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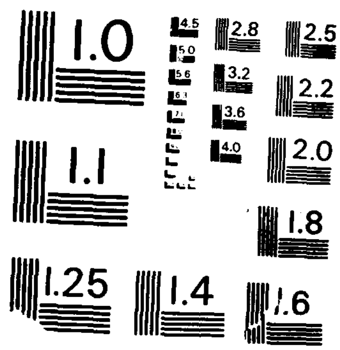

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ANALYSIS OF THREE COBBLE RING SITES AT ABIQUIU RESERVOIR, RIO ARRIBA COUNTY, NEW MEXICO

Prepared for

U.S. Army Corps of Engineers
Albuquerque District
Albuquerque, New Mexico

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ABSTRACT

During September 1987, field work was conducted by archaeologists from Mariah Associates, Inc. at three cobble ring sites located along the upper Chama River segment of Abiquiu Reservoir in Rio Arriba County, New Mexico. A contract with the U.S. Army Corps of Engineers, Albuquerque District, specified that investigations should attempt to obtain chronometric, activity, and subsistence information using controlled surface collection, site and feature mapping, and testing at LA 25417, LA 25419, and LA 25421. During the three weeks of field work, 32 cobble rings and 33 hearth features were mapped; 13 cobble rings and 19 hearth features were tested using core augers or hand excavated test units. A number of areas at all three sites were subjected to controlled surface collections with artifact proveniencing to within one meter resolution.

The occupational ages of the sites were determined from 29 cross-dated projectile points, 24 obsidian hydration dates, five radiocarbon dates, and one archaeomagnetic date. These chronometric samples indicate that the sites were intermittently occupied from the Bajada Phase of the Archaic Period through the Historic Period. The most intensive utilization at all sites occurred during the Archaic Period San Jose and Armijo Phases. Site LA 25419 also had a considerable Developmental Period occupation. The multicomponent aspect of these sites is in keeping with the majority of sites recorded in the Abiquiu Reservoir area as a whole.

K-means cluster analysis was performed on the artifact assemblages and the hearth and cobble ring features to discern and describe variability in the morphology of features and the nature of the associated artifacts. Some cobble ring clusters are morphologically similar to tipi rings; others may have functioned as drying racks or windbreaks.

Subsistence information was obtained from analysis of pollen and macrobotanical samples recovered from hearth contexts. Charred seeds of goosefoot, purslane, and beeweed were identified. Very few faunal remains were encountered. Most subsistence activities must be inferred from the artifactual remains. The high proportion of points and scrapers suggests that hunting was a major component of the subsistence pattern.

The present investigations document the complexity of all three sites. The limited time available for field work did not permit examination of all features. However, considerable information regarding prehistoric activities can be extracted from sites LA 25417 and LA 25419. Recommendations for future work at cobble ring sites include block excavation of interior and exterior areas of cobble rings and associated hearths. Additional work is recommended at LA 25417 and LA 25419. On the former site, the cluster analysis suggested that features on the southern portion of the site were morphologically similar; one of these features produced a Jicarilla Apache sherd. Comparable areas within and outside of the rings should be excavated in a search for datable samples, ring-associated artifacts, and outside activity areas. On LA 25419, excavations should include Features 1-3 and 5-6 on the south terrace and Feature 15 (large number of associated artifacts) and either Feature 36 or

37 and their associated hearths on the high slope to the southwest on the north terrace. Additional work will provide more detail on morphological attributes, particularly presence of central hearths and associated activity areas, that are important to determining details of occupation, dates, and site structure.

ACKNOWLEDGMENTS

This report would not have been possible without the cooperation of many people. We would first like to thank the gracious personnel at Ghost Ranch, which housed and fed the crews during the three weeks of field work. Jim Shibley, Ghost Ranch foreman, was particularly helpful in facilitating access to the project area through Ghost Ranch lands. Both he and Cheryl Muceus very kindly helped the crew to launch our boat from an arroyo. Jim Talent, supervisor of Abiquiu Dam, provided useful information, and Mrs. Lena Salazar, the landowner, granted access.

Ms. Sandy Rayl of the U.S. Army Corps of Engineers, Albuquerque District, was, as usual, very helpful in structuring the field work to produce the most useful information on cobble ring structures with sparse associated artifacts. Of the consultants, Ms. Mollie Toll kindly identified the uncharred corn cob, and Mr. Tom Reust and Mr. Craig Smith of Mariah Associates, Inc., Laramie, performed the processing and analysis, respectively, of flotation samples. Ms. Betty Garrett performed the petrographic analysis, and Mr. Peter Wigand performed the pollen analysis. The dating laboratory personnel were especially helpful: Dr. Christopher Stevenson for the obsidian, Mr. Sam Valastro for the C-14, and Dr. Jeff Eighmy for the archaeomagnetic.

Analysis of historic artifacts was greatly aided by Charles Carrillo, who identified the ceramics, and Bill Lees of the Kansas State Historical Society, who assisted in identifying and dating the gunflint and Case knife. Mr. Frank Shofner of Shofner's World of Knives, Albuquerque, also provided useful data on the knife.

Finally, we would like to thank Mr. Scott Geister and Mr. Rick Sleeter, who served as crew members. Dr. Christopher Lintz was crew chief, and Dr. Amy Earls served as project director. Mr. John Acklen was principal investigator. At the office, Dr. Nicholas Trierweiler performed artifact analysis, Dr. Christopher Lintz typed the points, Mr. Roman Fojud drafted site and feature maps, Ms. Sharon Breitweiser edited the report, and Mrs. Nancy Cochran Sanchez directed report production.

MANAGEMENT SUMMARY

The purpose of the work was to investigate the research potential at three cobble ring sites at Abiquiu Reservoir. The work involved limited data recovery, focusing primarily on mapping, surface collection, and testing. The level of effort at each site was flexible, but research was to focus on those sites most likely to yield intact remains. All three sites had been determined eligible for inclusion in the National Register of Historic Places.

Mariah's work indicated that as a whole the sites possess excellent research potential to further knowledge of cobble ring sites in north central New Mexico. LA 25421 offers less potential than the other two sites, as it contains only two cobble rings, and the eight thermal features located upslope appear to date to earlier Archaic occupations. On LA 25417, Feature 2 indicated a Jicarilla Apache occupation during the 1800s; block excavations are recommended in and around this feature and Feature 8, both located in the south portion of the site. The cluster analysis on cobble ring attributes indicated similarities of rings on this portion of the site. On LA 25419, evidence of Developmental Period occupation on the south terrace point suggested the possibility of a contemporaneous occupation at some of these cobble rings. Future research on this site should focus on block excavation in and around Features 1, 2, 3, 5, and 6, as well as additional excavation on the north terrace--particularly Feature 15, with a large associated artifact assemblage, and either Feature 36 or 37, located on the high southwestern slope and associated with two thermal features.

Impacts to the three sites are relatively minor. A major impact, particularly on thermal features, is slope erosion; this is particularly marked on LA 25421 thermal features and LA 25419 Feature 10 lithic concentration. A second impact is grazing, which has been greatest on LA 25419, which contains evidence of domestic and wild animal use, best shown by the presence of an animal trail along the south terrace. LA 25417 and LA 25421 appear to have been little affected by grazing. A third impact is recent camping activity; this is most evident at LA 25419 in the vicinity of Feature 8, where a campfire has been built. Amateur collection has probably also been most intense on LA 25419, which has the terrace best suited for boat landing of the three sites. Despite these impacts, the sites have proven to have promising research potential for learning about cobble rings in a part of the world that has seen little study of these sites compared to the northern plains, where the rings are much more common.

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1.0 INTRODUCTION

Amy C. Earls

The project area is located at the northern, upper end of the reservoir formed by the creation of Abiquiu Dam on the Chama River. The project area is in south central Rio Arriba County, in north central New Mexico, about 16 miles northwest of the town of Abiquiu. It is on the west bank of the Chama River on cobble-lined terraces that were approximately 80 feet above the reservoir water level at the time of field work, which took place September 8-25, 1987. Personnel were Dr. Amy Earls (project director), Dr. Christopher Lintz (crew chief), and Mr. Scott Geister and Mr. Rick Sleeter (crew members). Mr. John Acklen was principal investigator. Field notes are to be filed at the Laboratory of Anthropology, Museum of New Mexico. Artifacts are to be curated at an approved facility or returned to the landowner at her request.

Work at three Abiquiu Reservoir cobble ring sites was funded by the U.S. Army Corps of Engineers (ACOE), Albuquerque District. This study (performed under Contract No. DACW47-86-D-0002) was a pilot effort aimed at assessing the research potential of cobble ring sites and obtaining information on the nature of site remains, including structural and artifact assemblage and locational variability. Two important questions to be addressed are: 1) How do these cobble rings compare with ethnographically documented tipi rings? and 2) How do these cobble ring sites compare with models of subsistence and settlement for groups using tipi rings? In order to address these questions, mapping, surface collection, and limited testing were planned for three sites, LA 25421, LA 25417, and LA 25419. The selected sites, which were geographically clustered, were thought to have the most promising research potential.

The report is organized in the following way. A brief summary of the project area environment is given in Chapter 2.0. Chapter 3.0 presents an overview of culture history in the Abiquiu Reservoir area and a research design based on previous work at cobble ring sites. Chapter 4.0 discusses archaeological and comparative historical methods. The site descriptions, including descriptions of each feature and test pit, are given in Chapter 5.0. Chapter 6.0 presents the artifact and chronological analyses. Chapter 7.0 discusses feature analyses. Research design conclusions and recommendations for future work are given in Chapter 8.0. Finally, references on cobble ring studies and other literature cited are listed in Chapter 9.0.

2.0 ENVIRONMENT

Amy C. Earls

Discussion of the physical environment in the northern portion of Abiquiu Reservoir is based primarily on Bertram et al. (1987) and Schander (1986), representing work in the area during the last few years. Topics discussed are geology and soils, local topography, climate, vegetation, and fauna. Figure 2.1 shows the location of the three cobble ring sites, area water resources and mountains, and lands of Abiquiu Reservoir potentially subject to controlled inundation.

2.1 GEOLOGY

The Chama River valley in the upper reaches of Abiquiu Reservoir has been formed by both sedimentary and volcanic events. Important forces between 200 million years ago (mya) and 10 mya were the following (see Figure 2.2 for a geologic cross section). Chama Basin stratigraphy begins with Pennsylvanian times, when Precambrian rocks projected above the sea where swamps and lagoons formed along the margins of the coastlines. The poor sorting and the large size of the Cutler Formation materials indicate that a flood plain environment supplanted the Pennsylvanian marine environment. During Late Permian or Early Triassic times, the basin became tilted. The landscape became a low surface overlain by nonmarine mud and silt; eventually, the area was savannah-like, with sluggish streams. By Jurassic times, deposition reflected alternating wet and dry conditions, producing aeolian and fluviatile, possibly marine, deposits. The Late Jurassic Morrison Formation was laid down in a broad, flat basin, which experienced slight erosion before an invasion by the sea. The Cretaceous deposits are characterized by a beach and lagoon environment. The Cenozoic era began with the Laramide orogeny and associated uplifts, which created the Jemez Mountains, among many others. The materials forming the El Rito Formation were deposited through erosion from the newly created highlands around the basin. Vulcanism reappeared with the Laramide orogeny and produced flows, tuffs, and other debris which underwent erosion and were deposited along the flanks of the new highlands. Between 10 and 5 mya, relatively gentle lava flows occasionally blocked the Chama River's flow and built deltas of sand, silt, and mud. These deltas partly account for the smooth terraces along the portion of the river within the project area. Less than 1 mya, the volcanic activity culminated in a series of explosions which produced widespread layers of ash and impressive craters. Finally, three series of glaciations are reported during the Pleistocene. Continuing postglacial erosion has produced the present landscape (Schander 1986, Smith n.d.).

Major formations exposed in the project area, from oldest to youngest, include the uppermost part of the Cutler Formation, a Permian stratum approximately 220 million years old. This stratum is exposed at the bottom of the Rio Chama gorge and consists of brick red to purplish shales and other weak rocks containing a few fossils. This formation represents a cyclic alternation of cross-bedded, arkosic sandstone, local conglomerates, and mudstones. Above it is the Chinle Formation, the lower part of which is primarily sandstones which were stream-laid and contain fossilized leaves,

Figure 2.1 Location of the Three Cobble Ring Sites and Abiquiu Reservoir Location, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

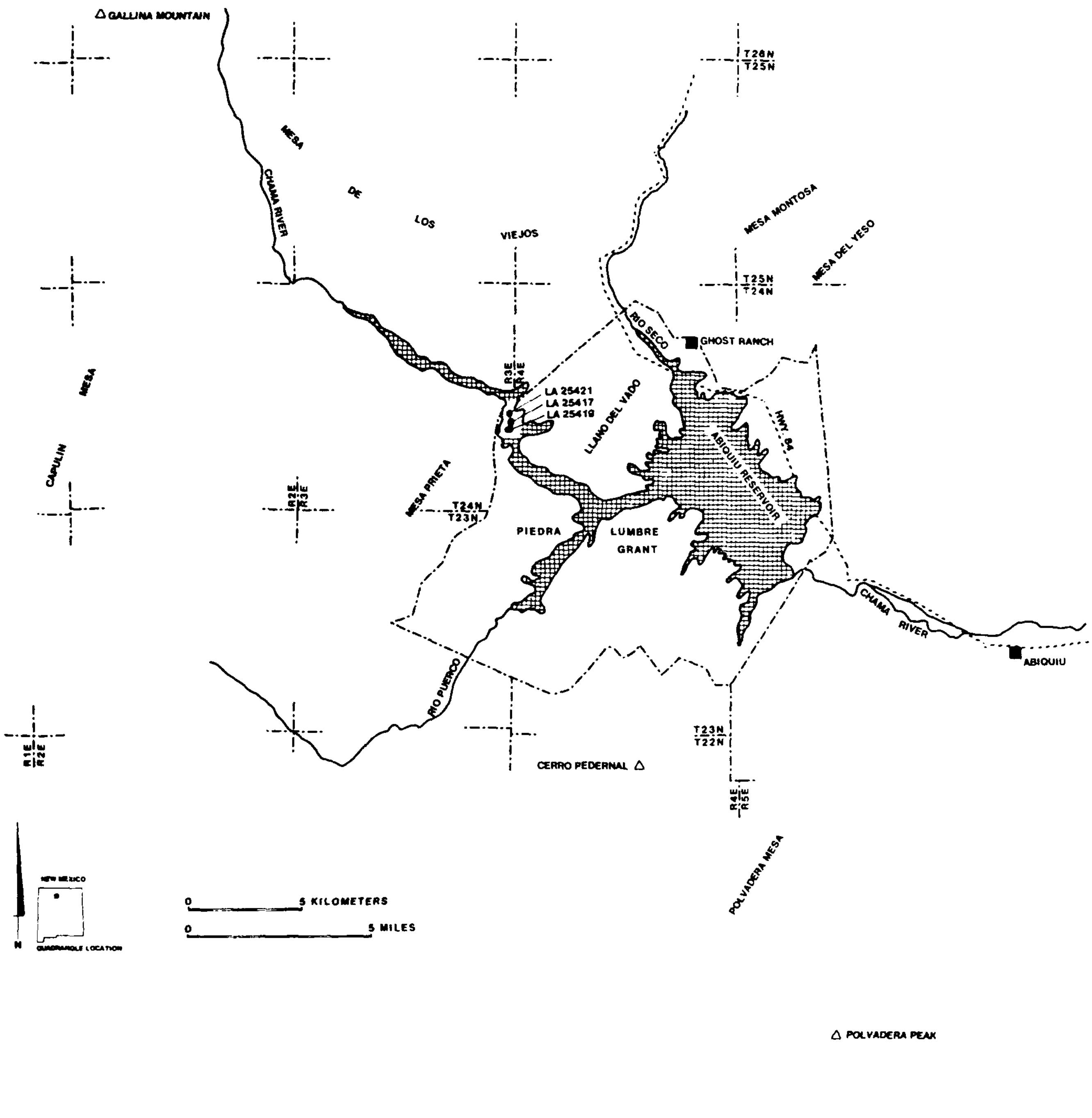
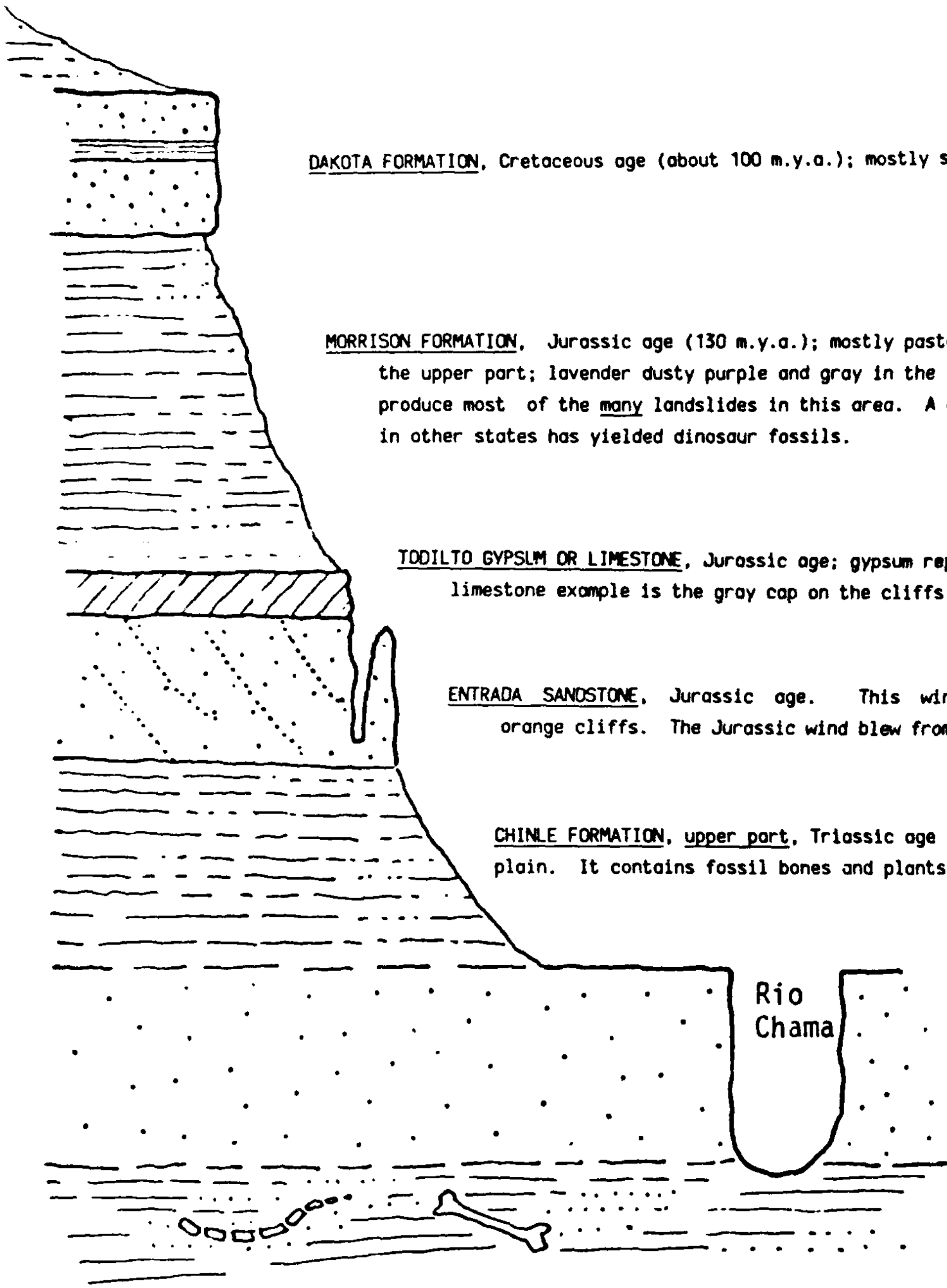


Figure 2.2 **Geologic Cross Section for the Abiquiu Reservoir Area, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.**



DAKOTA FORMATION, Cretaceous age (about 100 m.y.a.); mostly sandstone. This stream-laid unit caps Mesa Montosa.

MORRISON FORMATION, Jurassic age (130 m.y.a.); mostly pastel colored shales, on gentler slopes: reds and greens in the upper part; lavender dusty purple and gray in the lower part. This is the weak rock which has given way to produce most of the many landslides in this area. A coastal plain deposit, laid down by streams, the Morrison in other states has yielded dinosaur fossils.

TODILTO GYPSUM OR LIMESTONE, Jurassic age; gypsum represented by the white cap on the cliffs above Ghost Ranch; limestone example is the gray cap on the cliffs at Chimney Rock.

ENTRADA SANDSTONE, Jurassic age. This wind-deposited sandstone (old sand dunes) makes the ~~yellow-white-dusty-orange~~ cliffs. The Jurassic wind blew from northeast to southwest.

CHINLE FORMATION, upper part, Triassic age (170 m.y.a.); mostly maroon shales, deposited by streams on a coastal plain. It contains fossil bones and plants.

CHINLE FORMATION, lower part, is mostly sandstones. These can be seen along U.S. 84 southeast of the Rest Area and in the Chama River canyon. The lower Chinle sandstones were stream laid; they contain leaves, twigs, and small logs.

CUTLER FORMATION, Permian age (220 m.y.a.), is brick red to purplish shales and other weak rocks. This stream deposit can be seen near the bottom of the Rio Chama gorge on Ghost Ranch; near the bottom of the gorge below Abiquiu Dam; and along the west wall of Red Wash canyon and Arroyo del Cobre. The Cutler Formation contains fossil bones at a few localities. Only the uppermost part of the formation is exposed to view.

twigs, and small logs. The lower portion of the Chinle lies unconformably upon the Cutler Formation and ranges from fine to coarse sands. This portion of the formation comprises the banks of the Rio Chama in the project area. The upper part of the Chinle Formation, a Triassic stratum approximately 170 million years old, consists primarily of maroon shales deposited by streams on a coastal plain. This stratum contains fossil bones, primarily terrestrial vertebrates, and plants. The upper shale member intertongues in a complex manner with the lower member. The uppermost section is relatively resistant to erosion and forms the base of the overlying cliffs of Entrada (Early Jurassic) sandstone. This member outcrops in a belt of intricately dissected low hills along the base of Mesa Prieta, for example (Muehlberger and Muehlberger 1982, Schander 1986, Smith n.d.).

Above the Chinle are three formations of Jurassic age. The Entrada wind and water deposited sandstone is represented by yellow, white, and dusty orange cliffs well exposed on Mesa Prieta to the west of the project area. The Entrada sandstone consists of medium to fine grained, well sorted and rounded quartz sand grains in a cross-bedded matrix. The Entrada Formation often weathers in a manner producing rounded amphitheaters. The Todilto Formation comprises white gypsum (well exposed on Kitchen Mesa near Ghost Ranch) or gray limestone. The lower member is a dark, calcareous shale grading into a gray, thin-bedded limestone. The upper member is massive white gypsum with conspicuous shale partings. This formation caps the Entrada and offers protection from erosion. The Morrison Formation, approximately 130 million years old, is a coastal plain deposit, laid down by streams. The Morrison Formation forms steep cliffs and outcrops on the Mesa Montosa and Mesa del Yeso escarpments. The formation consists of pastel colored weak rocks which have produced most of the landslides in the area. The lower beds are sandstones and siltstones interbedded with mudstones in lesser amounts. As the unit grades upward, mudstone and siltstone predominate over sandstone. The lower member consists of alternating mudstones and siltstones. This formation and the one above are well exposed on Mesa Montosa to the north of the project area (Schander 1986, Smith n.d.).

Finally, the Dakota Formation is Cretaceous (approximately 100 million years old) and consists primarily of sandstone. The lower unit is medium to coarse grained sandstone, well sorted and cemented. The middle unit is dark gray silty claystone and clayey siltstone. Beds of carbonaceous material and coal occur in thin layers. The upper unit is essentially the same as the lower unit (Schander 1986, Smith n.d.). This stream-laid formation contains many quartzites used for knapping on the cobble ring sites.

Other formations are the Cretaceous Mancos shale, the Tertiary El Rito Formation and Abiquiu tuff, and the Quaternary Bandelier tuff, and rhyolite and basalt members also occur. The Mancos shale contains two shale members and one limestone member. The upper shale, consisting of shale, mudstones, and siltstones, forms much of the ground surface throughout the Chama Basin. The El Rito Formation is a remnant of alluvial aprons formed by erosion of the Laramide Rockies. It contains boulders and conglomerates cemented by micaceous, arkosic sandstone. The conglomerate is a well-rounded, bluish gray quartzite. Inclusions are feldspar, schist, and gneiss cobbles. The Abiquiu tuff of the Santa Fe Formation consists of very silty tuff and tuffaceous, micaceous sandstone with small amounts of volcanic conglomerate. The Bandelier tuff is ryolitic welded tuff in the Jemez Mountains consisting primarily of pumice fragments. The north flanks of these mountains contain Quaternary rhyolite and Late Tertiary-Quaternary basalt (Muehlberger and Muehlberger 1982, Schander 1986).

Local soil properties are important to understanding artifact disturbance and site postdepositonal processes. Soils in the project area are sandy and silty. They have experienced both aeolian erosion and movement from drainages of various depths fed by runoff from the low hills at the base of Mesa Prieta. Most of the ground surface exhibits cracks of less than 5 cm depth which may act as artifact sinks. Other artifacts are pedestalled when their presence prevents erosion of the soil directly below.

2.2 LOCAL TOPOGRAPHY

The project area is located in the southern extension of the San Juan region of the southern Rocky Mountain Province, specifically in the southeast portion of the Chama Basin. This shallow structure merges with the much larger San Juan Basin to the northwest. The Chama Basin is bounded by Gallina Mountain and Capulin Mesa to the west, the Brazos uplift to the northeast, the Arroyo del Cobre anticline to the southeast, and the Jemez Plateau to the south. The Rio Grande trough is to the east. The reservoir area is a wide valley with high mesas to the north and west and Cerro Pedernal dominating the southern skyline. The valley constitutes the only well watered, reliably passable route connecting the San Juan Basin with the upper Rio Grande Valley. Because of this situation, the valley has probably long served as a major travel and migration route for both humans and large game animals (Bertram et al. 1987, Schander 1986).

The Rio Chama flows in a general southeasterly direction to its confluence with the Rio Grande. In the project area, the river flows through a deeply incised canyon with stepped mesa benches 100 feet high on either side. The project area is located on the right (west) bank of the river above the confluence with the Rio Puerco and below the right angle turn to the south at the southeastern edge of Mesa de los Viejos. The project area is located at 6300-6400 feet elevation within the northwestern boundary of the Hispanic Piedra Lumbre land grant, now under the ownership of Ghost Ranch and private individuals. Bounding the project area are Mesa de los Viejos to the north, Mesa Prieta to the west and southwest, and the Chama River and the Llano del Vado to the east. The three sites studied overlook the river; there is at least one cobble ring on each point. The two northern sites, LA 25421 and LA 25417, are situated on relatively flat terrace edges, while LA 25419 includes more broken topography in the form of hills at the base of Mesa Prieta; the boundaries of LA 25419 are also very well defined by two flooded arroyos at the northern and southern edges of the site.

2.3 CLIMATE

The project area's climate may be characterized as semiarid continental, with most precipitation derived from summer thunderstorms, which produce much runoff. The four local weather recording stations are situated at the town of Abiquiu, at Ghost Ranch (two stations), and at Abiquiu Dam; these stations record precipitation and/or temperature but do not collect data on wind, insolation, and humidity (Schander 1986).

The area experiences relatively cool, wet summers and rather dry, mild winters. Only in December and January does the mean temperature drop below freezing; only in July does the mean temperature rise above 70 degrees Fahrenheit. Mean annual precipitation is 10.18 inches, and annual precipitation varies from 9.63 inches at the dam to 11.24 inches at the 6900 feet Ghost Ranch station. The winter snowline in the area is above 8000 feet, with snow at elevations similar to that of the project area generally light and melting rapidly (Bertram et al. 1987, Schander 1986).

2.4 VEGETATION

Vegetation in the project area varies according to elevation, proximity to water, slope, and slope exposure. Other factors involve grazing intensity and brush clearing programs, the latter aimed at improving grazing for cattle. Vegetation is mountain valley pygmy conifer woodland, with slopes, outcrops, and escarpments dominated by one seed juniper (*Juniperus monosperma*), with pinyon pine (*Pinus edulis*) as a subdominant. Areas of gentle slope are dominated by sagebrush (*Artemisia* spp.) and grasses, usually grama grasses (*Bouteloua* spp.), galleta (*Hilaria jamesii*), squirreltail (*Sitanion hystrix*), and needlegrasses (*Stipa* spp.) (Bertram et al. 1987, Schander 1986). Also occurring are narrowleaf yucca (*Yucca angustissima*), rabbitbrush and chamisa (*Chrysothamnus nauseosus*), four-wing saltbush (*Atriplex canescens*), cane cholla (*Opuntia imbricata*), snakeweed (*Gutierrezia sarothrae*), Indian paintbrush (*Castilleja* spp.), prickly pear (*Opuntia* spp.), datil or banana yucca (*Yucca baccata*), and Mormon tea (*Ephedra torreyana*).

Vegetation on the three sites is dominated by sagebrush (*Artemisia* sp.), with prickly pear, cholla, and grasses also occurring on the flat terrace tops. Juniper and pinyon occur in arroyos and along terrace edges. Willow is present in tributary arroyos.

Prehistoric vegetation is indicated by the macrobotanical and pollen floral analyses. Five macrobotanical samples were collected from LA 25417, two from LA 25419, and one from LA 25421. Goosefoot (*Chenopodium* sp.) seeds were found in occasionally large quantities in six of the samples, while beeweed (*Cleome* sp.) and purslane (*Portula* sp.) seeds were each found in one sample. Charcoal fragments were identified as pinyon pine.

Three pollen samples from LA 25419 were analyzed. The similarity of the modern and past pollen rain samples (the latter based on a pollen wash from the buried face of a metate) suggested that vegetation at the time the artifact was buried was much as it is today. In these pollen rains pine and juniper constitute nearly 60% of the grains, with sagebrush (*Ambrosia* sp.), greasewood (*Sarcobatus* sp.), grasses, and Cheno-ams occurring in proportions less than 10%.

2.5 FAUNA

Animals occurring in the project area today are pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), jackrabbit (*Lepus californicus*), and cottontail (*Sylvilagus audoboni*). Animal resources probably found in the project area during the PaleoIndian and Early Archaic Periods until historical times may have included Rocky Mountain bison (*Bison bison*), elk (*Cervus elaphus canadensis*), and bighorn sheep (*Ovis canadensis*). Other mammalian food or fur sources in the past may have included wolf (*Canis lupus*), coyote (*Canis latrans*), mountain lion (*Felis concolor*), bobcat (*Felis rufus*), various mustelids, and larger rodents such as prairie dog (*Cynomys gunnisoni*), marmot (*Marmota flaviventris*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethica*), and porcupine (*Erethizon dorsatum*) (Bertram et al. 1987).

Avian resources available until historical times may have included turkey (*Meleagris gallopavo*), various raptors (*Falconiformes*), migratory waterfowl and shorebirds (*Anseriformes* and *Charadriiformes*), smaller galliform birds such as grouse and quail, and columbiform birds such as dove (*Zenaida macroura*) and bandtail pigeons (*Columba fasciata*). Aquatic resources would have included cutthroat trout, channel catfish, various suckers and chubs, and crayfish. The Rio Chama probably was too cold for most edible turtles.

3.0 OVERVIEW AND RESEARCH DESIGN

Amy C. Earls

The data recovery program is aimed at limited testing at three cobble ring sites in Abiquiu Reservoir to obtain sufficient information for evaluating research potential. The goal is to learn what kind of deposition and artifact and feature assemblage to expect from cobble ring sites at Abiquiu Reservoir. To date, none of the sites under consideration have been inundated.

The sample of cobble ring sites was selected for study on the basis of apparent integrity of remains and geographical proximity. Documentary evidence suggested that the sites may have originated as historic occupations (Schaafsma 1978:20). Data presented in Chapters 6.0 and 7.0 of this report indicate that the sites are multicomponent, a common phenomenon in the Abiquiu Reservoir area, and suggest that the sample was well chosen for providing a sample of stone circles large enough to examine patterning (both regularities and variability) and to structure future research.

Primary research goals for data recovery were 1) the recovery of chronometric samples to refine the dates of occupation, 2) the recovery of flotation and palynological samples to reconstruct subsistence strategies and 3) the examination of possible site use and evaluation of models of adaptive change. Hypotheses concerning the use of features and the range of activities at sites can be explored through artifact and feature analysis. The research objectives relating to aspects of these goals are discussed below.

This study is relevant also to more broadly based objectives, but the recovery of data from only three Abiquiu sites restricts the breadth of this study. Much general information is presented on cobble rings, and these data provide a comparative context. This report is not a definitive study of cobble ring sites in the Abiquiu Reservoir and north central New Mexico, however. A larger data base would be needed for such a study.

The research design consists of several elements. First, an overview of culture history and previous archaeological research in the Rio Chama is presented. Then, cobble ring research is addressed. Third, research issues are defined and discussed. These issues are derived from current state of the art research previously conducted on cobble ring sites from the northern plains (Wyoming, Montana, South Dakota, Colorado, Manitoba, and Alberta) and New Mexico Abiquiu and (Santa Rosa) areas. The research issues involve both theoretical and methodological topics which generically focus on cobble ring sites regardless of occupation date or geographic location. Finally, sampling strategies are discussed. Sampling was employed during surface collection and during testing of the ring clusters and artifact concentrations.

3.1 CULTURE HISTORY AND PREVIOUS ARCHAEOLOGICAL RESEARCH IN THE RIO CHAMA AREA

This section summarizes the culture history of the project area. The area generally coincides with Thoms's (1977) study area for north central New Mexico projectile point typologies. Within each section, important previous archaeological research in the area is also discussed.

3.1.1 PaleoIndian Period

The north central New Mexico region has sustained human occupation for at least 12,000 years. However, recent radiocarbon dates from several sites in North America have been published which suggest that early man's presence in the New World could have occurred as early as 20,000 or 30,000 years ago (Adovasio et al. 1977, 1980). At present, material remains from these early hunters and gatherers is limited to rare surface finds, but PaleoIndian occupation of the region may well be more extensive than current data would suggest.

Research on the PaleoIndian Period has been hampered by problems in locating sites because of their great age and the intervening geological processes of deposition and soil formation that cover cultural remains. Adding to this problem is that of low site visibility, which reflects low population densities and the ephemeral nature of remains left by hunters and gatherers. Also important are problems of site recognition due to the relatively few artifact types diagnostic of this period and the lack of detail in paleoenvironmental reconstruction (Cordell 1979). PaleoIndian materials are most likely to be found on extremely stable land surfaces or in areas that have experienced considerable erosion exposing old land surfaces.

