–251N/143E, macrobotanical sample taxa.

Category	Taxon	245N/143E	250N/143E	251N/143E	251N/143E	251N/143E
		FS 227 Level 4	FS 88 Level 1	FS 87 Level 1	FS 99 Level 2	FS 108 Level 3
Wood Conifers	Pine	1^{pc}/.26	–	–	–	–
	cf. Piñon	1^{pc}/.19	–	–	–	–
Non-Conifers	cf. Chokecherry	–	–	–	1 twig^{u}/.07	–
Cultivars	Maize kernel	–	–	–	1/.07	–
Other	Unknown plant part	–	1 fruit^{u}/.03	–	–	–
Perennials	Chokecherry seed	–	2^{u}/.22	–	1/.03, cf. 1/.02, 2^{u}/.02	cf. 1 frag./.01
	Juniper seed	–	18^{u}/.25	–	–	–
	Oak acorn	–	11^{u}/.84	1^{u}/.24	2^{u}/.06	–
	Oak cap	–	3^{u}/.05	–	–	–
Total		**2/.45**	**35/1.39**	**1/.24**	**6/.27**	**1/.01**

Count/weight in grams.
pc = partially charred; u = uncharred.

Table App4.3a. North Shelter, 270N/140E–271N/140E, flotation sample plant remains.

Category	Taxon	270N/140E			270N/141E			271N/140E
		FS 548 Level 1	FS 573 Level 3	FS 582 Level 4	FS 480 Level 1	FS 494 Level 2	FS 499 Level 3	FS 546 Level 1
Charred								
Annuals	Cheno-am	–	1.0	–	–	1.3	3.1	–
	Goosefoot	1.0	1.0	6.2	2.4	–	6.9	–
Cultivars	Maize	–	+ c	+ c	–	1.3 k/.08 g	–	+ cf. c
Grasses	cf. Grass family	–	–	–	3.6	–	–	–
Other	Unidentifiable seed	1.0	1.0	2.5	1.2	1.3	0.8	1.1
	Vervain	1.0	–	–	–	–	–	–
Perennials	Chokecherry	–	–	–	–	–	0.8	1.1*
	Douglas fir	–	–	–	+ needle	–	+ needle	–
	Ponderosa pine	+ needle	+ needle	–	+ needle	+ needle	–	–
Uncharred								
Annuals	Amaranth	++++	+++	++	+++	++++	+++	+
	Goosefoot	++	++	–	++	++	++	+
	Purslane	++	++	–	++	+++	++	–
	Spurge	+	–	–	+	+	+	+
	Stickleaf	–	–	–	–	–	–	+
	Strawberry blite	+++	++	–	++	+	+	–
	Sunflower	–	–	–	–	–	–	+
Grasses	Dropseed grass	+	–	+	–	–	–	–
	Grass family	–	–	–	–	–	+	+
Other	Aster family	+	+	–	+	+	+	+
	Groundcherry	+	+	–	+	+	–	+
	Mint family	–	–	–	+	–	–	–
	Mullein	–	–	–	+	–	–	–
	Scorpionweed	–	–	–	+	–	–	–
	Sedge family	++	+	++	+	++	–	–
	Unidentifiable seed	+	+	+	–	–	–	+
	Vervain	+	–	+	+	+	–	–
	Wild lettuce	–	–	–	+	–	–	+
Perennials	Alder	–	–	–	–	–	+	+
	Bulrush	+	–	–	–	–	–	–
	cf. Chokecherry	+ frag.	–	–	–	–	–	+ frag., + fruit
	Dock	–	–	–	–	–	–	+
	Hedgehog cactus	+	+	+	+	+	+	+
	Juniper	–	–	–	+ twig	–	–	+ twig
	Oak	–	–	–	+ cup	+ cup	–	+ acorn, + cup, + leaf, + nutshell
	Pine	–	–	–	+ umbo	–	–	–
	Ponderosa pine	–	–	–	+ needle	–	–	+ needle, cf. +
	Raspberry	+	–	–	–	+	–	–
	cf. Strawberry	–	+	–	–	–	–	–

Count/weight in grams.
* = evidence of gnawing present.
Plant parts are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample; ++++ = >100/sample.
c = cupule; cf. = compares favorably; k = kernel.

Table App4.3b. North Shelter, 271N/140E (continued)–271N/141E, flotation sample plant remains.

Category	Taxon	271N/140E				271N/141E			
		FS 559 Level 2	FS 569 Level 3	FS 580 Level 4	FS 601 Level 6	FS 479 Level 1	FS 491 Level 2	FS 503 Level 3	FS 512 Level 4
Charred									
Annuals	Amaranth	–	–	–	–	–	–	–	1.0
	Cheno-am	1.4	1.2	–	1.0	–	5.0	1.0	3.1
	Goosefoot	–	1.2	10.0	9.5	1.7	10.0	4.8	11.5
Grasses	Grass family	–	–	–	–	+ stem	–	–	–
Cultivars	Maize	–	–	–	–	–	–	+ c	–
Other	cf. Buckwheat fam.	–	–	–	1.0	–	–	–	–
	cf. Sedge family	–	–	–	–	–	–	1.0	–
	Unknown plant part	2.9 frags.	–	–	–	0.8 cf. bud, 0.8	–	1.0	–
Perennials	Chokecherry	–	–	–	–	0.8	–	–	–
	Douglas fir	–	+ needle	+ needle	–	+ needle	–	+ needle	+ needle
	Hedgehog cactus	–	–	–	–	–	1.7 frags.	–	–
	Ponderosa pine	–	+ needle	+ needle	+ needle	–	–	+ needle	–
Uncharred									
Annuals	Amaranth	+++	+	++	+	++	+++	+++	+
	Goosefoot	++	++	+	+	+	+	++	+
	Purslane	++	++	++	+	++	+	++	+
	Spurge	+	+	+	–	+	+	–	–
	Strawberry blite	+	+	+	–	+	+	+	+
	Sunflower	+	–	–	–	+	–	–	–
	Tumbleweed	+ **	–	–	–	–	–	–	–
Grasses	Brome	–	–	–	–	+	–	–	–
	Dropseed grass	+	+	–	–	–	–	–	–
	Grass family	+	+	–	–	+	cf. +	cf. +	+
Other	Aster family	+	–	+	+	+++	+	+	+
	Borage family	+	–	–	–	–	–	–	+
	Groundcherry	+	+	–	–	+	+	+	–
	Mint family	+	–	–	–	–	–	–	–
	Mullein	+	–	–	–	+	–	+	–
	cf. Sedge family	+	+	+	+	+	–	–	–
	Unidentified seed	–	–	–	–	+	–	–	–
	Vervain	+	–	–	–	+	+	–	+
	Wild lettuce	–	–	–	–	–	+	+	–
Perennials	Alder	+	–	–	–	–	–	–	–
	Chokecherry	cf. +	–	–	–	+	–	cf. +	cf. + frag.
	Dock	–	–	–	–	–	+	+	–
	Hedgehog cactus	+	+	+	+	+	+	+	–
	Juniper	–	+ twig	–	–	+ twig	–	–	–
	Oak	+ acorn, + nutshell	–	–	–	+ acorn, + nutshell	+ nutshell	+ nutshell	–
	cf. Pine	–	–	–	–	+	+	–	–
	Ponderosa pine	+ needle, cf. +	–	–	–	+ needle	+ needle	–	+ needle
	Raspberry	+	–	–	–	–	–	–	–
	Russian olive	+	–	–	–	–	–	–	–
	Strawberry	–	–	–	–	+	+	cf. +	–

Plant parts are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred unless indicated otherwise.
** = charred; '+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample.
c = cupule; cf. = compares favorably.

Table App4.3c. North Shelter, 271N/141E (continued)–272N/141E, flotation sample plant remains.

Category	Taxon	271N/141E	272N/140E					272N/141E	
		FS 532 Level 6	FS 755 Level 2	FS 758 Level 3	FS 760 Level 4	FS 763 Level 5	FS 766 Level 6	FS 716 Level 2	FS 719 Level 3
Charred									
Annuals	Amaranth	–	1.2	–	–	2.5	–	–	–
	Cheno-am	–	–	6.3	4.4	1.3	5.2	–	–
	Goosefoot	8.2	–	3.2	–	6.3	8.2	–	–
Cultivars	cf. Maize	–	–	–	–	–	+ cupule	–	–
Grasses	cf. Grass family	–	1.2	–	–	–	–	–	–
Other	Unidentifiable seed	1.8	–	–	–	–	2.1	–	–
	Unknown plant part	1.8	–	–	–	–	–	–	–
Perennials	Douglas fir	–	–	–	–	–	+ needle	–	+ needle
	Hedgehog cactus	–	–	–	–	1.3	–	–	–
	Pine	–	–	–	–	–	+ bark	–	–
	Piñon pine	–	–	–	–	–	+ cf. nutshell	–	–
	Ponderosa pine	–	+ needle	–	–	–	–	–	–
Uncharred									
Annuals	Amaranth	+	++	+++	–	+	+	+	+
	Goosefoot	+	+	+	++	+	+	+	+
	Purslane	+	+++	+++	+	+	+	++	++
	Spurge	–	+	–	–	–	+	+	–
	Strawberry blite	+	+	+	–	+	+	+	++
	Sunflower	–	+	–	–	–	–	–	–
Grasses	cf. Brome	–	–	–	–	–	–	+ floret	–
	Dropseed grass	–	–	–	–	–	–	cf. +	+
	Grass family	+	+	+	+	–	–	+	+
Other	Aster family	+	+	–	–	+	–	++	+
	Groundcherry	+	+	+	+	–	+	+	+
	Mint family	–	–	–	–	+	–	–	–
	Purslane family	–	–	–	–	+	–	–	–
	cf. Skullcap	–	–	–	–	–	–	+	–
	Unidentifiable seed	–	–	–	–	–	–	+	–
	Unknown plant part	–	+ fruit	–	–	–	–	–	–
	Vervain	–	++	+	–	–	–	++	+
	Wild lettuce	–	–	–	–	–	+	+	–
Perennials	Dock	–	+	–	–	–	–	+ fruit, +	–
	Globemallow	–	–	–	–	–	–	+	–
	Hedgehog cactus	+	+	+	+	–	+	++	+
	Juniper	–	+, + twig	–	–	–	–	+ twig	+ twig
	Oak	+ acorn	+ nutshell	–	–	–	–	+ acorn, + leaf	+ nutshell
	Strawberry	–	+	–	–	–	–	–	–

Plant parts are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample.
cf. = compares favorably.

Table App4.3d. North Shelter, 272N/141E (continued)–273N/140E, flotation sample plant remains.

Category	Taxon	272N/141E					273N/140E		
		FS 724 Level 4	FS 728 Level 5	FS 736 Level 6	FS 742 Level 7	FS 750 Level 8	FS 598 Level 1	FS 608-A Level 2	FS 608-B Level 2
Charred									
Annuals	Amaranth	–	–	–	–	–	–	0.8	1.4
	Cheno-am	3.4	3.8	–	–	2.6	–	0.8	1.4
	Goosefoot	6.3	1.3 frag.	7.0	16.7	11.7	2.3	1.7	–
Cultivars	Maize	–	–	–	–	poss. + c	–	–	–
Grasses	Grass family	cf. 1.3	–	–	–	–	1.6	–	cf. 0.7
Other	cf. Aster family	–	–	–	–	–	–	0.8	–
	Sedge family	–	1.3	–	1.7	–	–	–	–
	Unidentifed seed	–	–	–	1.7	–	–	2.5 frags., 1.7	–
	Unknown plant part	1.3	1.3 bud, 1.3 frag.	–	–	–	–	–	–
Perennials	Douglas fir	–	+ needle	+ needle	–	–	–	–	–
	Pine	+ bark	–	+ bark	–	–	–	–	–
	Ponderosa pine	–	+ needle	+ needle	–	–	+ needle	–	+ needle
Uncharred									
Annuals	Amaranth	++	+	++	+	+	++	+	+
	Goosefoot	+	+	+	+	+	+	++	++
	Purslane	++	++	++	+	+	++	+	+
	Strawberry blite	+	++	+	+	+	+	+	+
	Spurge	–	–	–	–	–	+	–	–
Grasses	Dropseed grass	–	–	–	–	–	–	+	–
	Grass family	+	+	+	+	++	+	–	+
Other	Aster family	+	–	+	–	–	++	–	–
	Ground-cherry	–	+	+	+	–	+	+	+
	Mint family	–	–	–	–	–	–	–	+
	Mullein	–	–	–	–	–	+	–	–
	Vervain	+	–	+	+	–	+	–	–
	Wild lettuce	–	–	–	–	–	+	–	–
Perennials	Dock	–	–	+ fruit, +	–	–	+	–	–
	Hedgehog cactus	–	+	+	+	+	+	+	+
	Oak	–	–	+ acorn	–	+ nutshell	+ acorn, + nut shell	–	–
	Ponderosa pine	–	–	+ needle	–	–	–	–	–
	cf. Strawberry	–	–	–	–	–	+	–	–

Plant parts are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ 1-10/sample; = ++ 11-25/sample.
c = cupule; cf. = compares favorably.

Table App4.3e. North Shelter, 273N/140E (continued)–273N/141E, flotation sample plant remains.

Category	Taxon	273N/140E	273N/141E					
		FS 611 Level 3	FS 530 Level 3	FS 540 Level 4	FS 542 Level 5	FS 554 Level 6	FS 566 Level 7	FS 586 Level 8
Charred								
Annuals	Amaranth	0.5	–	–	–	0.4	0.8	1.5
	Cheno-am	2.2	–	–	–	–	2.3	3.0
	Goosefoot	11.5	3.5	2.0	1.4	7.5	11.5	11.1
Cultivars	Maize	–	–	–	–	–	+ c	+ c
Grasses	cf. Grass family	–	–	–	0.7	0.4 frag.	–	0.7
Other	Unidentifiable seed	1.1 frags.	–	1.0	–	0.4	0.8	–
	Unknown plant part	–	–	–	cf. 0.7 fruit	0.4	–	–
Perennials	Douglas fir	+ needle	–	–	–	+ needle	–	–
	Ponderosa pine	+ needle	–	+ needle	cf. + needle	+ needle	–	–
Uncharred								
Annuals	Amaranth	+	++	+	+	+	+	–
	Goosefoot	+	++	+	+	+	+	+
	Purslane	+	++	++	+	++	++	+
	Spurge	–	+	+	–	–	–	–
	Strawberry blite	+	+	+	++	++	++	+
Grasses	Grass family	+	+, + floret	+	–	+	+	+
Other	Aster family	–	+	+	+	+	+	+
	Groundcherry	–	+	+	–	–	+	+
	Mullein	–	+	+	–	–	–	–
	cf. Sedge family	–	–	–	–	–	++	+
	Unidentifiable seed	–	+	+	–	–	–	–
	Vervain	–	+	–	+	–	+	–
	Wild lettuce	–	–	+	–	–	+	–
Perennials	Alder	–	+	–	–	–	–	–
	Dock	–	+	–	–	+	–	–
	Hedgehog cactus	+	+	+	+	+	+	–
	Oak	–	–	+ nutshell	+ nutshell	+ nutshell	+ acorn	–
	cf. Strawberry	–	–	–	–	–	+	–

Plant parts are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample.
c = cupule; cf. = compares favorably.

Table App4.3f. North Shelter, 274N/141E, flotation sample plant remains.

Category	Taxon	274N/141E			
		FS 476 Level 1	FS 486 Level 2	FS 500 Level 3	FS 515 Level 4
Charred					
Annuals	Amaranth	–	–	1.6	–
	Cheno-am	–	–	–	1.7
	Goosefoot	0.6	4.1	0.8	9.2
Cultivars	Maize	–	+ c	–	–
Grasses	Grass family	–	–	cf. 1.6	0.8
Other	Unidentifiable seed	–	0.7	–	1.7
	Unknown plant part	0.6	–	0.8	–
Perennials	Douglas fir	–	–	–	+ needle
	Ponderosa pine	–	+ needle	+ fascicle, + needle	+ needle
Uncharred					
Annuals	Amaranth	+++	+++	++	++
	Goosefoot	++	++	++	+
	Purslane	+++	++	++	++
	Spurge	+	+	+	–
	Strawberry blite	+++	++	++	++
	Sunflower	+	+	–	+
Grasses	Brome	–	–	cf. + floret	–
	Dropseed grass	+	–	–	–
	Grass family	+	–	+	+
Other	Aster family	++	+	+	+
	Groundcherry	+	+	+	–
	Scorpion weed	–	–	+	–
	cf. Sedge family	+	+	+	+
	Unidentifiable seed	–	+	–	–
	Vervain	+	+	+	–
	Wild lettuce	–	+	–	–
Perennials	cf. Chokecherry	–	+ frag.	+	–
	Dock	–	+	+	+
	Hedgehog cactus	+	+	+	+
	Juniper	–	–	–	+ twig
	Oak	+ acorn	+ nutshell	+ acorn	+ nutshell
	Ponderosa pine	–	+ needle	–	+ needle

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred unless indicated otherwise.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample.
c = cupule; cf. = compares favorably.

Table App4.3g. North Shelter, 270N/140E–271N/141E, flotation sample wood taxa.

Category	Taxon	270N/140E			270N/141E			271N/140E					271N/141E	
		FS 548 Level 1	FS 573 Level 3	FS 582 Level 4	FS 480 Level 1	FS 494 Level 2	FS 499 Level 3	FS 546 Level 1	FS 559 Level 2	FS 569 Level 3	FS 580 Level 4	FS 601 Level 6	FS 479 Level 1	FS 491 Level 2
Conifers	Ponderosa pine	8/.28	14/.45	17/.32	14/.31	8/.17	14/.60	7/.17	8/.20	11/.52	13/.37	13/.65	13/.30	11/.10
	Unknown conifer	–	–	–	–	–	–	–	–	1/.01	–	–	–	–
Non-Conifers	cf. Alder	4/.04	1/.01	–	–	4/.03	–	6/.18	5/.06	2/.02	6/.09	3/.04	3/.05	3/.06
	cf. Chokecherry	1/.01	–	–	–	–	–	–	–	–	–	1/.02	–	–
	cf. Cottonwood/ Willow	–	–	–	–	–	–	2/.02	–	–	–	–	–	–
	Oak	7/.10	4/.07	3/.02	6/.09	5/.09	6/.06	5/.13	7/.17	6/.10	1/.01	3/.04	3/.07	6/.09
	Unknown Non-conifer	–	–	–	–	–	–	–	–	–	–	–	1/.02	–
Total		**20/.43**	**20/.53**	**20/.34**	**20/.40**	**17/.29**	**20/.66**	**20/.50**	**20/.43**	**20/.65**	**20/.47**	**20/.75**	**20/.44**	**20/.25**

Count/weight in grams.
cf. = compares favorably.

Table App4.3h. North Shelter, 271N/141E (continued)–272N/141E, flotation sample wood taxa.

Category	Taxon	271N/141E				272N/140E					272N/141E			
		FS 503 Level 3	FS 512 Level 4	FS 724 Level 4	FS 532 Level 6	FS 755 Level 2	FS 758 Level 3	FS 760 Level 4	FS 763 Level 5	FS 766 Level 6	FS 716 Level 2	FS 719 Level 3	FS 728 Level 5	FS 736 Level 6
Conifers	cf. Douglas fir	–	–	–	–	–	–	–	–	1/.02	–	–	1/.03	–
	Pine	–	1/.03	–	–	–	–	1/.02	–	1/.14	1/.05	–	–	–
	Ponderosa pine	9/.23	8/.33	12/.34	5/.10	4/.08	7/.32	6/.23	10/.25	10/.22	3/.16	4/.20	3/.11	9/.21
	Unknown Conifer	–	–	–	–	2/.06	–	–	–	–	–	–	–	–
Non-Conifers	cf. Alder	–	4/.08	–	1/.01	2/.04	2/.03	4/.08	4/.04	2/.02	–	2/.01	2/.03	2/.09
	cf. Cottonwood/ Willow	–	2/.03	–	–	4/.10	5/.15	–	–	–	7/.24	6/.09	4/.05	2/.03
	Oak	10/.24	5/.10	6/.15	14/.47	8/.15	6/.19	9/.34	6/.14	6/.11	9/.33	8/.44	10/.66	7/.14
	Unknown Non-conifer	1/.01	–	2/.03	–	–	–	–	–	–	–	–	–	–
Total		**20/.48**	**20/.57**	**20/.52**	**20/.58**	**20/.43**	**20/.69**	**20/.67**	**20/.43**	**20/.51**	**20/.78**	**20/.74**	**20/.88**	**20/.47**

Count/weight in grams.
cf. = compares favorably.

Table App4.3i. North Shelter, 272N/141E (continued)–273N/141E, flotation sample wood taxa.

Category	Taxon	272N/141E		273N/140E				273N/141E					
		FS 742 Level 7	FS 750 Level 8	FS 598 Level 1	FS 608-A Level 2	FS 608-B Level 2	FS 611 Level 3	FS 530 Level 3	FS 540 Level 4	FS 542 Level 5	FS 554 Level 6	FS 566 Level 7	FS 586 Level 8
Conifers	Pine	–	1/.09	–	–	–	–	–	–	–	–	–	–
	Ponderosa pine	8/.10	15/.51	6/.44	8/.40	8/.40	14/.91	9/.26	11/.53	11/.46	10/.49	7/.16	9/.15
	Unknown Conifer	1/.02	–	–	–	–	–	–	–	1/.02	–	–	–
Non-Conifers	cf. Alder	2/.05	–	4/.08	–	2/.03	–	4/.06	1/.03	2/.11	3/.12	5/.09	1/.02
	cf. Cottonwood/ Willow	–	1/.01	3/.15	–	–	2/.04	–	2/.03	–	1/.04	–	1/.01
	Oak	7/.20	3/.07	7/.17	12/.30	10/.60	4/.15	7/.13	6/.12	6/.20	6/.50	8/.16	9/.07
Total		**18/.37**	**20/.68**	**20/.84**	**20/.70**	**20/1.03**	**20/1.10**	**20/.45**	**20/.71**	**20/.79**	**20/1.15**	**20/.41**	**20/.25**

Count/weight in grams.
cf. = compares favorably.

Table App4.3j. North Shelter, 273N/143E–274N/141E, flotation sample wood taxa.

Category	Taxon	273N/143E	274N/141E		274N/141E		Totals	
		FS 380 Level 3	FS 476 Level 1	FS 486 Level 2	FS 500 Level 3	FS 515 Level 4	Weight	%
Conifers	possible Douglas fir	–	–	–	–	2/.04	**0.09**	**<1**
	Pine	–	–	–	–	–	**0.33**	**1**
	Ponderosa pine	7/.07	10/.22	14/.65	11/.38	13/.44	**13.56**	**56**
	Unknown Conifer	–	–	–	–	–	**0.11**	**1**
Non-Conifers	cf. Alder	–	2/.06	1/.01	–	2/.04	**1.71**	**7**
	cf. Chokecherry	–	–	–	–	–	**0.03**	**<1**
	cf. Cottonwood/ Willow	1/.01	–	–	1/.01	–	**1.01**	**4**
	Oak	–	8/.21	5/.14	7/.14	3/.07	**7.49**	**31**
	Unknown Non-Conifer	–	–	–	1/.02	–	**0.07**	**<1**
Total		**8/.08**	**20/.49**	**20/.80**	**20/.55**	**20/.59**	**24.4**	**100**

Count/weight in grams.
cf. = compares favorably.

Table App4.3k. North Shelter, wood sample taxa.

Category	Taxon	270N/141E	271N/141E		272N/141E			273N/141E			
		FS 519 Level 5	FS 503 Level 3	FS 532 Level 6	FS 719 Level 3	FS 736 Level 6	FS 750 Level 8	FS 541 Level 4	FS 554 Level 6	FS 555 Level 6	FS 587 Level 8
Conifers	possible Douglas fir	–	–	1/.02	1/.11	–	–	–	–	–	–
	Pine	2/.09	3/.34	–	1/.16	–	–	–	–	–	–
	Ponderosa pine	3/.37	60/7.29	10/.72	26/3.75	39/5.31	21/6.20	39/5.85	8/.90	16/2.70	34/4.30
	Unknown conifer	–	–	1/.02	2/.32	–	–	–	–	–	1/.10
Non-Conifers	cf. Alder	1/.03	4/.20	3/.26	10/1.66	3/.14	2/.14	3/.49	–	–	1/.10
	Chokecherry	–	–	–	–	4/.75	–	–	–	1/.20	–
	cf. Cottonwood/ willow	–	11/.81	2/.17	5/.29	1/.08	1/.06	8/1.07	–	2/1.4	–
	cf. Mountain mahogany	–	–	–	–	2/.17	–	–	–	–	–
	Oak	1/.71	21/3.16	4/.19	8/2.08	25/6.33	7/1.27	16/6.29	–	3/.30	13/2.40
	Unknown non-conifer	–	–	1/.01	–	–	–	–	1/.10	–	1/.10
Total		**7/1.20**	**96/11.80**	**22/1.39**	**53/8.37**	**74/12.78**	**31/7.67**	**66/13.70**	**9/1.0**	**22/4.60**	**50/7.0**

Count/weight in grams.
cf. = compares favorably.

Table App4.3l. North Shelter, macrobotanical sample taxa.

Category	Context	270N/141E FS 494 Level 2	271N/140E FS 546 Level 1	271N/140E FS 559 Level 2	272N/140E FS 754 Level 2	272N/140E FS 755 Level 2	272N/140E FS 760 Level 4
Wood Conifers	Juniper	1/.02	–	–	–	–	–
	Pine	4/.38	–	–	–	–	–
	cf. Piñon	1/.06	–	–	–	–	1/.25
	Ponderosa pine	40/3.87	–	cf. 1^{pc}/2.06	–	cf. 1^{pc}/.39	–
	Unknown conifer	7/.73	–	–	1^{u}/1.32	1^{u}/.53	–
Non-Conifers	cf. Alder	13/.85	–	–	–	–	–
	Oak	16/1.62	–	–	–	1^{u}/.17	–
	Unknown non-conifer	1/.08	–	–	–	–	–
Cultivars	Maize kernel	–	2^{u}/.55	–	–	–	–

Count/weight in grams.
pc = partially charred; u = uncharred.

Table App4.4a. South Talus, 237N144E–244N/145E, flotation sample plant remains.

Category	Taxon	237N/144E	242N/146E		242N/147E	243N147E	244N/145E	
		FS 697 Level 1	FS 421 Level 1	FS 426 Level 2	FS 412 Level 2	FS 389 Level 2	FS 65 Level 4	FS 85 Level 5
Charred								
Annuals	Amaranth	–	–	–	–	–	–	0.5
	Cheno-am	–	–	–	–	2.0	–	1.5
	Goosefoot	–	–	1.9	0.6	–	2.4	1.0
Cultivars	Maize	–	–	+ cupule	–	+ cupule	–	–
Grasses	cf. Dropseed grass	–	–	–	–	–	–	0.5
Other	cf. Aster family	–	–	–	–	–	–	0.5
	Unidentifiable seed	–	–	0.6	–	–	–	1.0
	Unknown plant part	–	–	0.6	–	–	–	–
Perennials	cf. Dock	–	0.9	–	–	–	–	–
	Douglas fir	–	+ needle	+ needle	–	–	+ needle	+ needle
	Pine	+ bark, + umbo	–	–	–	–	–	–
	Piñon pine	+ needle	–	–	–	–	–	–
	Ponderosa pine	+ needle	+ needle	+ needle	–	–	–	–
Uncharred								
Annuals	Amaranth	+	–	+	+	–	–	–
	Goosefoot	++	++	+++	+++	++++	+	+
	Purslane	+	–	+	+	+	+	+
	Spurge	+	–	–	–	+	–	–
	Stickleaf	–	++	+	+	+++	–	–
	Sunflower	–	–	–	+	–	–	–
Grasses	Brome	–	–	–	–	–	–	+ floret
	Dropseed grass	+	+	+	+	++	+	–
	Grass family	+	+	+	–	+	–	–
	Panic grass tribe	–	–	–	cf. +	–	+	–
Other	Aster family	–	+	+	+	–	–	+
	Groundcherry	–	–	+	+	+	–	+
	Mint family	–	–	–	+	–	–	–
	Mullein	–	–	+	+	+	+	–
	Sedge family	–	–	–	–	–	–	+
	Unidentifiable seed	+	–	–	–	–	–	–
	Unknown plant part	–	–	–	–	–	–	+ fruit
	Vervain	+	+	+	+	+	–	–
	Wild lettuce	–	+	–	+	–	–	–
Perennials	Alder	–	+	–	–	–	–	+
	Chokecherry	+	–	+	–	–	–	–
	Dock	–	+	–	–	–	–	–
	Douglas fir	–	+ needle	–	–	+ needle	–	–
	Hedgehog cactus	+	+	+	+	–	–	–
	Oak	–	–	–	–	+ cup, + nutshell	–	+ nutshell
	Ponderosa pine	–	–	–	+ needle	+ needle	–	–
	Raspberry	–	–	–	–	+	–	–
	cf. Sumac	–	–	–	–	+	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample; ++++ = >100/sample.
cf. = compares favorably.

Table App4.4b. South Talus, 244N/145E (continued)–246N/145E, flotation sample plant remains.

Category	Taxon	244N/145E		244N/147E		244N/148E	245N/147E	246N/145E
		FS 90 Level 6	FS 96 Level 8	FS 45 Level 2	FS 46 Level 3	FS 26 Level 2	FS 66 Level 1	FS 143 Level 1
Charred								
Annuals	Amaranth	1.4	0.7	–	–	–	–	–
	Cheno-am	2.1	4.8	–	–	–	–	–
	Goosefoot	8.5	11.0	–	–	–	–	1.4
Cultivars	Maize	–	–	–	–	–	–	0.7 embryo
Other	cf. Bean family	–	–	–	–	–	–	0.7
	Unknown plant part	–	–	–	–	–	–	0.7
Perennials	Douglas fir	+ needle	+ needle	+ needle	–	–	–	+ needle
	Pine	+ bark	–	–	–	–	–	–
	Ponderosa pine	–	–	++ needle	–	–	–	+ needle
Uncharred								
Annuals	Amaranth	–	–	–	–	–	–	+
	Goosefoot	–	+	+++	++	+	+++	+
	Mustard	–	–	+	–	+	++++	–
	Purslane	–	–	–	–	–	–	+
	Stickleaf	–	–	+	+	–	+	–
	Strawberry blite	–	–	–	–	–	–	+
	Sunflower	–	–	–	–	–	–	+
Grasses	Brome	–	–	cf. +	–	–	+	+ floret, ++
	Dropseed grass	–	–	+	+	+	+	–
	Grass family	–	–	+ floret	–	+	–	–
	Panic grass tribe	–	–	+	+	++	–	–
Other	Aster family	+	–	+	–	–	+	++
	Bean family	–	–	–	–	+	–	–
	Groundcherry	–	+	–	–	–	–	+
	Mullein	–	–	+	+	+	+	+
	Scorpion weed	–	–	–	–	+	–	–
	Sedge family	+	+	+	–	+	–	–
	Unidentifiable seed	–	–	–	–	–	+	+
	Unknown plant part	+ fruit	–	–	–	–	–	–
	Vervain	–	–	+	+	+	–	–
	Wild lettuce	–	–	–	–	–	–	+
Perennials	Alder	–	–	–	–	–	+	+
	Common dandelion	–	–	–	–	–	–	+
	Dock	–	–	–	–	–	–	+
	Douglas fir	–	–	–	–	–	++ needle	+ needle
	Hedgehog cactus	–	–	+	+	–	+	+
	Juniper	–	–	+ twig	–	+ twig	+ twig	+, + twig
	Oak	–	–	+ acorn, + cup	–	–	+ cup	–
	Piñon pine	–	–	–	–	–	+ needle	–
	Ponderosa pine	–	–	+ needle	–	–	++ needle	–
	cf. Strawberry	–	–	–	–	+	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred, non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample; ++++ = >100/sample.
cf. = compares favorably.

Table App4.4c. South Talus, 246N/145E (continued)–250N/146E, flotation sample plant remains.

Category	Taxon	246N/145E			246N/146E	247N/146E	250N/144E	250N/146E
		FS 145 Level 2	FS 147 Level 3	FS 159 Level 7	FS 19 Level 1	FS 13 Level 1	FS 72 Level 1	FS 6 Level 2
Charred								
Annuals	Cheno-am	4.0	6.3	0.7	–	1.0	–	–
	Goosefoot	1.3	3.5	34.3	–	–	–	–
Grasses	Grass family	–	cf. 0.7	9.0	–	–	1.1	–
Other	cf. Aster family	–	–	–	–	1.0	1.1	–
	cf Bean family	–	–	0.7	–	–	–	–
	Scorpion weed	0.7	–	–	–	–	–	–
	Unknown plant part	–	3.5	–	1.1	–	2.2	1.3
	Unknown seed	–	0.7	–	–	–	–	–
Perennials	possible Banana yucca	–	–	0.7	–	–	–	–
	Douglas fir	+ needle	+ needle	–	–	–	–	–
	Pine	–	–	–	–	–	+ bark	–
	Ponderosa pine	+ needle	+ needle	–	–	–	–	–
Uncharred								
Annuals	Amaranth	+	+	–	–	–	+	+
	Goosefoot	+	+	–	+	++	+	–
	Purslane	+	–	–	+	–	+	–
	Stickleaf	+	–	–	+	–	–	–
	Sunflower	+	–	–	–	–	–	–
Grasses	Brome	+ floret	–	–	–	+ floret	+ floret	–
	Dropseed grass	+	–	–	–	–	–	+
	Grass family	–	–	–	–	–	+ rhizome	–
	Panic grass tribe	–	–	–	+	–	+	+++
Other	Aster family	+	+	–	+	+	+	–
	Bean family	–	–	–	–	–	+	–
	Groundcherry	+	+	–	–	–	–	–
	Mullein	+	–	–	+	+	+	+
	Scorpion weed	–	–	–	+	–	–	+
	Sedge family	–	–	–	–	–	cf. + leaf, +++	–
	Unknown plant part	–	–	–	–	+ fruit	–	–
	Vervain	+	–	–	–	–	–	+
Perennials	Alder	–	–	–	–	–	+	–
	Douglas fir	+ needle	–	–	–	+ needle	–	–
	Hedgehog cactus	+	+	–	–	+	+	–
	Juniper	+, + twig	–	–	+ twig	+ twig	–	+
	Ponderosa pine	–	–	–	+ needle	+ needle	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample.
cf. = compares favorably.

Table App4.4d. South Talus, 250N/147E–252N/146E, flotation sample plant remains.

Category	Taxon	250N/147E	251N/146E	251N/146E	252N/143E		252N/146E	
		FS 27 Level 1	FS 8 Level 1	FS 12 Level 3	FS 197 Level 2	FS 185 Level 2	FS 208 Level 3	FS 216 Level 4
Charred								
Annuals	Amaranth	–	–	–	0.8	–	–	2.8
	Cheno-am	–	–	–	2.5	0.6	3.3	–
	Goosefoot	–	–	–	2.5	–	4.3	–
Other	Sedge family	–	–	–	–	–	–	0.9
	Unknown plant part	–	–	–	–	0.6	+ stem	0.9
Perennials	Pine	–	–	–	–	–	–	+ bark
	Ponderosa pine	+ needle	–	–	+ needle	+ needle	+ needle	+ needle
Uncharred								
Annuals	Amaranth	+	+	+	–	+	+	+
	Goosefoot	–	+	–	+	–	+	+
	Purslane	–	+	+	+	+	+	++
	Spurge	–	–	–	+	+	–	+
	Stickleaf	+	+	+	–	–	–	–
Grasses	Brome	–	–	–	–	+ floret, +	–	–
	Dropseed grass	–	+	+	–	–	–	–
	Grass family	+ floret, +	+	–	–	+	–	+
	Panic grass tribe	+++	+++	++	–	–	–	–
Other	Aster family	–	+	–	–	+	–	+
	Bean family	+	–	–	–	–	–	–
	Curlycup gumweed	–	+	–	–	–	–	–
	Groundcherry	–	–	–	–	–	–	+
	Mullein	+	+	+	–	+	–	–
	Scorpion weed	–	+	–	–	+	–	–
	Unknown plant part	+ fruit	+ fruit	+ fruit	–	–	–	–
	Unknown seed	–	+	–	–	–	–	+
	Vervain	+	+	+	–	–	–	–
Perennials	Alder	–	–	–	–	+	+	+
	Chokecherry	–	+	–	–	–	–	–
	Dock	–	–	–	+	–	–	–
	Douglas fir	+ needle	+ needle	–	–	+ needle	–	–
	Hedgehog cactus	+	+	+	+	–	+	+
	Juniper	–	+, + twig	–	–	–	–	–
	Oak	–	–	–	–	+ cup	–	+ nutshell
	Ponderosa pine	+ needle	+ needle	–	–	+ needle	–	–
	Raspberry	–	+	–	–	–	+	–
	cf. Strawberry	–	+	–	–	–	–	–
	cf. Sumac	–	+	–	–	–	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample.
cf. = compares favorably.