Three major divisions of PaleoIndian adaptation have been proposed, based primarily on the appearance of a series of diagnostic projectile point types. The Clovis Phase has been variously dated to 9,500-9,000 B.C. (Irwin-Williams 1965, Irwin-Williams and Haynes 1970), or 10,000-9,000 B.C. (Agogino 1968). The succeeding stage of adaptation, called Folsom, has been dated to approximately 9,000-8,000 B.C. (Agogino 1968, Judge 1973) and marks a trend towards specialized hunting practices. Folsom materials have frequently been found in association with the extinct *Bison antiquus*. The Plano Phase closes the PaleoIndian occupation of the North American continent and incorporates a number of distinctive technological traditions. These include the Agate Basin (8,300-8,000 B.C.) and Cody Complexes (6,600-6,000 B.C.) (Irwin-Williams and Haynes 1970). Post-Folsom groups appear to have been highly specialized big game hunters, with a reliance on bison (Stuart and Gauthier 1981). There may have been a return to a more generalized hunting strategy during terminal PaleoIndian times as evidenced by the use of more generalized projectile point types.

In the project area, PaleoIndian projectile points manufactured from Pedernal Peak cherts and chalcedonies as well as from Jemez obsidian clearly document that early hunters and gatherers were exploiting lithic sources in the Jemez and Chama areas as early as Clovis times. For example, the Los Encinos artifacts from a chert quarry near Cerro Pedernal suggest quarrying activities dating to the Clovis Period. Other surface finds include those in the southern Sangre de Cristos and elsewhere in northeastern New Mexico (Cordell 1979). Reed and Tucker (1983) report projectile points in association with lithic materials, and Schaafsma (1976) reports a single secondarily deposited cultural horizon of unknown age from Abiquiu Reservoir. Unambiguous PaleoIndian sites with strong diagnostic association in good context are yet to be recognized in the project area and would comprise a very important resource.

3.1.2 Archaic Period

Succeeding the PaleoIndian Period is the Archaic, characterized as mobile hunting and gathering cultures seasonally exploiting a diverse resource base (Schroeder 1976). Irwin-Williams (1979) feels that PaleoIndian groups withdrew from the northern Southwest to the North and East, and that the Archaic occupation represents an influx of peoples from the West. However, Stuart and Gauthier (1981) both disagree and argue for an in situ development of the Archaic tradition out of a PaleoIndian base.

Aikens (1970) and Thomas (1973) propose that the Archaic stage, as it is manifested in the arid West, may be identical with Jenning's (1964) "Desert Culture". The Desert Culture concept has been described as a widespread uniform culture characterized by a hunting and gathering way of life during the period 8,000 to 3,000 B.C. (Martin and Plog 1973). However, at least two "traditions" and several successive stages of adaptation have been defined within the Desert Culture. The Cochise and the Oshara Traditions have long been thought of as spatially distinct, with the Cochise south and west of the Oshara. However, recent evidence (Baker and Winter 1981) suggests that the two traditions may merge to some degree in the Jemez Mountains, or that a boundary between the two traditions may exist in the region.

3.1.2.1 Cochise Tradition

The Cochise Tradition (Sayles and Antevs 1941, Jennings 1964) is composed of three stages of development based on settlement patterns, subsistence mechanisms, and projectile point morphologies. These are the Sulphur Springs Stage (8,000 B.C. to 6,000 B.C.) the Chiricahua Stage (6,000 B.C. to 4,000 B.C.), and the San Pedro Stage (1,900 B.C. to A.D. 1). Early pit structures first appear during the San Pedro Stage. No pottery occurs during any of these stages, although limited agriculture can be inferred from the presence of maize recovered for Chiricahua Phase sites such as Bat Cave (Dick 1965) and Danger Cave (Jennings 1957). Beckett (1973) defines the Cochise Culture area as bounded by southeast Arizona on the west, Interstate 40 in New Mexico on the north, the San Andres Mountains on the east, and northern Mexico on the south. Since Beckett's work, however, laterally thinned projectile points have been recorded throughout southeast Utah and the Colorado Plateau as well as northwestern New Mexico (Baker and Winter 1981), suggesting that the original boundaries for the Cochise Culture area may be larger than originally defined, and may in fact include the north central New Mexico area.

3.1.2.2 Oshara Tradition

In contrast to the Cochise Tradition of southern Arizona and New Mexico, the Oshara Tradition (Irwin-Williams 1970, 1973) has been specifically applied to north central New Mexico and seems to have begun around 5,500 B.C. and ended around A.D. 400. It is generally grouped into Early Archaic (Jay, Bajada, and San Jose Phases) and Late Archaic (Armijo and En Medio Phases) based on the introduction of limited maize horticulture at the beginning of the Armijo Phase. It should be noted that, while generally useful in northern New Mexico, the chronology outlined by Irwin-Williams and based on work in the Arroyo Cuervo may not necessarily be directly applicable to Archaic Period adaptations in north central New Mexico.

Population size appears to have been relatively stable during the Jay and Bajada Phases (5,500 to 4,800 B.C. and 4,800 to 3,200 B.C.), with an increased rate of population growth during the San Jose Phase (3,200 to 1,800 B.C.), based on the increase in the size and number of sites, located primarily in canyon heads. During the Armijo Phase (1,800 to 800 B.C.) the settlement pattern seems to replicate that of the Early Archaic Period except for a seasonal population aggregation at canyon heads accompanied by a slight decrease in the total number of sites. During the En Medio Phase (800 B.C. to A.D. 400), the population had increased significantly as reflected by higher site densities.

Whereas there are relatively few material remains from PaleoIndian cultures in areas of north central New Mexico, Archaic materials are comparatively abundant. Early Archaic sites in this area consist primarily of small, limited base camps (Vierra 1980, Moore and Winter 1980). Seasonally occupied base camps show evidence of repeated occupations, accompanied by a pronounced seasonal pattern of aggregation of bands at base camps followed by dispersal into microbands. As early as 1934, for example, Frank C. Hibben recorded lithic scatters measuring several acres in extent on the terraces adjacent to the Rio Chama (Hibben 1937). Numerous Archaic Period lithic scatters were recorded during the School of American Research (SAR) Abiquiu Project. D. Snow (1983) recorded 176 sites of Late Archaic affiliation, and Archaic-Basketmaker II sites account for the single most common site type in the vicinity of Abiquiu Reservoir (Schaafsma 1978). This work indicates a long period of Late Archaic use of river terraces. Schaafsma (1978) identified 56 Archaic sites in the Reservoir area and excavated 13. Five of the excavated sites (AR-5, AR-6, AR-8, AR-12, and AR-23) are large base camps on terraces overlooking the Rio Chama at the mouths of major side drainages. The base camps range from 6,000 m^2 to 44,500 m^2 and occur along a nearly 20-mile extent of the Chama from AR-5 near the dam to AR-241 at the northern maximum flood pool boundary near Burns Ranch. The sites sometimes contain thousands of lithics and four types of heating features: basins with ash-stained fill, both with and without fire-cracked rocks; cobble- or slab-lined basins; large piles of fire-cracked cobbles; and small clusters of fire-cracked rocks without basins. Since the Abiquiu sites do not seem to differ functionally, Schaafsma (1976) suggests they represent one aspect of a seasonal round, with the complementary seasonal activities perhaps occurring at higher elevations (Cordell 1979). Beal (1980) notes that the larger Archaic sites in the Abiquiu region exhibit evidence of site reoccupation in the form of multiple hearths and projectile point styles that span multiple time periods (Anschuetz et al. 1985). Warren (1974) recorded several sites containing diagnostic artifacts, suggesting Bajada through Basketmaker II occupations located along the west slope of Cerro Pedernal.

During the San Juan to Ojo survey, Enloe et al. (1974) documented a number of ceramic and lithic scatters located adjacent to the lower Rio Chama Valley and in the Piedra Lumbre Valley, one of which (LA 11836) was excavated by Snow (1983). Lang (1979) recorded seven lithic scatters with Late Archaic or Basketmaker II materials near the confluence of the Rio Chama and the Ojo Caliente River. Wendorf and Miller (1959) note the occurrence of a number of Late Archaic sites at high elevations in the southern Sangre de Cristos (Cordell 1979). Finally, the Pajarito Archaeological Research Project recorded 20 Archaic lithic scatters, including nine dated to the Early Archaic (Hill and Trierweiler 1986).

One serious difficulty in many of these studies is that the temporal identification is based on a few, or even a single, Archaic style projectile point. This approach ignores the possibility of repetitive reuse of site loci, not to mention artifacts, over long periods of time. It is probable that many of the sites currently identified as Archaic also have significantly later components. Conversely, many undated lithic scatters may be Archaic but lack temporally diagnostic artifacts. This problem can be fruitfully addressed by a systematic program of obsidian hydration analysis of nondiagnostic debitage materials.

3.1.3 Anasazi Period

The Anasazi, or Puebloan, occupation of the region has been classified previously according to Kidder's (1927) Pecos scheme. Used in this report is the more geographically specific Upper Rio Grande sequence of Wendorf and Reed (1955).

3.1.3.1 Developmental Period

Evidence of Developmental Period (ca. A.D. 400-1200) occupation in the western half of the north central New Mexico area is very sparse. The Pajarito Archaeological Research Project recorded a single Developmental site in an 11% sample of 621 km^2 on the Pajarito Plateau (Hill and Trierweiler 1986). The lack of Developmental Period habitation sites strongly suggests a hiatus in occupation between the Archaic Period (i.e., Late Basketmaker) and the early Coalition Period (i.e., middle Pueblo III). Occasional surface finds of Basketmaker III projectile points suggest that the Developmental Period use of the area may be restricted to seasonal hunting episodes.

In the Chama District nine Basketmaker III-Pueblo I points were located by Schaafsma (1976) within the Abiquiu Reservoir area. These points are found on sites lacking in ceramics, structures, hearths, or other artifacts, suggesting little more than temporary use of the district during Basketmaker-Pueblo I times.

3.1.3.2 Coalition Period

In contrast, there is much more direct evidence for Coalition Period (ca. A.D. 1200-1325) occupation in the project area. This occupation is marked by significant population growth and an expansion of permanent sedentary settlements by agriculturalists into areas of higher elevation.

Pueblo III sites range in size from 1-2 rooms to more than 200 rooms. The most common site size is 13-30 rooms. Most are small, linear or L-shaped room blocks. The largest room blocks are on the northern Pajarito Plateau, with many arranged around an enclosed plaza (Stuart and Gauthier 1981).

Information from sites of this period in the Chama District has been obtained primarily through the excavations conducted at Riana Ruin (Hibben 1937), Leaf Water Site (Luebben 1953), and Palisade Ruin (Peckham 1959, 1981). These communities have been tree-ring dated to the early and mid-1300s (Anschuetz et al. 1985). Recent excavations in the Abiquiu area on Coalition Period sites include LA 11830, a seasonally occupied field house and garden plot complex (Enloe et al. 1974, Fiero 1976) and LA 20325, a large garden complex (Lang 1979, 1980, 1981). Peckham (1981) reports that habitation settlements were typically widely scattered along the Rio Chama and its tributaries during the Coalition Period. However, he views the placement of Palisade Ruin, which is on a high mesa overlooking the Chama drainage, as evidence that demographic factors compelled agriculturalists to exploit areas previously considered marginal for agriculture (cf. Anschuetz et al. 1985, Peckham 1981). Hibben (1937) distinguished between Wiyo and Biscuit sites in size and site plan. The Wiyo sites, which include Leaf Water, Riana Ruin, Palisade, and LA 3505, are roughly quadrangular, with room blocks on three sides of a plaza closed on the fourth side by a palisade of jacal or a line of stones. The Wiyo sites contain Santa Fe and Wiyo Black-on-white and small amounts of St. Johns Polychrome and are dated to A.D. 1200-1375.

The work by Hibben (1937) and Peckham (1959), as well as Mera's (1934) earlier surveys, demonstrated that the Piedra Lumbre Valley was the northwestern extent of Rio Grande Anasazi large habitation sites. No villages or agricultural settlements from the Coalition Period were found in Schaafsma's (1976) survey area upriver from the Riana Ruin at the mouth of Canones Creek. Several Anasazi hunting camps were located, however, and one (AR-10) was excavated (Schaafsma 1976:13).

Nondiagnostic lithic scatters are common in the Chama District. One of these, LA 11828, yielded considerable quantities of fire-cracked rock from excavation; corrugated, Abiquiu Black-on-gray (Biscuit A), and Tewa polychrome sherds; and points comparable to those from large Pueblo III-IV sites in the area.

3.1.3.3 Classic Period

The Classic Period (ca. A.D. 1325-1600), postdates the abandonment of the San Juan Basin by sedentary agriculturalists. It is characterized by Wendorf an' Reed (1955) as a time of general cultural florescence. Regional populations attained their greatest levels; large communities with multiple plaza, kiva, and room block complexes were occupied; and material culture underwent substantial elaboration. The beginning of the Classic Period in the northern Rio Grande coincides with the appearance of locally manufactured red-slipped and glaze-decorated ceramics, the Glaze A wares, in the Santa Fe, Albuquerque, Galisteo and Salinas Districts after ca. A.D. 1315 (Mera 1935). In the Jemez, Pajarito, and Chama areas, carbon painted black-on-white wares, such as Wiyo Black-on-white and later Biscuit A and B, continue to be manufactured (Cordell 1979).

The large biscuitware sites of the Chama District and the Pajarito Plateau have been the subject of archaeological investigations since the turn of the century. The Biscuit sites date to the Classic Phase. The Biscuit sites include Po-shu-ouinge, Te'ewi, Sapawe, Tsama, Howiri, and others. While the Wiyo sites range from an estimated 25 to 100 rooms, the Biscuit sites contain many hundreds of rooms. Ceramics include Santa Fe and Wiyo Black-on-white, plus Biscuit A and B, Potsuwi'i Incised, corrugated and mica plainwares. Tradewares include Galisteo Black-on-white, St. Johns Polychrome, and Rio Grande Glazes. Small sites occupied in high uplands bordering the Chama Valley during Wiyo times were apparently abandoned when the larger pueblos appeared in the Pajarito Plateau and Chama areas. Recent investigations of Classic Period sites in the Chama District consist primarily of limited contract projects at Ponsipa-akweri and excavations of portions of Howiri within the U.S. 285 construction right-of-way (Fallon et al. 1981).

The Anasazi occupation of the Rio Chama Valley during the Classic Period may be a pattern of gradual withdrawal downstream toward the Rio Grande (Schaafsma 1979). Mera (1934), Wendorf (1953), and Wendorf and Reed (1955) assert that this contraction of settlement culminated shortly before A.D. 1600 with the abandonment of the entire district by permanent year-round Anasazi agriculturalists. Mera (1934) further cites absence of any mention of the numerous ruins in the region as evidence that the communities were no longer occupied at the time of the Spanish entradas. Whether the large Pueblo IV sites were occupied on a year-round basis at the time of contact is uncertain. Ellis (1975), citing the presence of sheep and cattle bones at Sapawe, and a piece of metal from Tsama, believes they were occupied. Schaafsma (1979) feels that the historic artifacts may only represent seasonal use of these sites by Pueblo herdsmen. Three sites in the Chama District contain Tewa Polychrome and were probably occupied historically; these are the site underlying the Abiquiu chapel of Santa Rosa de Lima de Abiquiu, Greenley ruin, and San Gabriel de Yunque (Cordell 1979).

3.1.4 Historic Period

3.1.4.1 Protohistoric Occupation

Despite much research, it is not certain when the first southern Athabaskan peoples entered the Southwest. Dates have been suggested as early as A.D. 1000 (Kluckhohn and Leighton 1962) and as late as A.D. 1525 (Gunnerson 1956). However, it seems probable that by the early sixteenth century, Athabaskan speaking groups that had earlier emigrated southward from points in northern Canada were established on the plains of Texas and New Mexico (Gunnerson 1956, 1969; Gunnerson and Gunnerson 1971; Hester 1962; Vogt 1961).

The first area that the Navajos appear to have settled was along the upper San Juan River and in Largo and Gobernador Canyons (Kelley 1982). Dittert et al. (1961) place the first occupation of the Navajo Reservoir District at 1550, and Keur (1944) dates that of Gobernador Canyon at 1656. Schaafsma (1978) asserts that the presence of Navajos in the Chama River Valley between A.D. 1620 and 1710 indicates that the Navajos were part of the general movement of the Apacheans into the Pueblo area and that they were not a unique wave of Athabaskans that early settled northwestern New Mexico.

Regardless, Navajos shared in the Pueblo Revolt of 1680 (Reeve 1959, Brugge 1968). During the Reconquest, Navajos aided the refugees. More permanent settlement by the refugee population, by this time probably well mixed with the Athabaskan element, seems to have begun between 1710 and 1715 in the canyons tributary to the San Juan. Sites of this period are characterized by pueblitos, small pueblo-style structures of one or more rooms, usually built in defensive locations and with associated hogans, towers, and defensive walls (Carlson 1965). Pottery of this time period includes Dinetah Utility, Gobernador Polychrome, and non-glaze trade polychromes. During this phase, which ends around 1800, there was a shift from forked stick hogans to stone masonry, cribbed log hogans as well as the addition of domesticated livestock such as horses, cattle, and sheep.

There is some indirect evidence to suggest that Navajos occupied the Pajarito Plateau during early historic times. The name "Navajo" may be derived from "Navahu'u", the Tewa name for LA 21427, a pueblo site in the Los Alamos area (Harrington 1916). The Tewa site name was apparently mistakenly applied by the Spanish explorers to the recent Dine' immigrants who were temporarily occupying the area. Regardless, Navajos clearly lived adjacent to the Tewa villages of Santa Clara, Tesuque, Pojoaque, San Juan, Cochiti and San Ildefonso Pueblos, and are described as living in *rancherias* and practicing agriculture (with large planted fields) as well as animal husbandry (cf. Hodge et al.1945, Ayer 1916). Further, Redondo Peak is one of the sacred eastern mountains, and Navajos are known to have made pilgrimages to its top (Baker and Winter 1981). It is probable that the Navajos also utilized the lithic resources available at Polvadera and Pedernal Peaks throughout the seventeenth and eighteenth centuries. The survey of Abiquiu Reservoir by the SAR recorded 33 sites believed to be historic Navajo settlements ranging from habitation sites to lithic and ceramic scatters located on the second or third benches of the Chama. These Piedra Lumbre sites may also be attributed to the Tewa, Hispanics, or other groups (Bertram et al. 1987, Kemrer 1987).

A recent paper by Carrillo (1988 personal communication) suggests that the stone masonry circular to subrectangular Piedra Lumbre structures reflect a pastoralist adaptation as opposed to a cultural indicator of Navajo occupation as suggested by Schaafsma (1976). Carrillo cites documentary evidence supporting a pastoral adaptation on the part of Tewa peoples during a time period prior to the wholesale adoption of that subsistence practice on the part of the Navajo. This argument has enormous potential for the reevaluation of assignations of ethnicity in the Abiquiu area and is deserving of further attention and evaluation.

Navajo settlements may have extended south of Abiquiu into the lower Rio Chama Valley during the seventeenth century. However, no indisputably Navajo sites have been documented there, and documentary data are sparse on the lower Rio Chama Valley from the abandonment of San Gabriel in 1610 to the Spanish reconquest in 1692. By the beginning of the eighteenth century, when Spanish settlement extended into the Chama, it is apparent that Navajos were being pushed westward by a combination of Spanish pressure from the south and Ute pressure from the north and east (Anschuetz et al. 1985). Conflict between Spanish and Navajos was acute throughout the late eighteenth century. Constant Navajo raiding of *rancherias* and their depredations of Spanish sheep flocks resulted in the fortification of Spanish homesteads with stockades and *torreones*.

Lodge sites are numerous in the Chama area and are generally ascribed to the Navajo or Ute. Hibben (1937) describes the lodges as built of posts and split beams set vertically on end and joining at a central apex, with the bases of the posts supported by boulders and sandstone slabs (Cordell 1979).

Another group that visited the valley was the Guaguatu or Capote Utes, mentioned by the Jemez Pueblos in a Spanish account dating to 1626 (Schroeder 1965:54). The Utes used the reservoir longer than any other aboriginal group, from the early seventeenth to late nineteenth centuries (Wozniak 1987). The Utes visited Jemez before Spanish colonization, and, on departing, "they traveled northwest by the way of the Chama River in order to return to their homes beyond the Navajo Indians" (Schroeder 1965:54). These Utes were said to live in thatch-covered huts (Schroeder 1965:54). Utes brought juvenile captives, deer and bufalo meat, and hides to Abiquiu to trade for knives, maize, and wheat flour (Schaafsma 1978:22). The Capote Utes were reported as raiding in the Abiquiu area by 1747 (Schroeder 1965:59), leading to abandonment of Abiquiu in 1748 and Ute movement from the northwest through the abandoned settlements on the lower Chama River. By 1754, peace with the Utes to the northwest was achieved and Abiquiu resettled (Schroeder 1965:59). Beginning about 1810, the Capote band spent part of the year in the Chama River Valley. In 1844, the Utes had a large camp beside the river near the mouth of Canones Creek. After the Capote Utes signed a treaty with the United States, an agency was established at Abiquiu in 1852. The Capote Utes were moved to southern Colorado in 1878. In 1853, a band of Jicarillas was settled on the Rio Puerco headwaters and assigned to the Abiquiu agency. The Cimarron agency Jicarillas were moved to Abiquiu in 1878, both bands moved to Dulce in 1881, and the Abiquiu agency was closed (Schaafsma 1978:23).

Archival evidence suggests that, besides the Utes and Apaches, Navajos and Tewas visited the reservoir area for trading and raiding purposes from the seventeenth to late nineteenth centuries. The Jicarilla Apaches are only recorded west of the Rio Grande at only two times, 1694 and 1818, before the American Period; they settled in the Rio Chama area after 1846. The Comanches were infrequent but memorable raiders of the Chama Valley for a few years in the mid-eighteenth century. From 1598 to 1760, documents (Wozniak 1987) show that the Navajos are only mentioned in the Piedra Lumbre Valley in association with raids on Spanish and Pueblo settlements, particularly during the 1704-1713 period. Tewa occupation of the Chama Valley lasted until the early seventeenth century, with continued use of the reservoir area in the 1620s to obtain piedra lumbre (alum) for dying cloth and Pedernal chert for stone tools. Tewa traders moved through the valley to reach Ute territory. Tewas may well have herded sheep in the area, producing the Piedra Lumbre structures (Wozniak 1987).

Hispanic expansion into the area occurred during the first half of the eighteenth century. Sheep camps in the reservoir area during the nineteenth century are described as canvas tents apparently held down by stones and pegs forming a circular structure; most cooking was done outside (Carrillo 1987b).

Thus, at least seven ethnic groups are documented in the Chama Valley at least sporadically from the time of Spanish contact to the late nineteenth century. Of these, the Comanches are not likely to have left structural evidence, and the Tewas are not believed to have used tents or cobbles (although they may have built brush structures with stone supports at the base). The Navajos are reported to have raided in the valley, but there is little evidence of settlement (but see Schaafsma 1975). The most likely candidates for production of the cobble ring remains are the Apaches (supported by comparative information for an 1800s date), the Utes (supported by archival evidence that they used the Chama Valley extensively from the early 1600s to the late 1800s), or Hispanics/Genizaros (extensive use of the valley beginning in the mid-1700s).

3.1.4.2 Hispanic Occupation

Following the Spanish reconquest of New Mexico in 1692-1696, the northernmost frontier of Mexico was permitted to redevelop (Snow 1979). The seventeenth and eighteenth centuries saw a rapid increase in the number of Spaniards who wanted to settle in the colony; however, it does not appear that Spanish immigrants successfully settled the Chama River Valley past the present dam area until about 1806. The Spanish, Utes, and Jicarillas all occupied the valley from 1806 to 1881. In the late 1870s, the village of Tierra Amarilla assumed the role of administrative and commercial center of the Rio Chama region. For centuries, the Chama Valley has been the natural land route for trade and transportation between the valley of the Rio Grande and the San Juan Valley to the north. After the 1970s, the Chama ceased to be a major artery of traffic and trade, which may explain why the Chama Basin today remains an enclave of traditional Hispanic culture in northern New Mexico (Schroeder 1953, Anschuetz et al. 1985).

Within the Abiquiu Reservoir District, Schaafsma (1976) investigated 14 Spanish sites, including five Territorial Period homesteads in the Puerco Valley. The typical homestead has a two or three-room house, corrals, and outbuildings perhaps including subterranean facilities and outdoor ovens. Artifacts are glass, china, crockery, metal, Tewa black or red pottery, and micaceous pottery, indicating occupation in the late nineteenth and early twentieth centuries (Schaafsma 1978:24).

Ceramics from the Colonial Phase sites consist of ollas, bowls, and jars from the Rio Grande pottery centers as well as from the Zia area. The question of an indigenous Spanish pottery tradition is somewhat problematic. It has been suggested that Mexican Indians brought in by the Spanish immigrants may have produced pottery using identifiable Mesoamerican techniques (Hurt and Dick 1946, Riley 1974). Many vessel forms from Historic Period ceramics, such as hemispherical bowls, ring-bases, and soup-plate forms, appear to reflect Spanish design influence. In fact, Carrillo (1987a) asserts that much of the pottery attributed to Rio Grande Pueblos in the Abiquiu area may in fact be locally manufactured by Hispanics as late as the 1940s.

3.2 METHODOLOGICAL AND THEORETICAL RESEARCH ISSUES AND COBBLE RING SITES

This section introduces four research issues. The issues are presented within a comparative framework of previous studies of cobble ring sites. The last section presents formal expectations for evaluating feature function and site structure on cobble ring sites and for interpreting site characteristics in terms of settlement and subsistence.

Theoretical research issues to be addressed are chronology, subsistence-settlement systems, and site structure and function. Methodological research issues to be addressed include structural and nonstructural feature function and interpretive implications based on ethnographic analogy.

Work at the three sites focused on four research issues 1) Chronology was a major issue, since tipi rings elsewhere in the West have been dated to prehistoric as well as historic and protohistoric periods; Mariah's work was aimed at dating the cobble rings on these sites to determine when these structures might *have been* used. 2) A second research issue was methodological and involved assessing the goodness of fit of these structures with tipi rings known ethnographically and archaeologically; it was not assumed that the structures were tipi rings. 3) A third issue was site structure and function. Previous work at the reservoir had indicated that site reoccupation was extremely common and site structure was likely to be complex. 4) Site and feature function relate to activities that may have taken place on these sites. 5) Finally, subsistence-settlement issues related to site structure and the role of these sites in adaptive strategies were an important consideration.

3.2.1 Chronology

The first theoretical research issue involves chronology. Chronometric samples obtained from the three Abiquiu sites facilitate placement of the sites into prehistoric and historical chronological classifications and allow comparisons with site types of similar age. Chronology establishes the contemporaneity of sites or components required to permit construction of both settlement and subsistence models for particular time periods and for identifying change. Refinement of the temporal placement of these sites can be accomplished through analysis of chronometric dates, artifact cross-dating, and ethnographic/archival research. In this study, particular emphasis has been placed on obsidian sourcing and hydration. Other chronometric dating methods employed during the study are radiocarbon assay and archaeomagnetic dating. The chronometric dates have suggested that, contrary to expectations, all of the obsidian hydration and C-14 sample proveniences date to the prehistoric rather than historic period. Only the archaeomagnetic date, two beads, a knife blade, and a possible protohistoric projectile point confirmed pre-1900s historic occupation at the two larger sites. Artifact cross-dating was employed to date the fairly large number of points found on these sites (all but one recovered from the surface), and the several ceramic sherds, knife, and glass beads. The utility of ethnographic analogy largely depends on when the sites were occupied, assuming that adaptational differences are greater the farther the sites are removed from the documented historic period.

Prehistoric dates at cobble ring sites are commonly reported. For example, excavations at LA 48826, Devoy's Cobble Ring Site in Upper Long Canyon, near the Dry Cimarron River in northeastern New Mexico, produced a date of A.D. 1070±60. This date places the site in the Apishapa Focus of the Panhandle Aspect. In the Dry Cimarron area, the earliest cobble ring sites date to the same time as the latest Apishapa Focus sites (the later portion of the period A.D. 1000-1350) (Winter 1988).

On the northern plains, cobble rings have been dated to prehistoric periods. Work at the Hermosa cobble ring site in South Dakota typed the three points inside Stone Circle 7 as Yonkee points of the McKean Complex (dated 3,050-1,200 B.C.) and Pelican Lake points of the early Late Plains Archaic (dated beginning 1,160 B.C.) (Hovde 1983:32). Frison (1978) dates stone circles on the northwestern plains to the Middle and Late Plains Archaic and the Late Prehistoric Periods. Of 42 dated sites in the northern U.S. and southern Canadian plains reviewed by Quigg and Brumley (1984:75), 31 were dated, most commonly by cross-dated artifacts. Dates in Alberta range from 1940 B.C. to A.D. 1740.

A study of northeastern Colorado cobble rings (Morris et al. 1983) reported rings dating between A.D. 1 and 1875, based on radiocarbon dates on hearth charcoal from ring floors and association with side-notched points and plain ceramics, although some rings are possibly older. Brumley (1983) reported 4,000-5,000-year-old cobble ring sites. Kehoe (1983) doubts most of these earlier dates. A study of rings at the Johnson Bison Kill Site in north central Montana recovered 30 points dating from different time periods; two-thirds of the points were found outside of ring features even though only 40% of the excavated area was outside of features (Deaver 1983), suggesting that temporally diagnostic artifacts may be more often found outside rings than inside.

Work by Bertram (1987) on sites on the left bank (east side) of the Rio Chama at Abiquiu Reservoir used dated obsidian points to examine trends in Abiquiu point styles. He suggests that, beginning about 200 B.C., corner-notched dart points occurred in small (<10 mm haft width) and large (>10 mm haft width) sizes, while during the Developmental Period (A.D. 600-1200) or later corner-notched points occurred in three forms, arrow points (approximately <8 mm), medium dart points (approximately 8-15 mm), and very large points (approximately >15 mm). Side-notched points, on the other hand, gradually decreased in size until, around A.D. 900, most side-notched points were of arrow point size. Stemmed points and Osharan point types remain similar in size and form from the Archaic through Developmental Period, a use-life much longer than expected from Late Archaic cross dates. It may be that high elevation occupants routinely used point forms of a large and discontinuous range of types differing in style and size. These differences may be due to increasingly specialized tool kits used in logistical hunting during the Developmental Period. In contrast to a more mobile Archaic adaptation using compromise technology designed to maximize encounter hunting success, the Developmental Period hunters were faced with probable scheduling conflicts arising from agricultural investment, reduction in local game, and sedentism. The Developmental Period hunters would perhaps have had to travel to unoccupied country and may have had specific targets in mind, such as migrating elk, yarding deer, or rutting mountain sheep; specialized points may have been used for each target type (Bertram 1987). The preceding model covers the period for which dates were obtained from the three cobble rings, and while it does not specifically include late prehistoric (post-A.D. 1400) sites, presumably the constraints would be even greater for this post-Developmental Period than for the Developmental. Bertram's (1987) model and the utility of cross dates are evaluated in Section 6.2.4.

3.2.2 Goodness of Fit with Ethnographic Analogy

A second research objective concerns methodological issues. This research issue has been substituted for the archival and ethnographic study suggested by the scope-of-work. After talking with Charles Carrillo and Frank Wozniak, both of whom have done extensive archival and oral history research in the Abiquiu area, it was determined that with the exception of Spanish and Mexican archival material, there is little potential for further archival research on the area. Presently there are no Utes or Apaches residing in the Abiquiu area, and previous interviews with local Abiquiu area Hispanic residents did not yield productive information regarding "Indian sites" (Carrillo 1987b), nor was oral history research productive. What appeared to be most useful was the ethnological/archaeological approach employed herein which consolidates information about tipi/wickiup camps and resulting archaeological remains such as fire-cracked rock and cobble rings. The utility of combining archival and ethnographic literature is to address the issues of ethnicity and settlement-subsistence system of the site occupants, and, more importantly, to provide potential ethnographic analogies for the function of structural and nonstructural features identified at the site. Sources used during the study include ethnographies, studies of cobble use, and archaeological reports. Particularly important is L. Davis's ([ed.] 1983) volume on advances in cobble ring investigation and interpretation. A methodological issue addressed during the Abiquiu study is the goodness of fit between stone circles and fire-cracked rock features recorded at the three Abiquiu sites and ethnographically and historically documented tipi villages and stone boiling features and hearths. Reliability of ethnographic analogy to these kinds of features at Abiquiu Reservoir is assessed. Based on work on the Blackfeet Reservation in Montana, Kehoe (1960:463) defined tipi rings as approximately regular stone circles, about 7-30 feet (2.1-9.1 m) in diameter, "averaging about 16 feet (4.9 m), the boulders of the circle being of a size and weight suitable for securing a lodge cover. Rock-lined hearths may be present, but more commonly are not", based on surface examination only.

Quigg and Brumley (1984:5) take the position that the "vast majority of stone circles fall into the category of tipi rings, that is, stone features constructed to hold down lodge covers". Stones were only one of four methods used to secure tipi bases. Pieces of wood, sod, and wooden pegs were also used, wooden pegs being particularly prevalent after the availability of axes (Quigg and Brumley 1984:32). They recommend definitions of tipi rings by Kehoe (1960, above) and Finnegan (1981). Finnegan (1981:4) defines a tipi ring as a stone circle with: a shape not deviating significantly from a circle; no interior stone features rendering the interior uninhabitable unless they are clearly postdepositional; an interior diameter of 2.5-9 m; a ground slope less than or equal to 5^{o}; and a dry and stable ground surface. These definitions will be compared with the Abiquiu cobble ring data.

Do some of the cobble ring clusters at Abiquiu represent tipi rings? This question will be examined in the context of at least three of the research issues: ethnographic analysis, site structure and function, and subsistence and settlement. Morris et al. (1983) provide comparative data on 32 stone ring sites in the Livermore, Keota, and Ft. Morgan areas of Colorado and the Point of Rocks area of western Nebraska. Ring diameters usually range from 2.5 to 5 m. Of the 32 sites, most rings are slightly disturbed, most rings are not quite round, and all sites but three have rings ranging from 2 to 7 m in diameter. Fourteen of 34 sites have rings ranging from 3 to 6 m in diameter. Rings at the T-W-Diamond site in Colorado are consistent in size (4.5-6.4 m diameter), and seven of 17 tested rings contained central hearths (Morris et al. 1983).

Work at the Copper Mountain area of Wyoming (W. Davis 1983) investigated 113 stone circles on five sites. Most common were double course rings. Based on historic accounts, the number of stones utilized would depend on availability and tipi size and would range from 20 to 60 stones. The most reliable tipi rings are those with double course elliptical outlines, containing stones of a relatively constant number, size, and weight.

Quigg and Brumley (1984:30) summarize, on the basis of excellent bibliographic research, ethnographic reasons for variation in circle size and site structure. Stone circle size may vary according to available transport mechanisms, strategies used in constructing the tipi, sectioning of the tipi cover, number of inhabitants, wealth and social status of the inhabitants, and tipi function. Variability in stone circle shape and stone distributions may relate to type of doorway, direction of prevailing winds, and weather conditions. Ethnographic data indicate that low stone density or gaps in the ring may reflect the raising of the tipi cover for ventilation in warm weather, doorway presence, or direction of prevailing winds.