Table App4.4e. South Talus, 237N/144E–244N/145E, flotation sample wood taxa.

Category	Taxon	237N/144E	242N/146E		242N/147E	243N147E	244N/145E	
		FS 697 Level 1	FS 421 Level 1	FS 426 Level 2	FS 412 Level 2	FS 389 Level 2	FS 65 Level 4	FS 85 Level 5
Conifers	Pine	–	–	–	–	–	–	1/.04
	cf. Piñon pine	–	–	–	–	–	1/.06	–
	Ponderosa pine	3/.02	15/.30	14/.30	8/.17	10/.13	13/.36	11/.36
	Unknown conifer	–	–	–	–	–	2/.19	2/.07
Non-Conifers	cf. Alder	–	1/.01	2/.01	–	–	1/.04	1/.01
	cf. Cottonwood/ Willow	–	–	1/.01	–	–	–	–
	Oak	–	4/.01	3/.01	6/.06	3/.01	3/.08	5/.20
Total		**3/.02**	**20/.32**	**20/.33**	**14/.23**	**13/.14**	**20/.73**	**20/.68**

Count/weight in grams.
cf. = compares favorably.

Table App4.4f. South Talus, 244N/145E (continued)–246N/145E, flotation sample wood taxa.

Category	Taxon	244N/145E		244N/147E		244N/148E	245N/147E	246N/145E
		FS 90 Level 6	FS 96 Level 8	FS 45 Level 2	FS 46 Level 3	FS 26 Level 2	FS 66 Level 1	FS 143 Level 1
Conifers	Pine	6/.21	1/.03	–	–	–	–	–
	Ponderosa pine	11/.40	13/.72	3/.11	1/.01	–	–	8/.13
Non-Conifers	cf. Alder	1/.04	–	–	–	–	–	1/.01
	possible Chokecherry	–	–	–	–	–	–	1/.01
	Cottonwood/ Willow	–	–	–	–	–	–	1/.01
	Oak	2/.01	6/.08	1/.01	1/.01	–	1/.03	9/.24
	Unknown Non-Conifer	–	–	1/.01	–	1/.01	–	–
Total		**20/.66**	**20/.83**	**5/.13**	**2/.02**	**1/.01**	**1/.03**	**20/.40**

Count/weight in grams.
cf. = compares favorably.

Table App4.4g. South Talus, 246N/145E (continued)–250N/146E flotation sample wood taxa.

Category	Taxon	246N/145E			246N/146E	247N/146E	250N/144E	250N/146E
		FS 145 Level 2	FS 147 Level 3	FS 159 Level 7	FS 19 Level 1	FS 13 Level 1	FS 72 Level 1	FS 6 Level 2
Conifers	Ponderosa pine	10/.20	11/.20	10/.20	5/.08	3/.02	4/.05	3/.03
	Unknown conifer	1/.01	–	–	–	2/.02	–	1/.01
Non-Conifers	cf. Alder	4/.08	2/.07	–	3/.03	–	–	–
	cf. Cottonwood/ Willow	–	–	–	–	–	1/.01	–
	Oak	5/.07	7/.13	4/.07	3/.05	–	1/.05	–
Total		**20/.36**	**20/.40**	**14/.27**	**11/.16**	**5/.04**	**6/.11**	**4/.04**

Count/weight in grams.
cf. = compares favorably.

Table App4.4h. South Talus, 250N/147E–252N/146E, flotation sample wood taxa.

Category	Taxon	250N/147E	251N/146E	251N/146E	252N/143E		252N/146E		Totals	
		FS 27 Level 1	**FS 8 Level 1**	**FS 12 Level 3**	**FS 197 Level 2**	**FS 185 Level 2**	**FS 208 Level 3**	**FS 216 Level 4**	**Weight**	**%**
Conifers	Pine	–	–	–	–	–	–	–	**0.28**	**4**
	cf. Piñon pine	–	–	–	–	–	–	–	**0.06**	**1**
	Ponderosa pine	3/.05	3/.04	3/.03	8/.20	3/.05	2/.02	2/.05	**4.23**	**63**
	Unknown conifer	–	3/.03	–	–	2/.02	–	–	**0.35**	**5**
Non-Conifers	cf. Alder	–	–	–	–	3/.03	–	3/.03	**0.36**	**5**
	cf. Chokecherry	–	–	–	–	6/.09	1/.06	2/.01	**0.17**	**3**
	cf. Cottonwood/ Willow	–	–	–	–	–	–	–	**0.03**	**<1**
	Oak	–	–	–	1/.01	2/.03	–	1/.01	**1.17**	**18**
	Sagebrush	–	–	–	1/.01	–	–	–	**0.01**	**<1**
	Unknown Non-Conifer	–	–	–	1/.01	1/.01	–	–	**0.04**	**1**
	Unknown wood	–	–	–	–	–	–	1/.01	**0.01**	**<1**
Total		**3/.05**	**6/.07**	**3/.03**	**11/.23**	**17/.23**	**3/.08**	**9/.11**	**6.71**	**100**

Count/weight in grams.
cf. = compares favorably.

Table App4.4i. South Talus, wood sample taxa.

Category	Taxon	237N/144E		238N/145E			239N/145E		250N/146E	251N/147E	252N/143E
		FS 697 Level 1	**FS 702 Level 2**	**FS 660 Level 2**	**FS 673 Level 3**	**FS 770 Level 4**	**FS 635 Level 1**	**FS 640 Level 2**	**FS 6 Level 2**	**FS 22 Surface**	**FS 196 Level 2**
Wood Conifers	possible Douglas fir	–	1/.13	–	–	–	–	–	–	–	–
	Ponderosa pine	–	1/.27, 2^{pc}/.12	46/21.84	10/5.02	27/26.51	10/2.17	6/3.68	cf. 1^{pc}/.34	–	–
	Unknown conifer	–	–	–	2^{pc}/25.66	–	–	–	–	1^{u}/.30	–
Non-Conifers	cf. Alder	1/.42	2/.17	1/.05	–	–	7/.68	3/.34	–	–	–
	cf. Chokecherry	–	–	–	–	–	–	–	–	–	1^{pc}/1.20
	Cottonwood/willow	–	–	–	–	–	–	cf. 1/.48	–	–	–
	cf. NM olive	–	–	–	–	–	1/.20	–	–	–	–
	Oak	–	–	–	–	1/.26	1/.28	–	–	–	–
	Unknown non-conifer	–	–	–	–	–	–	1/.10	–	–	–
Total		**1/.42**	**6/.69**	**47/21.89**	**12/30.68**	**28/26.77**	**19/3.33**	**11/4.60**	**1/.34**	**1/.30**	**1/1.20**

Count/weight in grams.
pc = partially charred; u = uncharred.

Table App4.4j. South Talus, 237N/145E–242N/148E, macrobotanical sample taxa.

Category	Taxon	237N/145E	237N/144E	238N/145E	238N/145E	239N/145E	241N/147E	242N/148E
		FS 684 Level 2	**FS 697 Level 1**	**FS 645 Level 1**	**FS 660 Level 2**	**FS 635 Level 1**	**FS 445 Level 1**	**FS 399 Level 1**
Wood Conifers	Ponderosa pine	–	–	–	–	–	–	1 twig^{u}/.33
Non-Conifers	Oak	–	–	1^{u}/.20	–	2^{u}/.87	–	–
	Unknown non-conifer	–	–	1^{pc}/.57	–	–	–	–
Perennials	Oak acorn	1^{u}/.06	6 frag.^{u}/.37	–	1^{u}/.34, 8 frag.^{u}/.30	–	1^{u}/.18	–
	Oak cap	–	–	–	–	–	–	1^{u}/.19
Total		**1/.06**	**6/.37**	**2/.77**	**9/.64**	**2/.87**	**1/.18**	**2/.52**

Count/weight in grams.
pc = partially charred; u = uncharred.

Table App4.4k. South Talus, 244N/146E–250N/144E, macrobotanical sample taxa.

Category	Taxon	244N/145E	244N/147E	245N/147E	246N/146E	249N/144E	249N/144E	250N/144E
		FS 93 Level 7	**FS 40 Level 1**	**FS 66 Level 1**	**FS 20 Level 1**	**FS 157 Level 1**	**FS 165 Level 2**	**FS 72 Level 1**
Wood Conifers	Pine	1/.33	1^{u}/9.55	–	–	–	–	–
Non-Conifers	cf. Chokecherry	–	–	–	–	–	1/.07	–
Other	Unknown plant part	–	–	–	–	–	–	1^{u}/.07
Perennials	Chokecherry seed	–	–	–	1^{u}/.08	–	–	–
	Juniper seed	–	–	2^{u}/.09	–	–	–	–
	Oak acorn	–	–	–	–	1^{u}/.16	–	1^{u}/.04
	Oak cap	–	–	–	–	–	–	2^{u}/.04

Count/weight in grams.
u = uncharred.

Table App4.4l. South Talus, 250N/144E (continued)–252N/143E, macrobotanical sample taxa.

Category	Taxon	250N/144E	250N/147E	251N/147E	251N/147E	251N/147E	251N/147E	252N/143E
		FS 80 Level 1	**FS 27 Level 1**	**FS 28 Level 1**	**FS 35 Level 2**	**FS 36 Level 2**	**FS 42 Level 3**	**FS 208 Level 3**
Wood Conifers	Ponderosa pine	–	–	–	–	cf. 1^{u}/.13	–	–
	Unknown conifer	–	–	–	2^{u}/.17	1^{u}/.26	2^{u}/.48	–
Non-Conifers	Oak	–	–	–	–	–	cf. 1^{u}/.03	–
Other	Unknown plant part	1^{u}/.09	–	–	–	–	–	–
Perennials	Oak acorn	–	–	–	–	–	–	1^{u}/.14, 2 frag.^{u}/.10
	Oak nutshell fragments?	–	–	2^{u}/.01	–	–	–	–
	Pinecone scale fragment	–	1^{u}/.01	–	–	–	–	–

u = uncharred.
cf = compares favorably.

Table App4.5a. North Talus, 269N/143E–271N/143E, flotation sample plant remains.

Category	Taxon	269N/143E	270N/142E		270N/143E	271N/142E	271N/143E
		FS 630 Level 2	FS 405 Level 3	FS 436 Level 7	FS 303 Level 2	FS 379 Level 3	FS 251 Level 3
Charred							
Annuals	Cheno-am	1.1	4.1	cf. 0.7	–	1.0	–
	Goosefoot	1.1	1.4	–	–	4.0	1.5
Grasses	Grass family	–	1.4	–	–	–	–
Other	Unknown plant part	2.2	1.4	–	–	–	–
Perennials	Douglas fir	–	+ needle	–	+ needle	–	–
	Hedgehog cactus	–	1.4	–	–	–	–
	Ponderosa pine	–	+ needle	–	–	–	–
Uncharred							
Annuals	Amaranth	–	++	+	+	+	+
	Goosefoot	+	+	+	+	+	+
	Purslane	+	+	+	+	+	+
	Spurge	–	+	–	–	–	–
	Strawberry blite	+	+	+	+	+	–
Grasses	Brome	–	+ floret, + spikelet	+ spikelet	+ spikelet	–	+ floret
	Dropseed grass	–	–	–	+	–	–
	Grass family	+++	–	+	cf. +	cf. +	cf. +
Other	Aster family	+	+	+	+	+	+
	cf. Evening primrose	–	–	+	–	–	–
	Groundcherry	+	–	–	–	+	+
	Mint family	–	–	–	–	–	+
	Mullein	–	+	+	+	–	–
	cf. Purslane family	+	–	–	+	–	–
	Vervain	–	+	+	–	–	–
	Wild lettuce	–	+	+	–	–	–
Perennials	Alder	–	–	+	+	–	+
	cf. Chokecherry	–	+	–	–	–	–
	Dock	–	–	–	–	+	–
	Hedgehog cactus	+	–	+	+	+	–
	Juniper	–	+ twig	–	–	–	–
	Oak	–	+ nutshell	–	–	–	–
	Ponderosa pine	+ needle	+ needle	–	+ needle	–	+ needle
	Sumac	–	+	–	–	–	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample.
cf. = compares favorably.

Table App4.5b. North Talus, 271N/143E–274N/143E, flotation sample plant remains.

Category	Taxon	271N/143E		272N/142E	272N/143E	273N/143E	274N/142E	274N/143E
		FS 262 Level 5	FS 296 Level 9	FS 691 Level 1	FS 666 Level 3	FS 380 Level 3	FS 393 Level 1	FS 310 Level 1
Charred								
Annuals	Cheno-am	2.2	–	–	–	0.7	–	–
	Goosefoot	1.1	–	2.1	1.0	2.7	2.6	1.4
Cultivars	Maize	–	–	–	–	–	–	+ cupule
Other	cf. Mint family	–	–	–	–	–	1.3	–
	Unidentifiable seed	–	2.0 frag.	–	–	–	–	–
	Unknown plant part	–	–	–	1.0 frag.	–	–	–
Uncharred								
Annuals	Amaranth	–	–	+	–	–	+	+
	Goosefoot	+	+	+	+	+	+	+
	Purslane	+	+	+	+	+	+	++
	Spurge	–	–	–	–	–	+	++
	Strawberry blite	–	–	–	+	+	+	+
Grasses	Brome	–	–	–	+ spikelet	cf. + floret	+ floret	++ floret
	Grass family	+	cf. +	+	+	++	+	+
Other	Aster family	+	–	+	+	+	+++	+++
	Groundcherry	–	+	–	+	+	–	–
	Mint family	–	–	+	–	–	–	+
	Mullein	–	–	–	–	+	+	+
	cf. Sedge family	–	–	–	–	++	–	–
	Vervain	+	–	–	+	–	+	–
	Wild lettuce	–	–	+	–	–	+	+
Perennials	Alder	–	–	+	+	+	+	+
	Chokecherry	–	–	–	–	–	+	–
	Dock	–	–	+	–	–	–	+ fruit, +
	Douglas fir	–	–	–	–	+ needle	–	–
	Hedgehog cactus	+	–	+	+	+	+	+
	Juniper	–	–	–	–	–	–	+, + twig
	Oak	–	–	+ nutshell	–	–	+ leaf, + nutshell	+ leaf, + nutshell
	cf. Pine	–	–	–	–	–	–	+
	Ponderosa pine	+ needle	–	+ needle	–	–	–	+ conescale, + needle
	Strawberry	–	–	–	–	–	+	–
	Sumac	–	–	–	–	–	+	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
+ = 1-10/sample; ++ = 11-25/sample; +++ = 26-100/sample.
cf. = compares favorably.

Table App4.5c. Central Talus, 253N/142E–254N/143E, flotation sample plant remains and wood taxa.

Category	Taxon	253N/142E FS 607 Level 1	253N/143E FS 618 Level 1	254N/143E FS 592 Level 1
Charred				
Other	Unidentifiable seed	cf. 2.5	–	–
Perennials	Pine	–	+ bark	–
	Ponderosa pine	+ needle	+ needle	–
Uncharred				
Annuals	Amaranth	++	+	+
	Goosefoot	+	+	+
	Pepperweed	–	–	+
	Purslane	+	+	+
	Spurge	+	+	+
	Strawberry blite	+	+	+
Grasses	Brome	+ floret	–	+ floret
	Grass family	+	+	+
Other	Aster family	++	+	+
	Groundcherry	–	+	–
	Mullein	+	–	+
	Wild lettuce	+	–	+
Perennials	Alder	+	+	+
	Chokecherry	+	–	–
	Hedgehog cactus	+	+	–
	Oak	+ nutshell	–	–
	cf. Pine	+	–	–
	Ponderosa pine	+ needle	–	–
Wood				
Conifers	Ponderosa pine	2/.05	7/.10	5/.05
Non-Conifers	cf. Alder	2/.02	1/.01	2/.01
	cf. Chokecherry	2/.04	–	–
	Unknown Non-Conifer	–	1/.01	–

Plant remains are seeds unless indicated otherwise.
Cultural plant material is charred; non-cultural is uncharred.
Count/weight in grams.
+ = 1-10/sample; ++ = 11-25/sample.
cf. = compares favorably.

Table App4.5d. North Talus, 269N/143E–274N/143E, flotation sample wood taxa.

Category	Taxon	269N/ 143E	270N/142E		270N/ 143E	271N/ 142E	271N/ 143E	271N/ 143E	272N/ 140E	272N/ 142E	274N/ 142E	274N/ 143E
		FS 630 Level 2	**FS 405 Level 3**	**FS 436 Level 7**	**FS 303 Level 2**	**FS 379 Level 3**	**FS 251 Level 3**	**FS 262 Level 5**	**FS 666 Level 2**	**FS 691 Level 1**	**FS 393 Level 1**	**FS 310 Level 1**
Conifers	Ponderosa pine	6/.06	12/.23	3/.04	2/.03	15/.60	4/.20	8/.08	12/.11	9/.07	16/.30	10/.30
Non-Conifers	cf. Alder	–	–	–	–	–	–	1/.01	–	–	1/.01	3/.02
	cf. Chokecherry	2/.02	–	–	–	–	–	–	–	–	1/.01	–
	cf. Cottonwood/ Willow	–	–	–	–	–	2/.02	–	–	–	–	–
	Oak	3/.02	8/.15	1/.12	5/.05	3/.04	2/.01	2/.01	8/.10	–	2/.02	7/.08
	Unknown Non-Conifer	–	–	–	–	2/.01	–	–	–	–	–	–
Total		**11/.10**	**20/.38**	**4/.16**	**8/.08**	**20/.65**	**8/.23**	**11/.10**	**20/.21**	**9/.07**	**20/.34**	**20/.40**

Count/weight in grams.
cf. = compares favorably.

Table App4.5e. North Talus and Central Talus, 274N/142E–255N/142E, wood sample taxa.

Category	Taxon	Context		
		North Talus		Central Talus
		274N/142E	274N/142E	255N/142E
		FS 393 Level 1	FS 397 Level 2	FS 576 Level 2
Conifers	Pine	–	2/.42	–
	Ponderosa pine	5/.60	28/3.64	2/.17
	Unknown conifer	–	3/.61	–
Non-Conifers	cf. Alder	–	2/.17	–
	Cottonwood/willow	–	1/.06	–
	Oak	–	11/1.51	–
Total		**5/.60**	**47/6.41**	**2/.17**

Count/weight in grams.
cf. = compares favorably.

Table App4.5f. North Talus, 267N/141E–241N/143E, macrobotanical sample taxa.

Category	Taxon	267N/141E	268N/141E	269N/142E	271N/143E
		FS 764 Level 1	FS 771 Level 2	FS 465 Level 3	FS 254 Level 4
Conifers	Juniper	–	–	2/.15	–
	Pine	–	–	1/.11	–
	Ponderosa pine	–	–	1/.19	–
Non-Conifers	Oak	–	cf. 1/.52	1/.07	–
Perennials	Oak acorn	1^{u}/.15	–	–	1^{u}/.05
Total		**1/.15**	**1/.52**	**5/.52**	**1/.05**

Count/weight in grams.
pc = partially charred; u = uncharred.

Appendix 5 ⩡ Radiocarbon Analysis

Appendix 5.1: SEDIMENT

BETA
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Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

July 22, 2015

Ms. Nancy Akins
Museum of New Mexico
Office of Archaeological Studies
7 Old Cochiti Road
Santa Fe, NM 87501
United States

RE: Radiocarbon Dating Results For Samples 139965NS-494, 139965NS-503, 139965NS-532, 139965NS-719, 139965NS-736, 139965NS-750, 139965SS-113, 139965SS-258, 139965SS-578, 139965SS-603, 139965SS-614, 139965SS-627, 139965SS-639, 139965ST-640

Dear Ms. Akins:

Enclosed are the radiocarbon dating results for 14 samples recently sent to us. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable. The Conventional Radiocarbon Ages have all been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

Reported results are accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all chemistry was performed here in our laboratories and counted in our own accelerators here in Miami. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analyses.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result.

When interpreting the results, please consider any communications you may have had with us regarding the samples. As always, your inquiries are most welcome. If you have any questions or would like further details of the analyses, please do not hesitate to contact us.

Our invoice has been sent separately. Thank you for your prior efforts in arranging payment. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood
Digital signature on file

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Ms. Nancy Akins — Report Date: 7/22/2015

Museum of New Mexico — Material Received: 7/16/2015

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415255	1240 +/- 30 BP	-22.3 o/oo	1280 +/- 30 BP
SAMPLE : 139965NS-494			
ANALYSIS : AMS-Standard delivery			
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 665 to 775 (Cal BP 1285 to 1175)			
Beta - 415256	590 +/- 30 BP	-22.3 o/oo	630 +/- 30 BP
SAMPLE : 139965NS-503			
ANALYSIS : AMS-Standard delivery			
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 1285 to 1400 (Cal BP 665 to 550)			
Beta - 415257	1450 +/- 30 BP	-23.7 o/oo	1470 +/- 30 BP
SAMPLE : 139965NS-532			
ANALYSIS : AMS-Standard delivery			
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 545 to 645 (Cal BP 1405 to 1305)			
Beta - 415258	840 +/- 30 BP	-24.2 o/oo	850 +/- 30 BP
SAMPLE : 139965NS-719			
ANALYSIS : AMS-Standard delivery			
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 1155 to 1255 (Cal BP 795 to 695)			

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

BETA ANALYTIC INC.

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beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Ms. Nancy Akins

Report Date: 7/22/2015

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415259	720 +/- 30 BP	-22.8 o/oo	760 +/- 30 BP

SAMPLE : 139965NS-736
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1220 to 1285 (Cal BP 730 to 665)

Beta - 415260	1030 +/- 30 BP	-21.8 o/oo	1080 +/- 30 BP

SAMPLE : 139965NS-750
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 895 to 1020 (Cal BP 1055 to 930)

Beta - 415261	1050 +/- 30 BP	-23.3 o/oo	1080 +/- 30 BP

SAMPLE : 139965SS-113
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 895 to 1020 (Cal BP 1055 to 930)

Beta - 415262	650 +/- 30 BP	-21.6 o/oo	710 +/- 30 BP

SAMPLE : 139965SS-258
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1265 to 1295 (Cal BP 685 to 655) and Cal AD 1370 to 1380 (Cal BP 580 to 570)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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REPORT OF RADIOCARBON DATING ANALYSES

Ms. Nancy Akins

Report Date: 7/22/2015

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415263	1290 +/- 30 BP	-23.0 o/oo	1320 +/- 30 BP

SAMPLE : 139965SS-578
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 655 to 720 (Cal BP 1295 to 1230) and Cal AD 740 to 765 (Cal BP 1210 to 1185)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415264	720 +/- 30 BP	-23.0 o/oo	750 +/- 30 BP

SAMPLE : 139965SS-603
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1225 to 1285 (Cal BP 725 to 665)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415265	750 +/- 30 BP	-21.4 o/oo	810 +/- 30 BP

SAMPLE : 139965SS-614
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1165 to 1270 (Cal BP 785 to 680)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415266	860 +/- 30 BP	-22.7 o/oo	900 +/- 30 BP

SAMPLE : 139965SS-627
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1035 to 1215 (Cal BP 915 to 735)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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REPORT OF RADIOCARBON DATING ANALYSES

Ms. Nancy Akins

Report Date: 7/22/2015

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415267	920 +/- 30 BP	-22.8 o/oo	960 +/- 30 BP

SAMPLE : 139965SS-639
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1020 to 1155 (Cal BP 930 to 795)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 415268	1020 +/- 30 BP	-22.1 o/oo	1070 +/- 30 BP

SAMPLE : 139965ST-640
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 895 to 925 (Cal BP 1055 to 1025) and Cal AD 940 to 1020 (Cal BP 1010 to 930)

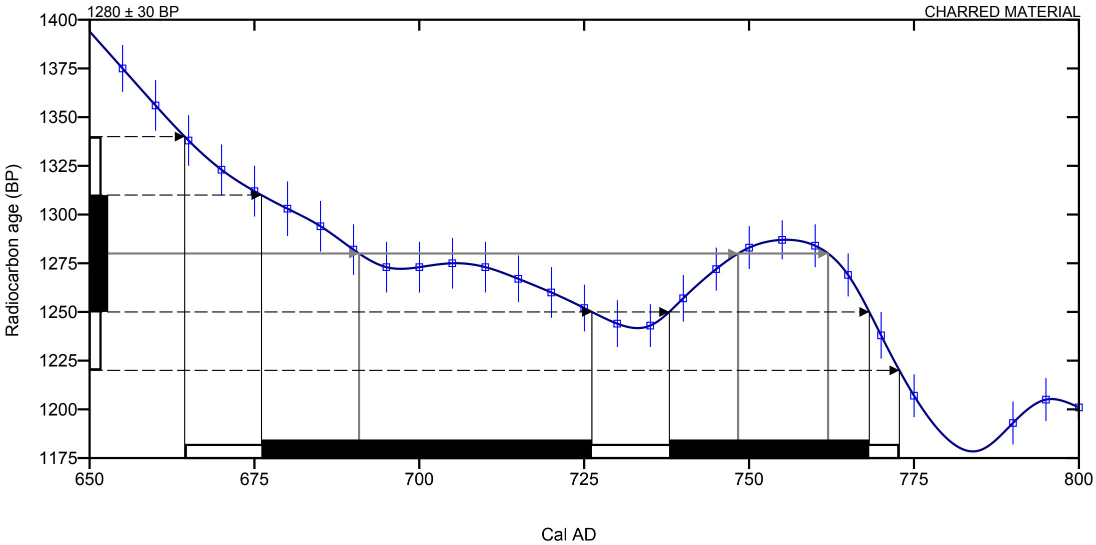
Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-415255**
Conventional radiocarbon age	**1280 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 665 to 775 (Cal BP 1285 to 1175)**
Intercept of radiocarbon age with calibration curve	Cal AD 690 (Cal BP 1260) Cal AD 750 (Cal BP 1200) Cal AD 760 (Cal BP 1190)
Calibrated Result (68% Probability)	Cal AD 675 to 725 (Cal BP 1275 to 1225) Cal AD 740 to 770 (Cal BP 1210 to 1180)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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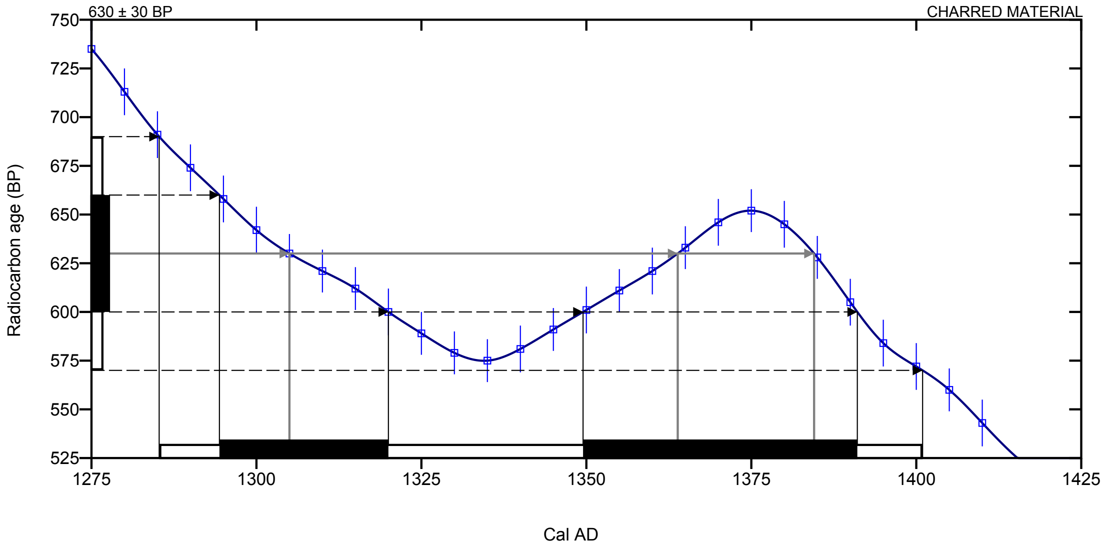
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-415256**
Conventional radiocarbon age	**630 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1285 to 1400 (Cal BP 665 to 550)**
Intercept of radiocarbon age with calibration curve	Cal AD 1305 (Cal BP 645) Cal AD 1365 (Cal BP 585) Cal AD 1385 (Cal BP 565)
Calibrated Result (68% Probability)	Cal AD 1295 to 1320 (Cal BP 655 to 630) Cal AD 1350 to 1390 (Cal BP 600 to 560)



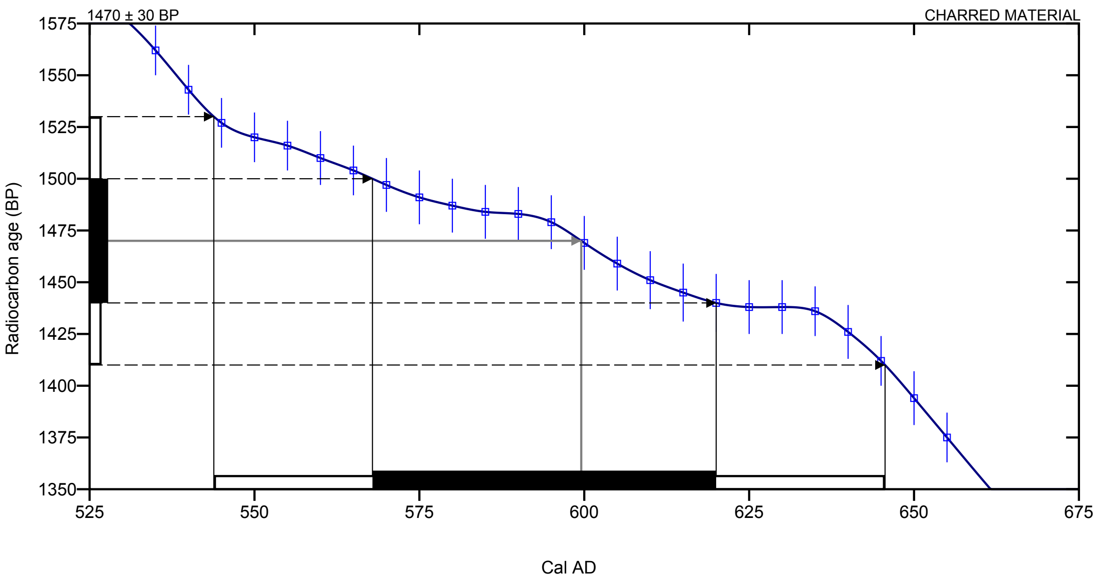
Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23.7 o/oo : lab. mult = 1)

Laboratory number	**Beta-415257**
Conventional radiocarbon age	**1470 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 545 to 645 (Cal BP 1405 to 1305)**
Intercept of radiocarbon age with calibration curve	Cal AD 600 (Cal BP 1350)
Calibrated Result (68% Probability)	Cal AD 570 to 620 (Cal BP 1380 to 1330)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.2 o/oo : lab. mult = 1)

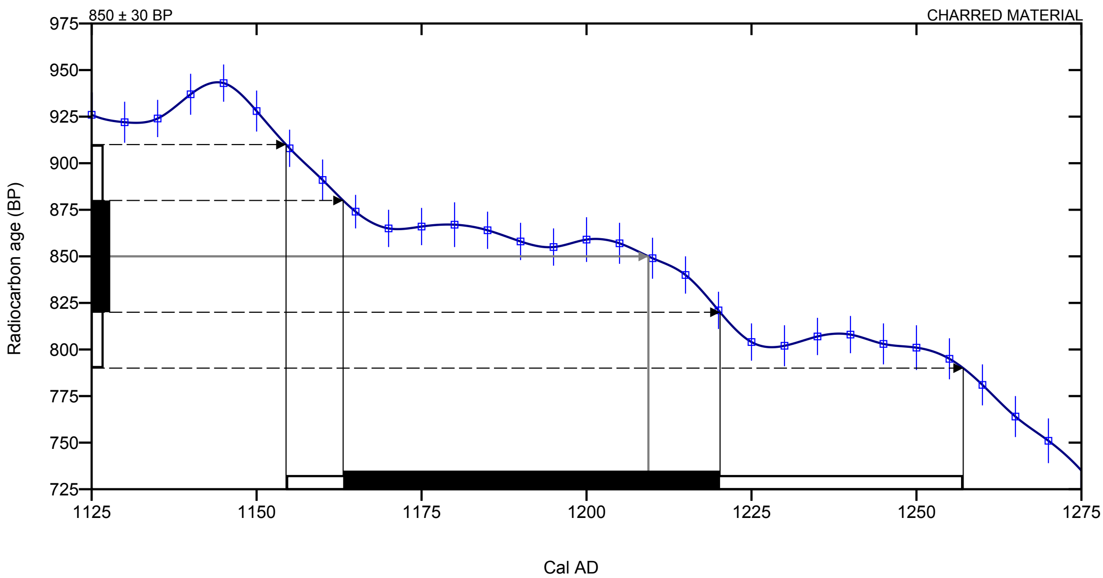
Laboratory number **Beta-415258**

Conventional radiocarbon age **850 ± 30 BP**

Calibrated Result (95% Probability) **Cal AD 1155 to 1255 (Cal BP 795 to 695)**

Intercept of radiocarbon age with calibration curve Cal AD 1210 (Cal BP 740)

Calibrated Result (68% Probability) Cal AD 1165 to 1220 (Cal BP 785 to 730)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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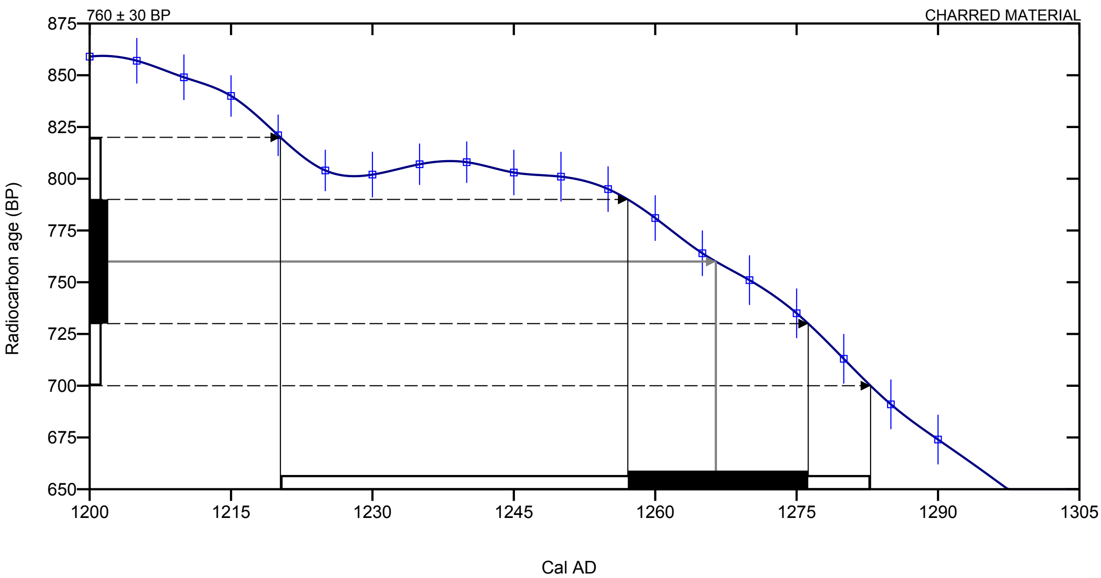
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.8 o/oo : lab. mult = 1)