Quigg and Brumley (1984) make useful recommendations for standardizing data collection on ring sites, including interior diameter, shape, stone number and spacing, and depth of stones. W. Davis (1983) recommends recording the following variables: type of course outline (single, double, or multiple concentric course), shape of outline (either a nominal category or an index obtained by dividing two perpendicular dimensions [L. Davis 1983]), density of stones (may be reported as number of stones per linear meter of circumference), and presence or absence of central stone concentrations (hearths). Cobble ring diameters are an important indicator, first, of goodness of fit with ethnographically recorded cobble sizes; secondly, they may reflect family size, economic status, and mode of transportation (Mobley

1983). For example, Kehoe's (1960) work among the Blackfoot suggested that cobble ring sizes increased with the introduction of the horse, which made transport of large numbers of skins and poles more feasible than when transport was solely dog-based. Variation in size may also relate to availability of suitable lodge poles, season, and age (Wilson 1983). Schneider (1983) found that test units placed in the center of a ring may provide useful data on site culture and age, artifact assemblage, and quantity and density of artifacts.

Cobble ring sites vary considerably in the nature and quantity of remains, with some sites averaging 3,000-4,000 artifacts (Morris et al. 1983). At the Johnson Bison Kill Site, more cultural materials and activity areas were documented between rings than in them. At the Copper Mountain project in north central Wyoming (W. Davis 1983), no features were located either inside or outside stone circles. At these sites, double course rings were common. The best fit between ethnographic analogy and stone circles on the Copper Mountain project was for double course elliptically shaped rings with a relatively constant number, size, and weight of stones (W. Davis 1983).

In terms of nonstructural features, stone boiling was documented ethnographically as a cooking process used for immediate consumption of fresh meat by site occupants. Also important in hunting camps was initial boiling of fresh strips prior to laying them on drying racks for jerking (Brumley 1983).

3.2.3 Site Structure and Function

The third research issue concerns site structure and occupational intensity. This issue can be addressed through analysis of chronometric dates, feature and artifact distribution, feature and artifact density, and the types of features and artifacts present. An exciting aspect of cobble ring sites is their potential to offer single component, fairly short-term encampments, particularly in an area such as Abiquiu where the majority of sites represents multiple occupations, which are difficult to segregate culturally and temporally.

The presence or absence of possibly related features such as central hearths has been used as an indicator of duration of occupation (Brumley 1983, Loendorf and Weston 1983, Wilson 1983). Brumley (1983) found that, in southeastern Alberta, stone circles containing hearths tended to have more items associated, both interior and exterior, indicating a longer-term occupation. The identification of "missing" stones in a ring has been used as evidence of "cannibalization" of older facilities and an indication of reoccupation (Deaver 1983). However, caution is dictated since half circles may be windbreaks or meat drying racks rather than cobble rings (Kehoe 1983).

Site structure is often cited as one of the most important indicators of duration of occupation; variables such as spacing between rings, overlaps in rings, and topographic location may indicate duration and seasonality of occupation (Reher 1983). Quigg and Brumley (1984:31) note that duration of occupation of a tipi camp could vary from one day to several weeks. Availability of fuel, water, game, and pasturage was often critical to length of stay. The type and intensity of activity areas depended on available resources and season. Major activities documented were food processing and preparation, hide working, and tool manufacturing. Greater degrees of site protection from wind and weather may favor longer occupations (Loendorf and Weston 1983). As others (e.g., Kehoe [1960] and Deaver [1983]) have noted, cobble ring sites are often correlated with minimal artifact disposal (<20 artifacts/m^2), which makes it difficult to distinguish occupations because of a lack of distinctive stratigraphy. Frison (1983) notes the difficulty of associating stone circles with stone-filled firepits, such as those found upslope from the cobble rings at LA 25421. It may also be difficult to associate interior materials with cobble rings (L. Davis 1983). Boundaries may be difficult to determine on sites that are shallow and extensive and that contain artifacts from PaleoIndian to late prehistoric or historic periods (Kehoe 1983). Finally, if as some have suggested (Reher 1983), certain locales are increasingly used through time, then the intensity of reoccupation would directly reflect the subsistence system and site functional role of some of these sites.

Site structure may also reflect site function. Data sets relevant to site function are cobble ring size, feature morphology and associated remains, and artifact and feature distributions.

Reher (1983) found that stream terraces near cobble rings in Wyoming were often lined with small fire hearths that showed evidence of large game processing (bone dump remnants). On the Johnson Bison Kill Site, Middle Plains Period points were found on the highest point of the site, a low knoll (Deaver 1983). A possibly comparable situation exists at LA 25419 at Abiquiu Reservoir, where points from many different time periods were located on a long ridge in the north half of the site. Outside activity areas may be 6-7 m from the ring for the Blackfoot or 25 m for the Wyoming sites. Site function is also discussed in the context of subsistence, in Section 3.2.4.

3.2.4 Subsistence and Settlement

The fourth research issue involves subsistence and settlement patterns. Faunal and floral remains (including macrobotanical and pollen) may inform on site use, seasonality, dietary preferences, and the mix of wild and domesticated plant and animal foods in the diet. The data may indirectly inform on procurement strategies.

Unfortunately, small faunal assemblages are fairly common on cobble ring sites, even where bison is the most common species on the northern plains sites. The relative lack of faunal remains has been attributed to a lack of reliance on animals, poor preservation, and processing away from the site (Brumley 1983). Taphonomic study may be impractical at many stone circle/firepit sites because there is so little bone to work with (L. Davis [ed.] 1983).

The number of rings may indicate whether encampments consisted of large hunting bands or family groups (Kehoe 1983). In terms of sites as a whole, the Morris et al. (1983) study of 32 ring sites in Colorado and Nebraska found that 20 sites had 1-6 rings each, nine sites had 9-16 rings each, and three sites had between 47 and 76 rings each. Overlapping rings are very rare in the Colorado and Nebraska sample studied. Most ring sites in the Colorado and Nebraska study have small surface collections that typically lack points, sherds, and other artifacts providing cross dates. Loendorf and Weston (1983) found that 10 of the 13 larger sites in their south central Montana study area are located on good travel routes, including the Bad Pass and Bozeman Trails. In these instances, the large numbers of cobble rings may represent short-term occupations by different groups of people at different times. There is considerable variation in ring sizes, outline, and central stones on these sites.

Reher (1983) has related site structure to expectations of subsistence organization and settlement system based on Wyoming sites. The subsistence categories are aggregated or dispersed specialized big game hunters and aggregated or dispersed generalized hunter-gatherers; these are discussed in more detail in Section 3.3.

3.3 EVALUATION OF ASPECTS OF TIPI RING MODELS

The research issues introduced in the previous section are components of two models relating to tipi camps evaluated here. Chronological results aid in model evaluation by indicating which components or features could be contemporaneous.

3.3.1 Stone Circles as Tipi Rings

First is an evaluation of how well the Abiquiu cobble ring data fit ethnographic, ethnological, and historical data on tipi camps. Issues involved in this model are site structure and function and are summarized under the rubric of goodness of fit with ethnographic analogy. The second model concerns subsistence and settlement and site structure and function and relates big game hunting and generalized hunting and gathering to dispersed or aggregated settlements. While the expectations were developed for Wyoming cobble ring sites, they are relevant for nonagricultural sites in the Rio Chama, with the exception that faunal aggregations probably were never as great as those in bison-inhabited regions of the Great Plains. No predictive models based on elevational, ecotone, or vegetational differences among the three sites were possible in this study because of the sites' proximity and their location in similar topographic, exposure, soil, and vegetational situations.

Comparative bibliographic research has identified the following variables as important in defining stone circles as tipi rings. Size is most often 2.1-9.1 m, averaging 4.9 m for the Blackfoot in Montana (Kehoe 1960); 2.5-9 m on the northern plains, including Canada (Finnegan 1981); and 2-7 m, 3-6 m, and 4.5-6.4 m for various data sets in Colorado and Nebraska (Morris et al. 1983). The expected size for tipi rings should be approximately 2-9 m in diameter (a broad range is given because exterior vs. interior diameter often is not specified). Size can vary according to transport mechanisms, strategy of construction, number of inhabitants, inhabitants status, and tipi function.

Shape tends to be an approximately regular circle (Kehoe 1960), a shape not deviating significantly from a circle (Finnegan 1981), or "not quite round" (Morris et al. 1983). Shape varies according to doorway type and perhaps direction of prevailing winds. Central hearths commonly are absent on the Blackfeet Reservation (Kehoe 1960), and their presence or absence has been used as an indicator of duration of occupation (Brumley 1983) and weather (cold weather, precipitation, or wind, which may or may not be seasonally specific) as well as support for tipi ring function. At least one project in Wyoming has reported a relatively constant stone number, size, and weight (W. Davis 1983) as an important variable in goodness of fit.

Based on this literature review, the following variables will be used in evaluating the Abiquiu cobble rings' goodness of fit with tipi ring data. The longest interior diameter will be used to indicate ring size, a shape index (north-south interior diameter divided by east-west diameter) will be used to quantify shape, and the standard deviation of the mean number of stones per meter will indicate constancy in number of stones per ring. These data are presented and evaluated for the Abiquiu rings in Chapter 7.0.

3.3.2 Stone Circles and Subsistence Settlement Systems

The second model relates site structure, site location, and resource availability to subsistence strategy and settlement pattern (Reher 1983). The subsistence strategy options are either big game hunting or generalized hunting and gathering. Settlement pattern may be either aggregated or dispersed. The models expectations for aggregated specialized big game hunters would be use of local settings in areas of maximum diversity and abundance of edible plants, easy access to surrounding upland grasslands, or areas of regular big game movement or congregation. Sites used by aggregated specialized big game hunters would often be large with many rings, distinct village plans, and regular spacing. Dispersed specialized big game hunter sites occur in exposed upland grasslands and areas with game forage species. Sites are usually moderate in size, although reoccupation can result in large ring counts. Village plans are arcs or linear arrangements, for example, with distinct subclusters, which may be obscured by reoccupations (Reher 1983).

Aggregated generalized hunters-gatherers tend to camp in stream confluences where the shortgrass component is a relatively minor part of the vegetation. Sites are of small to moderate size; larger ring counts only occur with clear evidence of reoccupation, and these may yet be broken down into separate clusters. Village plans are relatively amorphous; some subclusters may be identified, but regular spacing is uncommon. Finally, dispersed generalized hunter-gatherers tend to camp in topographically diverse settings that may include minor "unproductive" settings. Sites are small; ring counts may be affected by reoccupation but do not approach numbers seen at other sites. Village plans are very amorphous, with ring spacing variable (Reher 1983).

Data collected to evaluate this model concern site setting, ring counts and distributions. The three Abiquiu Reservoir cobble ring sites will be compared to these expectations in Chapter 7.0.

4.0 HISTORICAL AND ARCHAEOLOGICAL METHODS

Christopher R. Lintz and W. Nicholas Trierweiler

The procedures for gathering archaeological and historical documentation are discussed in this chapter. Two types of methods were used, archaeological and historical/ethnological. There is actually considerable overlap in the kinds of methods since much of the comparative literature of greatest value referenced ethnographic and ethnological studies but was aimed at an archaeological audience (e.g., the published reports of the 1981 Plains Conference [W. Davis 1983]) and reported archaeological studies of stone circle sites. The archaeological field methods involve general site and specific feature map compilation, surface artifact collections, and feature and extramural excavations. Laboratory methods entail washing and sorting recovered samples, and analyzing and describing artifacts. The historic methods consist of examining published historical, ethnological, and comparative archaeological reports.

4.1 HISTORICAL METHODS

Research on historical, ethnological, and comparative archaeological topics involved only published documents. Important sources were previous studies in Abiquiu Reservoir and other (Northern) Plains-based studies, including Carrillo (1987b), articles in L. Davis ([ed.] 1983), Wozniak (1987), and selected reports on cobble ring sites from southeastern Colorado, eastern Wyoming, and other Plains areas. Data gathered were of three kinds--historical data both for the Abiquiu area and for documented groups (such as the Utes) in other portions of their range; ethnological data on various Plains groups living in tipis or wickiups and cooking using stone boiling techniques; and archaeological data on a wide variety of stone circle sites with varying number of rings, size of assemblage, and topographic setting. Relevant comparative data are combined to determine how closely the Abiquiu cobble ring site data fit various examples and models of reasonably mobile camps. Goodness of fit is examined in Chapter 7.0, which presents the results of the feature analysis.

4.2 ARCHAEOLOGICAL METHODS

4.2.1 Mapping

Mapping was directed at the important objective of obtaining information on size, shape, and stone density of the structural and nonstructural features *and* on recording their spatial relationships and associations with temporally diagnostic artifacts. The mapping effort was conducted on two levels for the production of general site maps and/or specific feature plan maps. The general site maps provide details of surface topography and show the distribution and spatial relationships of features and temporally diagnostic artifacts, collection areas, and locations of permanent and temporary data points across the site landscape. These data are critical for interpreting community patterning and provide the basis for distribution studies of features, artifacts, and samples which underlie all research issues. The topographic maps were prepared from information collected using an Ushikata transit and stadia rod. Because of optical limitations of the transit and dense vegetation along terrace margins, secondary data points and/or mapping stations were required to cover all sites.

At LA 25421, a series of six data points (and rest of page) was aligned northwest to southeast at 20-m intervals and assigned alphabetic designations. Since the permanent datum reportedly established during earlier surveys was not found, Mariah established a metal rebar marked with the site number at Datum D as the permanent site reference. A second alignment of three subdatums was placed from 40 to 80 m southeast of the permanent datum to facilitate collecting and mapping efforts on the terrace end.

Baselines were not used at LA 25417 or LA 25419. Instead, wooden stakes served at temporary subdatums which were established at all recognizable features/lithic concentrations. Topographic and feature distribution areas were plotted from four mapping stations located on various terrace segments at each of these two sites. The feature subdatums further served as reference points to record and collect surface artifacts.

Concentrations of fire-cracked rock and circular to semicircular alignments of oversized cobbles were recorded as archaeological features; many were surficially exposed on all three sites. Because of the limited time allocation for field work, we focused field efforts on features. At each site, spatially discrete fire-cracked rock clusters and cobble ring alignments were assigned sequential feature designations F-1 through N. At LA 25417, subsurface hearth features inside cobble ring Feature 1 were designated as Hearths 1A and 1B. A scaled plan map and photograph were provided for all surficially recognizable features; subsurface excavations were also conducted on as many features as practical under the field work time and budgetary constraints.

Plan maps were made of every recognized feature on all three sites. Features were defined as structural or spatial material clusters with homogeneity of material (cobbles, fire-cracked rock, chipped stone material and artifact type) in a limited area indicating a particular past behavior, such as cobble ring construction, stone-boiling, hearth preparation and use, or reduction of a core. Lithic concentrations lacking material type homogeneity were not treated as features because of the greater likelihood that they accumulated as a result of numerous reduction events in the same general area. Specific feature maps were used to gather information about the size, shape, density, and distribution of artifacts and fire-cracked rock or cobble ring construction details. Maps of individual features provided information to address research issues about feature variability, and details to infer contemporaneity, seasonality, and function. Scaled maps of surface feature indications were measured with the aid of a rope marked in 1-m intervals and laid over the features in a "grid" oriented to true north. The distribution of fire-cracked rock and cobble ring elements was measured from the meter mark reference points on the rope and plotted to scale on metric graph paper. All feature maps show the location of feature-specific subdatums (usually incorporated in the rope grid), the locations of nearby artifacts, and placement of any test units.

4.2.2 Surface Collections

Surface collection provided the necessary information on artifact type, artifact distribution, and artifact density near stone circles and in lithic reduction areas. Four means of surface collection were employed. 1) Low density temporally diagnostic artifacts (such as points, drills, metal, ceramics) were point-provenienced and collected from the entire site area. 2) For stone circle exteriors with moderate artifact density, items were point-provenienced from within a 10-m radius of the center point of the stone circle. 3) In areas of high lithic density and apparent integrity, based on similarity of material type, 4 x 4 m collection units were placed and collected by square meter units. 4) Finally, two of these lithic reduction areas on ridge slopes were collected by large (12 x 13 m and 7 x 5 m) units designed to collect much of the scatter. The collected surface artifacts were used to examine research design issues involving site chronology, feature function, ethnicity, occupation intensity, and intrasite activities. Field data were not recorded in those areas not collected.

Unique field specimen (FS) numbers were assigned to every surficial provenience unit (usually single artifacts) in order to inventory and track surface artifacts. All surficially collected materials were placed in resealable plastic envelopes and marked in a format specified by the curation repository with the project name, site number, appropriate provenience information, date, and FS number.

The first surface collection method entailed point-plotted artifact proveniencing from low density and broad site areas. This method was used particularly for temporally diagnostic artifacts. Artifacts were located during formal and informal surface reconnaissance and marked with pin-flags. Information was then obtained on the distance and bearing from temporary data points and mapping substations using Brunton compasses and 30- and 50-m tapes.

The second method was used to record/collect artifacts associated with specific features at LA 25417 and LA 25419. Individual feature data points were used as central points for measuring approximately 10-m radius circles around a feature. All surface artifacts within the approximately 20-m diameter circle were pin-flagged, and either the materials were counted and left in the field, or the distance/bearing from the central feature datum was used to point-plot the items as they were collected. At LA 25417, this method was used to collect artifacts associated with Features 2, 3/4, 6/7, and 8. The method was used to collect artifacts at Features 3 and 5 and field inventory artifacts at Features 1, 2, 4, 6, 7, 15, 16, 17, and 18 at LA 25419.

The third method was used at high density lithic reduction areas at sites LA 25417 and LA 25419. Once a high density lithic concentration was identified, a subdatum stake was arbitrarily placed which served as the southwest corner of a 4 x 4 m collection unit oriented to true north. From south to north, the grid axis was assigned alphabetic designations A through D, and from west to east, it was given numerical designations 1-4. Each of the 16 one-meter units was examined for artifacts, and all materials were bagged together and labeled with the unique alpha-numeric unit designation.

Two such collection units were used at distinct lithic concentrations at the middle terrace portion of LA 25417, and similar collection units were placed near cobble ring Features 1, 15, and 18 at LA 25419 to sample artifacts at the southeast and northwest parts of the site. It is interesting to note that initial surface reconnaissance (method 2 above), conducted at Lithic Concentration 1 at LA 25419 pin-flagged 14 artifacts during the general reconnaissance and prior to establishing the 4 x 4 m grid; yet 47 artifacts were ultimately collected. This 3.35:1 ratio provides a general comparative measure of the amount of artifacts potentially missed using the reconnaissance and pin-flagging methods of locating and collecting artifacts.

The fourth surface collection method was used on only two single episodic lithic reduction areas (Features 10 and 11) on steeply sloping terrain at the south edge of LA 25419. Both areas were believed to have experienced extensive slope washing and material displacement. The precise plotting of artifacts seemed less important than obtaining potential data on downslope movement of artifacts. Consequently, block areas measuring 12 x 13 m and 7 x 5 m for Features 10 and 11, respectively, were set over the lithic scatters parallel to the slope axis. All materials from a 1-m wide swath oriented perpendicular to the slope were collected.

4.2.3 Testing

Test excavations were conducted at all three sites to examine feature stratigraphy, to ascertain subsurface preservation conditions, to obtain datable materials (carbon, subsurface obsidian, and in situ baked clay), and to collect macro- and microbotanical remains for interpreting subsistence activities. Both hand-augering and test unit excavations were used as appropriate.

Excavation involved two levels of intensity. First, auger holes were placed in both nonstructural and structural features to test for presence of charcoal and other artifactual material, so that test units were placed on features suitable for obtaining chronometric samples. Not every feature was augered before placement of a test unit. The more intense level of excavation involved 1-m^2 test units. These were placed on both structural and nonstructural features. The units were most often placed in the center of stone circles for several reasons. First, this placement allowed a quick assessment of stratigraphy, including any evidence of a prepared floor surface; this evidence was particularly important for stone circles that were not well defined and where classification as cobble rings was especially open to question. Second, placement in the center of cobble rings allowed determination of the presence or absence of a central hearth, which is important to assess seasonality and duration of occupation and also may produce chronometric samples. Finally, Schneider (1983) suggests that interior excavations produce information on site culture and age, artifact assemblage, and quantity and density of artifacts.

A five-inch diameter hand auger was used to quickly check subsurface stratigraphy and to ascertain the presence of burned matrix at hearth features. Fill from the holes was screened through 1/4-inch hardware cloth to check for artifacts (none were recovered from this method), and the depths of soil color/texture boundaries were recorded as the holes were excavated. From one to seven auger holes were aligned at 50-cm intervals at two axes on hearth Features 4, 5, 6, 7, 9, and 10 at LA 25421; a single auger hole was also dug inside cobble ring Feature 3 at the same site to check subsurface stratigraphy prior to digging the test pit. At LA 25417, augering was conducted at cobble ring Features 6, 7, 8, and 12 and fire-cracked rock Features 9 and 11. Augering was used at LA 25419 only to examine hearth Features 12, 13, 21, 22, and 23; no cobble ring features at this latter site were augered. All auger holes were backfilled.

Controlled test excavations typically used 1-m^2 units at all three sites to expose hearth features and to sample the interior portions of cobble ring features. Variations on the test unit size include a 50-cm^2 pit (Test Unit 7) excavated in Lithic Concentration 2 at LA 25417 to obtain subsurface obsidian for dating, and the alignment of two and a half excavation units inside cobble ring Feature 1, LA 25417, in order to expose a series of interior hearth features. The main objectives were to record stratigraphy, obtain a subsurface sample of associated artifacts, and collect datable samples and flotation samples. Since testing was biased toward sample recovery from features, the number of test units per site depended on the feature population at each site and the variability in type and depositional integrity in that population. Attempts were made to test different cobble ring and thermal feature types and to obtain comparative information from each site.

Test units were oriented to true north and excavated to sterile soil in 10 cm arbitrary horizontal intervals unless discernible stratigraphic units could be observed and followed. All fill was excavated by hand tools (shovels, trowels, etc.) and passed through 1/4-inch mesh screen (in the future it is recommended that the excavated soil be periodically screened through finer mesh to maximize recovery of artifacts such as seed beads or small mammal mandibles). Two liter samples of soil were collected from recognizable feature matrix for flotation recovery of macrobotanical remains. Different kinds of materials (i.e. lithics, faunal remains, charcoal, soil samples, etc.) from a single provenience unit (point-plotted or general fill from a level) within a test unit were assigned separate FS numbers for tracking artifacts and samples. FS numbers from each test unit started with 1. A stratigraphic profile was drawn of one wall of every test unit before it was backfilled.

Single test units were excavated inside cobble ring Features 1 and 3 and over hearth Features 2 and 8 at LA 25421. Besides the the small test unit in Lithic Concentration 2 and the 2.5-m trench excavated inside cobble ring Feature 1, test units were dug inside cobble ring Features 2 and 3 and over hearth Features 4 and 5 at LA 25417. At LA 25419 test units were dug inside cobble ring Features 2, 3, 6, and 18 and hearth Features 9 and 22; an additional unit was dug in a lithic concentration area near cobble ring Feature 1 to obtain datable obsidian.

4.2.4 Artifact Analytical Techniques

All artifactual materials returned from the field were sorted by material type in preparation for submittal to analytical organizations or individuals. The archaeomagnetic, carbon, pollen, and flotation soil samples were sent to specialists. The lithic, ceramic, and historic artifacts were analyzed by archaeologists at Mariah with the occasional consultation of other archaeologists with specialized expertise.

Prior to analysis, all artifacts were processed by washing, and provenience units were placed in labeled, self-sealing plastic bags. Fragile and very small artifacts were placed in labeled plastic vials. Subsequent to analysis, the labeled bags of artifacts were inventoried and placed in labeled cartons, preparatory to curation at an approved facility or for return to the landowner.

Chipped stone attributes recorded fall into the general categories of artifact type, material type, portion, cortex category, platform, retouch, wear, and recycling. The classification is aimed at 1) recording only attributes necessitated by the research design while at the same time 2) providing necessary comparative information. The primary artifact type categories of core, debitage, tool, and ground stone are considered mutually exclusive and include such artifacts as core and biface flakes, tested and retouched cobbles, single and multiple platform cores, thick (core-like) and thin bifaces, and angular debris, as well as formal tools. The categories provide information on functional distinctions and on stage in a lithic reduction sequence. Material types are divided into basic categories with some color distinctions, although the extreme variability in color and texture in local outcrops of Pedernal chert, obsidian, and other common local sources made the color distinctions only generally meaningful. The portion category allows a distinction among finished tools, tools broken in use, and unmodified lithic reduction debitage and flags artifact fragments that could not be identified definitely. The cortex categories (0%, 1-33%, 34-66%, 67-99%, 100%) allow a determination of lithic reduction stage. The platform information allows an assessment of reduction technology, such as whether bipolar technique was significant. Retouch categories suggest, for example, how often debitage was used as a tool. The wear category again suggests use of informal tools and "secondary" uses on formal tools (e.g., a core used as a hammerstone). The recycling category relates to resharpening of tools. Heat treatment of chipped stone types was recorded as indicating potential lithic material alteration strategies.

When combined with a spatial analysis taking into account obsidian, C-14, and artifact dates, the above attributes may allow distinction between lithic technologies or placement in a reduction sequence dating to different time periods. Cobble ring-related artifacts may differ from those occurring in distinct concentrations or associated with fire-cracked rock. The functionally related lithic categories may inform on tasks performed on the site. Finally, tools such as point types may reflect occupants' ethnicity. Thus, the attributes focused on in this study can be directly related back to the research design presented above.

All artifacts were individually examined and recorded. Since over 98% of the artifacts collected were either lithic or ground stone, the recorded artifact attributes focused on the lithic assemblage. Ten separate attributes were recorded for each artifact. These were: provenience, artifact type, material type, heat treatment, portion, cortex, platform, retouch, wear, and recycling. Appendix G discusses each of the 10 observed attributes and defines all alternative attribute states. In addition, two analytical attributes, average remaining cortex and reduction ratios, are discussed. For non-lithic artifacts, several of these attributes were necessarily recorded as "not applicable". In addition to basic attribute recording, selected individual artifacts (eg., obsidian, projectile points, ceramics) were selected for more detailed description and/or analysis (see Sections 6.2.4, and 6.2).

The analytical approach necessitated by the research design is aimed at facilitating spatial and chronological analyses. Because artifacts were predominantly lithic, the analysis focuses on this artifact class.

Lithic attribute recording sheets were designed to facilitate entry in Lotus 1-2-3 and manipulation in SYSTAT. In addition to site number, surface collection unit, or test unit, all artifacts either are located by 1-m grid (for 4 x 4 m units or test units) or are point-provenienced from a central feature or other subdatum in degrees (0-359) and distance (cm) (except for the lithic reduction area on a steep slope, Feature 10, which is provenienced by distance downhill in meters, varying from 0 to 12 m). For excavated artifacts, depth below datum is given. These data were converted using a digitizer to provide x and y coordinates for each feature and other datum. This conversion allows nearest neighbor analyses on feature distribution. Distance and bearing from each collected cobble ring feature are retained in order to investigate artifact distribution around the features but were also converted using trigonometric formulae to the x,y system to allow for cluster analysis on artifact distributions.

Recorded data were entered into an IBM-PC (MS-DOS) compatible data base which was then used to generate descriptive and summary statistics for each site and site area. Data were entered in Lotus 1-2-3 and manipulated in Systat.

Differences between Abiquiu cobble ring artifact and feature patterns (site plan, ring size and shape, and association of artifacts and features with cobble rings) can be addressed in terms of differing subsistence patterns, site functions, etc. Because artifact densities are relatively low but continuous in distribution, the Abiquiu sites offer good potential for sorting out the reoccupations and addressing such questions as seasonality of use, size of camps, and site function in a settlement-subsistence system. Site structure may be indicated by examining number of rings, ring spacing, and topographic setting. Comparisons with Reher's (1983) model of specialized vs. generalized hunters in aggregated vs. dispersed modes may allow placement of the sites into a similar system. Comparison with Bertram's (1987) obsidian points from other Abiquiu sites will address the question of specialized hunting tool kits. In addition, Pearson's r correlation matrices were calculated for the 10 observed variables. K-means cluster analysis was performed on cobble ring attributes from LA 25417 and LA 25419 and on distance among rings. The feature analysis examines goodness of fit between ethnographic data on cobble rings and heating features and the Abiquiu features. Chapter 7.0 provides details on methodology.

5.0 SITE DESCRIPTIONS

Christopher R. Lintz

This chapter provides basic descriptions of the three sites examined along the west side of the Chama River in the upper reaches of Abiquiu Reservoir during the fall of 1987. Site descriptions are presented from north to south for LA 25421, LA 25417, and LA 25419. For each site, discussions focus on the location/site setting, a synopsis of previous archaeological investigations, definition of site boundary and site area, and description of all structural and non-structural features, which includes descriptions of subsurface testing conducted at select features. Reported dimensions for structural features refer to inside diameters. Although test excavations were conducted inside several cobble rings at each site, no prepared floors or discrete living surfaces were discerned at any of the structures. Cobble rings occurring near exposed Pleistocene cobble terraces were distinguished from the natural surface on the basis of similarity of cobble size, completeness of ring, and artifact and feature plans so that the reader can evaluate the ring definition. Vandalism is not thought to have produced noticeable impacts on features except in the case of Feature 12 on LA 25417 and Features 8 and 44 on LA 25419. Erosion appears to have affected many features, particularly fire-cracked rock features, the elements of which are smaller and more easily disturbed by colluvial erosion and deflation than cobble rings. Thus, many of the fire-cracked rock scatters may have possessed greater spatial integrity before the forces of erosion acted upon them. Finally, the results of specialized micro- and macrobotanical analyses, and dates from archaeomagnetic, obsidian hydration and radiocarbon samples are discussed. Descriptions and analyses of artifacts from these sites are presented in Chapter 6.0.

5.1 LA 25421

5.1.1 Topographic Setting

This is the northernmost of the three sites examined during the fall of 1987. A sparse amount of artifacts and features was observed covering the top of a narrow terrace remnant defined by 25-m tall, steep terrace escarpments of the Chama River to the east and an unnamed arroyo to the south and west. Large to small cobbles cover the escarpment slopes, but the terrace top is mantled by fine sandy loam. A low natural hillock is present at the tip of the terrace, and a low swale separates this part of the site from a slightly taller hill towards the northwest.

5.1.2 Previous Work

Records indicate that the site was first visited in May 1975, by SAR crews for the Phase III Abiquiu Reservoir survey before reservoir construction and subsequently revisited by archaeologists from Nickens and Associates Inc. (NAI), in April 1982, for further recording (Schaafsma 1976, Reed et al. 1982). The SAR site forms record the site as AR-163 on the southernmost point of a terrace top setting. It is distinguished by two cobble rings (one of which is ill-defined) and "a great deal of fire-cracked rock to the west (SAR site form for AR-163, 1975)"., No site dimensions are provided, but the total area reportedly covers 5,000 m^2 The form variously claims that the site is a single component Historic Indian (Ute) site, but elsewhere maintains that two areas of fire-cracked rock are at an unspecified distance from the rings and may not be associated. Artifacts are also reported to be absent or very scarce. The site condition is reportedly good, and cultural deposits are unaltered. No site map accompanies the SAR forms, and no dimensions are provided for the features or the distances between features.

The NAI survey crew revisited the site in 1982 to place a site datum, map the site, conduct an artifact density study, and provide general site description and site integrity evaluation (Reed et al. 1982). The NAI report and records provide further observations about feature sizes and locations, and briefly characterize the artifact assemblage. The NAI site form suggests that the site is 90% intact. Site dimensions are reportedly 30 x 150 m for a total site area of 4,500 m^2. Only one of the two rings was found. It consisted of eight partially subsurface cobbles forming a 2.5-m diameter circle. The two fire-cracked rock concentrations measure one to two meters in diameter, and one contains ashy soil; other fire-cracked rock scatters are noted to the west of the hearths. A fairly clear sketch map portrays general topography and drainages and shows the site datum, the one possible stone ring, two small areas of fire-cracked rock, and the general distribution of artifacts including one biface, one scraper, and 11 flakes. Although correlations are possible for the mapped cobble ring with on-ground features, no such correspondence is possible between the two mapped hearths and great number of thermal features actually found during the 1987 testing phase.

A narrative section of the NAI form indicates that artifacts are sparse and consist of one biface and 13 flakes of cherts, chalcedonies, obsidian, and quartzite. These 14 artifacts which are plotted on the sketch map apparently constitute the basis for determining artifact density. The flakes are predominantly interior, but a few secondary decortication flakes are also recorded. No ground stone was found.

Although the SAR form suggests that the site has no research potential, the NAI form notes that there is some potential for radiocarbon dating the hearth. Livestock is the main factor impacting the site. A total of 2 m^2 of testing was recommended for the ash-bearing hearth, and the entire cobble ring was recommended for excavation. Given the low density of surface materials, no additional analysis of surficial artifacts was recommended (Reed et. al 1982:64).

5.1.3 Definition of Boundaries

A primary task of the 1987 work was to define accurate site boundaries and obtain dimensions of the site. The steep terrace escarpment readily defines the site limits on the northeast, east, south, and southwest. No such prominent topography marks the site boundaries to the northwest. Approximately six transect passes spaced approximately 15 m apart were walked between the known site and the Piedra Lumbre-Forest Service boundary fence line to the northwest. All encountered artifacts and features were systematically pin-flagged. This procedure identified a fairly continuous scatter of artifacts on the top and south slopes of the north site hillock, but few to no artifacts were encountered for a distance of 40 m along the north slope. A separate concentration of approximately 40 lithic flakes and bifaces and six potsherds identified as gray Tewa utility plainware (Charles Carrillo, 1988 personal communication) was found on broken terrain near the Piedra Lumbre fence line, but the unique presence of pottery and the intervening distance between the two lithic scatters suggested that the northern scatter should be a separate site.

Once site boundaries were identified on the basis of artifact and feature distributions, a topographic map of the site was made, from which site dimensions and total site area were calculated. The site is trianguloid, with two sides defined by escarpments. The northwestern site boundary is 200 m from the terrace point, and the width of the terrace at the site margin is 90 m. A compensating polar planimeter was used to calculate the site area of 8,024 m^2.

5.1.4 Surface and Subsurface Features

A total of 10 features, which consisted of two stone rings and eight hearths, was identified at the site. The distribution of features is indicated in Figure 5.1. The structural features are discussed below separately from the nonstructural features. Detailed analysis of associated debitage is discussed in Section 6.1.1. The structural features could be easily correlated with features found by SAR/NAI; however, precise correlation of hearth features was not possible due to the abundance of thermal features encountered on the northern hill slope. Attempts to make accurate correlations with the hearth areas indicated on the NAI map was also hampered by the inability to locate the permanent site datum.

5.1.4.1 Structural Features

Feature 1 is a spaced stone circle in the southern part of the site on the terrace point formed by the juncture of the Chama River and a small, unnamed tributary. This is the same feature indicated on the NAI site sketch map. The terrace edge to both drainages is within 15 m of the stone ring. This part of the site has experienced minimal erosion. The feature measures approximately 2.45 m (north-south) by 3.37 m (east-west) and is defined by nine cobbles ranging from 10 to 25 cm in diameter and spaced from 30 to 225 cm apart (Figure 5.2). The widest gap in the stones is towards the northeast and southwest parts of the ring. The perimeter stones are spaced, forming a single course of rock. No solitary prominent interior rock is present, but seven kgs of thermally-altered stones occurred scattered among the dense cobble substratum. Associated artifacts include a single tertiary flake. No features are in the immediate vicinity; the closest feature is another stone ring located 50-m to the north.