Laboratory number	**Beta-415259**
Conventional radiocarbon age	**760 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1220 to 1285 (Cal BP 730 to 665)**
Intercept of radiocarbon age with calibration curve	Cal AD 1265 (Cal BP 685)
Calibrated Result (68% Probability)	Cal AD 1255 to 1275 (Cal BP 695 to 675)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
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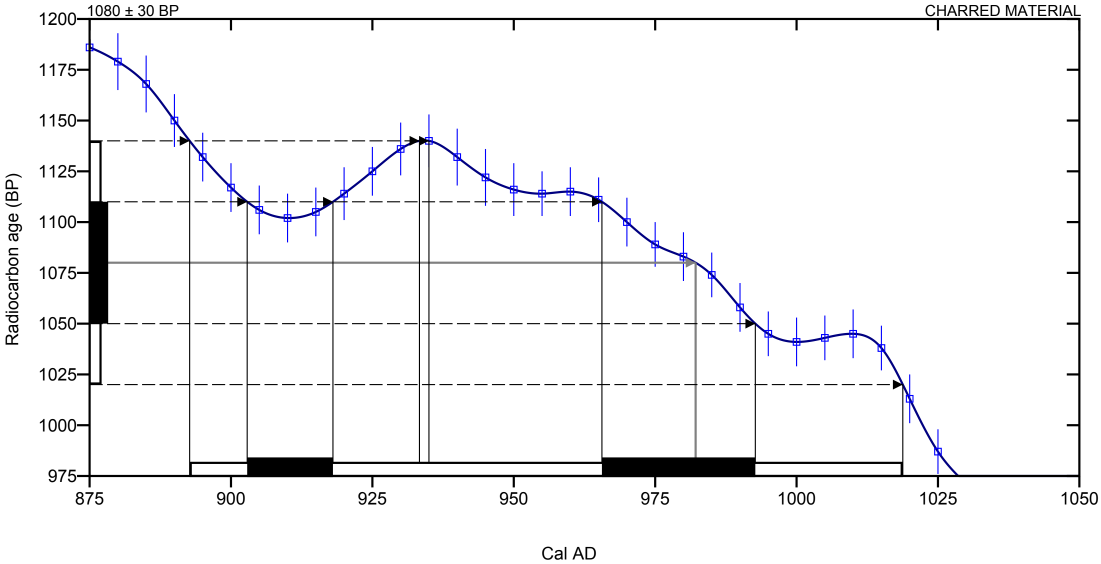
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -21.8 o/oo : lab. mult = 1)

Laboratory number	**Beta-415260**
Conventional radiocarbon age	**1080 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 895 to 1020 (Cal BP 1055 to 930)**
Intercept of radiocarbon age with calibration curve	Cal AD 980 (Cal BP 970)
Calibrated Result (68% Probability)	Cal AD 905 to 920 (Cal BP 1045 to 1030) Cal AD 965 to 995 (Cal BP 985 to 955)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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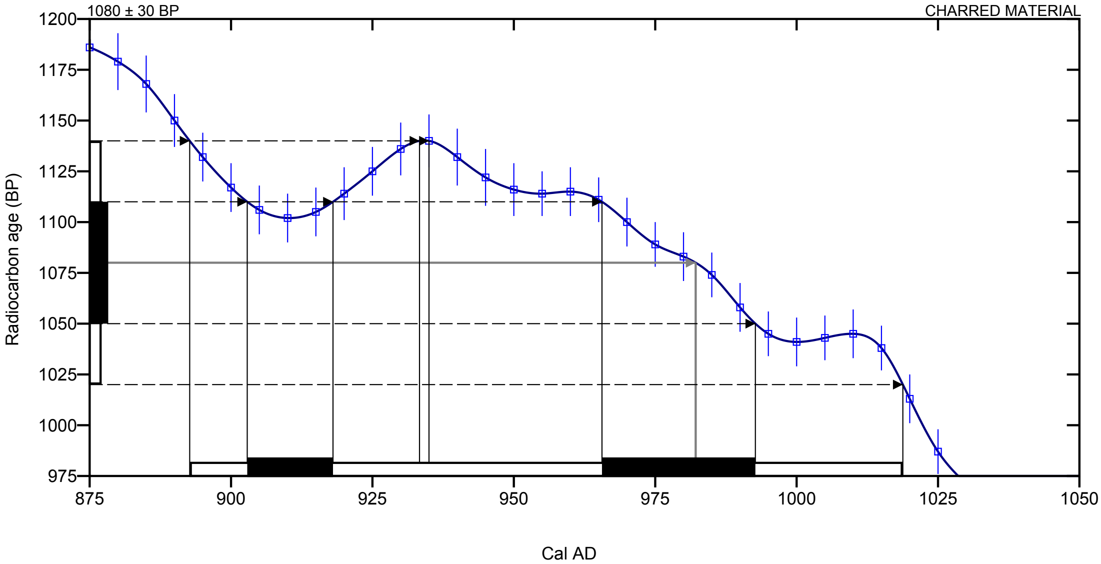
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-415261**
Conventional radiocarbon age	**1080 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 895 to 1020 (Cal BP 1055 to 930)**
Intercept of radiocarbon age with calibration curve	Cal AD 980 (Cal BP 970)
Calibrated Result (68% Probability)	Cal AD 905 to 920 (Cal BP 1045 to 1030) Cal AD 965 to 995 (Cal BP 985 to 955)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
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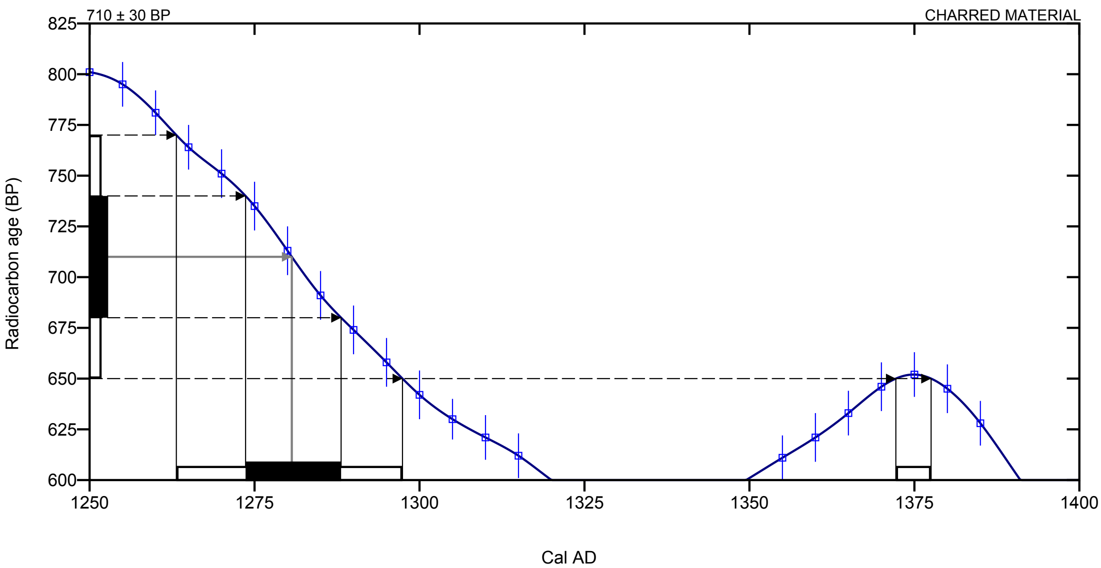
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -21.6 o/oo : lab. mult = 1)

Laboratory number	**Beta-415262**
Conventional radiocarbon age	**710 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1265 to 1295 (Cal BP 685 to 655)** **Cal AD 1370 to 1380 (Cal BP 580 to 570)**
Intercept of radiocarbon age with calibration curve	Cal AD 1280 (Cal BP 670)
Calibrated Result (68% Probability)	Cal AD 1275 to 1290 (Cal BP 675 to 660)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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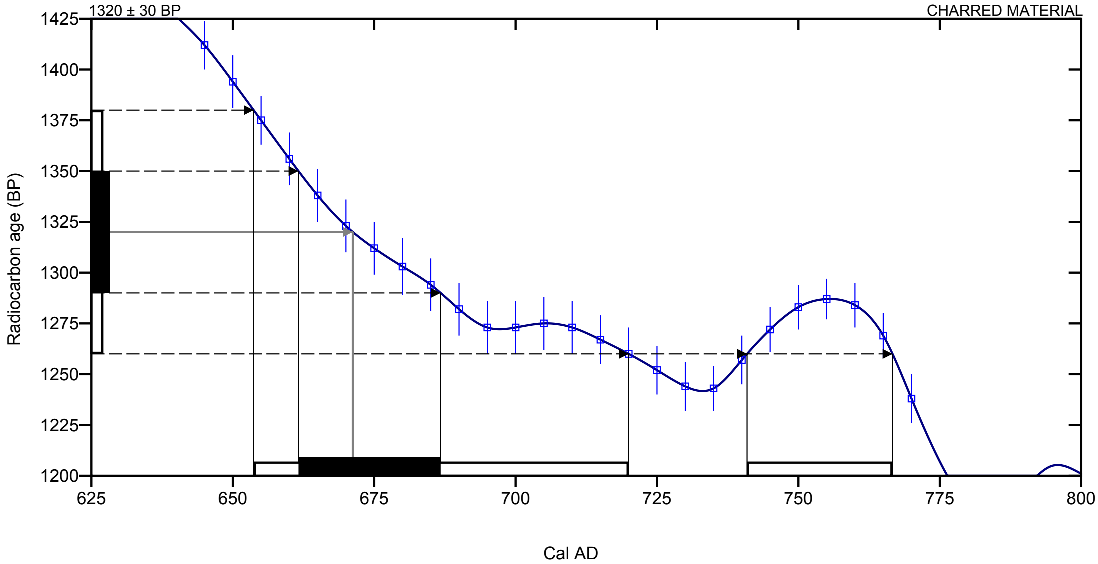
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23 o/oo : lab. mult = 1)

Laboratory number	**Beta-415263**
Conventional radiocarbon age	**1320 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 655 to 720 (Cal BP 1295 to 1230)** **Cal AD 740 to 765 (Cal BP 1210 to 1185)**
Intercept of radiocarbon age with calibration curve	Cal AD 670 (Cal BP 1280)
Calibrated Result (68% Probability)	Cal AD 660 to 685 (Cal BP 1290 to 1265)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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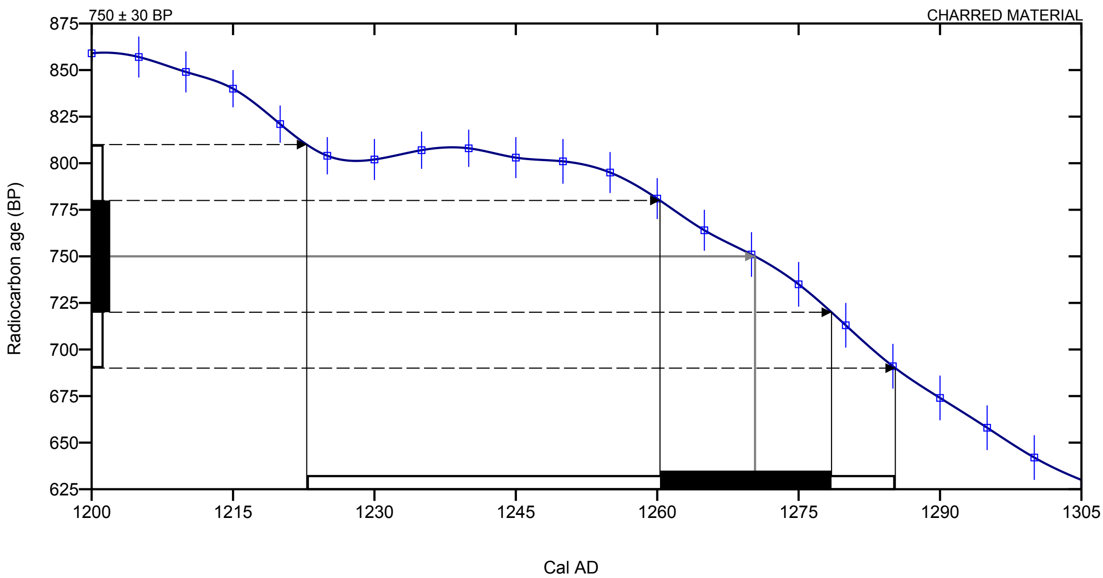
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23 o/oo : lab. mult = 1)

Laboratory number	**Beta-415264**
Conventional radiocarbon age	**750 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1225 to 1285 (Cal BP 725 to 665)**
Intercept of radiocarbon age with calibration curve	Cal AD 1270 (Cal BP 680)
Calibrated Result (68% Probability)	Cal AD 1260 to 1280 (Cal BP 690 to 670)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

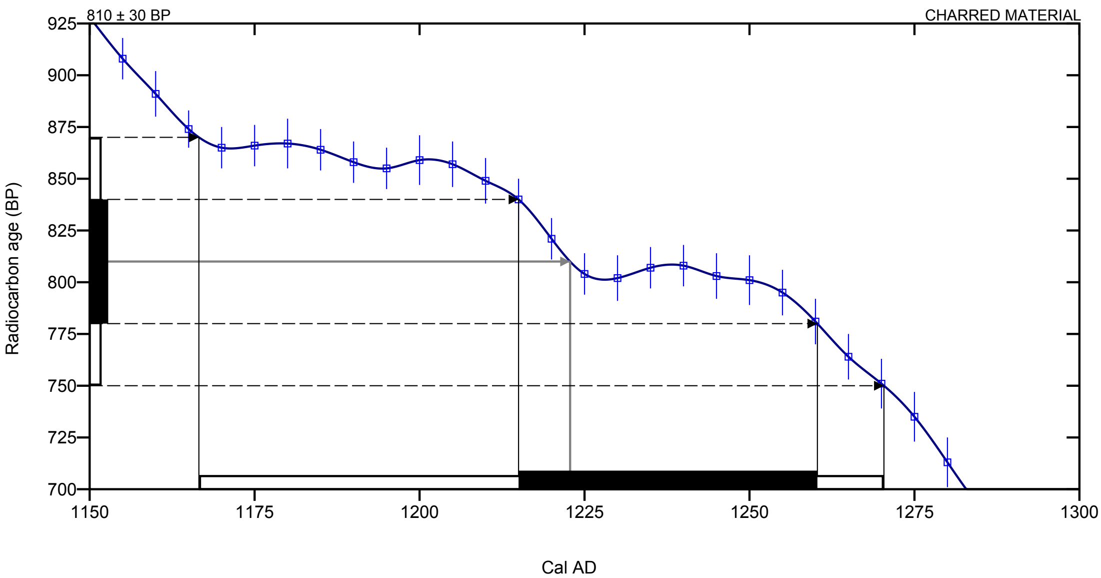
References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -21.4 o/oo : lab. mult = 1)

Laboratory number	**Beta-415265**
Conventional radiocarbon age	**810 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1165 to 1270 (Cal BP 785 to 680)**
Intercept of radiocarbon age with calibration curve	Cal AD 1225 (Cal BP 725)
Calibrated Result (68% Probability)	Cal AD 1215 to 1260 (Cal BP 735 to 690)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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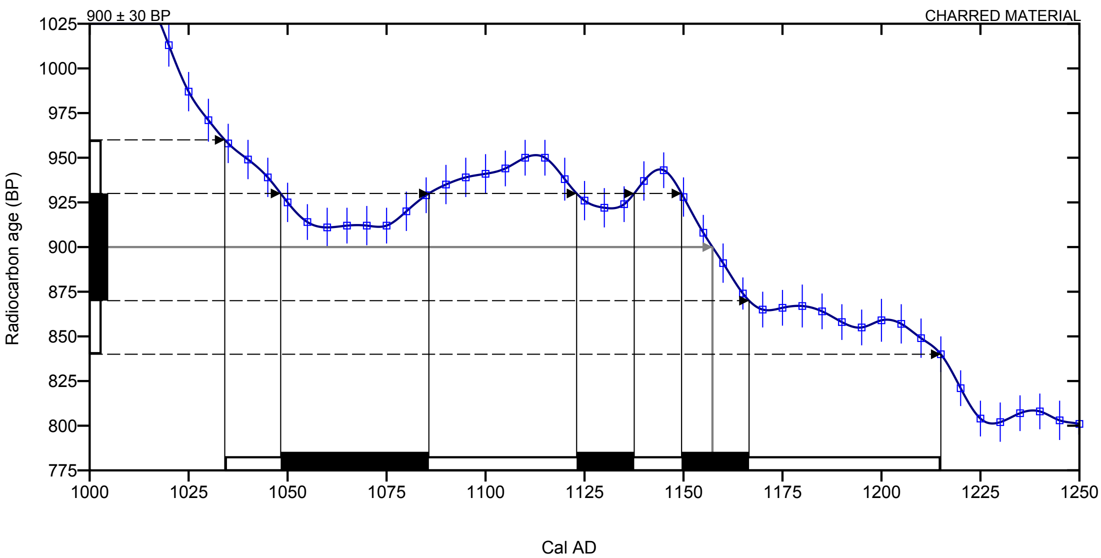
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.7 o/oo : lab. mult = 1)

Laboratory number	**Beta-415266**
Conventional radiocarbon age	**900 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1035 to 1215 (Cal BP 915 to 735)**
Intercept of radiocarbon age with calibration curve	Cal AD 1155 (Cal BP 795)
Calibrated Result (68% Probability)	Cal AD 1050 to 1085 (Cal BP 900 to 865) Cal AD 1125 to 1140 (Cal BP 825 to 810) Cal AD 1150 to 1165 (Cal BP 800 to 785)



Database used
INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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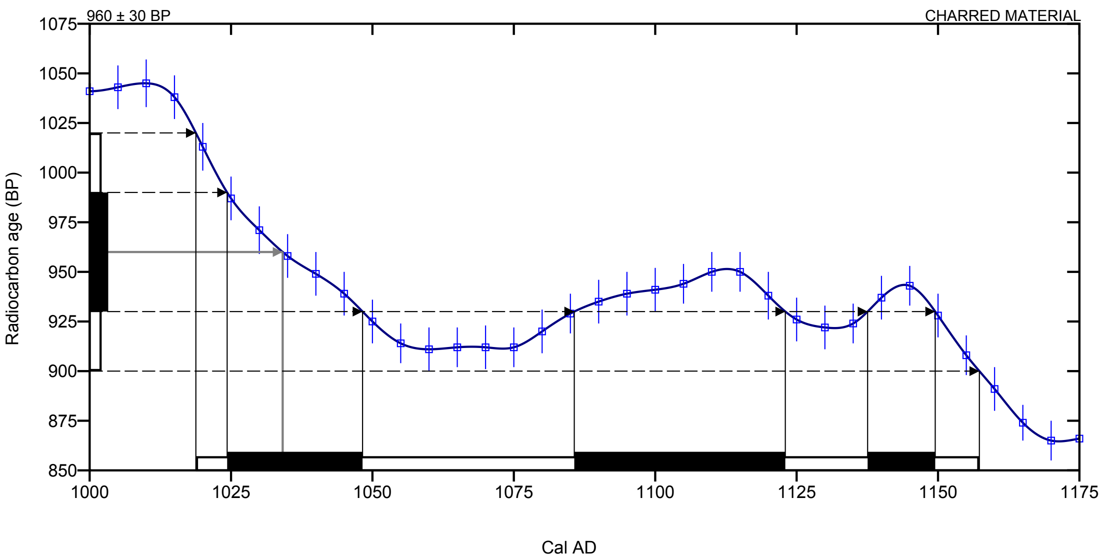
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.8 o/oo : lab. mult = 1)

Laboratory number	**Beta-415267**
Conventional radiocarbon age	**960 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1020 to 1155 (Cal BP 930 to 795)**
Intercept of radiocarbon age with calibration curve	Cal AD 1035 (Cal BP 915)
Calibrated Result (68% Probability)	Cal AD 1025 to 1050 (Cal BP 925 to 900) Cal AD 1085 to 1125 (Cal BP 865 to 825) Cal AD 1140 to 1150 (Cal BP 810 to 800)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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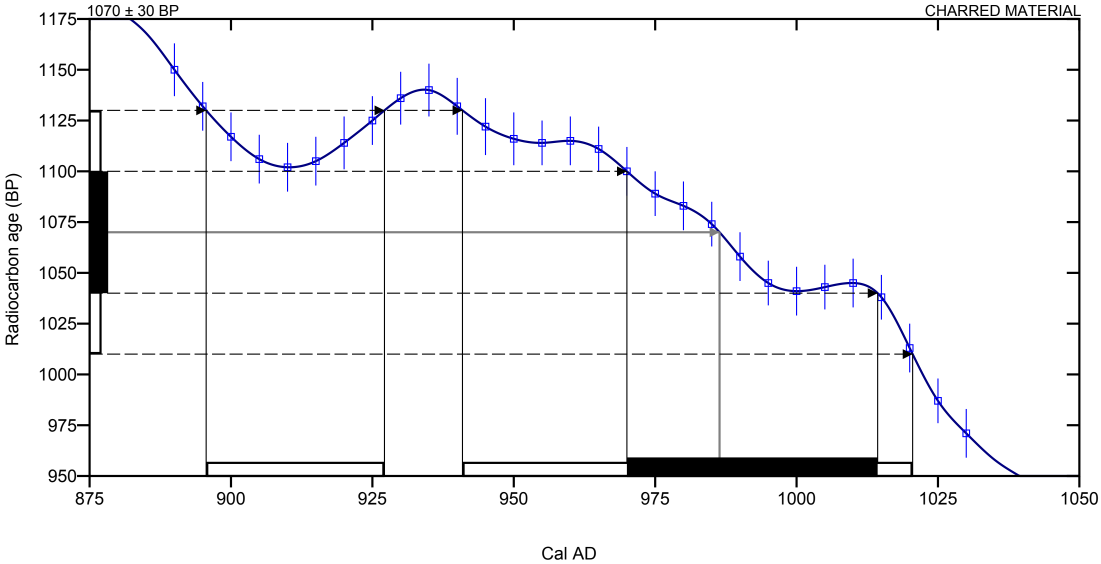
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.1 o/oo : lab. mult = 1)

Laboratory number	**Beta-415268**
Conventional radiocarbon age	**1070 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 895 to 925 (Cal BP 1055 to 1025)** **Cal AD 940 to 1020 (Cal BP 1010 to 930)**
Intercept of radiocarbon age with calibration curve	Cal AD 985 (Cal BP 965)
Calibrated Result (68% Probability)	Cal AD 970 to 1015 (Cal BP 980 to 935)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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Appendix 5.2: **CHARCOAL**

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Miami, Florida 33155 USA
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Fax: 305 663 0964
Beta@radiocarbon.com
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Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

March 10, 2015

Ms. Nancy Akins
Museum of New Mexico
Office of Archaeological Studies
PO Box 2087
Santa Fe, NM 87504-2087
United States

RE: Radiocarbon Dating Results For Samples 139965NS-622, 139965NS-621, 139965SS-657, 139965SS-387, 139965SS-382, 139965CT567

Dear Ms. Akins:

Enclosed are the radiocarbon dating results for six samples recently sent to us. The report sheet contains the Conventional Radiocarbon Age (BP), the method used, material type, and applied pretreatments, any sample specific comments and, where applicable, the two-sigma calendar calibration range. The Conventional Radiocarbon ages have been corrected for total isotopic fractionation effects (natural and laboratory induced).

All results (excluding some inappropriate material types) which fall within the range of available calibration data are calibrated to calendar years (cal BC/AD) and calibrated radiocarbon years (cal BP). Calibration was calculated using the one of the databases associated with the 2013 INTCAL program (cited in the references on the bottom of the calibration graph page provided for each sample.) Multiple probability ranges may appear in some cases, due to short-term variations in the atmospheric ^{14}C contents at certain time periods. Looking closely at the calibration graph provided and where the BP sigma limits intercept the calibration curve will help you understand this phenomenon.

Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result.

All work on these samples was performed in our laboratories in Miami under strict chain of custody and quality control under ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 accreditation protocols. Sample, modern and blanks were all analyzed in the same chemistry lines by qualified professional technicians using identical reagents and counting parameters within our own particle accelerators. A quality assurance report is posted to your directory for each result.

Our invoice has been sent separately. Thank you for your prior efforts in arranging payment. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood
Digital signature on file

BETA ANALYTIC INC.

DR. M.A. TAMERS and MR. D.G. HOOD

4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Ms. Nancy Akins — Report Date: 3/10/2015

Museum of New Mexico — Material Received: 2/23/2015

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 405311	820 +/- 30 BP	-23.3 o/oo	850 +/- 30 BP

SAMPLE : 139965NS-622
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 1155 to 1255 (Cal BP 795 to 695)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 405312	680 +/- 30 BP	-23.3 o/oo	710 +/- 30 BP

SAMPLE : 139965NS-621
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 1265 to 1295 (Cal BP 685 to 655) and Cal AD 1370 to 1380 (Cal BP 580 to 570)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 405313	510 +/- 30 BP	-22.5 o/oo	550 +/- 30 BP

SAMPLE : 139965SS-657
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 1315 to 1355 (Cal BP 635 to 595) and Cal AD 1390 to 1430 (Cal BP 560 to 520)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 405314	700 +/- 30 BP	-23.5 o/oo	720 +/- 30 BP

SAMPLE : 139965SS-387
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 1260 to 1295 (Cal BP 690 to 655)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

BETA

BETA ANALYTIC INC.

DR. M.A. TAMERS and MR. D.G. HOOD

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beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Ms. Nancy Akins

Report Date: 3/10/2015

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 405315	1140 +/- 30 BP	-23.3 o/oo	1170 +/- 30 BP

SAMPLE : 139965SS-382
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 770 to 905 (Cal BP 1180 to 1045) and Cal AD 920 to 965 (Cal BP 1030 to 985)

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 405316	1650 +/- 30 BP	-23.0 o/oo	1680 +/- 30 BP

SAMPLE : 139965CT567
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 260 to 280 (Cal BP 1690 to 1670) and Cal AD 325 to 420 (Cal BP 1625 to 1530)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23.3 o/oo : lab. mult = 1)

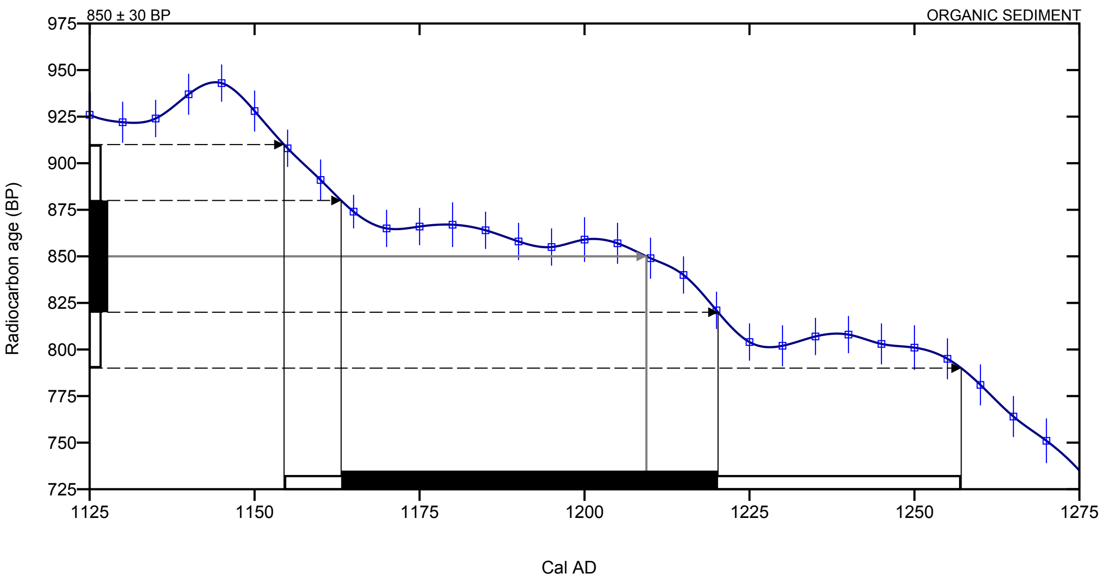
Laboratory number **Beta-405311**

Conventional radiocarbon age **850 ± 30 BP**

Calibrated Result (95% Probability) **Cal AD 1155 to 1255 (Cal BP 795 to 695)**

Intercept of radiocarbon age with calibration curve Cal AD 1210 (Cal BP 740)

Calibrated Result (68% Probability) Cal AD 1165 to 1220 (Cal BP 785 to 730)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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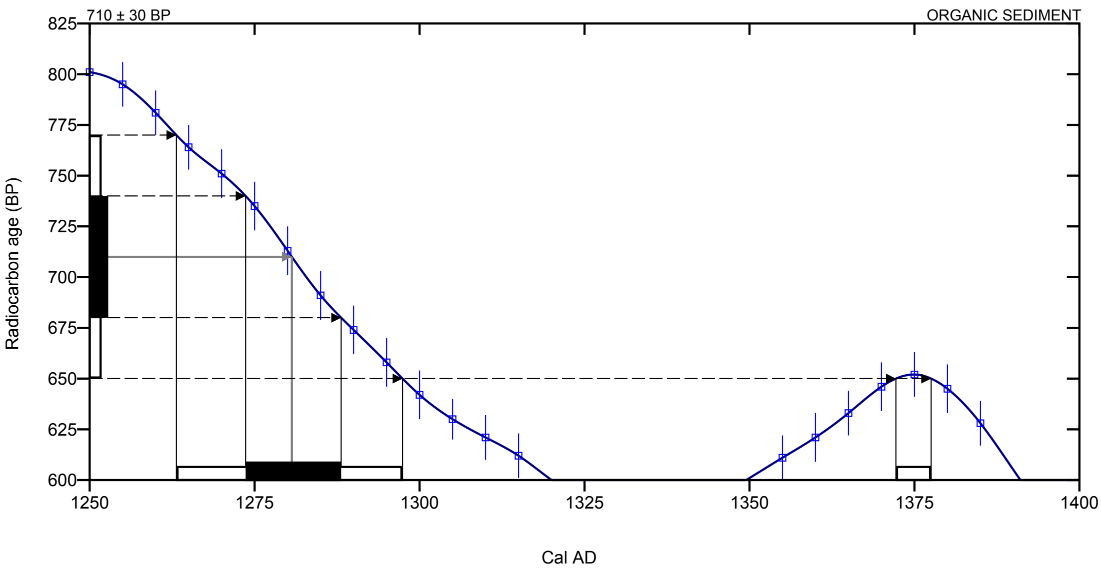
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-405312**
Conventional radiocarbon age	**710 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1265 to 1295 (Cal BP 685 to 655)** **Cal AD 1370 to 1380 (Cal BP 580 to 570)**
Intercept of radiocarbon age with calibration curve	Cal AD 1280 (Cal BP 670)
Calibrated Result (68% Probability)	Cal AD 1275 to 1290 (Cal BP 675 to 660)



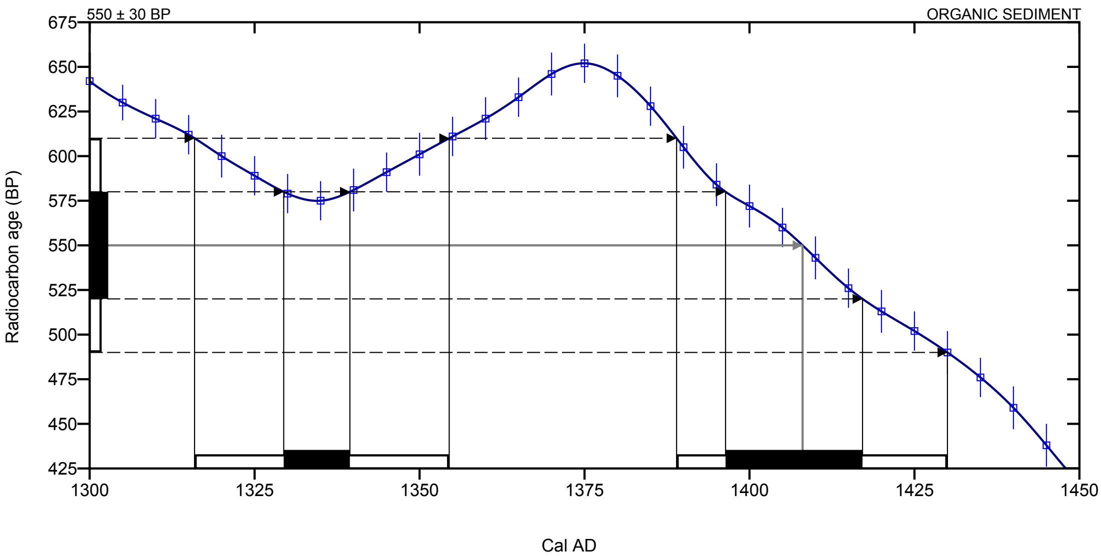
Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -22.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-405313**
Conventional radiocarbon age	**550 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1315 to 1355 (Cal BP 635 to 595)** **Cal AD 1390 to 1430 (Cal BP 560 to 520)**
Intercept of radiocarbon age with calibration curve	Cal AD 1410 (Cal BP 540)
Calibrated Result (68% Probability)	Cal AD 1330 to 1340 (Cal BP 620 to 610) Cal AD 1395 to 1415 (Cal BP 555 to 535)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23.5 o/oo : lab. mult = 1)

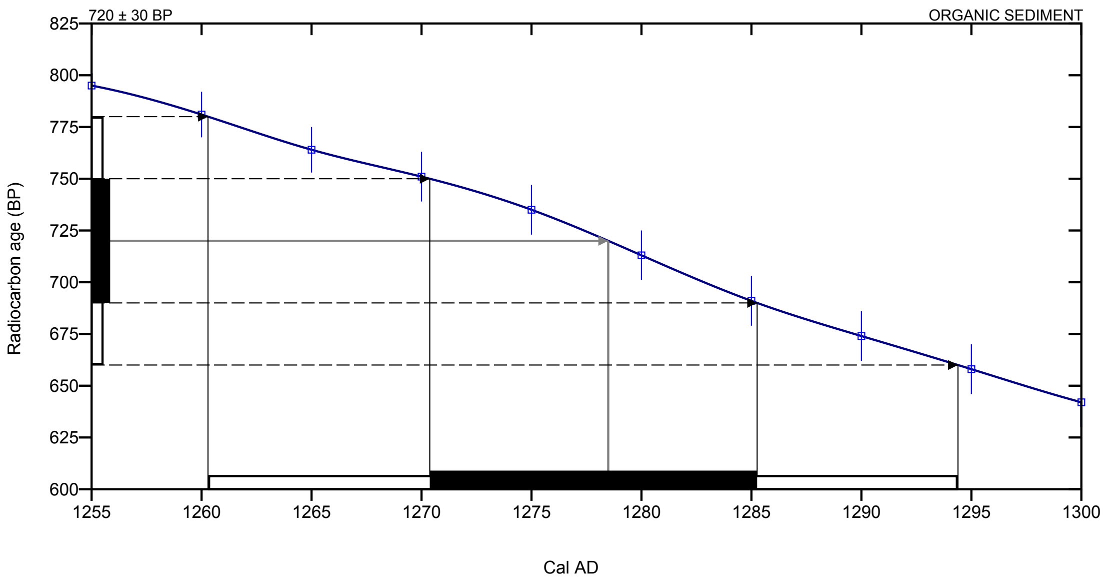
Laboratory number **Beta-405314**

Conventional radiocarbon age **720 ± 30 BP**

Calibrated Result (95% Probability) **Cal AD 1260 to 1295 (Cal BP 690 to 655)**

Intercept of radiocarbon age with calibration curve Cal AD 1280 (Cal BP 670)

Calibrated Result (68% Probability) Cal AD 1270 to 1285 (Cal BP 680 to 665)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