Test Unit 1 is a 1-m^2 pit placed in the middle of ring Feature 1 and excavated to a depth of 20 cm. A stratigraphic profile of the east wall revealed three strata (Figure 5.2). Stratum I is a 3-cm thick brown (7.5YR 5/4) fine sandy loam with rare gravel inclusions. Cultural materials are rare

Figure 5.1 LA 25421 Site Map, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

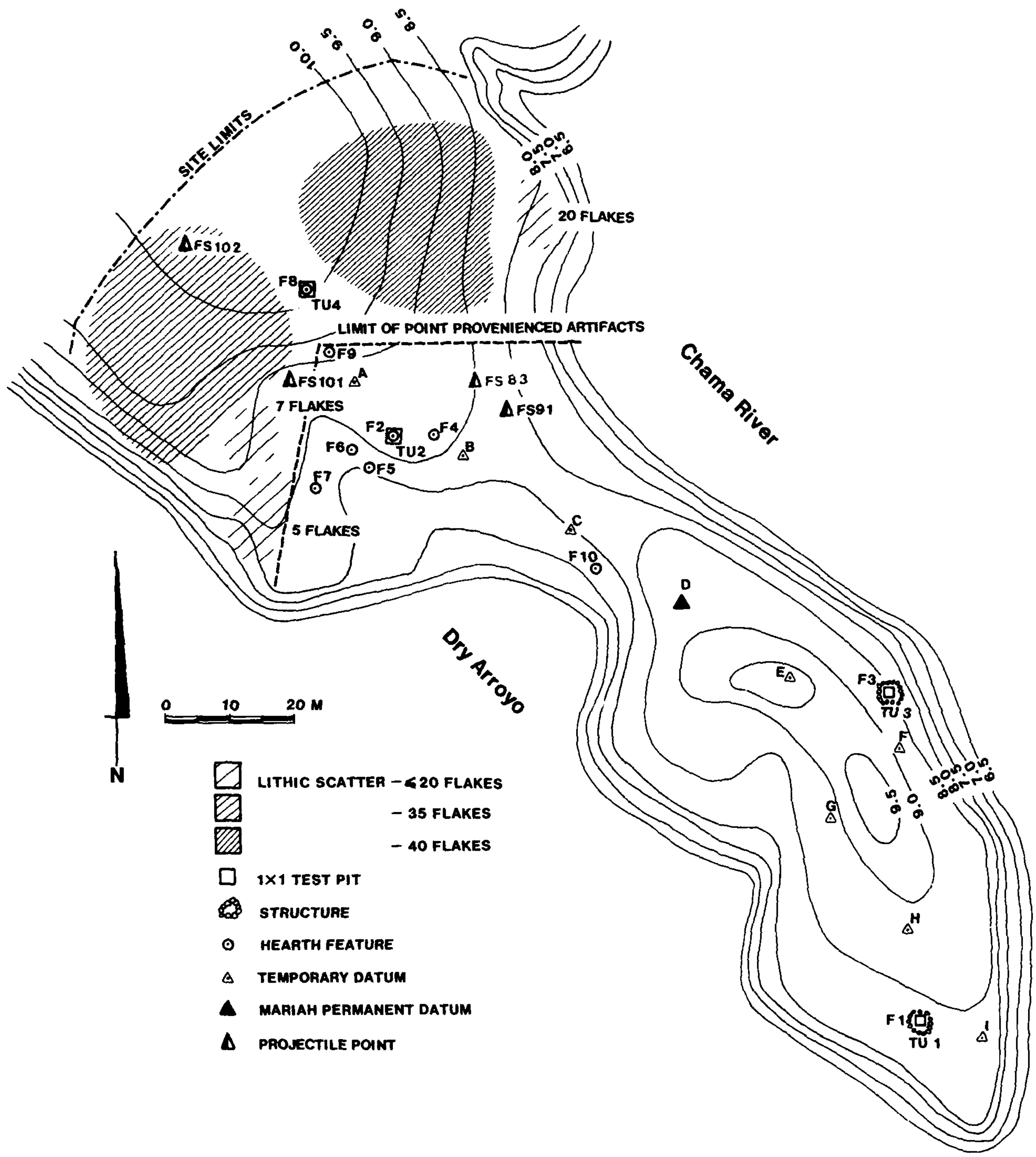
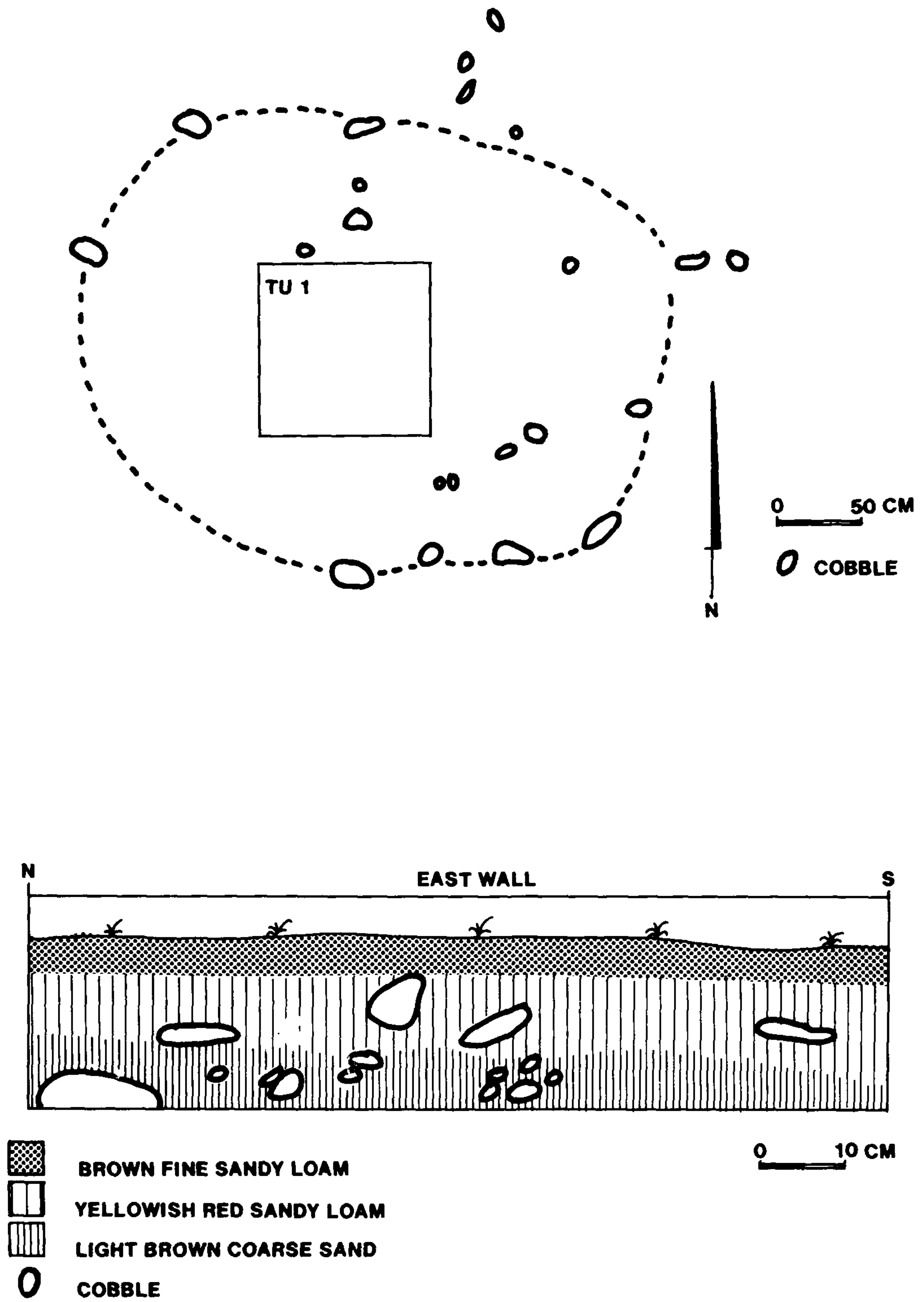


Figure 5.2 Plan of Cobble Ring Feature 1 and Profile of Test Unit 1, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



and are confined to a few widely scattered thermally-cracked cobbles. The lower boundary is smooth and abrupt. The stratum represents the organic A soil horizon.

Stratum II is a 10-cm thick compact yellowish red (5YR 4/6) coarse sandy loam with occasional gravel inclusions. Cultural materials are rare. The lower boundary is undulating and abrupt. The stratum represents the B soil horizon.

Stratum III is a compact light brown (7.5YR 6/4) coarse sand with dense spherical cobble inclusions. Caliche coats the underside of many cobbles. No cultural materials are present. The stratum represents stream rolled cobbles deposited prior to or during the Pleistocene.

Feature 3 is a spaced stone circle located about 50 m north of ring Feature 1 and situated 3 m from the Chama River terrace edge. This ring may be the ill-defined structure mentioned by Schaafsma but not relocated by the NAI archaeologists (Reed et al. 1982:64). This part of the site exhibits moderate erosion. The feature measures approximately 2.75 m (east-west) by 3.10 m (north-south) and is defined by 11 cobbles ranging from 10 to 35 cm in diameter and spaced from 85 to 175 cm apart (Figure 5.3). The widest gap in the stones is in the southeast part of the ring, towards the terrace edge. The perimeter stones seem to represent four sets of paired stones; no solitary interior stone is present. Thermally-altered stones rarely occurred in the ring; only 0.8 kgs of fire-cracked rock were recovered in 40 cm of excavation. Associated materials include four surficial and two excavated flakes. No other features are in the immediate vicinity.

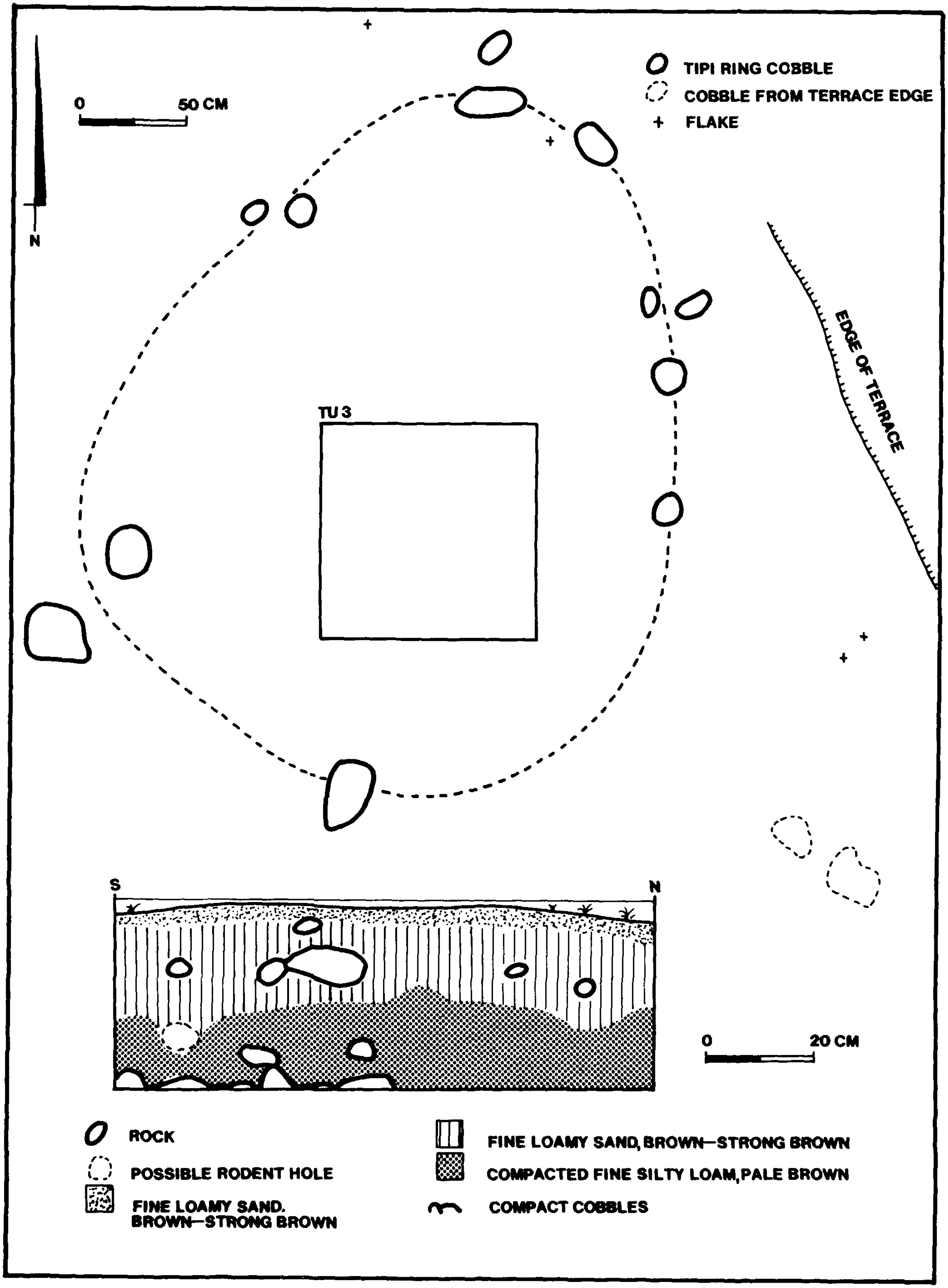
Test Unit 3 is a 1-m^2 pit placed in the center of Feature 3 and excavated to a depth of 40 cm. A stratigraphic profile of the west wall revealed four strata (Figure 5.2). Stratum I is a 3-cm thick layer of unconsolidated brown-strong brown (7.5YR 5/5) fine sandy loam with a few marble-sized pieces of gravel inclusions. No artifacts are present. The lower boundary is gradual and smooth. The stratum represents the organic A soil horizon.

Stratum II is a 17-cm thick, poorly consolidated layer of brown-strong brown (7.5YR 5/5) fine loamy sand with few rootlets and with cobbles measuring up to 13 cm in diameter. No artifacts are present. The lower boundary is abrupt and wavy with many large tree roots at the contact. Three excavated flakes may also occur on the lower contact of this stratum. The stratum possibly represents an aeolian deposit.

Stratum III is a 14-cm thick very compacted pale brown (10YR 6/3) fine silty loam with fewer cobbles than found in stratum II. Cultural materials are not present. The lower boundary is wavy and abrupt. The stratum may represent an old dunal deposit.

Stratum IV is a dense cobble terrace deposit with little soil between the rounded to subangular rocks which measure up to 15 cm in diameter. The cobbles are remnants of the Pleistocene or pre-Pleistocene terrace.

Figure 5.3 Plan of Cobble Ring Feature 3 and Profile of Test Unit 3, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



5.1.4.2 Nonstructural Features

Feature 2 is one of a cluster of rock filled hearths located on a gentle south-trending slope in the northwest part of the site. It is situated 30 m from the Chama River terrace edge and approximately 22 m from the unnamed tributary terrace edge. Seven other hearth features are located within 30 m of Feature 2, and the nearest stone ring is about 90 m to the southeast. This part of the site has experienced moderate erosion. Surficial indications of the feature consisted of approximately 29 sandstone slabs and rounded cobbles clustered within a 95 cm (north-south) by 95 cm (east-west) area for a dispersion index of 32.13 rocks/m^2. This feature is probably the same as the ashy hearth feature mentioned by the NAI archaeologists. A 2.5 liter soil flotation sample yielded six charred goosefoot (*Chenopodium*) seeds, one charred unidentified seed, and some fragments of wood charcoal (Appendix E).

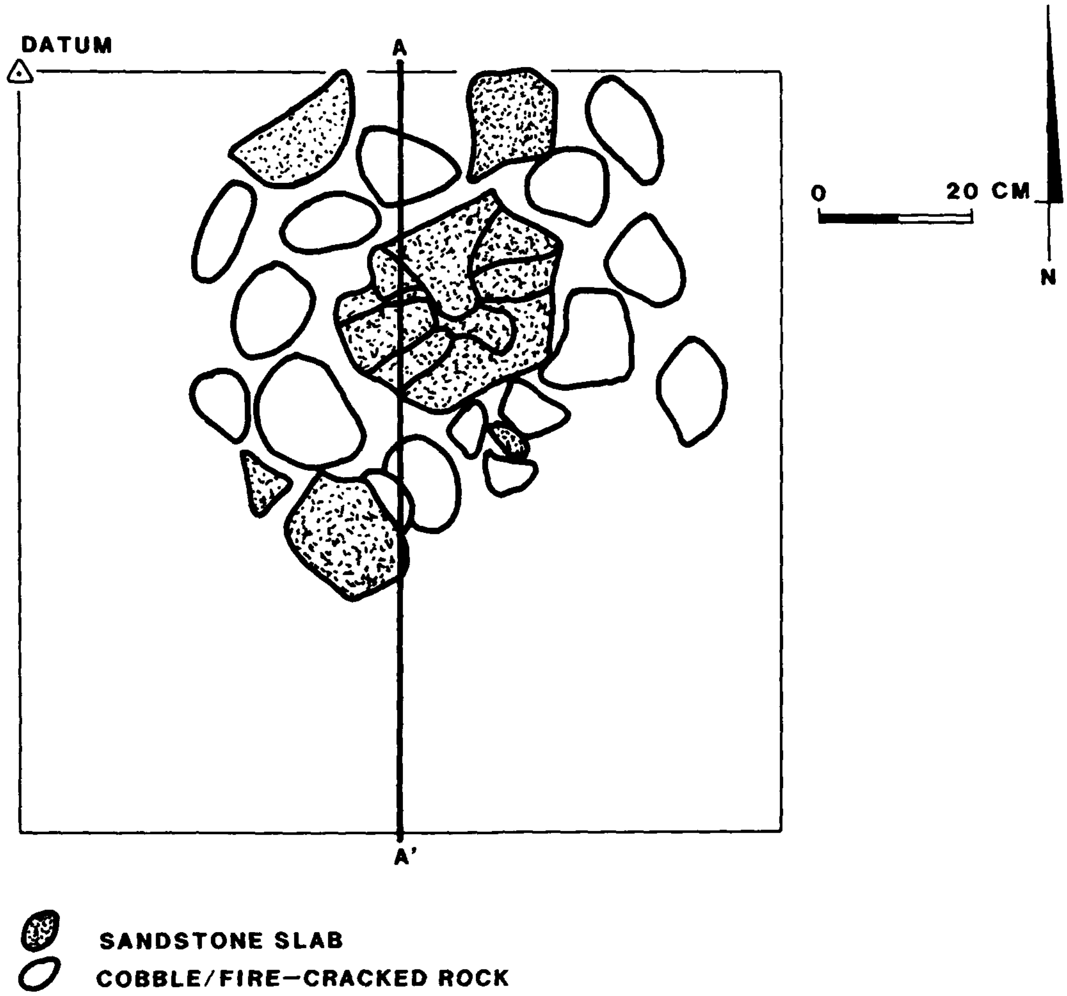
Excavations revealed that the hearth was a circular, basin-shaped feature with a sandstone slab-lined bottom surrounded by rounded cobbles and sandstone slab-lined walls. The hearth was concentrated within a 67-cm (north-south) by 72-cm (east-west) area (Figure 5.4). The feature was excavated 20 cm into the sterile substratum composed of a highly compacted reddish brown (5YR 5/4) silt. The hearth matrix was a very dark gray (10YR 3/1) silt with very small charcoal flecks and fire-cracked subrounded cobbles. Total weight of excavated rock in the feature is 32 kgs. The hearth was covered with about five cm of brown (7.5YR 5/4) silty loam.

Feature 4 is an angular fire-cracked rock scatter located about 6 m east of hearth Feature 2 in the northeast part of the site. The feature is approximately 25 m from the Chama River terrace edge. Most of the other nearby hearth features are located to the west. The nearest stone ring is about 82 m to the southeast. This part of the site has experienced heavy to moderate erosion. The feature is defined by approximately 128 angular cobble fragments within a 5.25-m (east-west) by 4.25-m (north-south) area for a dispersion index of 5.73 rocks/m^2 (Figure 5.5). No ashy stain was evident on the surface. Most rocks are fractured cobbles which measure up to 15 cm in diameter.

Seventeen auger holes were excavated at the feature along two axes. Most were dug to a depth of approximately 90 cm. None of the holes encountered hearth matrix; however, three sterile strata were encountered. The upper 15 cm consists of reddish-brown fine sandy loam; next is a yellowish-red sandy caliche zone from 15 to 40 cm below surface. Below 40 cm is a yellowish-brown medium sand. The hearth materials are probably severely deflated onto a sterile surface.

Feature 5 is an angular fire-cracked rock scatter located about 7 m southwest of hearth Feature 2 in the northeast part of the site. The terrace edge of an unnamed tributary of the Chama River is located about 19 m to the south. Four other nearby hearth features are located within 15 m to the north. This part of the site has experienced moderate to extensive erosion. The feature is defined by 32 chert and quartzite angular cobbles clustered within a 2.75 m (north-south) by 3.0-m (east-west) area for a dispersion index

Figure 5.4 Plan and Profile of Hearth Feature 2, Test Unit 2, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



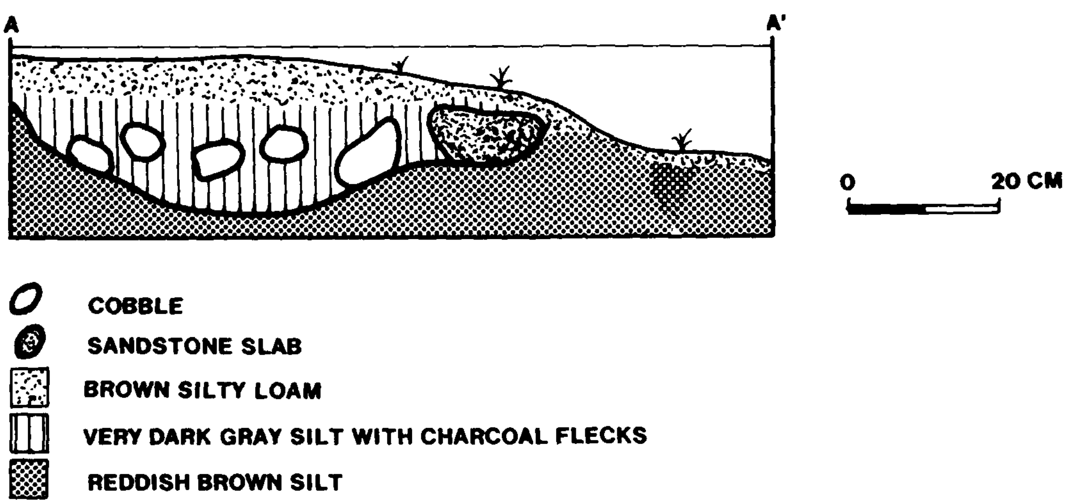
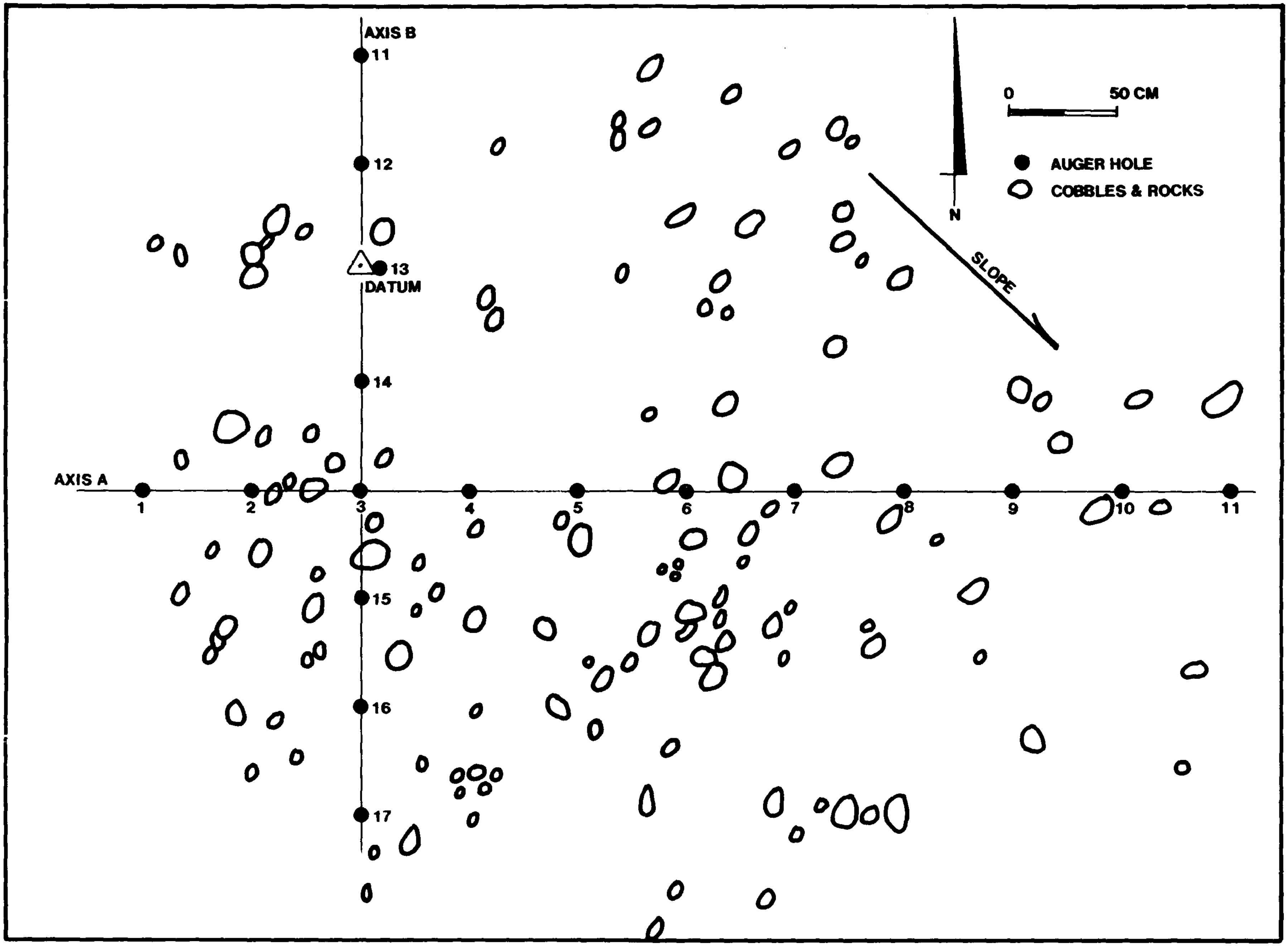


Figure 5.5 Plan of Hearth Feature 4, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



of 5.08 rocks/m^2 (Figure 5.6). Most rocks are fractured subrounded cobbles which measure up to 23 cm in diameter. Associated artifacts include a single obsidian flake.

Six auger holes were excavated at the feature. Most were dug to a depth of 75 cm, at which depth solid bedrock was encountered. None of the holes encountered hearth matrix; however, the auger holes documented the presence of a tan silty loam which tended to become coarser and more compact with depth. There is no evidence that intact hearth deposits are present.

Feature 6 is an angular fire-cracked quartzite and chert scatter located in the northwest part of the site situated about 25 m from the terrace edge of an unnamed tributary the Chama River. Other nearby hearth features are primarily located within 28 m to the north and east. The nearest stone ring is approximately 95 m to the southeast. This part of the site has experienced moderate to heavy erosion. The feature is defined by 31 cobbles clustered within a 2.65-m (north-south) by 2.2-m (east-west) area for a dispersion index of 5.32 rocks/m^2 (Figure 5.7). Most rocks are fractured cobbles which measure up to 15 cm in diameter.

Seven auger holes were excavated to a maximum depth of 110 cm. Small fire-cracked rock fragments were encountered in the upper 15 cm, but no soil discoloration or ashy matrix was observed. The auger holes suggest that no intact portions of the hearth are left.

Feature 7 is an angular fire-cracked rock scatter, the location of which is the southwesternmost of a cluster of hearths in the northeast part of the site. The Chama River terrace edge is about 45 m to the west, whereas the terrace edge of an unnamed tributary is only about 15 m to the east. Other nearby hearth features are within 25 m to the east and 35 m to the north. This part of the site has experienced moderate erosion. The feature is defined by 32 cobbles scattered within a 2.6-m (north-south) by 4.35-m (east-west) area for a dispersion index of 2.83 rocks/m^2 (Figure 5.8). The rocks measure up to 15 cm in diameter.

Two auger holes were excavated at the feature. A maximum depth was reached at 130 cm. No artifacts, fire-cracked rocks, or ashy soil was found. The soil profile reflected a series of compact strata described as light brown medium sandy loam above 43 cm; from 43 to 70 cm, the texture becomes finer, and color is slightly darker brown. From 70 to 90 cm, small caliche fragments occur in the solum; below 90 cm, the caliche disappears, and the color changes to a light brown. No cultural fill was encountered. Quite likely, the entire hearth is deflated.

Feature 8 is the northernmost fire-cracked rock scatter located in the northwest part of the site. It is situated near the crest of a low hill, approximately 38 m from the terrace edge of the Chama River. Seven other hearth features are to the southeast on the slope of the hill. This part of the site has experienced minimal erosion. The feature is defined by 13 cobbles clustered within a 1.25-m (north-south) by 0.6-m (east-west) area for a dispersion index of 17.33 rocks/m^2 (Figure 5.9) . Most rocks are fractured pieces of quartzite which measure up to 15 cm in diameter.

Figure 5.6 Plan of Hearth Feature 5, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

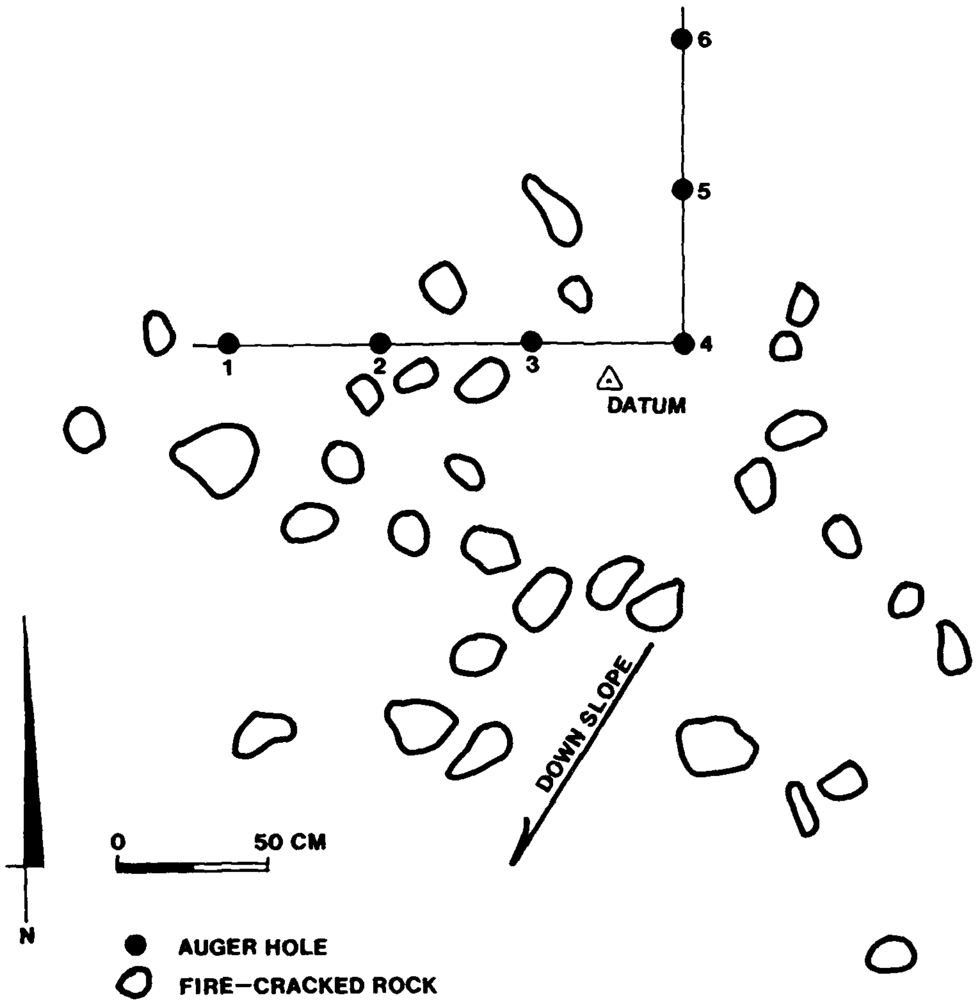


Figure 5.7 Plan of Hearth Feature 6, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

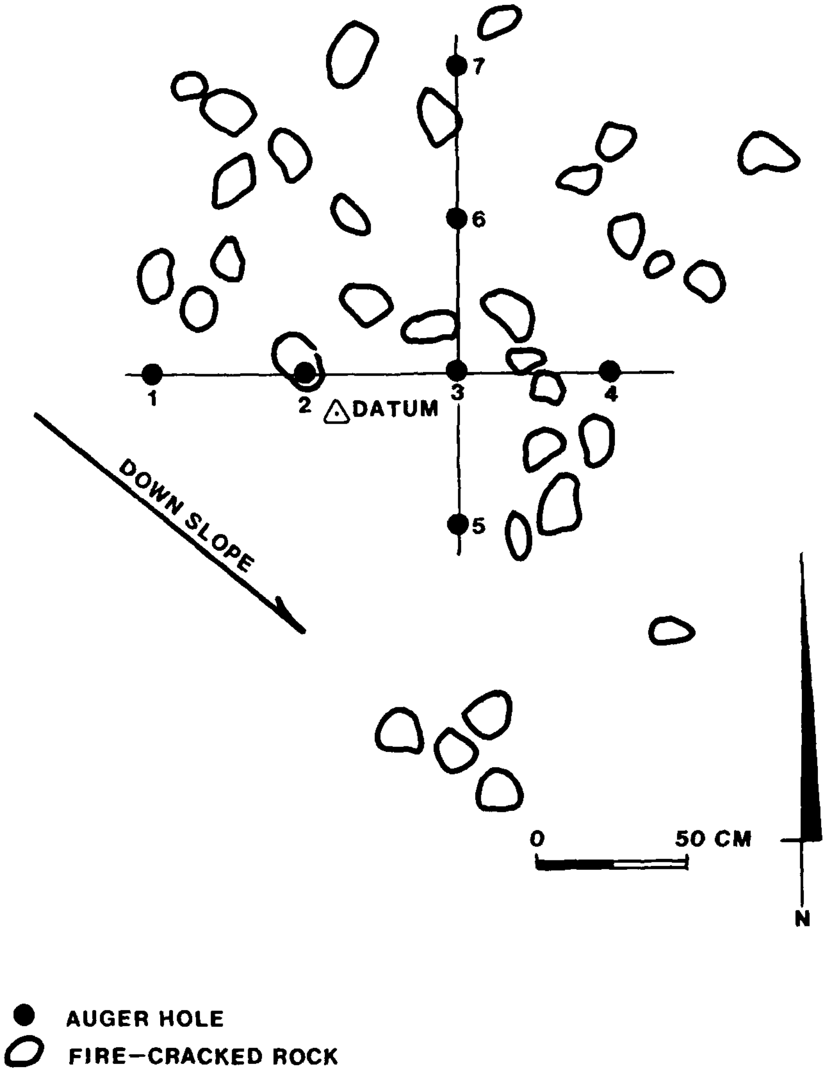


Figure 5.8 Plan of Hearth Feature 7, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

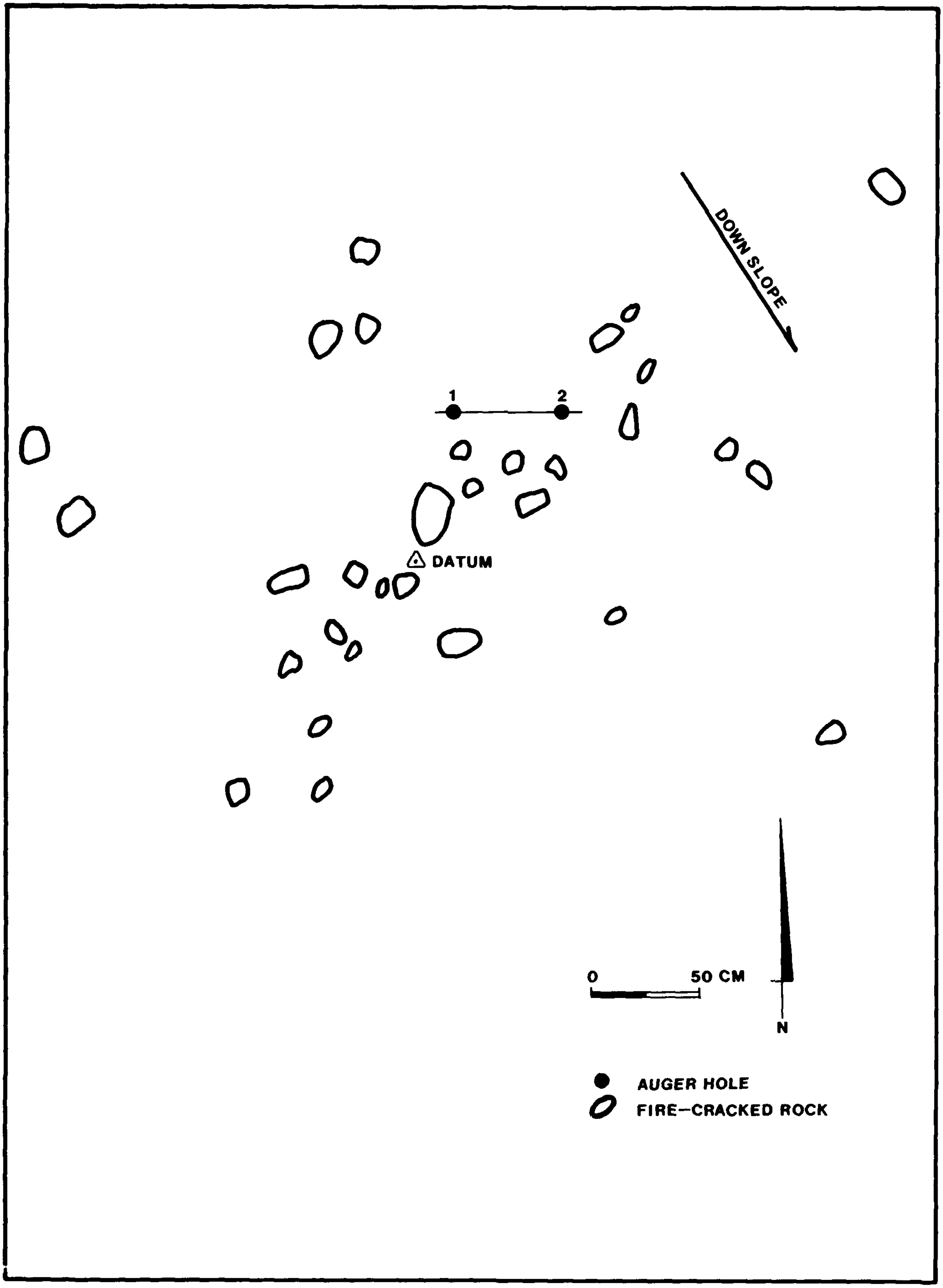
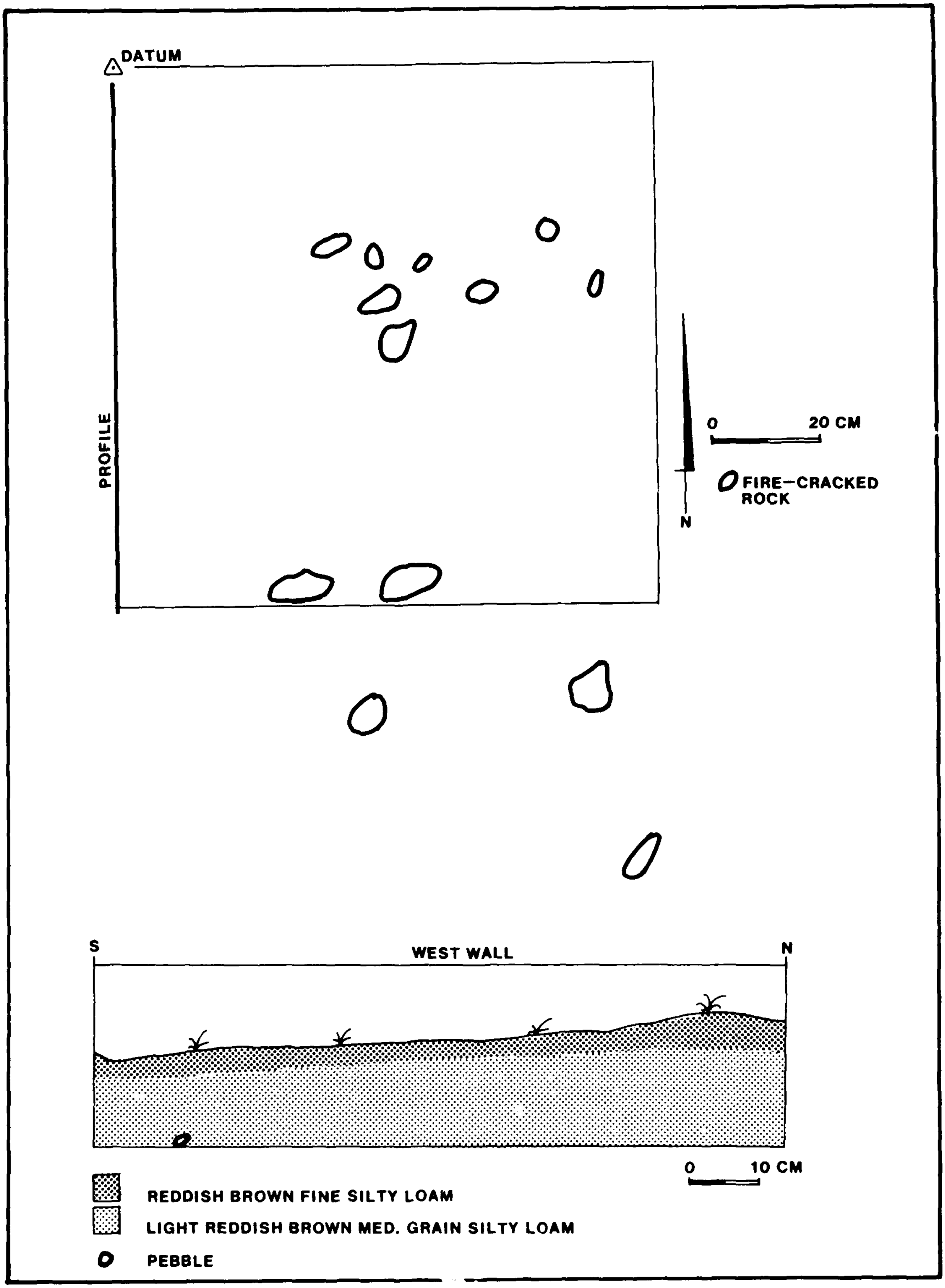


Figure 5.9 Plan and Profile of Hearth Feature 8, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Test Unit 4 is a 1-m^2 pit placed over Feature 8 and excavated to a depth of 20 cm. A stratigraphic profile of the west wall revealed two strata (Figure 5.8). Stratum I is a 3- to 5-cm thick unconsolidated reddish brown (5YR 5/4) fine silty loam. The lower boundary is smooth and abrupt. In contrast, Stratum II (at least 15 to 17 cm thick) is a compact reddish brown (5YR 6/3) medium-coarse silty loam with a few gravel inclusions. These excavations revealed that the hearth had little to no subsurface deposition. A single flake and a few pieces of fire-cracked cobbles were found in the upper 15 cm, but no ashy stain or charcoal was found. Total weight of excavated fire-cracked rock is 12.8 kgs.

Feature 9 is a sparse fire-cracked rock scatter located near the crest of the hill, approximately 10 m south of Feature 8 in the northeast part of the site. Other nearby hearth features are located within 25 m to the south and east. This part of the site has experienced extensive erosion. The feature is defined by 18 angular cobbles fragments clustered within a 1.85-m (north-south) by 1.5-m (east-west) area for a dispersion index of 6.49 rocks/m^2 (Figure 5.10). Many cobbles measure up to 20 cm in diameter.

One auger hole was excavated to a depth of 49 cm. Small fragments of fire-cracked rock were found in the loose pinkish brown loam in the upper 12 cm, but below this level, the loamy soil became compact and contained small pieces of caliche, rather than angular fire-cracked rock. No ashy matrix was found. Evidence from the limited excavation suggests that the hearth is deflated.

Feature 10 is an isolated amorphous fire-cracked rock scatter located in the central part of the site approximately 35 m southeast of a cluster of hearths and about 48 m northwest of stone ring Feature 3. It is situated near the south end of a gently sloping terrace edge of an unnamed tributary of the Chama River. No features are in the immediate vicinity of the hearth. This part of the site has experienced moderate erosion. The feature is defined by 20 angular cobbles clustered within a 1.6-m (north-south) by 2.55-m (east-west) area for a dispersion index of 4.9 rocks/m^2 (Figure 5.11). The largest rocks are fractured cobbles measuring up to 22 cm in diameter.

One auger hole was excavated to a depth of 42 cm. It indicated that the upper 18 cm consisted of light reddish brown fine loam with small fragments of fire-cracked rock. Below this, the matrix was moderately fine compact "tan" loam with a few small pebbles, but no fire-cracked rock or discolored ashy soil. Presumably, the feature is deflated.

5.1.5 Chronological Sample Proveniences

Five samples were submitted for specialized analysis. These include one bag of soil for flotation to obtain subsistence information, and three obsidian samples and one charcoal sample to obtain chronometric information. The proveniences of these various samples are indicated in Table 5.1. The macrobotanical discussions have been presented in conjunction with the previous feature descriptions. The specialized laboratory report is in Appendix E. The chronometric results are discussed in Chapter 6.0, and

Figure 5.10 Plan of Hearth Feature 9, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

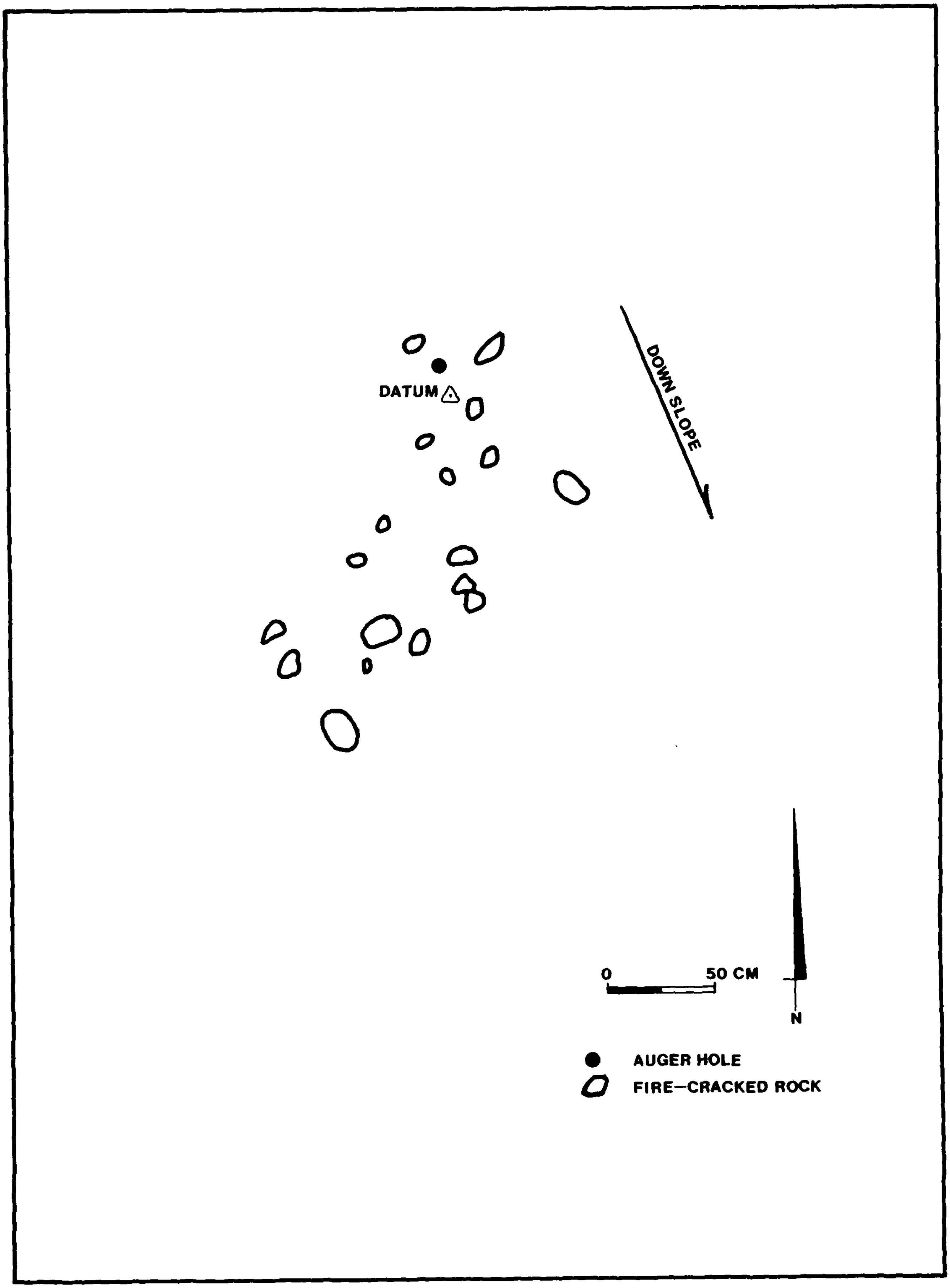
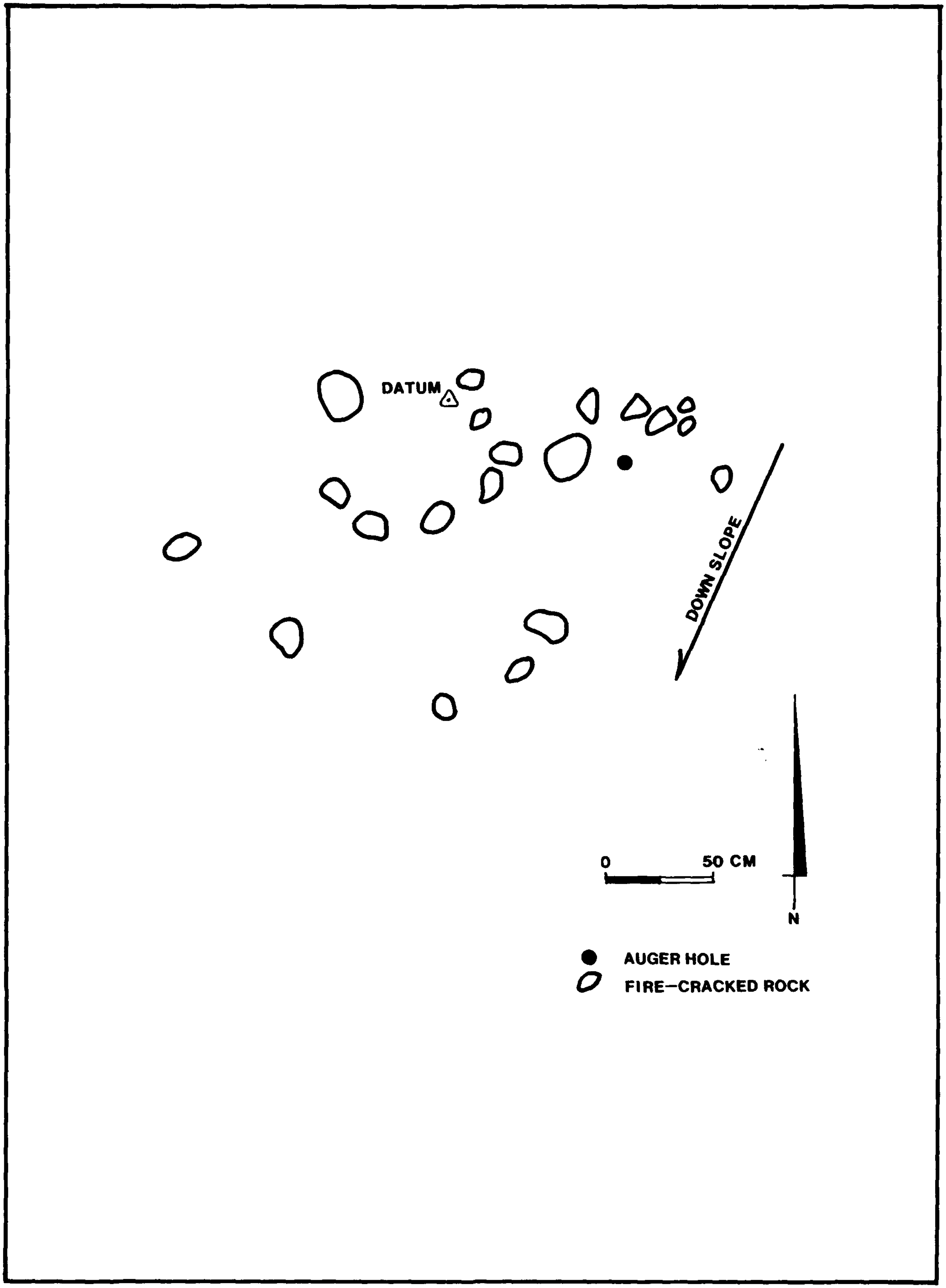


Figure 5.11 Plan of Hearth Feature 10, LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



laboratory results are in Appendidices A (obsidian hydration), B (C-14), and C (archaeomagnetic).

5.2 LA 25417

5.2.1 Topographic Setting

The middle site is an extensive area containing stone rings and sparse artifacts which covers the top of three remnants of the main terrace on the west side (right bank) of the Chama River. The structural features occur within 25 m of two prominent unnamed intrasite tributary terrace edge escarpments, and one cobble ring occurs on a slight bench below the terrace

Table 5.1 Macrobotanical and Chronometric Sample Proveniences from LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Sample Provenience	Depth	Feature Number	Field Specimen	Sample Type
Macrobotanical Flotation				
Test Unit 2 NE, Hearth Mat	7-20 cm	2	--	Hearth Matrix
Obsidian Hydration Dating Samples				
Datum B, 45°, 9.6 m	Surface	--	91	Point Base
Test Unit 3, Level 3	20-30 cm	3	1	Flake
Datum A, 268°, 10.30 m	Surface	--	115	Point Base
Radiocarbon Dating Samples				
Test Unit 2, Feature Matrix	23 cm	2	--	Stained Soil

rim. A ACOE benchmark is present at the east tip of the middle terrace remnant, and the site datum established by SAR is placed near a cobble ring feature along the north edge of the south terrace remnant. The land gently slopes up towards the west to form a series of low, sand-covered hills. Cobble and wood resources are abundant along the escarpments; the old terrace top is primarily covered with low, woody shrubs and grasses.

5.2.2 Previous Work

The site was apparently visited by SAR archaeologists during the Phase III survey in May 1975. The SAR site form designates the site as AR-159 and indicates that it is on the terrace edge overlooking the Chama River. Two or three circular cobble rings, each 6 min diameter, are reportedly spaced an average of 50 m apart; yet the total site area is reportedly only 50 m^2 (SAR site forms). No thermal features are reported, but a few pieces of chipped stone occur in the vicinity of the rings. The recovery of a basalt San Jose point located 65 m north-northeast of one ring indicates a multicomponent site occupied during the Late Archaic and Historic Periods. The historic occupation is provisionally attributed to the Capote Utes solely on the basis of historical documentation of this group in the region. The site condition is reportedly good and cultural deposits are unaltered. A site map prepared by SAR shows the location of two stone rings relative to the terrace edge, the site datum, and a ACOE benchmark. A second map, drawn to a larger scale, provides topographic and vegetation details of Feature 2, one of the previously mapped rings.

5.2.3 Definition of Boundaries

The definition of site boundaries followed procedures similar to those used at LA 25421. The steep terrace escarpments along the Chama River and a major tributary to the south are major topographic breaks which form effective site boundaries to the east and south. The north and west boundaries were determined by flagging artifacts along transects radiating away from the structural features. In most instances, artifact densities approached zero along the slopes of some low sandy hills, located approximately 115 to 130 m west of the Chama River terrace edge. Although the density of artifacts is not great across the entire site, most artifacts tend to occur near the cobble ring features and hearths or are concentrated on flat terrace surfaces within 80 m of the Chama River.

A limited survey along the south boundary tributary indicated that another extensive site with cobble ring structures, abundant lithic debris, and at least one historic single-log feed trough occurs along the north bank of the drainage. No extensive recording effort was made at this other site. It is separated from north and central portions of LA 25417 by the low hills and distinguished from the southern part of the site by a slight but noticeable decrease in artifact density; however, very sparse quantities of materials can be found between these two sites.

Two deeply incised intrasite tributaries have divided LA 25417 into three separate terrace areas. The dimensions of the entire site are approximately 130 m (east-west) by 410 m (north-south). A topographic map of the site was made, and a compensating polar planimeter was used to calculate the site area for each terrace portion. The north terrace measures about 115 m (east-west) by 120 m (north-south) and covers an area of about 10,403 m^2. The middle terrace portion is roughly triangular and measures approximately 120 m (east-west) by 115 to 40 m (north-south) with a measured area of 8,536 m^2. The south terrace portion is irregular with some bench areas. It measures about 130 m (east-west) by about 185 m (north-south) and has a measured area of 13,583 m^2. These calculated areas exclude the areas within the two intrasite drainages.

5.2.4 Surface and Subsurface Features

A total of 17 features was identified at the site. These include eight stone rings or other structural remains, six hearths, and three lithic reduction areas. The distribution of features is indicated in Figures 5.12 and 5.13. The structural features are discussed below separately from the nonstructural features.

5.2.4.1 Structural Features

Feature 1 is a spaced stone circle located on the north edge of the middle terrace point, situated within 4 m of the terrace edge and overlooking the northern intrasite tributary of the Chama River. The feature corresponds to the cobble ring designated Feature 1 by SAR. This part of the site has slight erosion. The feature measures approximately 3.85 x 3.85 m and is defined by 18 large cobbles spaced from 45 to 175 cm apart (Figure 5.14). The widest gap in the stones is in the southeast part of the ring. The perimeter stones are frequently paired, and a single interior stone is present. Thermally-altered stones surficially occurred in the south central part of the ring. Interior materials include two flakes and one thin metal strapping band (Section 6.2.2).

Three test units were excavated along a north-south axis within the ring to examine interior thermal features. Test Units 2 and 3 were 1 x 1 m units, but Unit 8 measured only 1.0 x 0.5 m. Within this 2.5 m long trench, two distinct hearths (designated Features 1A and 1B) were exposed. Each is described below.

Feature 1A is a rock filled hearth or oven located in the southern portion of the cobble ring. The feature is defined by a dense concentration of large angular cobbles clustered within a 1.3-m (north-south) by approximately 1.0-m (east-west) area; a few rocks were exposed on the surface, but the greatest density of cobbles ranged from 4 to 35 cm below surface. In excess of 65 cobbles with a maximum diameter of 18 cm were exposed in the feature; this quantity yields a dispersion index of 50 rocks/m^2 (Figure 5.15). The tight clustering of rocks suggested that they may have been placed within a shallow basin pit. The deeper occurrence of this feature relative to the depth of stones in the cobble ring suggests that the feature predates the ring.

The stratigraphic profile of Test Units 2 and 3 indicates that Feature 1A is intrusive into a culturally sterile, consolidated light reddish brown (5YR 6/3) silty loam substratum (Figure 5.15). The lower 4 cm of the feature matrix consists of a reddish gray (5YR 5/2) silty loam with ash; the presence of some yellowish red (5YR 4/6) silty loam matrix along the south edge of the profile may represent a discontinuous oxidized rim of the burned basin. The overlying feature matrix consists of 27 cm of densely packed, thermally spalled and discolored cobbles which are surrounded by dark reddish brown (2.5YR 3/4) ashy silty loam. The entire feature and sterile substratum is capped by 4 cm of poorly consolidated, reddish brown (5YR 5/4) silty loam. A 2.5-liter soil flotation sample yielded five charred purslane (*Portulaca*) seeds (Appendix E).

Figure 5.12 LA 25417 Site Map, North Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

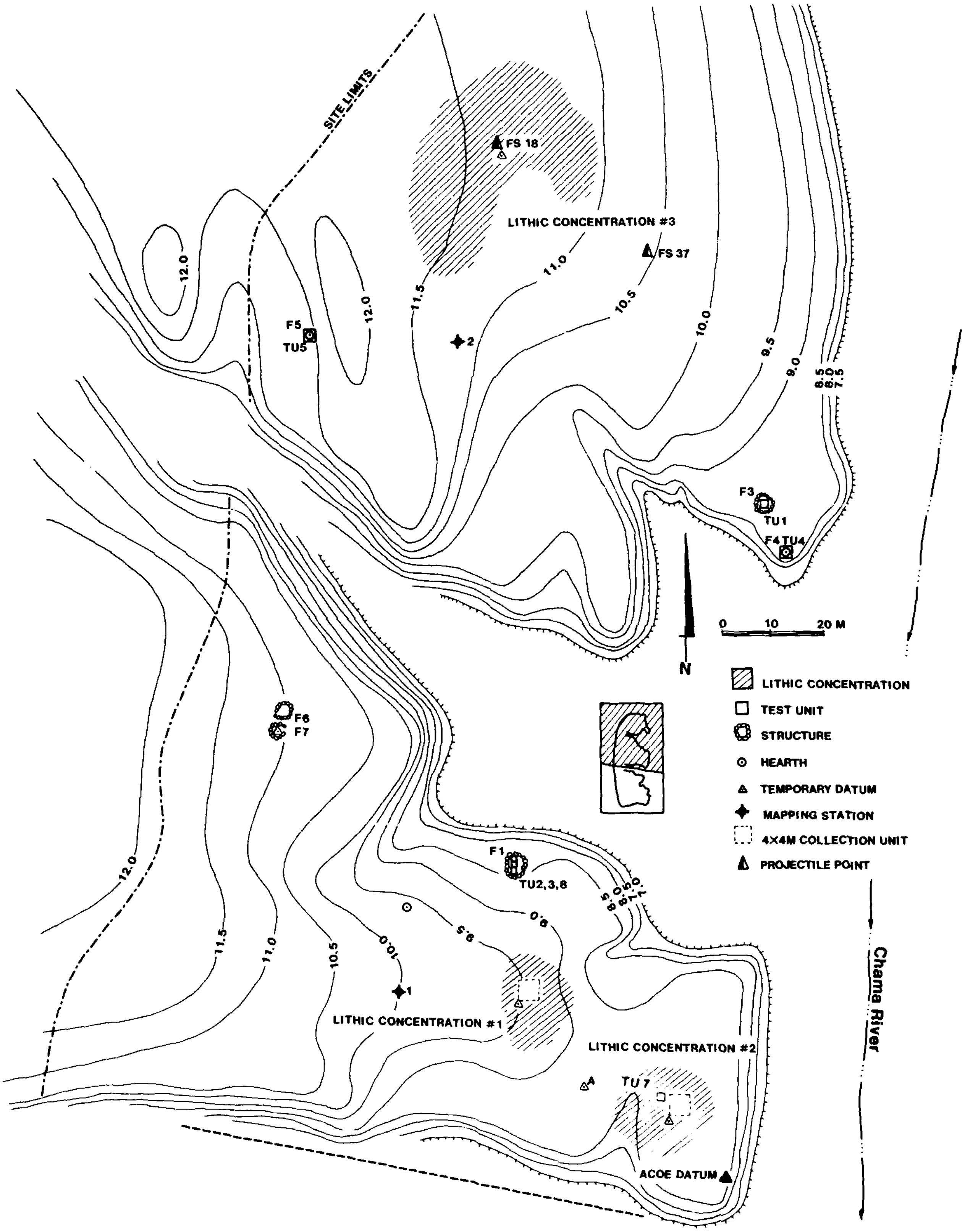


Figure 5.13 LA 25417 Site Map, South Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

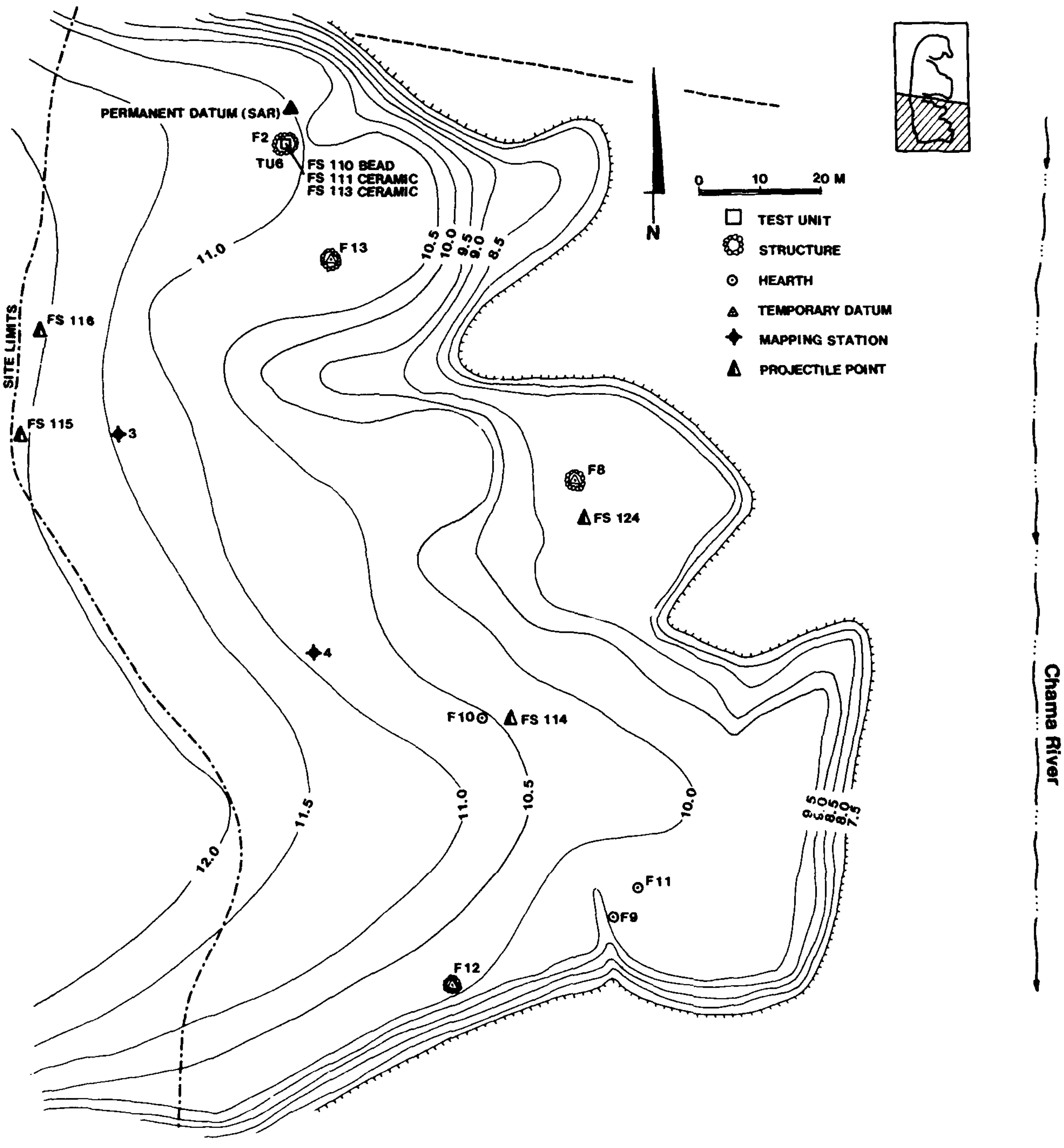


Figure 5.14 Plan of Cobble Ring Feature 1, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