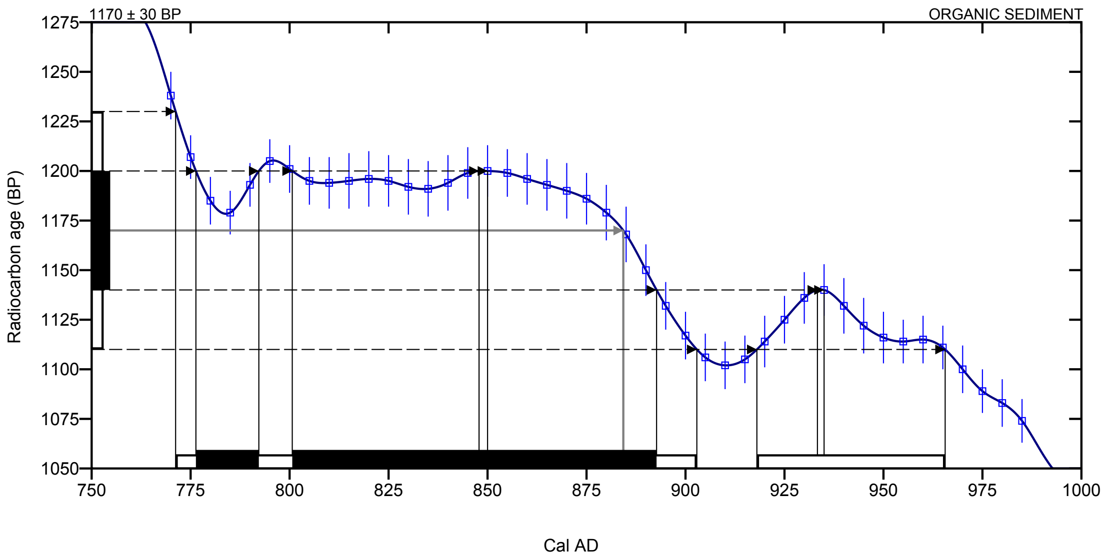
References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-405315**
Conventional radiocarbon age	**1170 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 770 to 905 (Cal BP 1180 to 1045)** **Cal AD 920 to 965 (Cal BP 1030 to 985)**
Intercept of radiocarbon age with calibration curve	Cal AD 885 (Cal BP 1065)
Calibrated Result (68% Probability)	Cal AD 775 to 790 (Cal BP 1175 to 1160) Cal AD 800 to 895 (Cal BP 1150 to 1055)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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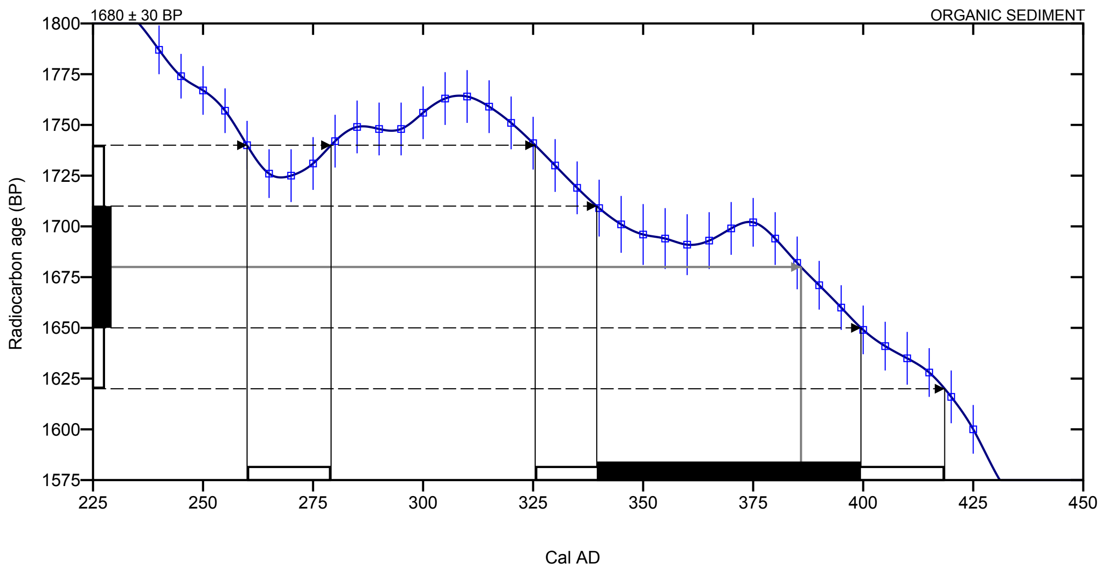
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -23 o/oo : lab. mult = 1)

Laboratory number	**Beta-405316**
Conventional radiocarbon age	**1680 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 260 to 280 (Cal BP 1690 to 1670)** **Cal AD 325 to 420 (Cal BP 1625 to 1530)**
Intercept of radiocarbon age with calibration curve	Cal AD 385 (Cal BP 1565)
Calibrated Result (68% Probability)	Cal AD 340 to 400 (Cal BP 1610 to 1550)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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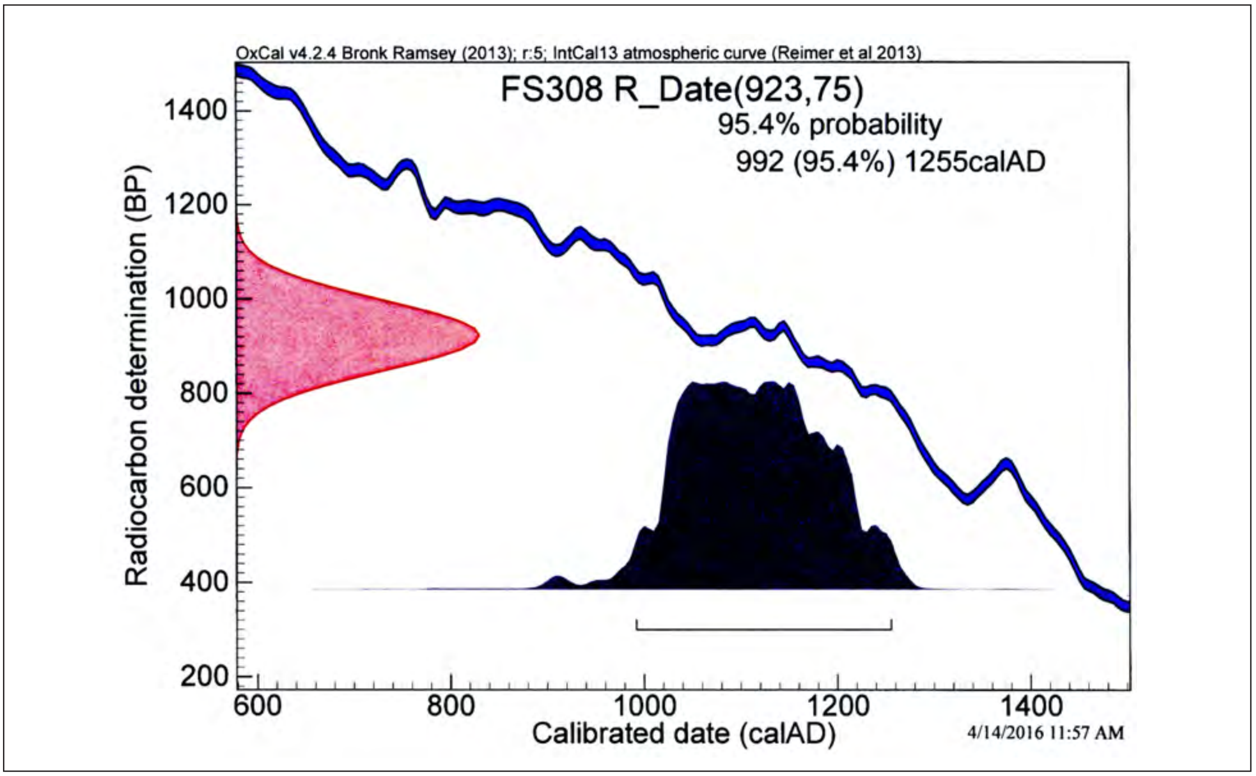
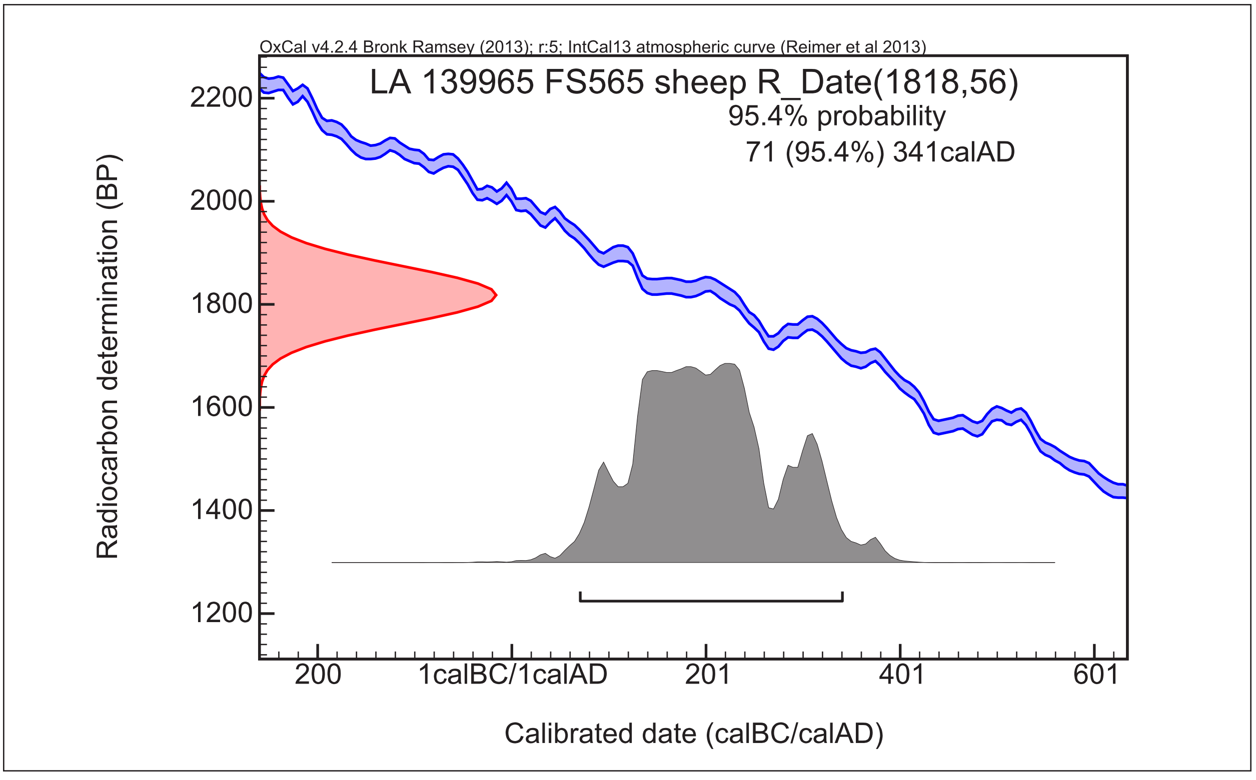
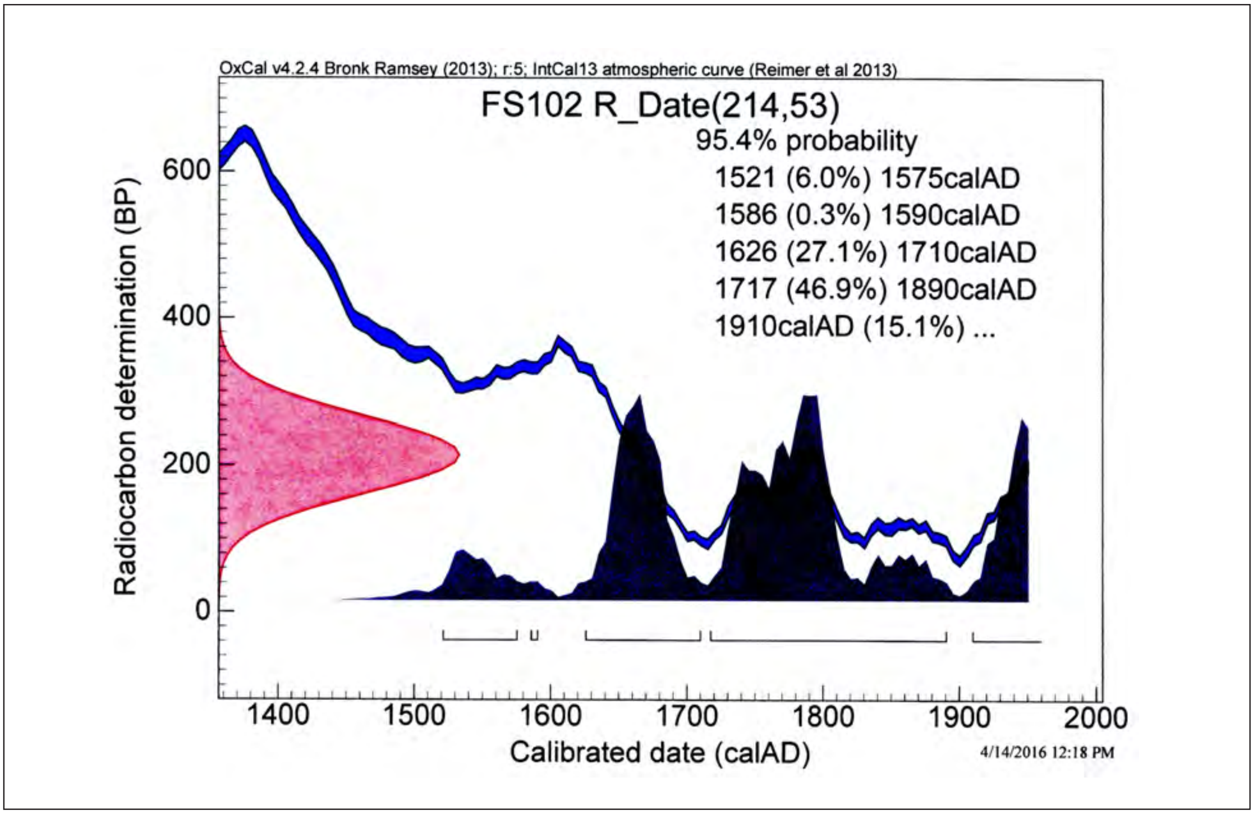


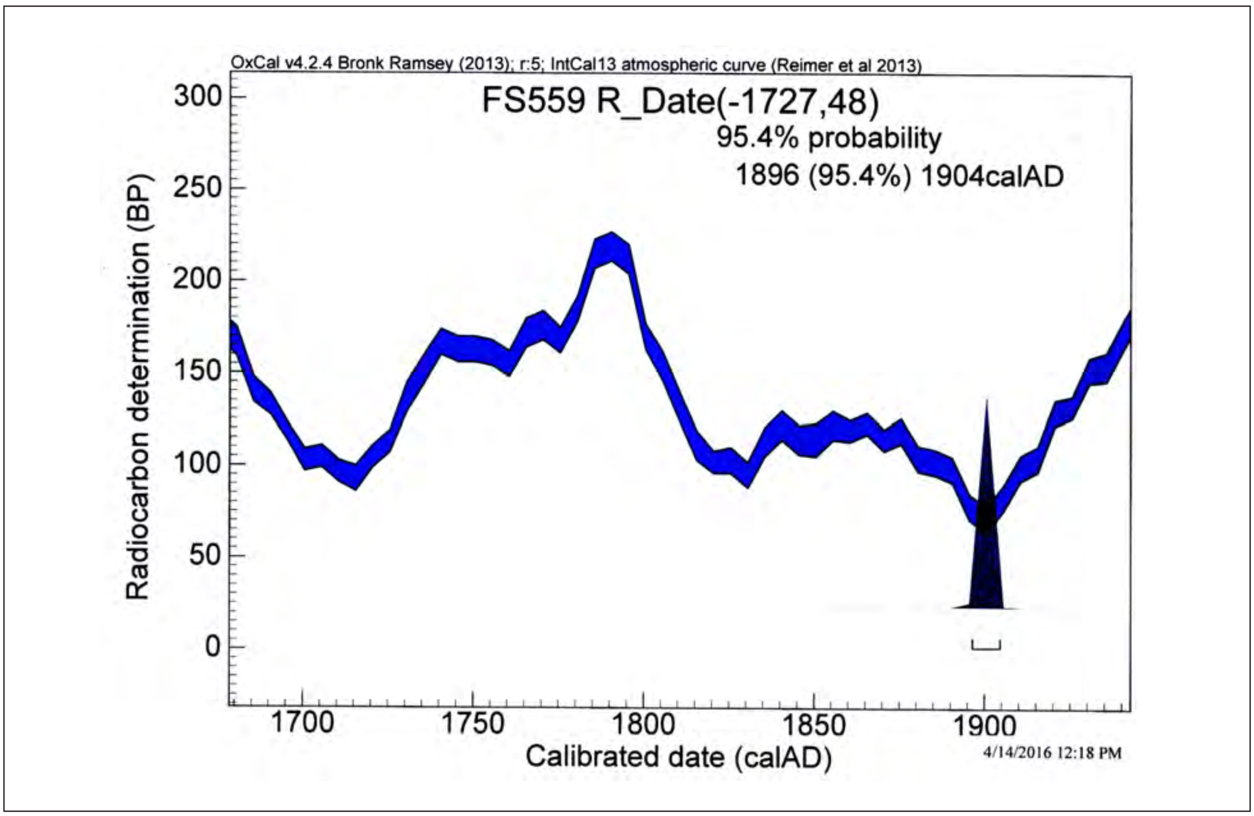
OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
FS308 R_Date(923,75)
95.4% probability
992 (95.4%) 1255calAD
Radiocarbon determination (BP)
1400
1200
1000
800
600
400
200
600
800
1000
1200
1400
Calibrated date (calAD)
4/14/2016 11:57 AM