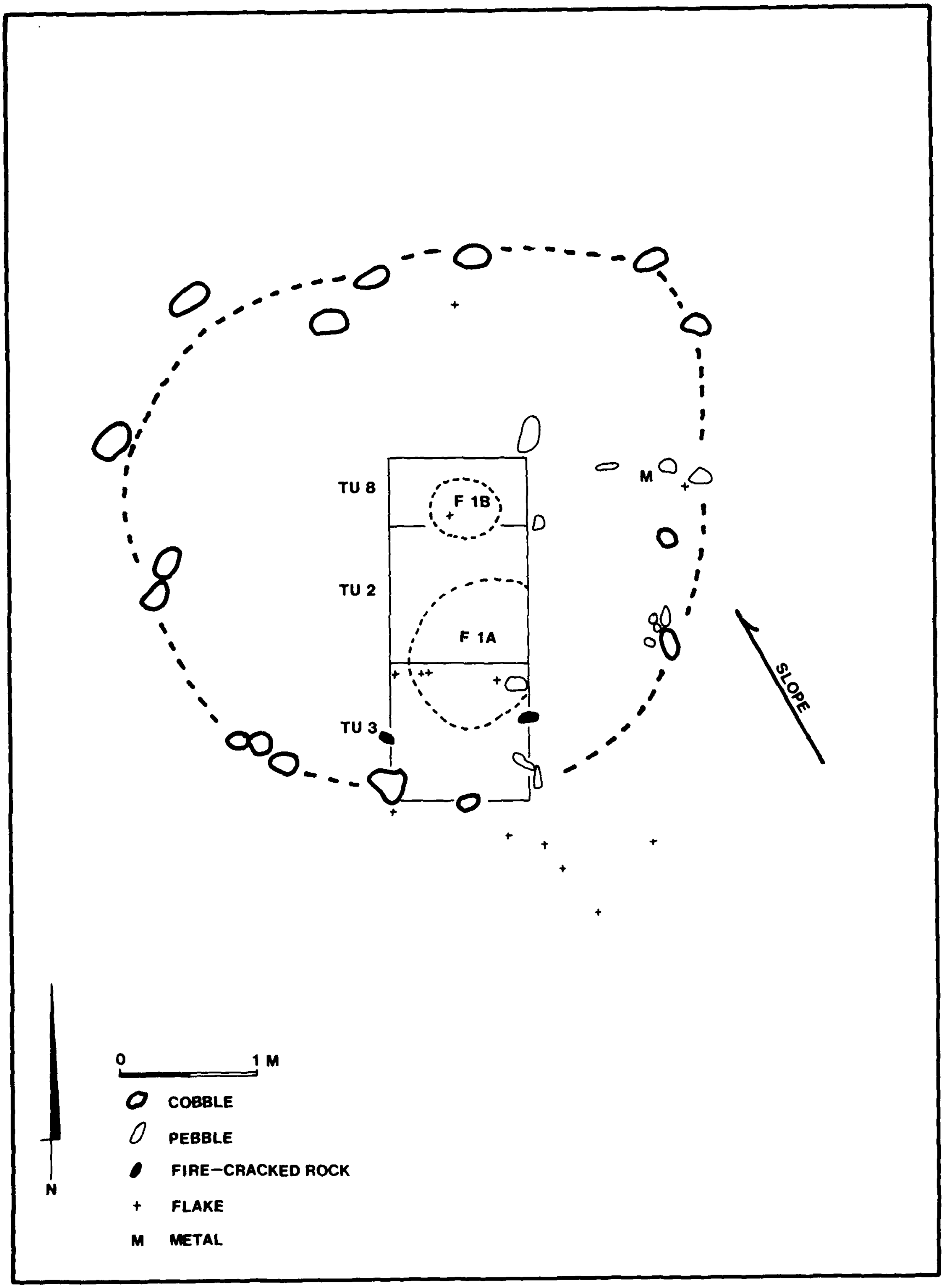
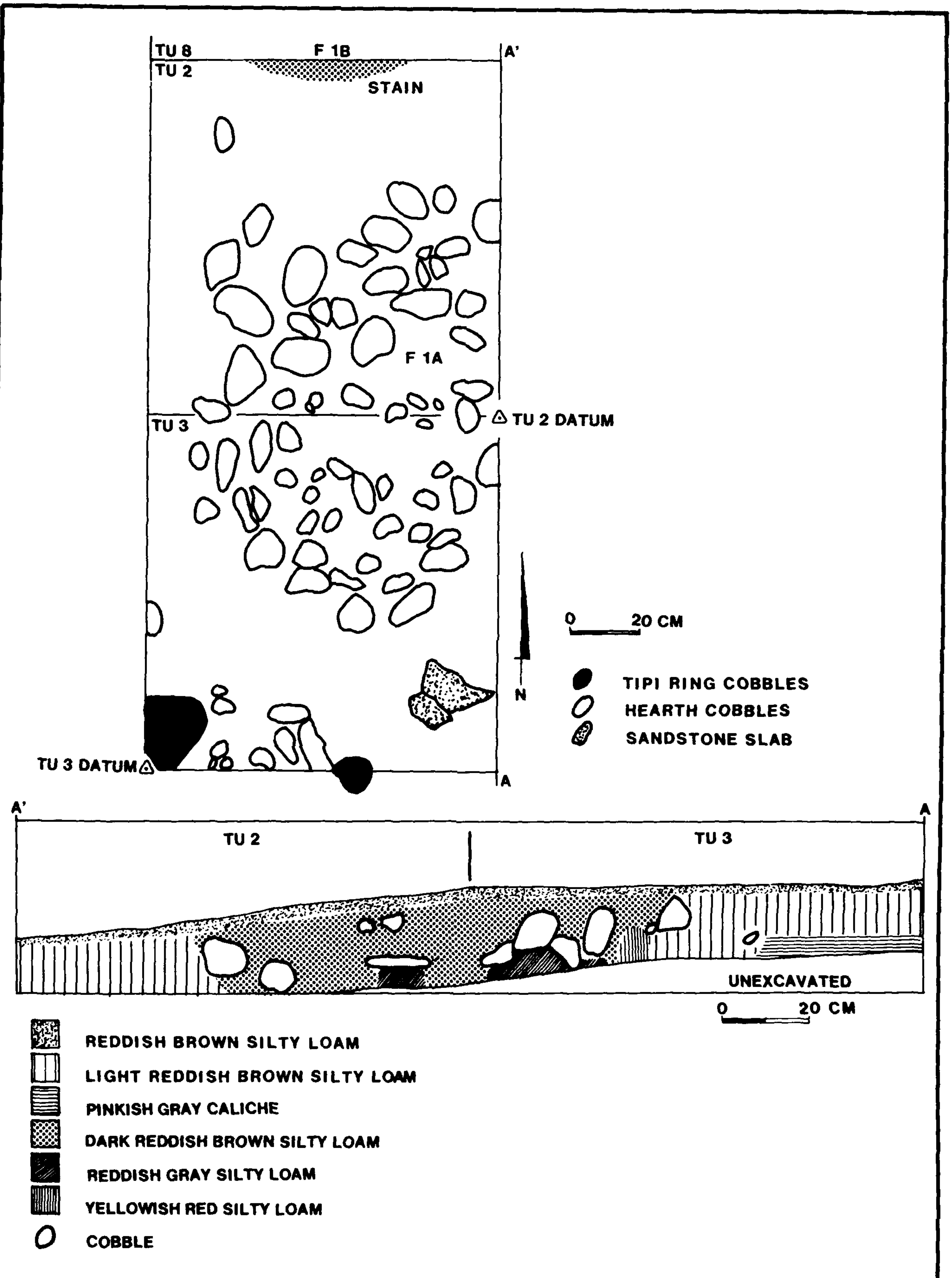


Figure 5.15 Plan and Profile of Hearth Feature 1A, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Feature 1B is a basin-shaped earthen hearth near the center of cobble ring Feature 1. The feature is defined by an oxidized basin-shaped pit measuring 50 cm (east-west) by 47 cm (north-south) which was excavated about 4 cm into the cobble terrace (Figure 5.16). The base of the hearth is not lined but merely consists of the exposed substratum, which showed minimal oxidation. In contrast, the hearth rim was a well oxidized reddish brown (5YR 4/4) compact sandy loam. The bottom hearth matrix consisted of a distinct layer of brown (7.5YR 5/3) sandy loam with some ash and pebbles. This is capped by a discontinuous layer of black (10YR 2/1) ashy matrix with charcoal pieces up to 2 cm long and a few chunks of dense coal. The overlying matrix is 3 cm thick and consisted of a fine yellowish-brown/dark yellowish-brown (10YR 4.5/4) sandy loam with some pebbles. The distinct hearth stratigraphy indicates multiple hearth usage, and the presence of large charcoal chunks and pebbles in the overlying matrix suggests that the last burning episode was smothered. Materials associated with the hearth feature include a few flakes, nine unburned bone splinters including one phalange (second digit) from an immature deer (*Odocoileus hemionus*), two unidentifiable splinters from a large mammal, and six other unidentified bone splinters. Archaeomagnetic samples were collected from the oxidized hearth rim, and charcoal from the basin was submitted for dating. A 2-liter soil flotation sample of hearth matrix yielded only charcoal tentatively identified as pinyon (Appendix E).

Feature 2 is a stone circle located on the north edge of the southern terrace point situated within 15 m from the terrace edge. Feature 2 corresponds to the cobble ring assigned the same designation by SAR; their permanent site datum was found approximately 1 m north of the cobble ring feature. This part of the site has slight erosion. The feature measures approximately 5.0 m (north-south) by 4.8 m (east-west) and is defined by 35 cobbles spaced from 20 to 100 cm apart (Figure 5.17). The widest gap in the stones is towards the west part of the ring. The perimeter stones are nearly continuous in the south half, and a single interior stone and a mano are present. Thermally-altered stones occur in the center. Interior materials surficially collected include a turquoise colored bead and two Chacon Micaceous sherds (Carrillo 1987a). Two other beads and two more sherds were recovered during excavations.

Test Unit 6 is a 1-m^2 pit placed in the middle of Feature 2 and excavated to a depth of 20 cm. A profile of the west wall shows three strata (Figure 5.17). Stratum I is a 3- to 5-cm thick, loose reddish brown (5YR 5/4) silty loam. The lower boundary is smooth and abrupt.

Stratum II is a 10 cm thick, compact light reddish brown (5YR 6/4) silty loam with coarse grain inclusions, with occasional pieces of pottery and a few fire-cracked rock. Total fire-cracked rock excavated from the test unit weighed only 1 kg. Two samples, each consisting of 2.5 liters of soil, were submitted for flotation recovery of botanical remains. One sample from the excavation unit yielded 68 charred goosefoot (*Chenopodium*) seeds. The second sample from the wall of the test unit yielded one uncharred goosefoot (*Chenopodium*) seed, one charred beeweed (*Cleone*) seed, and some unidentified fragments of charcoal (Appendix E). The lower boundary is wavy and abrupt.

Figure 5.16 Plan and Profile of Hearth Feature 1B, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

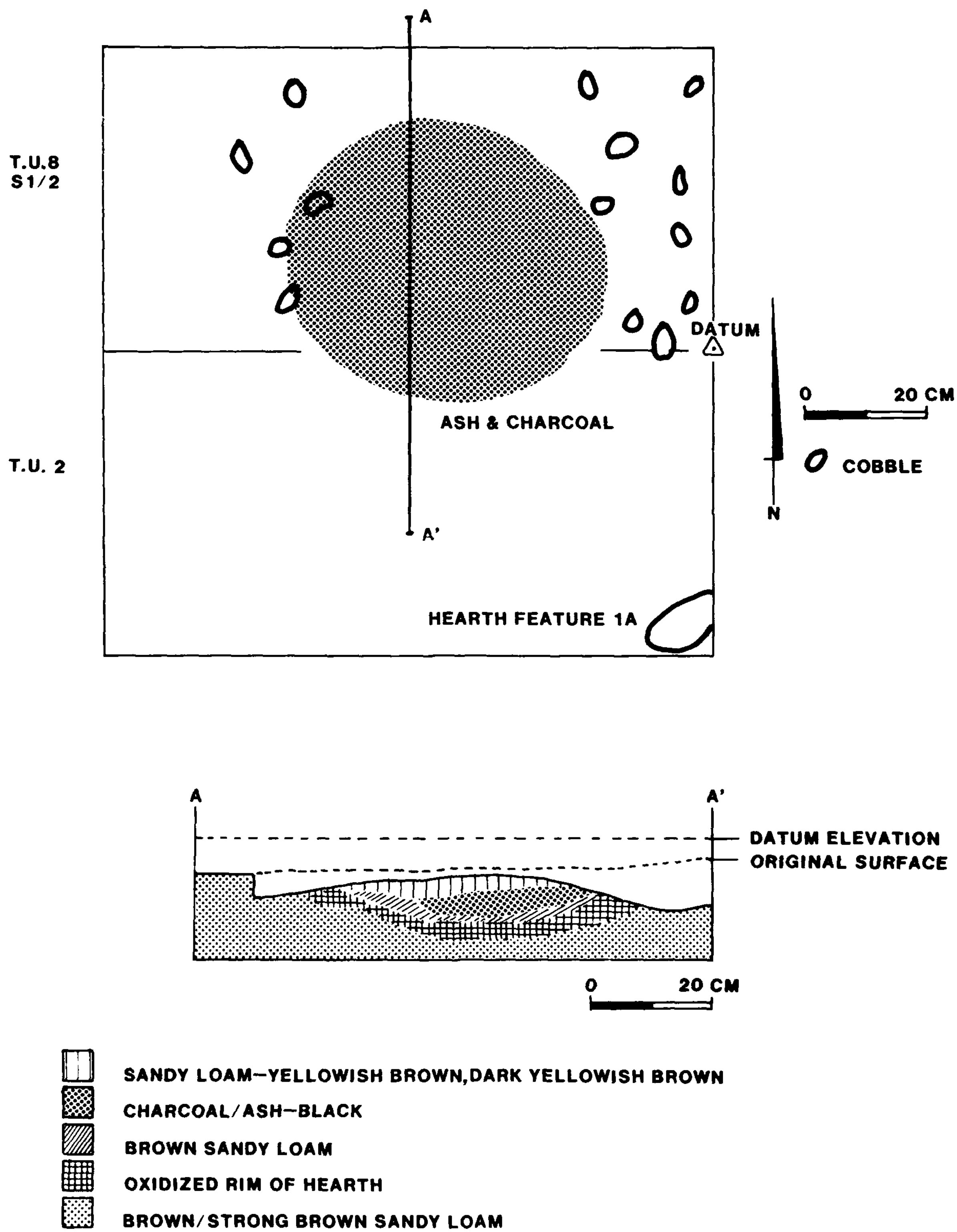
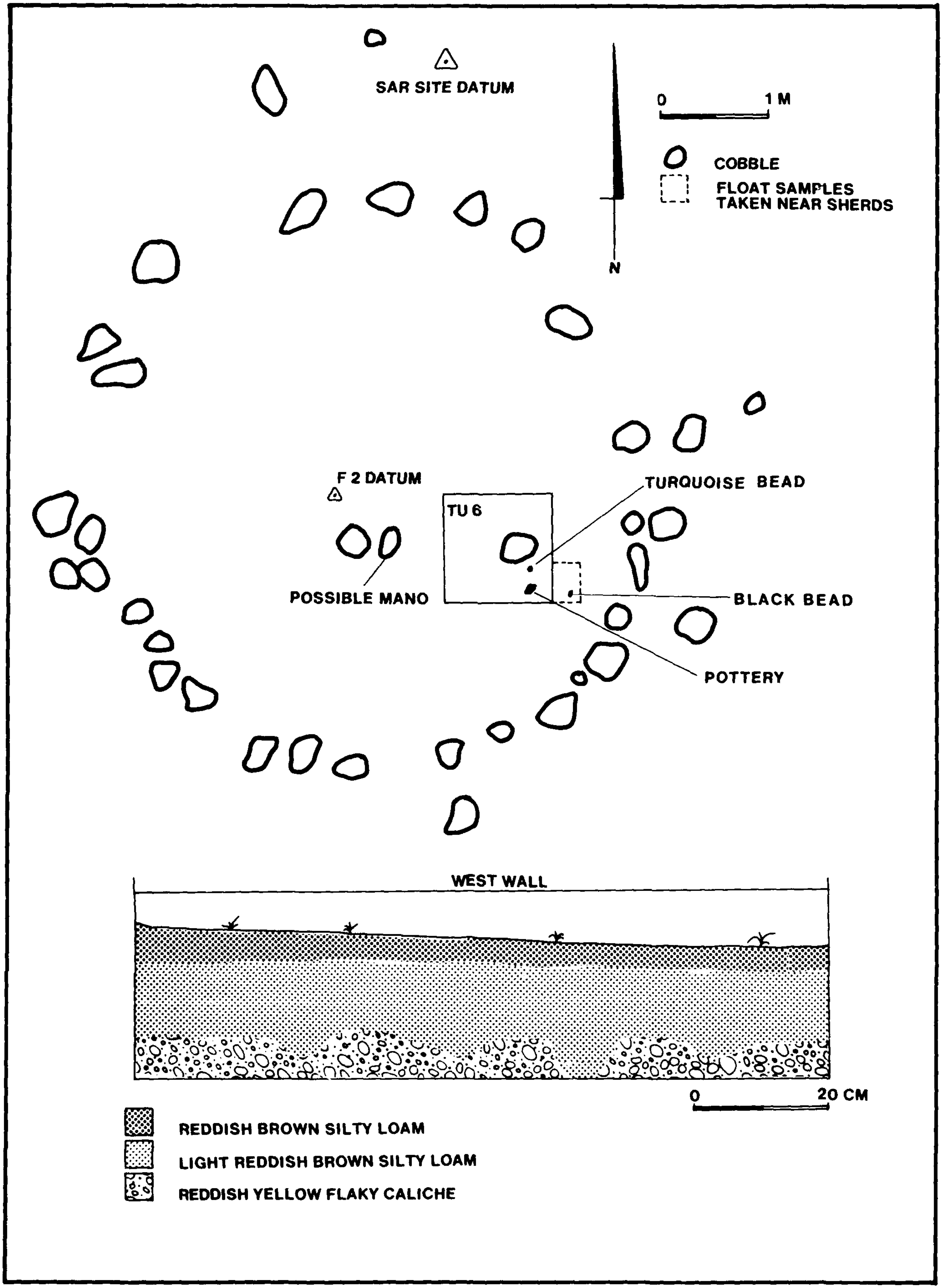


Figure 5.17 Plan of Cobble Ring Feature 2 and Profile of Test Unit 6, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Stratum III is at least 5 cm thick and is a compact reddish yellow (7.5YR 6/4) carbonate encrusted silty loam with gravel inclusions but lacks cultural remains.

Feature 3 is a spaced stone circle located at the end of the north terrace point. The Chama River terrace edge is 10 m east of the ring. This part of the site has experienced moderate erosion. The feature measures approximately 4.0 m (north-south) by 3.2 m (east-west) and is defined by nine large cobbles spaced from 50 to 250 cm apart (Figure 5.18). The widest gap in the stones is in the northeast part of the ring. The perimeter stones are somewhat paired. Neither an interior stone nor fire-cracked rock is present in the center. Four flakes were noted on the surface of the feature. Hearth Feature 4 is located a few meters to the southeast, near the tip of the terrace point.

Test Unit 1 is a 1-m^2 pit placed in the south half of ring Feature 3 and excavated to a depth of 20 cm. A stratigraphic profile of the north wall records three strata (Figure 5.18). Stratum I is a 7-cm thick, slightly compact brown (7.5YR 5/4) silty loam with fire-cracked rock fragments and pebbles less than 5 cm in diameter. Cultural materials consist of two flakes. The lower boundary is not well defined but is based primarily on textural differences.

Stratum II is a 10 cm thick, moderately compact brown (7.5YR 5/4) silty loam with gravel inclusions. A few flakes and fire-cracked rocks are present, but there is a marked reduction in the amount of spalled thermal cobbles. The main differences between Strata I and II are texture and compaction; there is a tendency for larger cobbles to occur at the base of the level. The lower boundary is wavy and abrupt.

Stratum III is a culturally sterile, very compact, pale brown (10YR 6/3) silt between dense subrounded cobbles. The stratum represents the top of the Pleistocene or pre-Pleistocene age terrace.

Feature 6 is the northern feature of a pair of spaced stone circles on the middle terrace point, about 50 m west of Feature 1. The rings are about 20 m south of the northern intrasite drainage terrace edge. This part of the site has minor erosion. The feature measures approximately 4.10 m (north-south) by 3.6 m (east-west) and is defined by six large and three medium-sized cobbles spaced from 35 to 300 cm apart (Figure 5.19). The widest gap in the stones is in the northeast and southwest portions of the ring. The perimeter stones form a solitary line and three interior stones are present. A cluster of thermally altered stones occurs within a 70 cm diameter area in the northwest part of the ring. Cobble ring Feature 7 is located about 1 m to the south.

Seven auger holes were excavated in a single north-south alignment across the feature. Most were dug to a maximum depth of 26 to 35 cm at which point the Pleistocene cobble terrace was encountered. Auger Hole 4 was terminated at a depth of 11 cm by a dense concentration of fire-cracked rock from a subsurface hearth, and sparse amounts of angular rock were recovered from the upper 10 to 30 cm in Auger Holes 3 and 5.

Figure 5.18 Plan of Cobble Ring Feature 3 and Profile of Test Unit 1, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

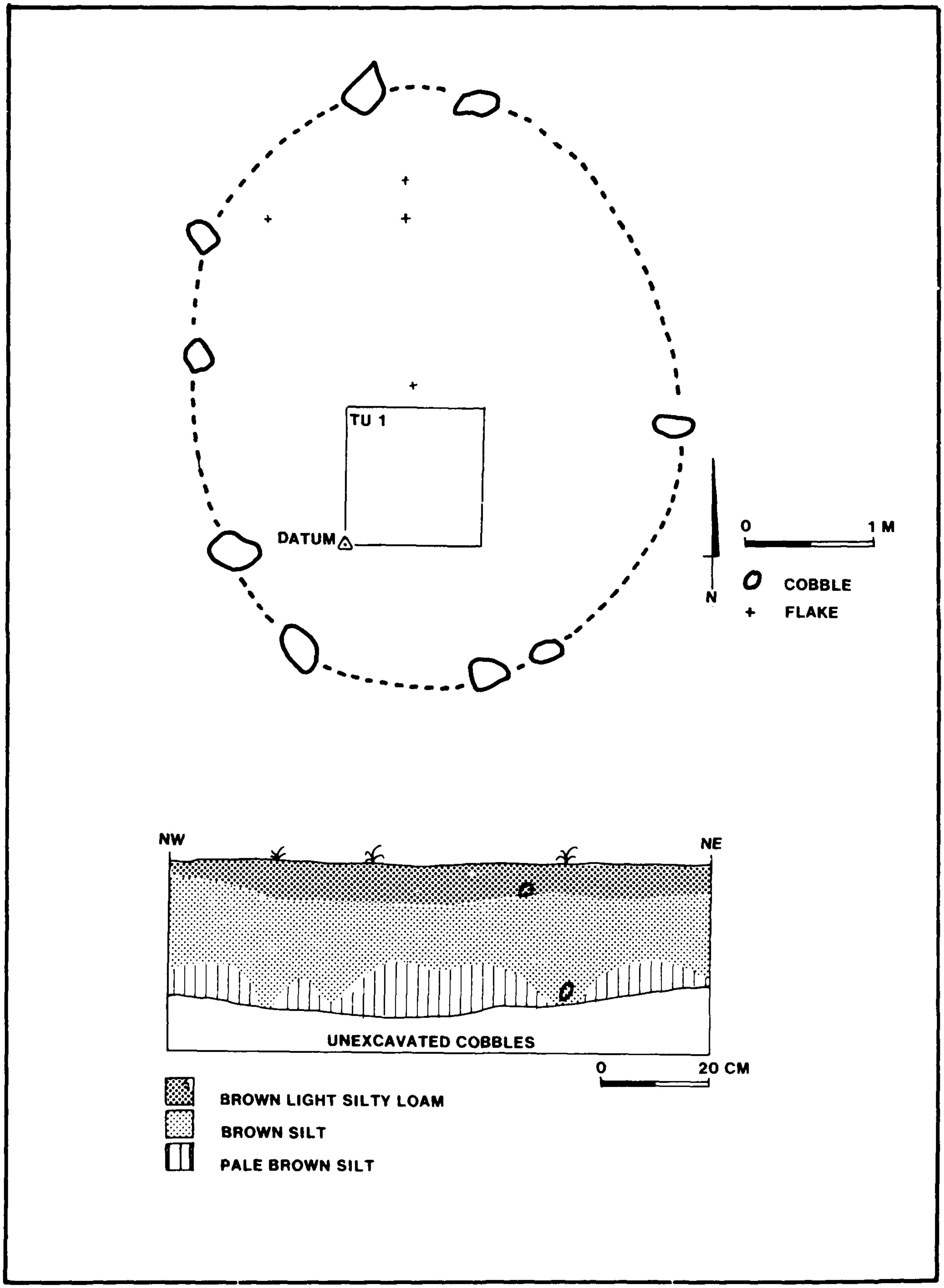
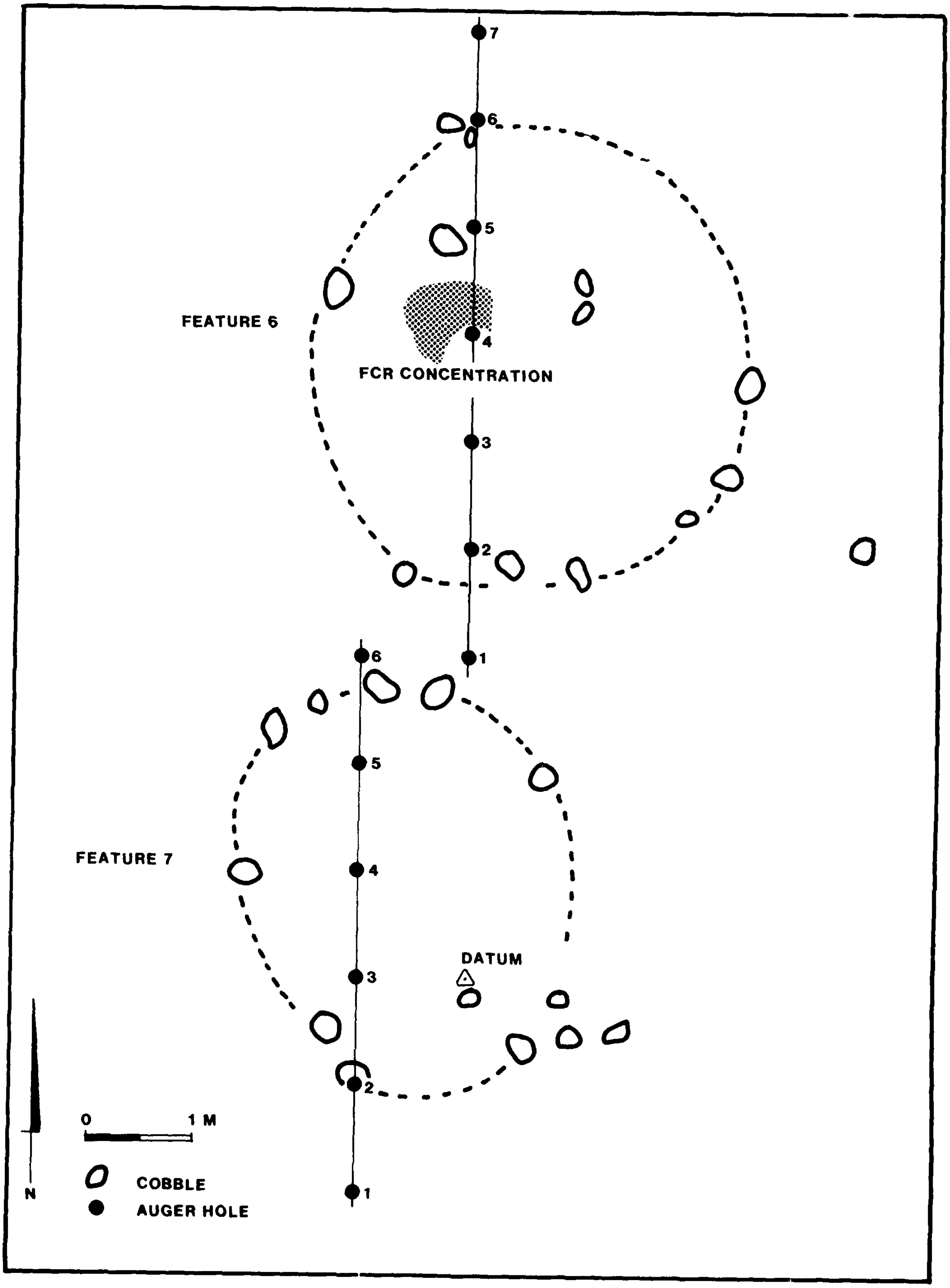


Figure 5.19 Plan of Cobble Ring Features 6 and 7, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Feature 7 is the southern feature of a pair of spaced stone circles west of Feature 1 in the middle terrace point. The rings are 20 m from the terrace edge and overlook the northern intrasite tributary of the Chama River. This part of the site has minor erosion. The feature measures approximately 3.50 m (north-south) by 2.9 m (east-west) and is defined by 12 large cobbles spaced from 40 to 185 cm apart (Figure 5.19). The widest gap in the stones is towards the east. The perimeter stones are irregularly spaced and do not seem to be paired. One stone occurs near the middle of the ring, but it may be a displaced wall stone. No ashy stains or fire-cracked rocks are evident from surface indications.

Six auger holes were dug in a north-south alignment across the feature. All but the second were dug to the Pleistocene cobble terrace at a depth of 26 to 45 cm. Subsurface fill consisted of light brown to reddish brown sandy loam. Small amounts of fire-cracked rock were encountered in Auger Holes 4 (8-30 cm deep) and 5 (0-9 cm deep). No charcoal or ashy soil was noted.

Feature 8 is a solitary spaced stone circle located on a lower portion of the southern terrace point overlooking the southern intrasite tributary of the Chama River. This part of the site has minor erosion. The feature measures approximately 5.4 m (north-south) by 4.75 m (east-west) and is defined by 14 large cobbles spaced from 30 to 175 cm apart (Figure 5.20). The widest gap in the stones is in the eastern part of the ring. The perimeter stones do not seem to be paired. Three interior stones are present; one of these is a mano. No soil stains or thermally altered stones occur in the center, but the central auger hole encountered ash. Interior associated materials include the mano, one smeared indented corrugated potsherd, and abundant flakes.

One auger hole was excavated near the center of the feature. Two distinct strata were observed in the hole before the Pleistocene cobble terrace was encountered at a depth of 25 cm. The upper 8 cm was a brown sandy loam mottled with gray ash and small charcoal flecks. This zone may represent hearth matrix associated with the ring, even though no oxidized soil was noted in the auger core. The layer from 8 to 25 cm deep was a reddish brown loam with occasional small pebbles. No evidence of cultural activities was observed in the lower fill overlying the cobble terrace.

Feature 12 is an amorphous structural feature located on the south terrace point adjacent to the south site boundary drainage. This part of the site is severely eroded. The feature measures approximately 5.0 m (north-south) by 4.4 m (east-west) and is defined by 12 large and 18 medium-sized cobbles irregularly spaced in a subrectangular pattern (Figure 5.21). The rocks seem to be clustered in four or five piles, each containing from four to 12 cobbles, with gaps of 150 to 200 cm between the piles. Erosion is so extensive that the morphology of the structure and the presence of central interior stones are uncertain. Associated materials include two cores and two flakes.

Four auger holes were randomly placed across the feature. Most were dug to a depth of 30 to 50 cm before hitting cobbles. These cores indicated that the upper 12 to 20 cm consisted of a brown fine sandy loam with a few small

Figure 5.20 Plan of Cobble Ring Feature 8, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

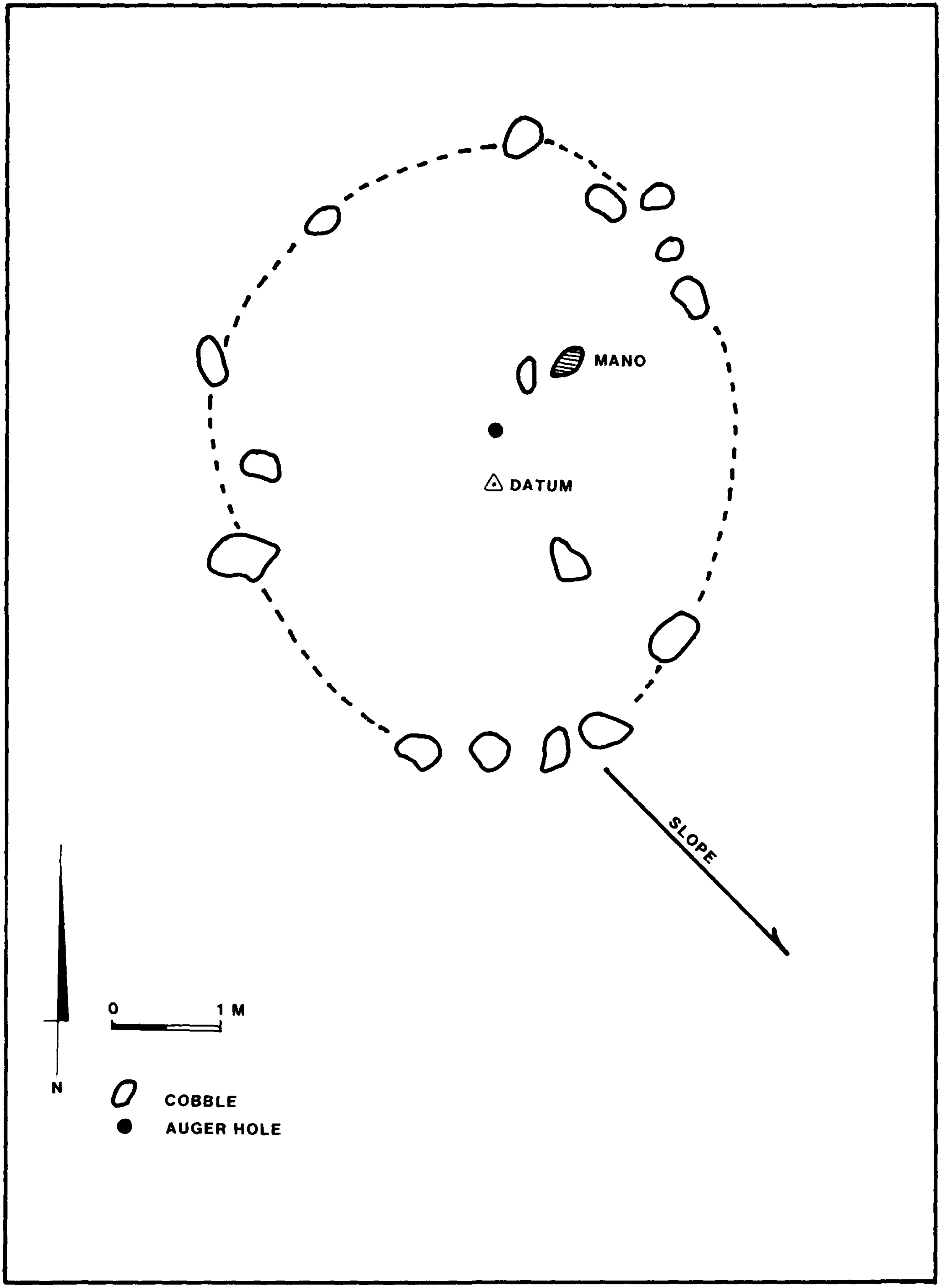
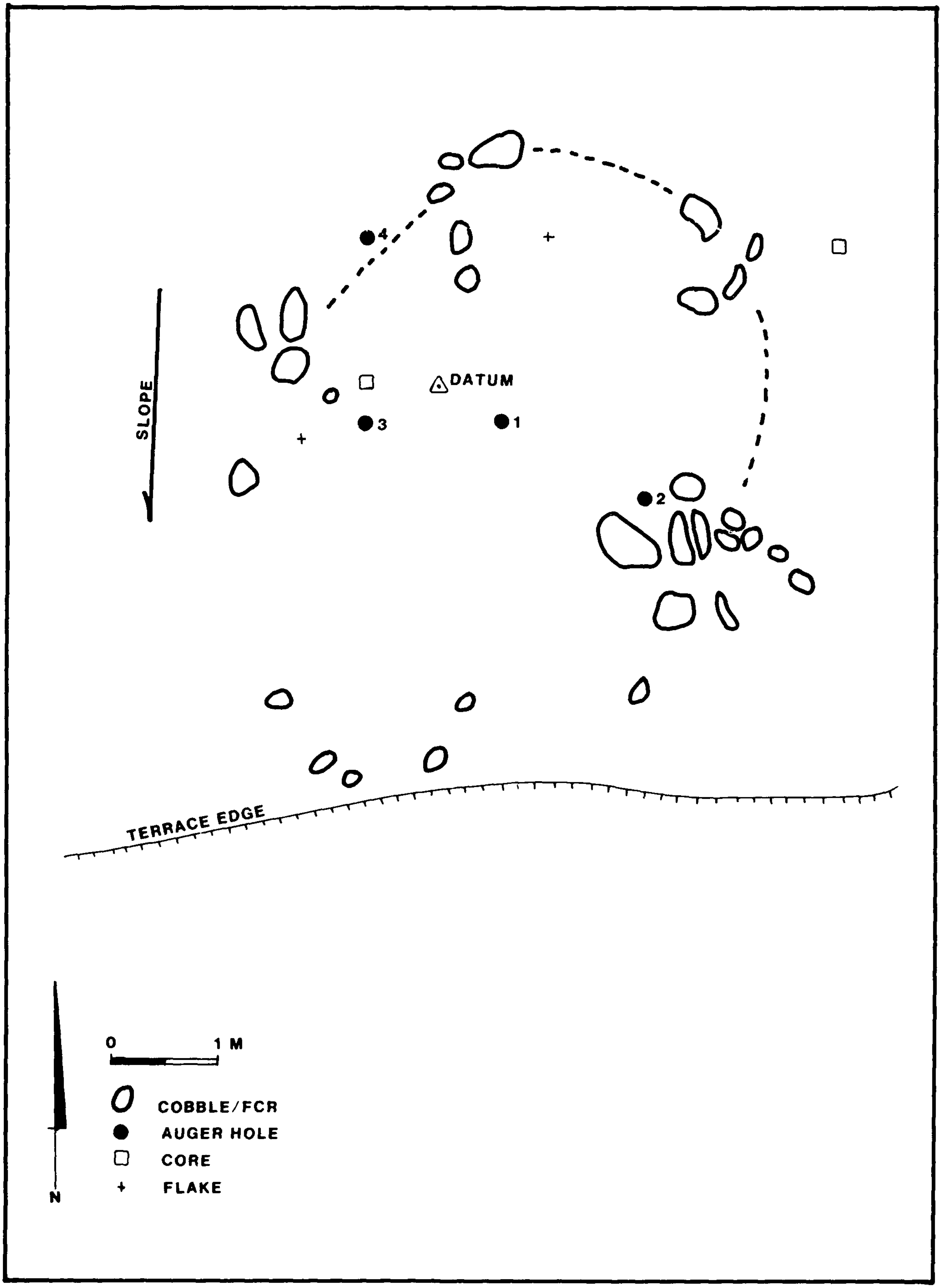


Figure 5.21 Plan of Structural Feature 12, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



pebbles; Auger Hole 2 encountered some fire-cracked rock in this level. From 12-20 to 20-30 cm, the soil became a compacted reddish brown loam with occasional small fragments of caliche. The lowest soil layer between 20-30 and 30-50 cm was a very light brown compacted sandy loam with an increase of caliche particles. No ash or discolored earth was encountered in the auger testing.

Feature 13 is a disturbed spaced stone circle located approximately 20 m southeast of Feature 6 on the south terrace point adjacent to the south intrasite drainage. This part of the site exhibits slight erosion. The feature measures approximately 2.65 m (north-south) by 2.0 m (east-west) and is defined by five large and two medium-sized cobbles spaced from 25 to 135 cm apart (Figure 5.22). The widest gap is towards the southwest part of the ring. The perimeter stones are spaced singular cobbles, and a single interior stone is present. No fire-cracked rock was visible on the surface, and no auger testing was conducted at this feature.

5.2.4.2 Nonstructural Features

Thermal Features

Feature 4 is a scattered rock hearth adjacent to cobble ring Feature 3 at the end of the north terrace point. This part of the site has experienced extensive erosion. The feature is defined by 22 large fire-cracked cobbles and a small, dense cluster of fine spalls within a 1.62-m (north-south) by 1.75-m (east-west) area for a dispersion index of 7.76 rocks/m^2 (Figure 5.23).

Excavation of Test Unit 4 revealed that hearth Feature 4 is amorphous in shape and was either built directly on the Pleistocene cobble terrace or deflated down to the terrace level. Fire-cracked rock extended no more than 10 cm below surface. No oxidized soil or extensive preparation was evident. Total weight of excavated fire-cracked rock in the feature is 13 kgs.

A stratigraphic profile of the north wall revealed a single homogeneous layer of a few angular and discolored quartzite cobble fragments scattered among dense subrounded cobbles (Figure 5.23). The sparse soil surrounding the densely packed rock is a brown (7.5YR 5/2) silty loam with occasional rootlets. The stratum predominantly represents the Pleistocene terrace remnant.

Feature 5 is an isolated rock-filled hearth on the west slope of a hillock on the north terrace point. The hearth is about 15 m from the north intrasite tributary and approximately 100 m from the Chama River terrace edge. This part of the site has experienced moderate erosion. The feature is surficially defined by 33 fire-cracked rocks clustered within a 1.25-m (north-south) by 0.9-m (east-west) area for a dispersion index of 29.33 rocks/m^2 (Figure 5.24).

Test Unit 5 is a 1-m^2 pit placed directly over the cobble scatter and excavated to a depth of 20 cm. The exposed feature represents a dense basin-shaped rock-filled hearth containing about 65 cobbles within a 1.1-m by 0.9-m area with a depth of about 20 cm. Some soil staining with small flecks of

Figure 5.22 Plan of Cobble Ring Feature 13, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

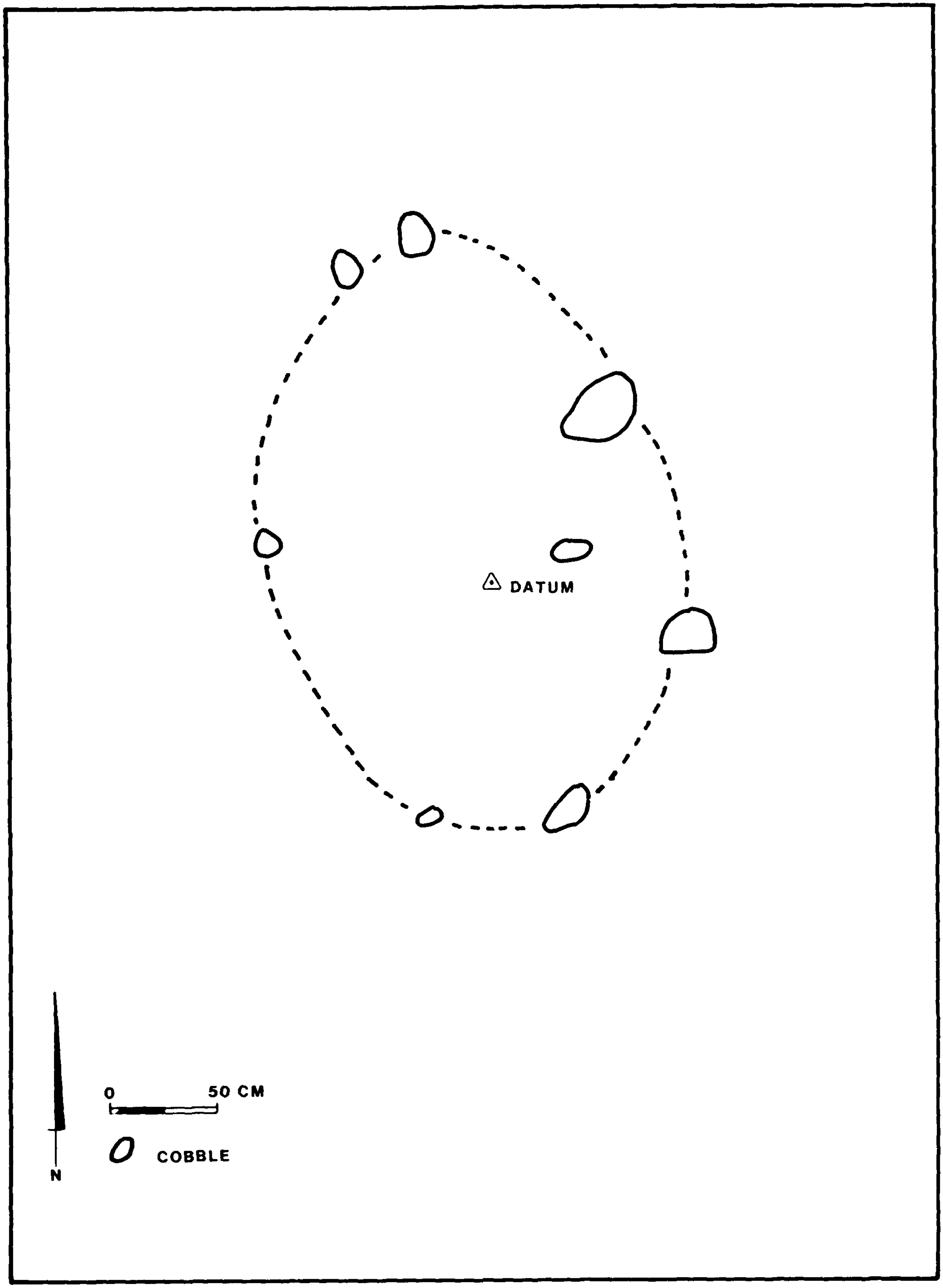


Figure 5.23 Plan and Profile of Hearth Feature 4, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

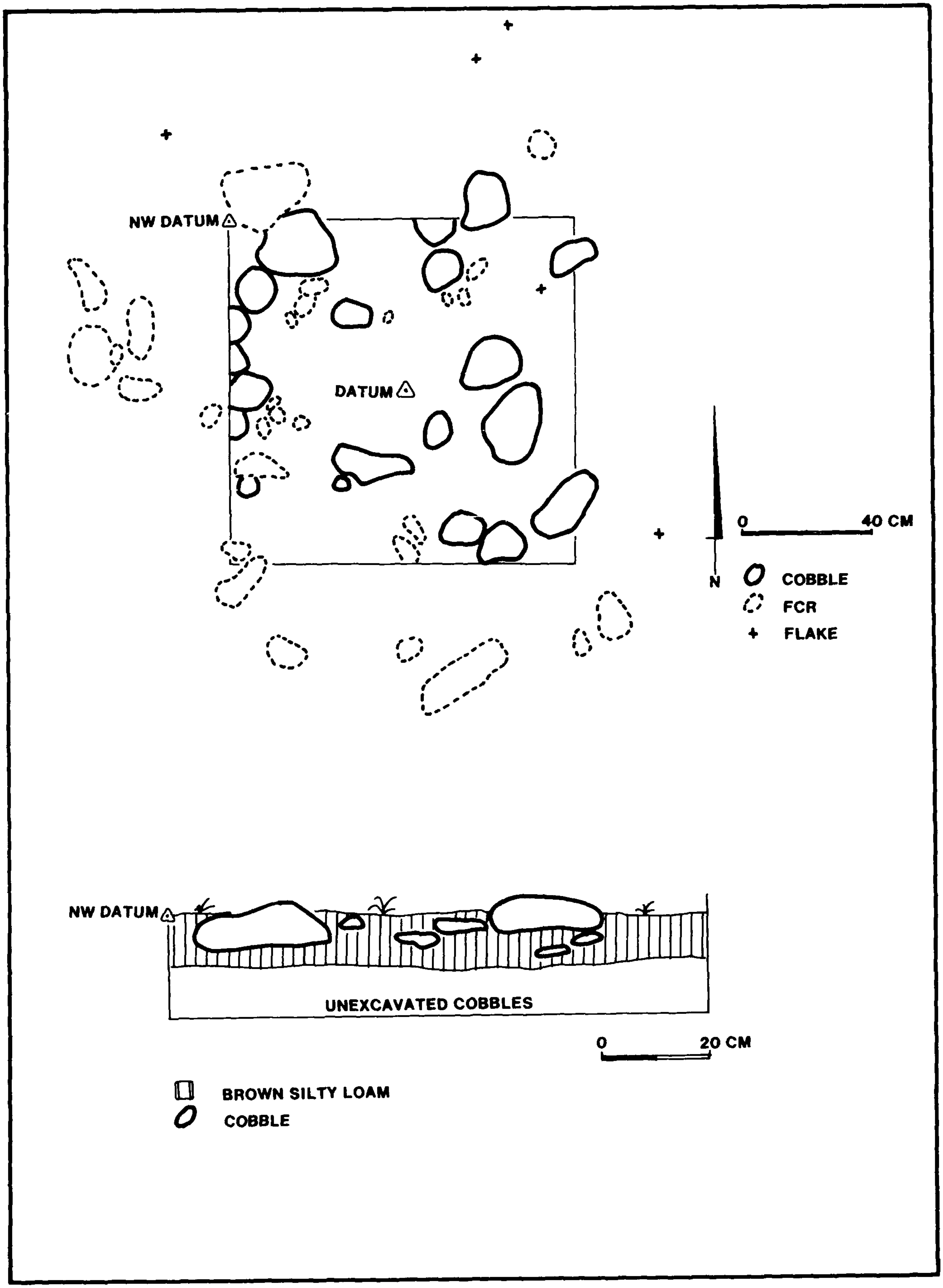
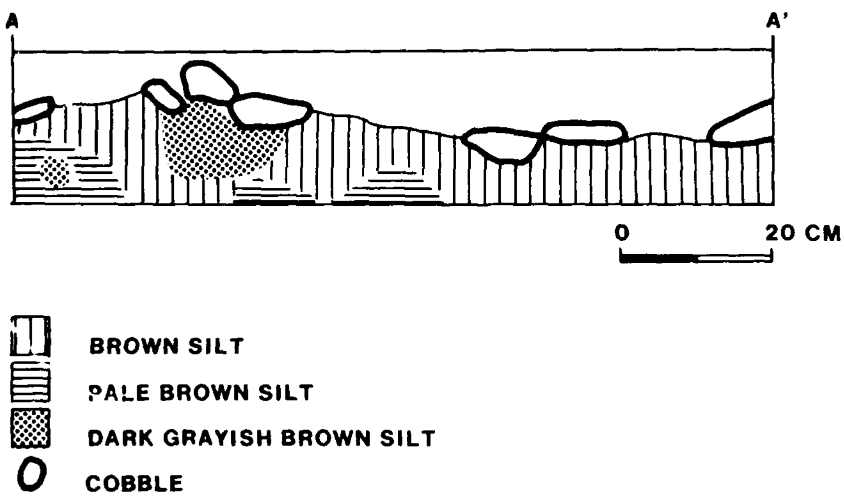


Figure 5.24 Plan and Profile of Hearth Feature 5, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



charcoal was observed in the northeast portion of the hearth. Slight oxidation was noted near the perimeter of the hearth. Total weight of the excavated fire-cracked rock is 51 kgs. A 1.5 liter soil sample was submitted for flotation recovery of plant remains. Only one charred goosefoot (*Chenopodium*) seed was recovered (Appendix E).

A stratigraphic profile along the north-south central axis of the feature revealed two strata within the hearth matrix (Figure 5.24). Stratum I is a 20-cm thick, compact brown (7.5YR 5/4) silty loam with dense fire-cracked rock and pockets of pale brown (10YR 6/3) compacted sandy silt. No artifacts were found in the hearth matrix. The lower boundary is smooth and abrupt.

Stratum II at the bottom of the hearth consists of pockets of moderately compacted dark grayish brown (10YR 4/2) ashy silt with small flecks of charcoal, surrounded by cracked cobble fragments. These different layers may indicate multiple use of the hearth feature.

Feature 9 is a scattered and moderately deflated rock hearth located along the south edge of the south terrace point overlooking the south site boundary tributary. This part of the site has experienced extensive erosion. The feature is defined by 26 cobbles clustered within a 1.6 m (north-south) by 1.05-m (east-west) area for a dispersion index of 15.48 rocks/m^2 (Figure 5.25). Most rocks are measure up to 18 cm in diameter.

One auger hole was excavated on the upslope part of the feature to a depth of 70 cm. The probe encountered a few fire-cracked rock fragments within a brown loam matrix in the upper 9 cm but failed to note any associated charcoal or ashy soil. From 9 to 19 cm, the soil was reddish brown and became more compact with some pebbles. From 19 to 70 cm, the soil was tan with few pebbles except for some caliche nodules. The profile suggests that the feature was moderately deflated.

Feature 10 is an isolated fire-cracked rock scatter along the mid-ridge line on the south terrace point. The nearest terrace edge is about 45 m to the south. This part of the site has experienced slight erosion. The feature is defined by 19 large cobbles clustered within a 1.85 m (north-south) by 2.2 m (east-west) area for a dispersion index of 4.67 rocks/m^2 (Figure 5.26). The hearth appears moderately deflated; there is no evidence of the feature structure or concentration. For this reason, no excavations or auger testing was conducted at the feature.

Feature 11 is a fire-cracked rock scatter located approximately 8 m northeast of hearth Feature 9 on the south terrace point. The southern site boundary tributary terrace edge is about 15 m to the south. This part of the site has experienced a moderate amount of erosion. The feature is defined by eight large cobbles clustered within a 1.8-m (north-south) by 0.9-m (east-west) area for a dispersion index of 5.93 rocks/m^2 (Figure 5.27). Individual rocks measure up to 12 cm in diameter.

Two auger holes were excavated towards the upslope side of the rock scatter. Auger Hole 1 was dug to a depth of 72 cm without encountering charcoal, ashy soil, or fire-cracked rock. Auger Hole 2 was terminated at 8

Figure 5.25 Plan of Hearth Feature 9, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

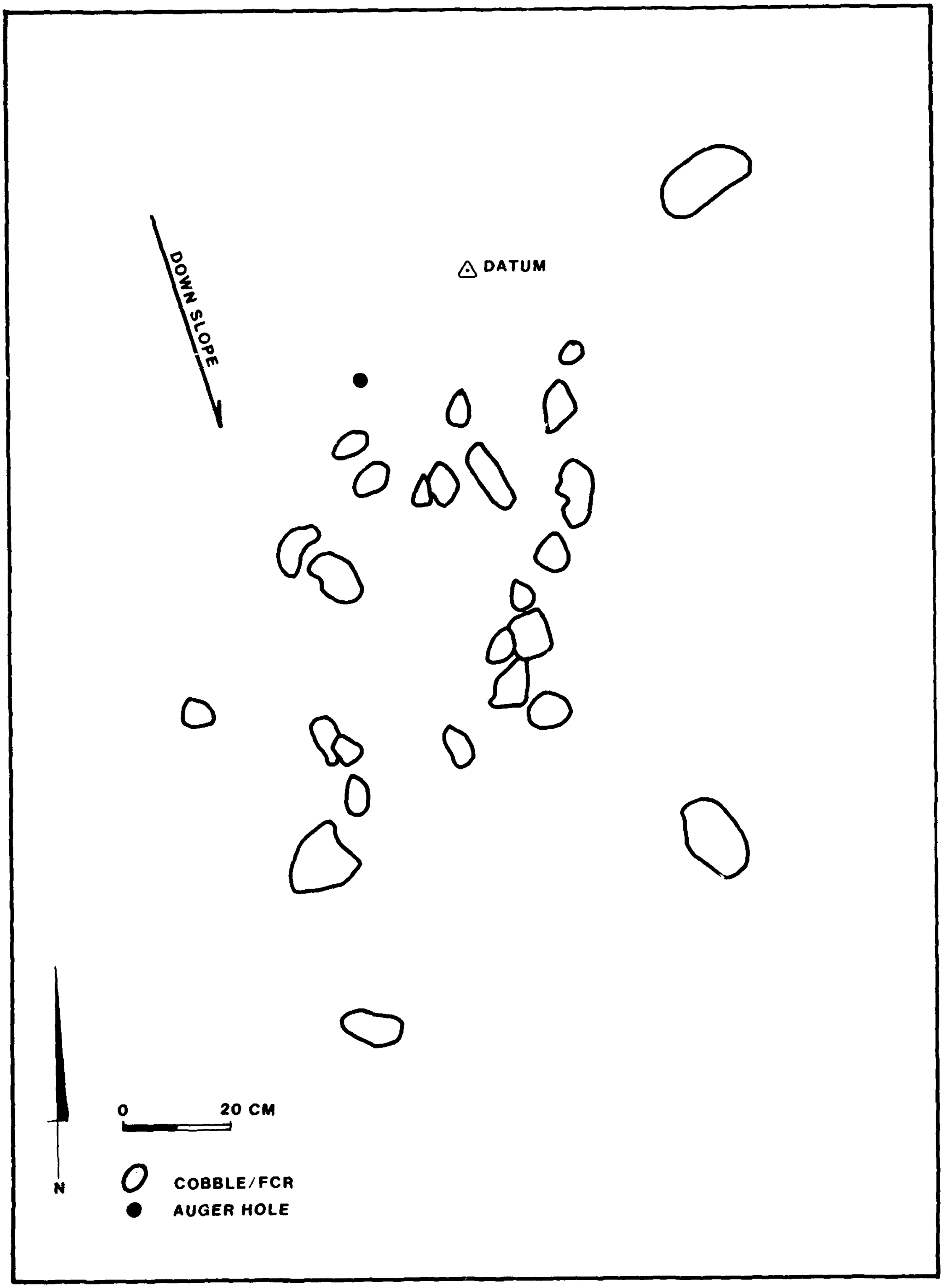


Figure 5.26 Plan of Hearth Feature 10, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

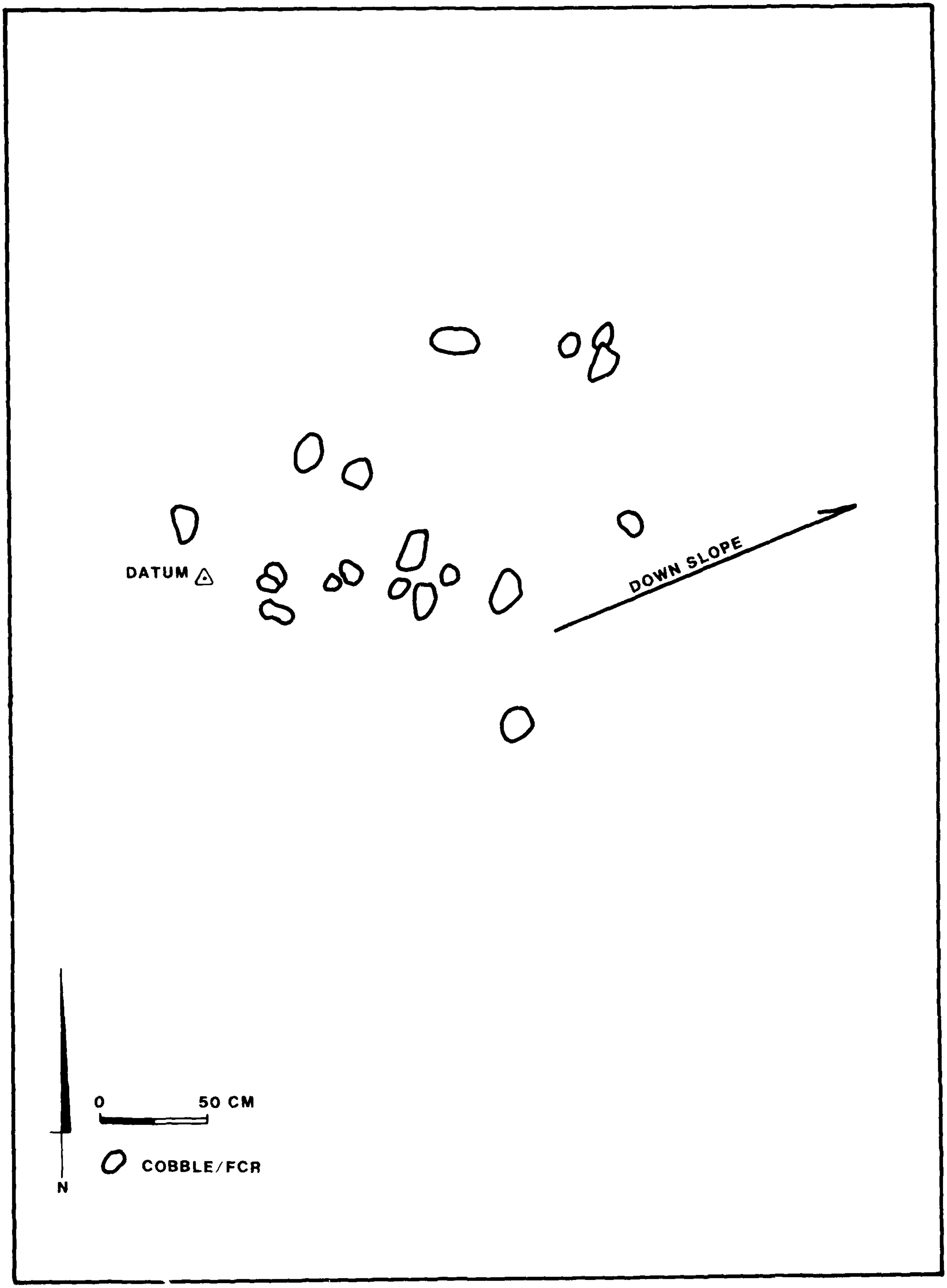
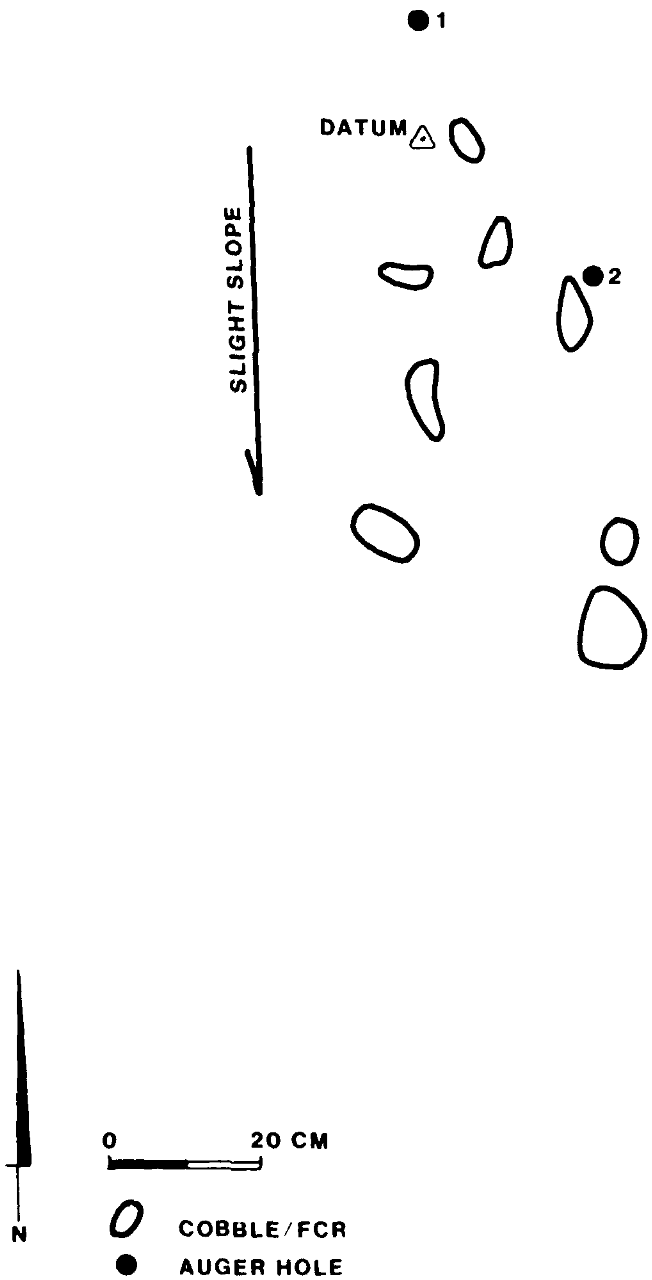
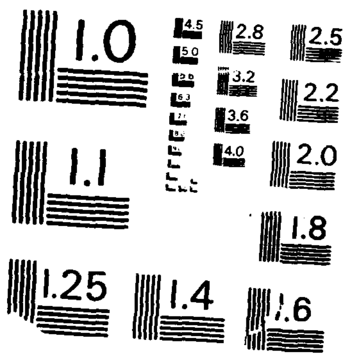


Figure 5.27 Plan of Hearth Feature 11, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



AD-A209 239   ANALYSIS OF THREE COBBLE RING SITES AT ABIQUIU   2/4
RESERVOIR RIO ARRIBA COUNTY NEW MEXICO(U) MARIAH
ASSOCIATES INC ALBUQUERQUE NM   A C EARLS ET AL. JAN 89
UNCLASSIFIED   DACW47-86-D-0002   F/G 5/6   NL



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

cm by a large piece of angular rock. Quite likely, some subsurface potential remains for this feature, but the dimensions, depth, and content remain unknown.

One other hearth feature was not assigned a feature designation through an oversight in the field. It is a sparse fire-cracked rock scatter located approximately 25 m southwest of cobble ring Feature 1 near the mid-ridge line of the middle terrace point. This part of the site has experienced considerable erosion. No observations or feature map was made on this dispersed burned rock scatter. Thus, the dimensions and rock sizes are not available. No subsurface testing was conducted on the hearth. The dispersed rocks reflect considerable deflation.

Lithic Reduction Acres

Lithic Concentration 1 is located south of cobble ring Feature 1 on the middle terrace point. Lithic Concentration 2 is located about 20 m to the southeast. This part of the site has experienced slight to moderate erosion. A high concentration of lithic debitage and tool fragments composed mainly of quartzite was noted in an 18.6-m (north-south) by 14.4-m (east-west) area. Surface monitoring conducted within a 4 x 4 m area yielded material densities ranging from one to 18 items per m^2.

Lithic Concentration 2 is located near the end of the middle terrace point overlooking the Chama River. Other nearby features include Lithic Concentration 1 and cobble ring Feature 1 to the northwest. This part of the site has experienced moderate erosion. A dense concentration of predominantly obsidian debitage and tool fragments was noted in a 16.1 m (north-south) by 20.2-m (east-west) area. Surface monitoring was conducted within a 4 x 4 m area, and artifact densities ranged from two to nine items per m^2.

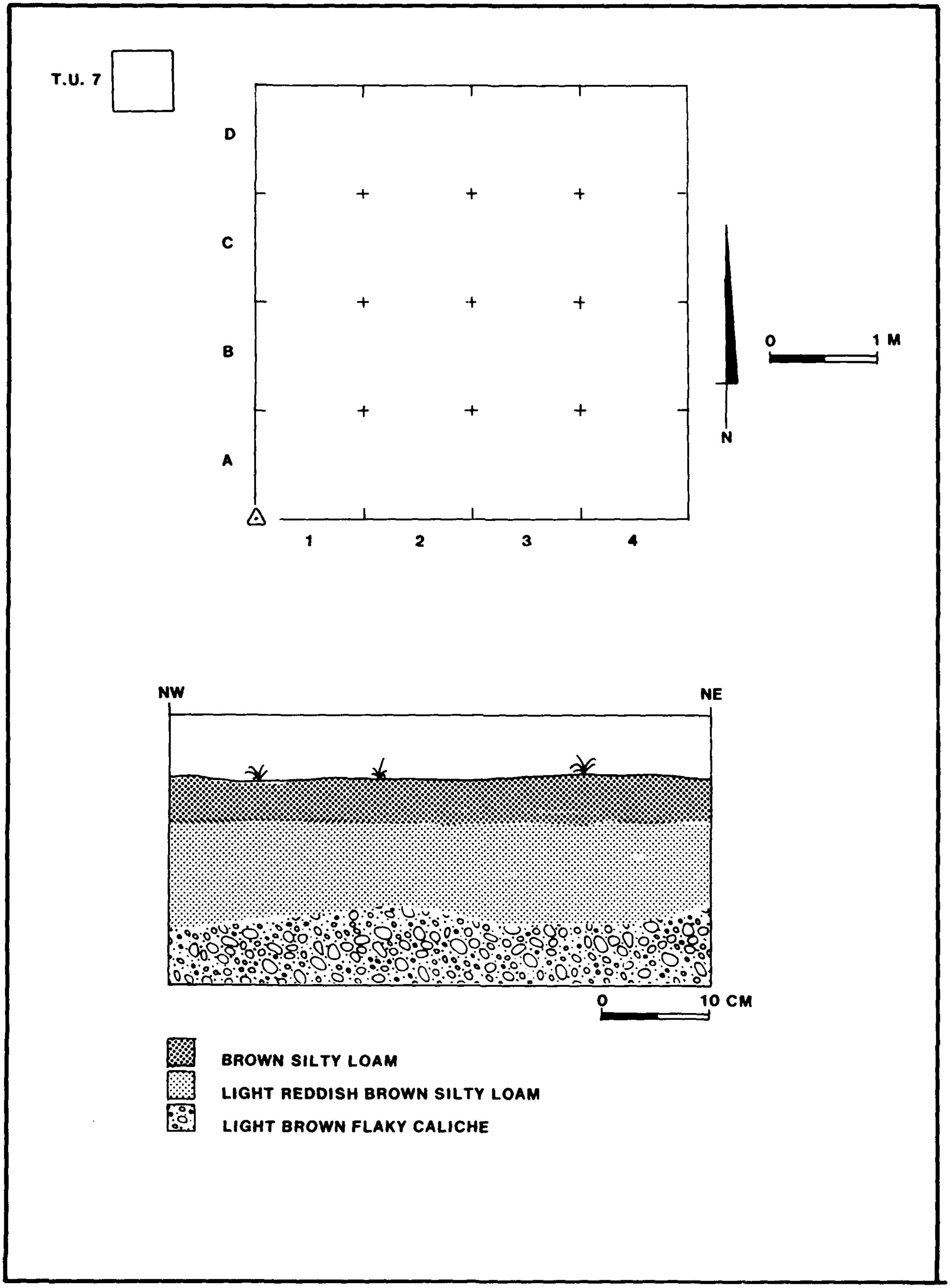
Test Unit 7 is a 0.5-m^2 pit placed 3.75 m north and 0.25 m west of the southwest corner of the collection unit. It was excavated to obtain subsurface obsidian for hydration dating. The pit was dug to a depth of 20 cm and encountered three strata (Figure 5.28). Stratum I is a 4-cm thick, loose reddish brown (5YR 5/4) silty loam containing subsurface obsidian debitage. The lower boundary is smooth and abrupt.

Stratum II is an 11-cm thick, culturally sterile, compact light reddish brown (5YR 6/4) silty loam with gravel inclusions. The lower boundary is smooth and abrupt.

Stratum III is a compact, light brown (7.5YR 6/4) silty loam without cultural materials.

Lithic Concentration 3 is a crescent-shaped lithic scatter in the mid-ridge area away from the terrace edges on the north terrace point. Other nearby features include hearth Feature 5 located 25 m to the southwest and cobble ring Feature 3 located about 65 m to the southeast. This part of the site has experienced slight erosion. The highest concentration of lithic debitage and tool fragments was noted in a 38-m (east-west) by 40-m (north-south) area, but other materials occurred over a broader area. The sampling

Figure 5.28 Plan and Profile of Test Unit 7 Relative to 4 x 4 m Collection Unit in Lithic Concentration 2, LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



strategy of this concentration involved piece-plotting and collecting the 37 specimens closest to the concentration Datum; also collected were three formal tools from a larger area. The mongrid collection strategy prevents comparability of material density information; however, the 37 specimens were recovered within a 31.2-m radius of the feature datum.

Another sample of lithic material at the end of the north terrace point was collected, but this area was not assigned a feature or lithic concentration number. The collection locality encompasses the areas around ring Feature 3 and hearth Feature 4. This part of the site has experienced moderate erosion. The highest concentration of lithic debitage was noted along the Pleistocene cobble terrace edge. As with Lithic Concentration 3, the sampling strategy involved piece-plotting and collecting 28 specimens from the concentration datum established at the northwest stake at Test Unit 4. All artifacts within 13.5 m of this datum stake were collected.