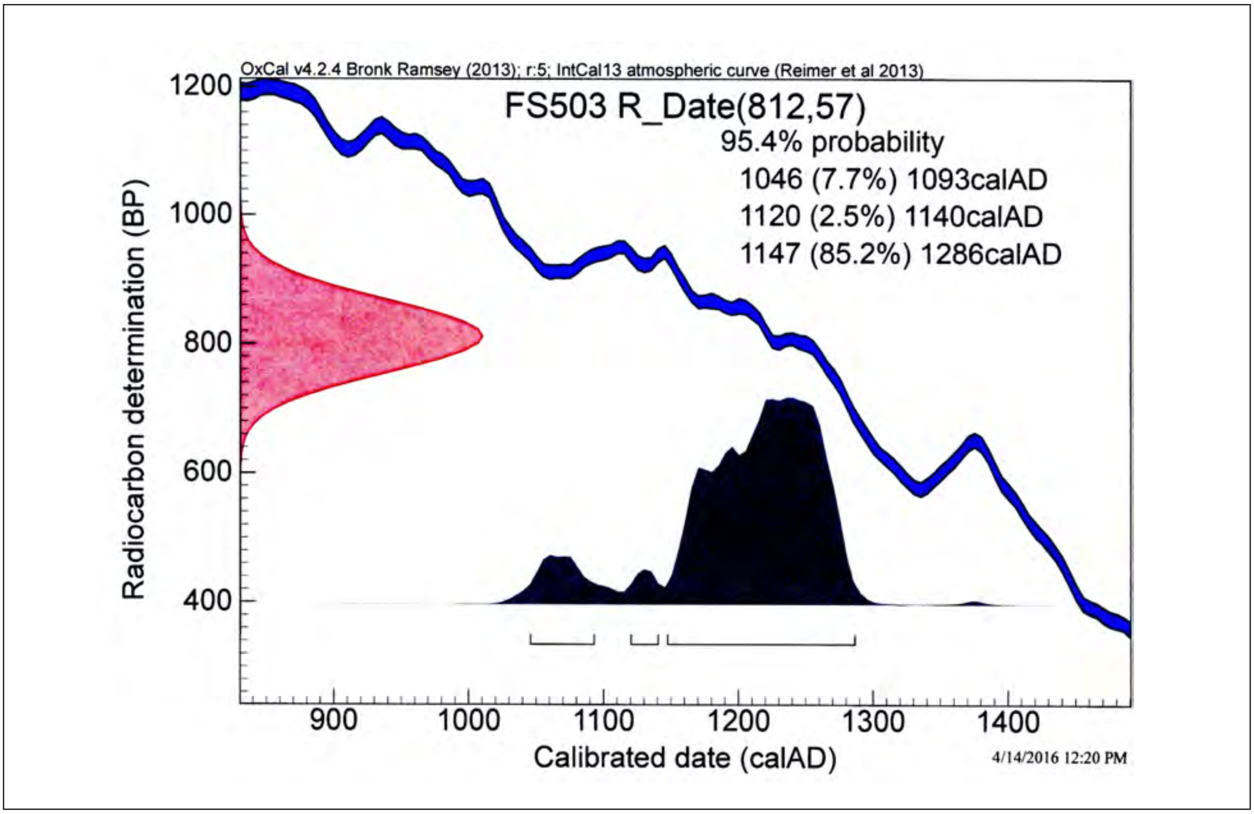
OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
LA 139965 FS565 sheep R_Date(1818,56)
95.4% probability
71 (95.4%) 341calAD
Radiocarbon determination (BP)
2200
2000
1800
1600
1400
1200
200
1calBC/1calAD
201
401
601
Calibrated date (calBC/calAD)

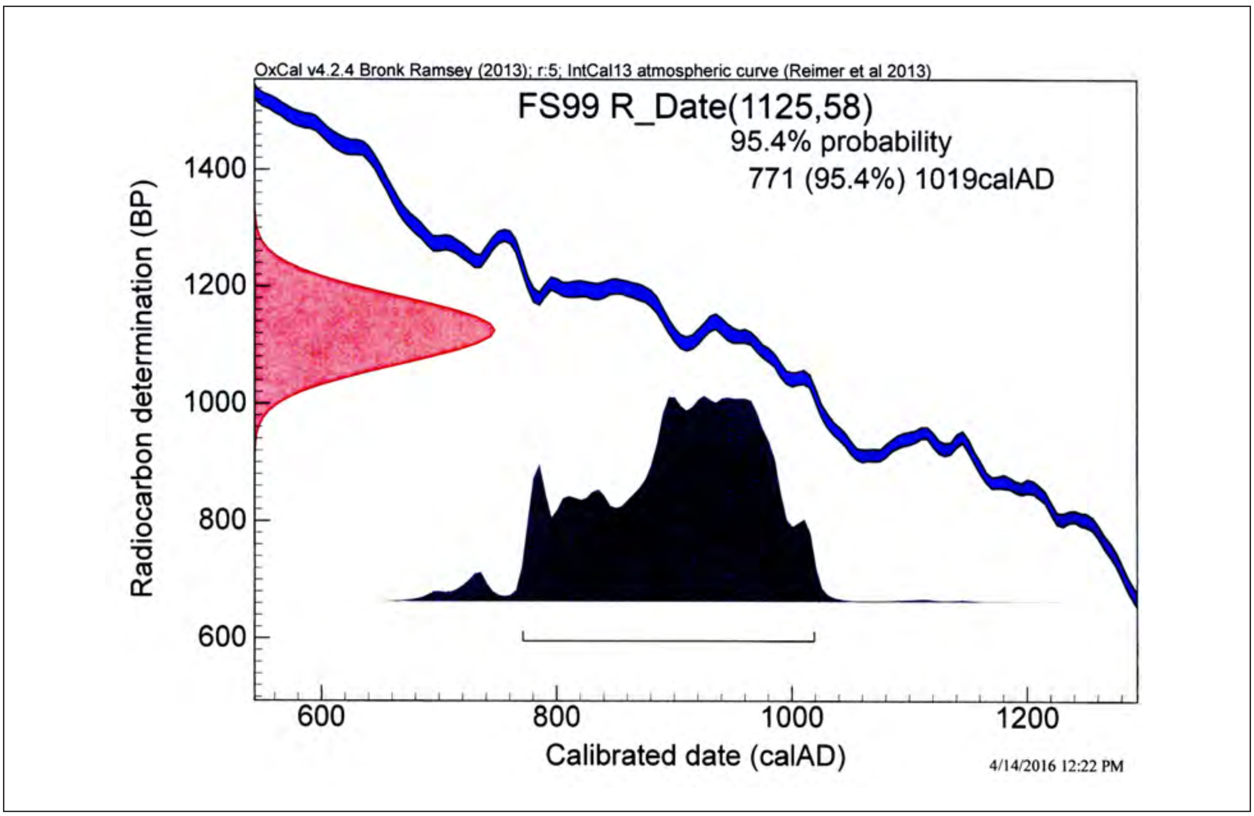


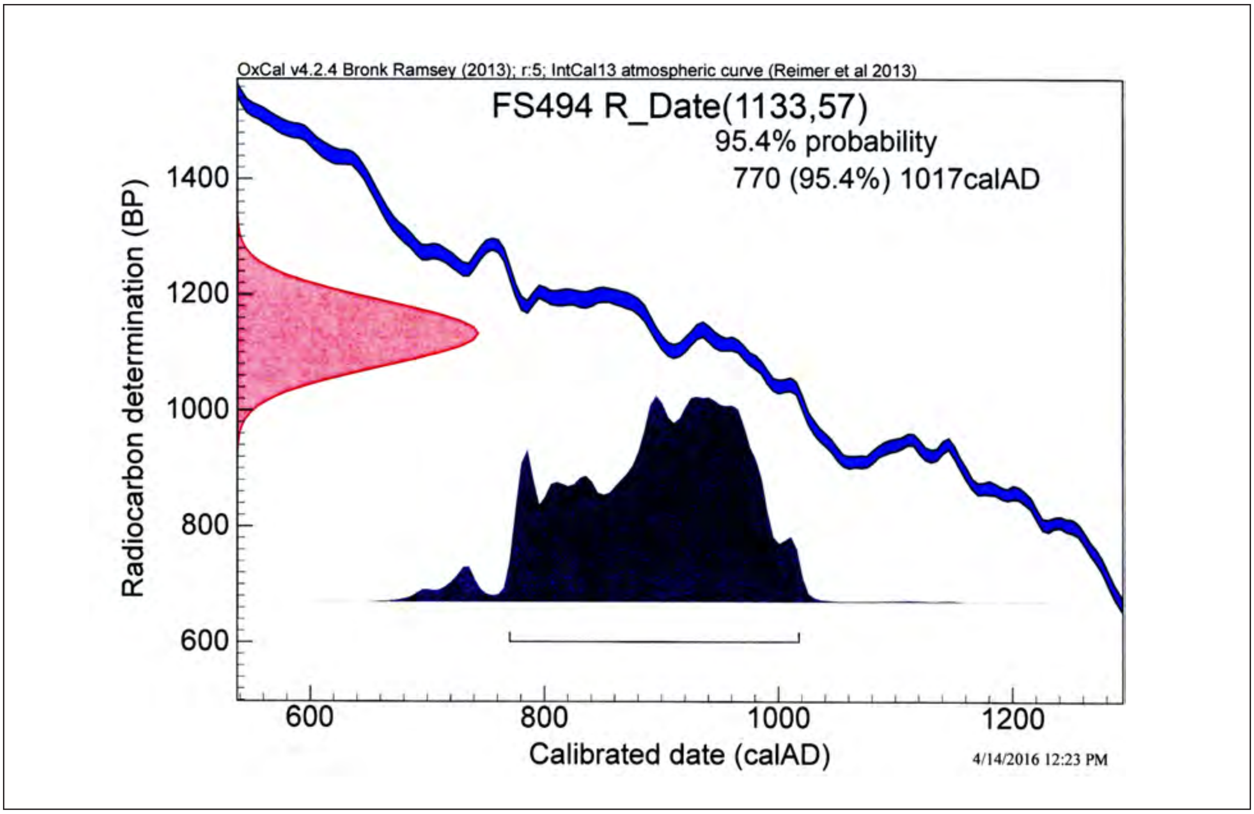
OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
FS102 R_Date(214,53)
95.4% probability
1521 (6.0%) 1575calAD
1586 (0.3%) 1590calAD
1626 (27.1%) 1710calAD
1717 (46.9%) 1890calAD
1910calAD (15.1%) ...
Radiocarbon determination (BP)
Calibrated date (calAD)
4/14/2016 12:18 PM



OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
FS559 R_Date(-1727,48)
95.4% probability
1896 (95.4%) 1904calAD
Radiocarbon determination (BP)
Calibrated date (calAD)
4/14/2016 12:18 PM


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
FS503 R_Date(812,57)
95.4% probability
1046 (7.7%) 1093calAD
1120 (2.5%) 1140calAD
1147 (85.2%) 1286calAD
Radiocarbon determination (BP)
1200
1000
800
600
400
900
1000
1100
1200
1300
1400
Calibrated date (calAD)
4/14/2016 12:20 PM


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
FS99 R_Date(1125,58)
95.4% probability
771 (95.4%) 1019calAD
Radiocarbon determination (BP)
1400
1200
1000
800
600
600
800
1000
1200
Calibrated date (calAD)
4/14/2016 12:22 PM


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
FS494 R_Date(1133,57)
95.4% probability
770 (95.4%) 1017calAD
Radiocarbon determination (BP)
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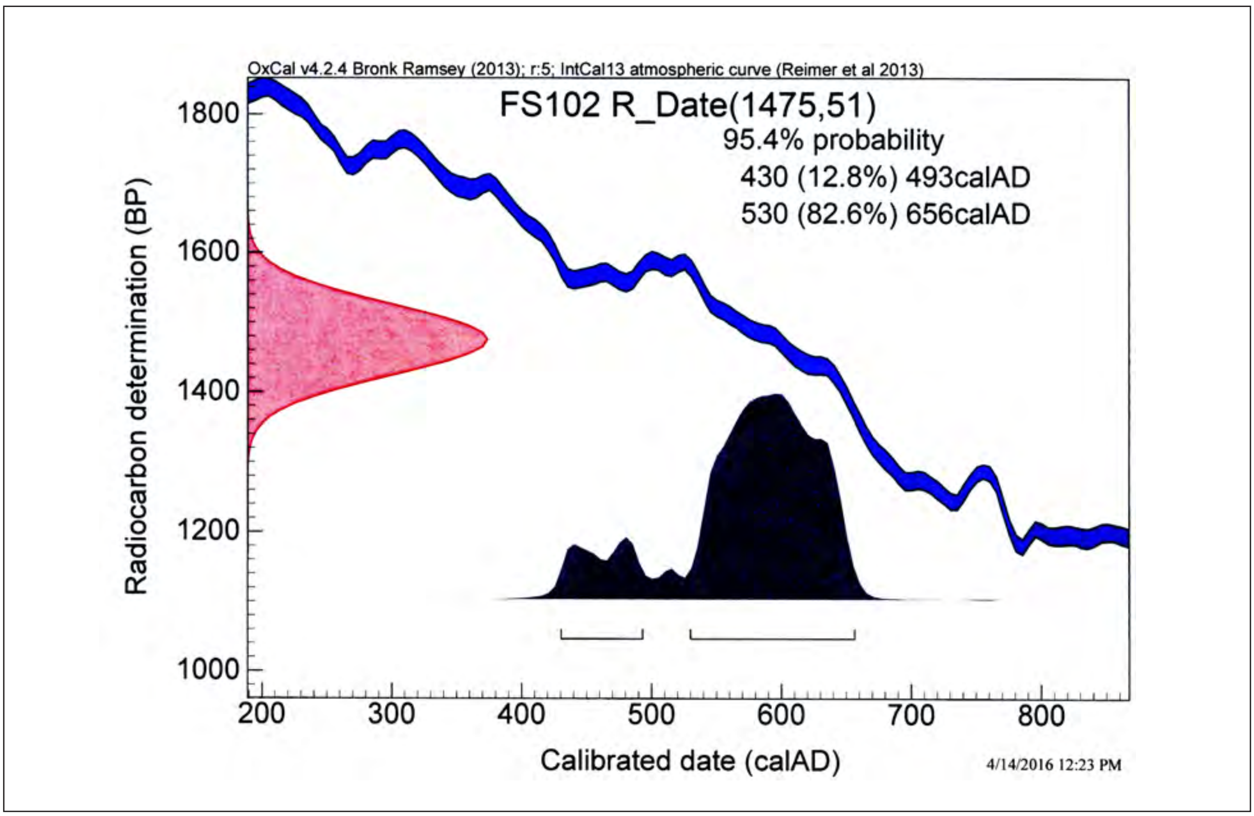
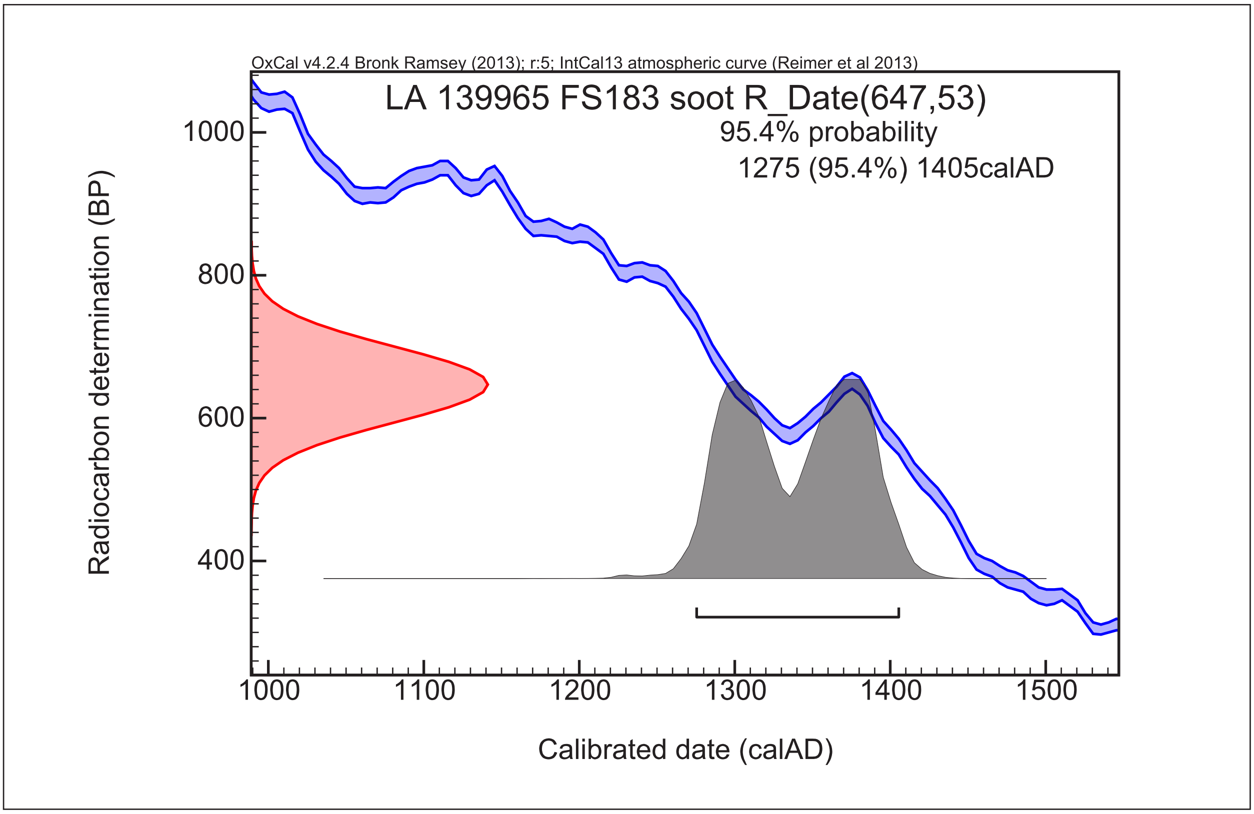
1200
1000
800
600
600
800
1000
1200
Calibrated date (calAD)
4/14/2016 12:23 PM


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
FS102 R_Date(1475,51)
95.4% probability
430 (12.8%) 493calAD
530 (82.6%) 656calAD
Radiocarbon determination (BP)
1800
1600
1400
1200
1000
200
300
400
500
600
700
800
Calibrated date (calAD)
4/14/2016 12:23 PM



OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
LA 139965 FS183 soot R_Date(647,53)
95.4% probability
1275 (95.4%) 1405calAD
Radiocarbon determination (BP)
1000
800
600
400
1000
1100
1200
1300
1400
1500
Calibrated date (calAD)

NMDOT

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Museum of New Mexico AN 477

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