5.2.5 Flotation and Chronological Sample Proveniences

A total of 13 samples was submitted for special analysis. Four bags of soil from excavated features were submitted for flotation and macrobotanical analysis to obtain subsistence information. In addition, one set of baked clay samples with measured orientations, six obsidian artifacts, and two charcoal samples were submitted to obtain information about the age of samples. The proveniences of these various samples are indicated in Table 5.2. The macrobotanical discussions have been presented in conjunction with the previous feature descriptions and are summarized in Appendix E; the chronometric results are discussed in Section 6.2.

5.3 LA 25419

5.3.1 Topographic Setting

This southernmost site is a very extensive locus with widely scattered cobble ring structures and fire-cracked rock hearths located on the west side of the Chama River. The site is bounded on the north and south by very prominent escarpments from major drainages, and a series of steep, high hills defines the western edge of the site. A deep but short intrasite drainage bisects the site into north and south terrace areas. The north terrace area is defined by escarpments along the north, east, and south, and it has a low ridge extending east-west down the central terrace axis; the land is rough and broken along the northwest portion of the terrace. The south terrace area is generally flatter, but a series of high hills rises steeply from the terrace along the south site boundary drainage. Some specialized lithic reduction and hearth features occur on the tops of these hills. Cobble and lithic resources are present along the steep terrace escarpments. Dense stands of pine are also present on the high hills along the western site boundary. The two terrace areas are mostly covered in grasses, sage, and low shrubs.

Table 5.2 Macrobotanical and Chronometric Sample Proveniences from LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Sample Provenience	Depth	Feature Number	Field Specimen	Sample Type
Macrobotanical Flotation				
Test Unit 8, Level 1	0-10 cm	1B	--	Hearth Matrix
Test Unit 6, Level 1	0-5 cm	2	--	Hearth Matrix
Test Unit 5, Level 2	10-20 cm	5	--	Hearth Matrix
Test Unit 2-3, Level 4	30-40 cm	1A	--	Hearth Matrix
Archaeomagnetic Dating Sample				
Test Unit 8, Level 1	0-10 cm	1B	--	Baked Clay
Obsidian Hydration Dating Samples				
Map Sta. 4, 110^{o} 43.00 m	Surface	--	114	Point Base
Test Unit 1, Level 1	0-10 cm	3	1	Flake
Test Unit 1, Level 2	10-20 cm	3	2	Flake
Map Sta. 4, 306^{o} 63.00 m	Surface	--	115	Point Base
Temp Dat. B, 356^{o} 2.30 m	Surface	--	18	Point Mid.
Temp Dat. C, 76^{o} 6.50 m	Surface	--	89	Ret. Flake
Radiocarbon Dating Samples				
Test Unit 8, Level 1	0-10 cm	1B	--	Charcoal
Test Unit 2-3, Level 1	30-40 cm	1A	--	Stained Soil

5.3.2 Previous Work

The site was initially visited in May 1975, by archaeologists from SAR for a Phase III survey and was subsequently revisited by NAI archaeologists in April 1982, for further recordation. The SAR site forms record the site as AR-161 covering an expansive terrace between two major tributaries and bifurcated by a short lateral drainage into northern and southern site sections. The site consists of 20 cobble rings, several lithic scatters, and some hearth loci within a 350-m (northwest-southwest) by 300-m (northeast-southwest) area (105,000 m^2).

The site is thought to be a single component locality utilized by the Utes during the Historic Period. Specific information is provided on the SAR forms for 10 "feature" loci which may contain one or more structures. Each feature locus is assigned an alphabetic designation--A through J. An accompanying site sketch map indicates the general topography and shows that feature loci are segregated by minor gullies or topographic breaks. The map indicates a total of 20 cobble rings, two hearth areas, and one lithic scatter in feature loci A through J. Features within each locus are not provided with a unique designation.

SAR site form continuation sheets and the map provide the following information about each of the feature loci. Locus A is a lithic concentration of unspecified size on the northeast point of the north site area which contains mostly medium-sized obsidian and white quartzite flakes. Locus B, located in the east central portion of the north site area, has a single ring measuring 5 to 6 m in diameter; associated materials include a large flake of coarse-grained quartzite. Locus C is a group of five rings measuring 5 to 6 m in diameter in the northeast part of the south site area; associated lithics include at least 50% obsidian materials. Locus D is a single ring 5 to 6 m in diameter located in the south central part of the south site area. Locus E is a pair of cobble rings measuring 5 to 6 m in diameter in the northwest part of the south site area. Locus F consists of two more cobble rings measuring 5 to 6 m which are located in the south central part of the north site area. Locus G has a single possible disturbed cobble ring in the north central part of the north site area. Locus H consists of three rings 5 to 6 m in diameter in the north-northwest part of the north site area; associated lithic materials include mostly chert debitage, but some obsidian and fine-grained red, white, and purple quartzite is also present. Locus I is near the head of the lateral drainage separating the two site areas; it consists of two [sic three] rings and a hearth. Locus J is north of Locus I and west of Locus H in the north site area; it has two cobble rings and a hearth with charcoal.

The site condition is reportedly good, and cultural deposits are unaltered. Major identified impacts include channel and sheet erosion and a two-track road. The site was recommended for inclusion in the nomination of the Abiquiu Reservoir district to the National Register of Historic Places.

The site was revisited in 1982 by NAI archaeologists in order to establish a site datum and conduct an artifact density study. The site visitation forms confirm the SAR observations but provide little new information. Features are "numerous", and the lithic scatter is sparse and continuous across the site. No tools, ceramics, or ground stone artifacts were found, but the debitage consisted mostly of cherts, chalcedonies, and obsidians. An artifact density study was initiated from two unspecified mapping stations on either side of the drainage bisecting the site (Reed et al. 1982:43). The study was accomplished by tabulating the number of flakes in a series of 40-m long segments, within eight transects radiating from each mapping station. The width of these transect segments is unspecified. A total of 29 lithic artifacts is reported from 14 of the 38 segments; the highest density per 40-m long segment is six items.

The NAI reevaluation judged the site to be in good condition (90% intact) with identified impacts stemming from surface collecting, livestock use, some deflation, and minor erosion. The research potential was uncertain; factors influencing such potential include the existence of subsurface cultural materials which could contribute to knowledge about local chronology and subsistence. Subsurface testing was recommended in a staged program near the cobble rings (Reed et al. 1982). Initially 10 structures and a sample of extramural areas (10 m^2 randomly selected from within a 400 m^2 area surrounding each of these rings) were recommended for excavation. If the data did not become redundant, then the number of excavated rings and extramural areas should be expanded until redundancy was achieved. In addition, point-plotted surface artifact collection within each 400 m^2 parcel surrounding the rings was recommended for supplemental data.

5.3.3 Definition of Boundaries

The site boundaries for LA 25419 are unambiguous and readily defined by marked changes in the terrace topography. The 25-m tall terrace escarpment of the Chama River and the two major tributaries constitute the north, east, and south site boundaries. The distribution of cultural materials was determined by pin-flagging features and artifacts along hill slopes towards the west. This method indicated that the western site limit is marked by the lower slopes of a line of hills to the west and southwest.

Within the site most cobble rings occur within 25 m of the escarpment edges of the Chama River. the north and south site boundary tributaries, or the intrasite site tributaries. The north terrace axial ridge is the locus of numerous hearth features. Major lithic reduction areas were noted near the cobble ring structures and on the high hills along the south site boundary.

The site dimensions and total site area were calculated from a topographic map made of the entire site. The site is essentially rectangular and measures approximately 300 m (north-south) by 210 m (east-west). A compensating polar planimeter was used to determine that the south terrace area and the high hills constitute 21,131 m^2 while the north terrace area is approximately 43,774 m^2. Excluding the intrasite tributary, the entire site covers 64,905 m^2.

5.3.4 Surface and Subsurface Features

A total of 45 features was identified at the site. These include 22 stone rings or other structural remains, 19 hearths, and four lithic reduction areas. The distribution of features is indicated in Figures 5.29 and 5.30. The structural features are discussed below separately from the nonstructural features. Detailed debitage analysis of artifacts associated with the lithic reduction areas and other features is discussed in Section 6.1.

5.3.4.1 Structural Features

Feature 1 is a partial spaced stone circle located in a low saddle between low hills at the northeast tip of the south terrace point. It is situated 15 m from the Chama River terrace edge 10 m south of the intrasite drainage terrace edge. The feature vicinity corresponds to SAR feature area C. This part of the site has moderate erosion. The feature measures approximately 5.1 m (north-south) by 5.25 m (east-west) and is defined by 15 large cobbles spaced from 30 to 175 cm apart (Figure 5.31). A 4.5-m segment of the southeast portion of the ring is missing cobbles. The perimeter stones are unpaired, and four interior stones are present. No fire-cracked rock was noticed in the center. No subsurface testing was conducted at the feature, but a 10-m radius surface collection area inventoried 54 flakes and two tools.

Figure 5.29 LA 25419 Site Map, North Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

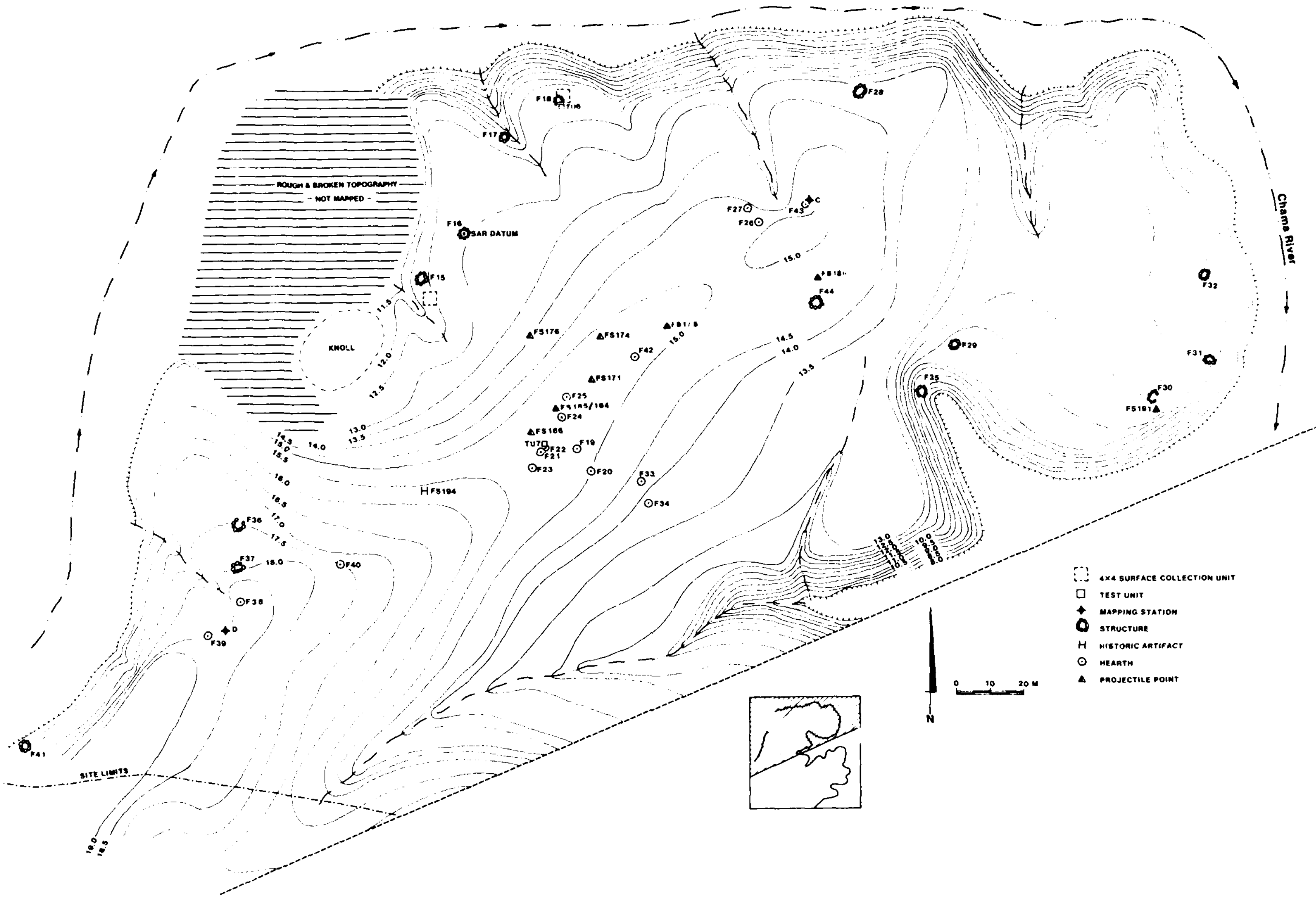


Figure 5.30 LA 25419 Site Map, South Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

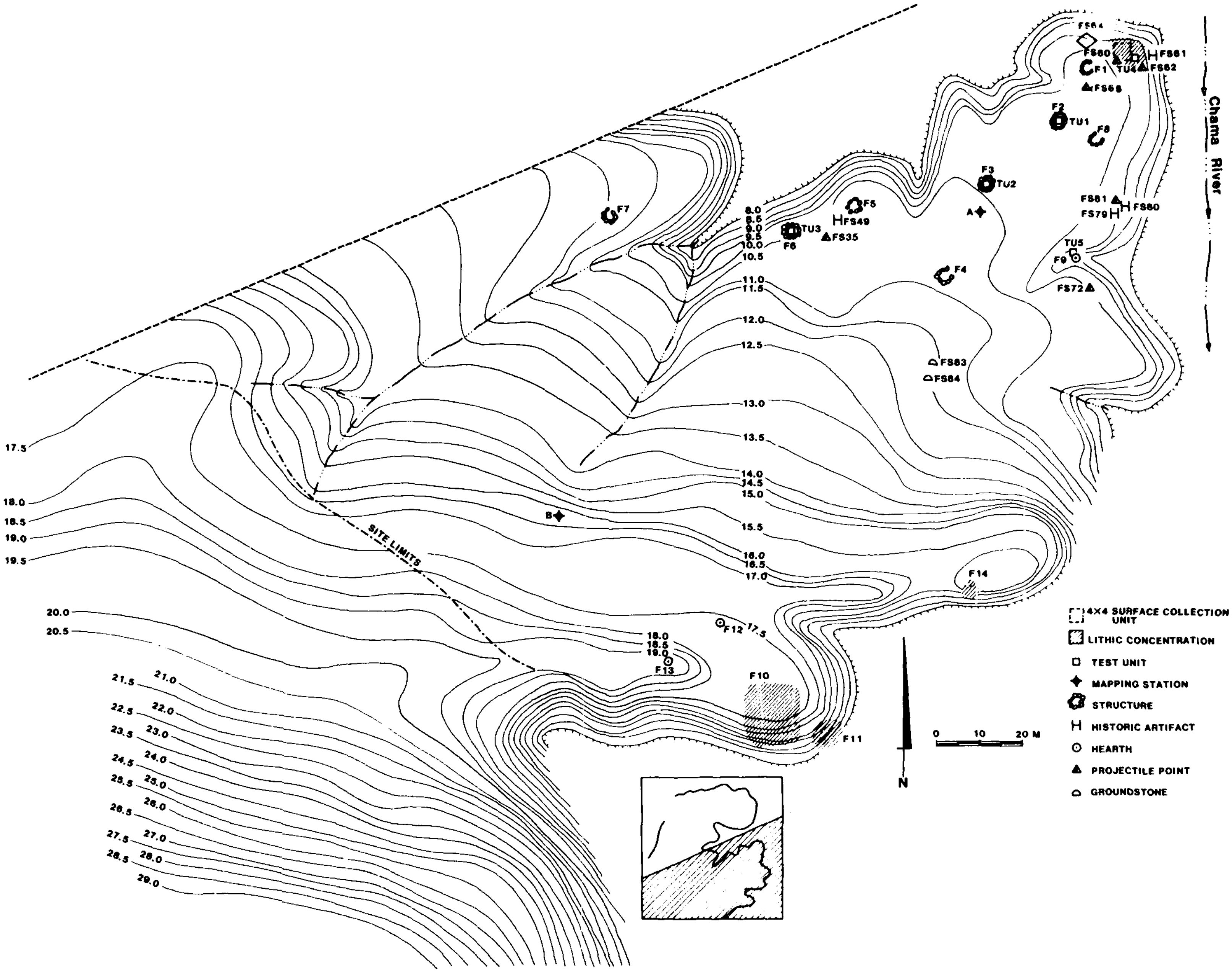
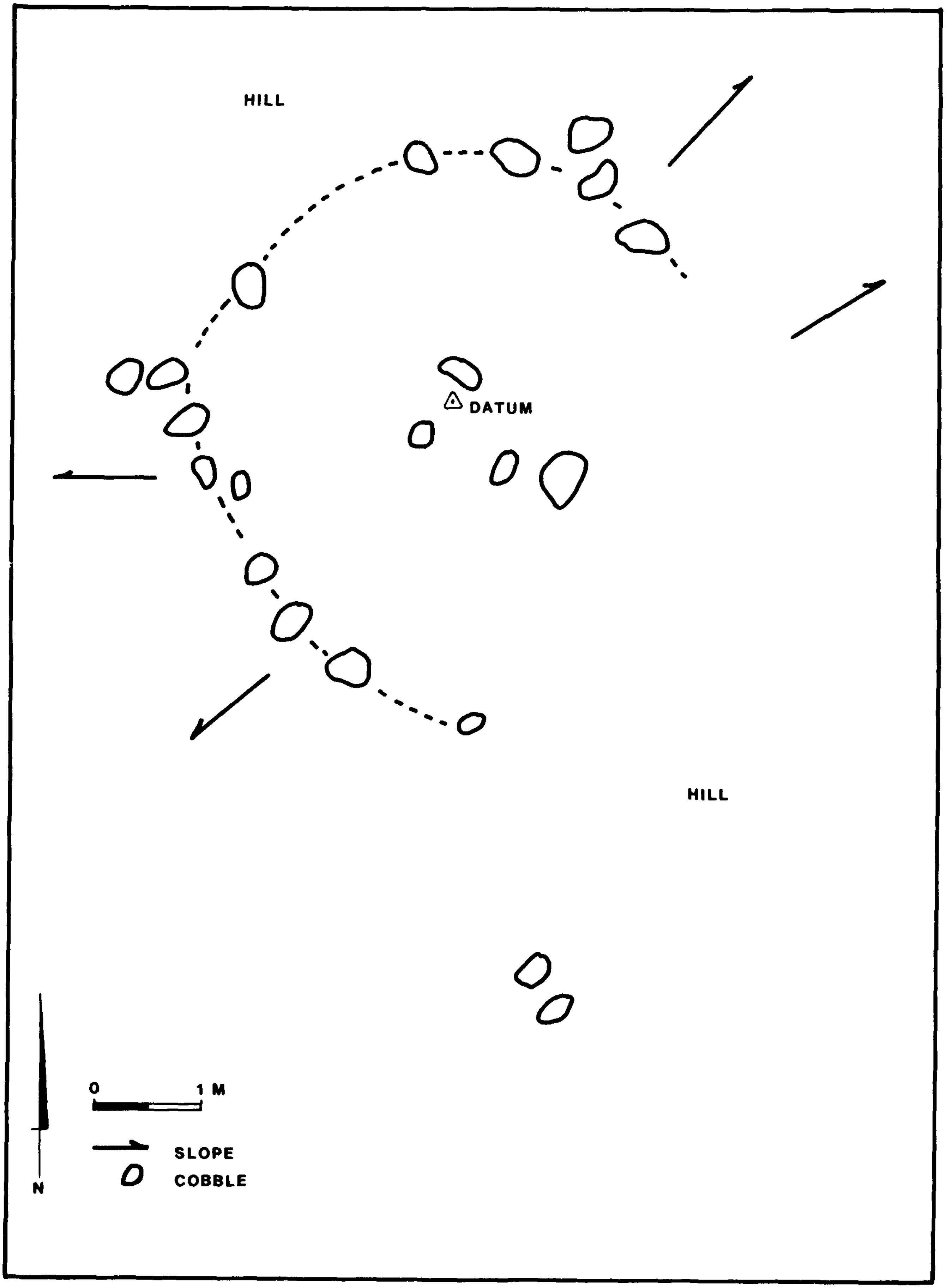


Figure 5.31 Plan of Cobble Ring Feature 1, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Feature 2 is a spaced stone circle located towards the northeast end of the south terrace point and situated about 25 m from the Chama River terrace edge overlooking the intrasite drainage. The feature vicinity corresponds to SAR feature area C. This part of the site has experienced slight erosion. The feature measures approximately 4.5 m (north-south) by 4.0 m (east-west) and is defined by 11 large and seven medium cobbles spaced from 35 to 100 cm apart (Figure 5.32). A 4.5 m segment of the southeast ring portion is missing. The perimeter stones seem to be unpaired, and two interior stones are present. A few pieces of fire-cracked rock were recovered in the upper 10 cm of Test Unit 1. A 10-m radius surface collection unit recovered 11 artifacts.

Test Unit 1 is a 1-m^2 pit placed in the center of the ring and excavated to a depth of 20 cm. A stratigraphic profile of the east wall revealed three strata (Figure 5.33). Stratum I is a 3 to 5 cm thick, poorly consolidated dark brown (10YR 4/3) fine silty loam with fine rootlets. Cultural materials consist of a few small fire-cracked rock fragments and an obsidian point fragment. The lower boundary is smooth and abrupt.

Stratum II is a 5- to 12-cm thick, compact dark yellowish brown (10YR 4/4) silty loam. The presence of cultural materials in this stratigraphic unit remains uncertain. The lower boundary is smooth and gradual.

Stratum III is at least 9 cm thick and is a culturally sterile, moderately compacted yellowish brown (10YR 5/6) coarse silty loam with few gravel inclusions.

Feature 3 is a spaced stone circle located southwest of Feature 2 along the northern edge of the south terrace point and overlooking the intrasite drainage. The feature vicinity corresponds to SAR feature area C, where seven cobble ring features were recorded. This part of the site is slightly eroded. The feature measures approximately 4.25 m (north-south) by 4.5 m (east-west) and is defined by 11 large cobbles spaced from 75 to 240 cm apart (Figure 5.34). The widest gap in the wall stones is towards the west. The perimeter stones are generally unpaired, although two cobbles in the northeast may be an adjoining set. Three small interior stones are present as is a metate fragment. A few thermally-altered stones occur inside the ring. A total of 33 artifacts was collected within a 10-m radius of the feature datum.

Test Unit 2 is a 11m^2 pit placed in the northeast portion of the ring and excavated to a depth of 30 cm. A one-liter flotation sample yielded one uncharred goosefoot (*Chenopodium*) seed and a small fragment of charcoal tentatively identified as pinyon pine (Appendix E). A stratigraphic profile of the east wall revealed three strata (Figure 5.34). Stratum I is a 7-cm thick, moderately compact reddish brown (5YR 5/4) fine silty loam. A slight ashy stain with some charcoal flecks was observed in the northeast part of the unit. No artifacts were found, but fire-cracked rock from Level 1 weighed 1.2 kgs. The lower boundary is smooth and abrupt.

Stratum II is a 12 to 20 cm thick, culturally sterile, compact reddish brown (5YR 6/3) silty loam with gravel inclusions. The lower boundary is smooth and abrupt.

Figure 5.32 Plan of Cobble Ring Feature 2, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

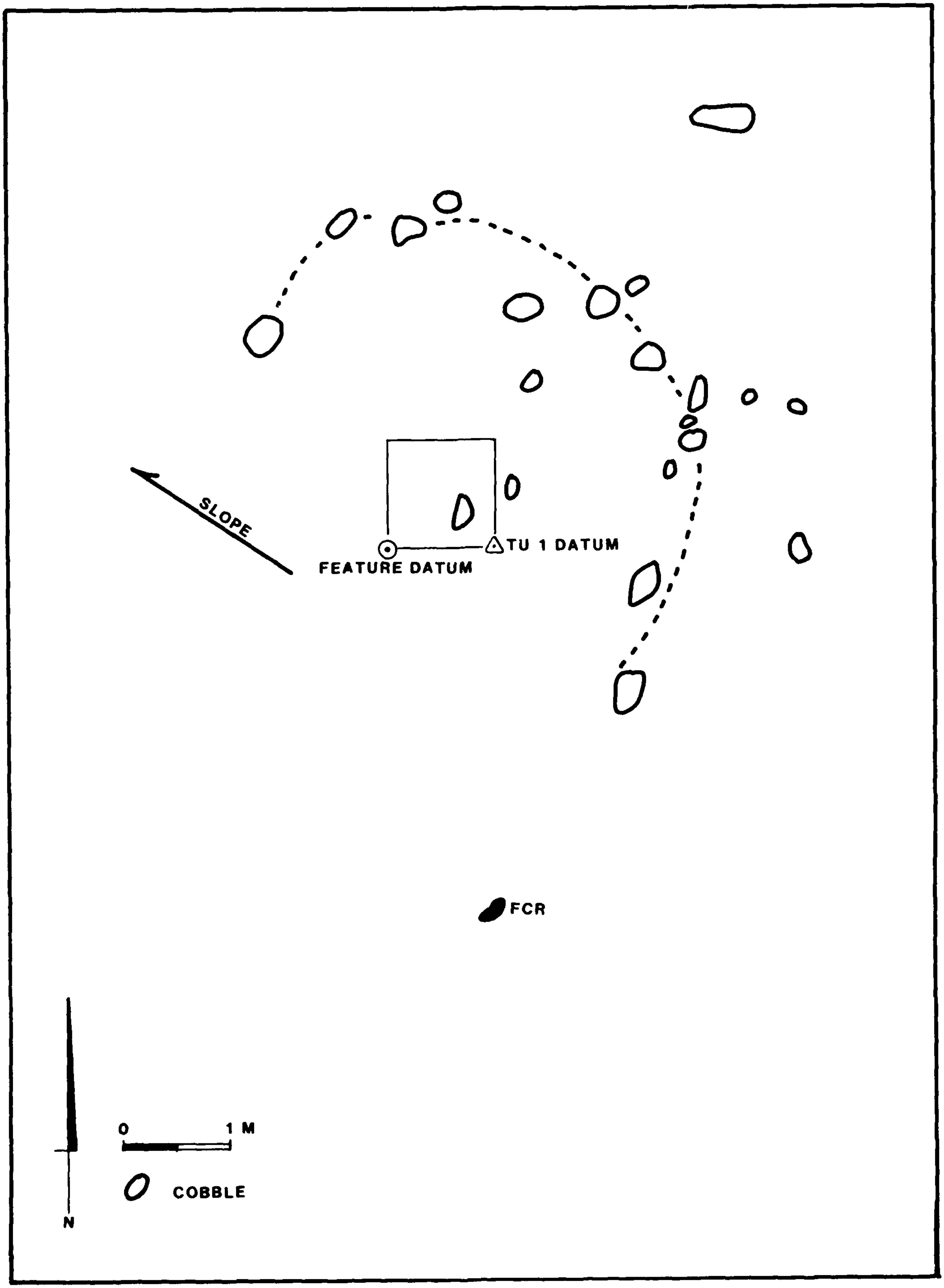


Figure 5.33 Plan and Profile of Test Unit 1 Inside Ring Feature 2, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

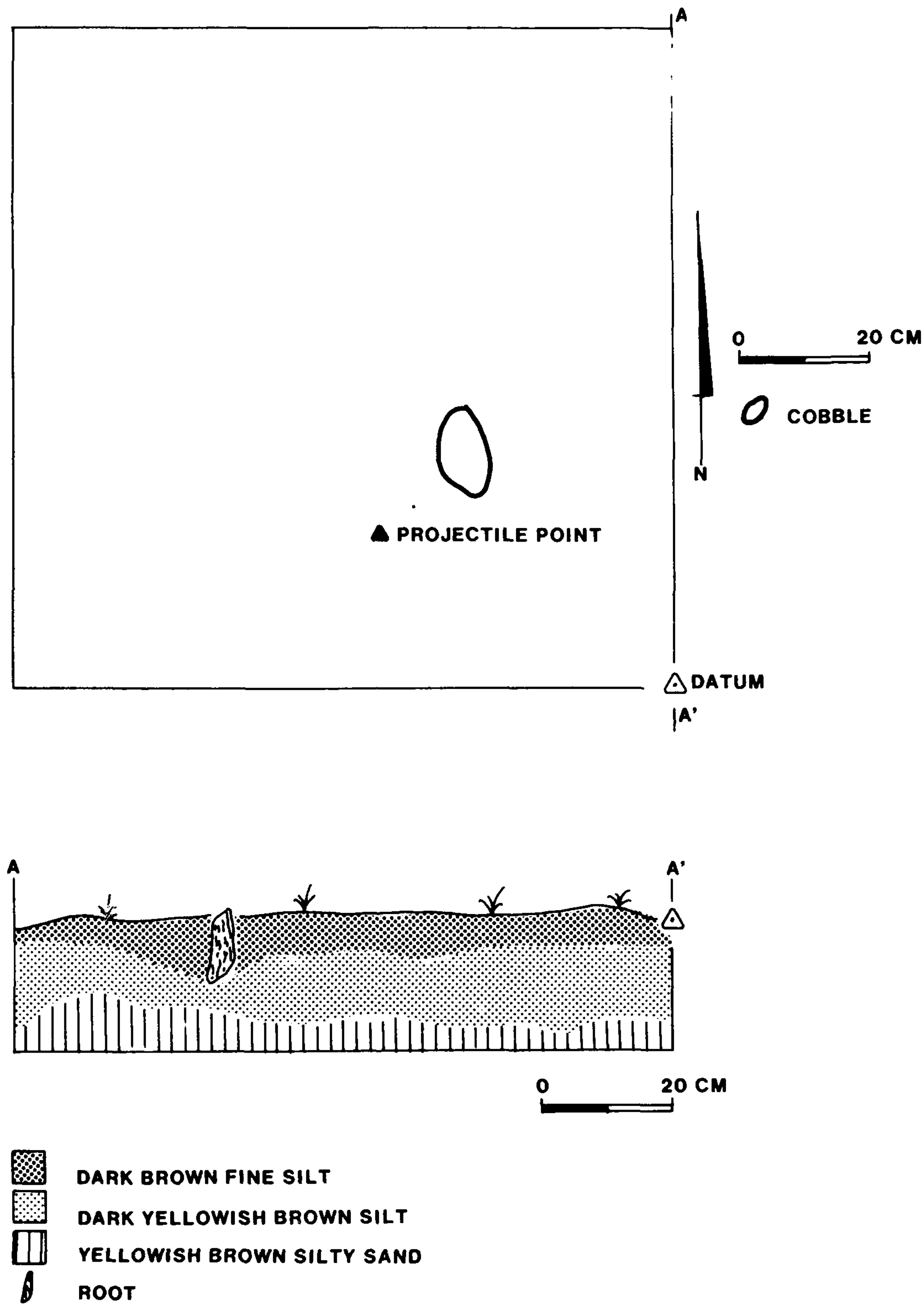
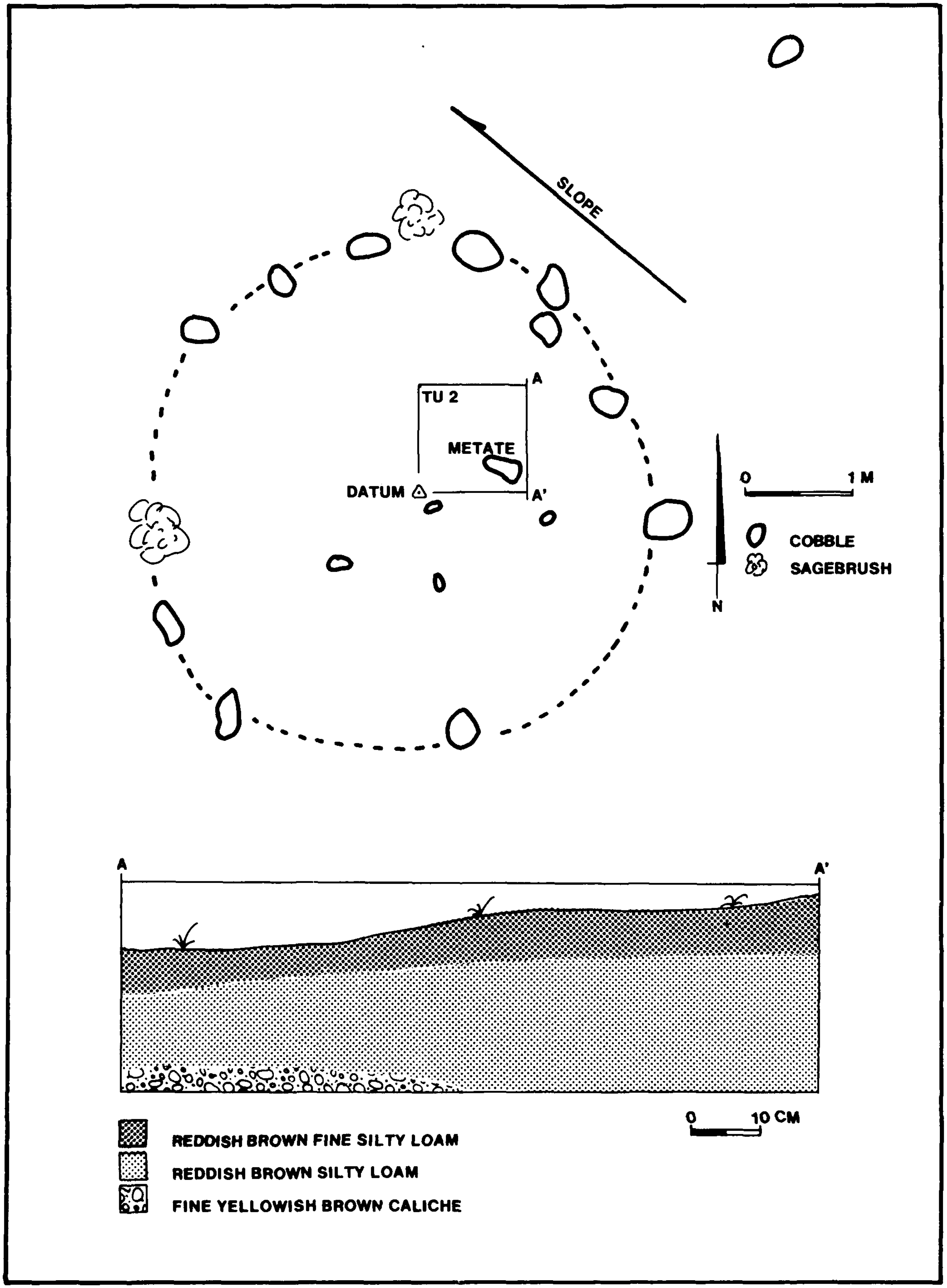


Figure 5.34 Plan of Cobble Ring Feature 3 and Profile of Test Unit 2, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Stratum III is at least 10 cm thick and is a culturally sterile, compact yellowish brown (10YR 6/4) fine silty loam with a high carbonate content.

Feature 4 is a relatively complete spaced stone circle located away from the terrace edge in the middle of the south terrace point. The Chama River terrace edge is about 40 m to the east. The feature vicinity corresponds to SAR feature area C. This part of the site has moderate erosion from a cattle trail passing near the ring. The feature measures approximately 4.50 m in diameter and is defined by eight large and six medium-sized cobbles spaced from 75 to 225 cm apart (Figure 5.35). The downslope cobbles in the northwest part of the ring are misaligned and presumably eroded. The perimeter stones are single cobbles; one interior stone is present. No fire-cracked rocks were noted. A total of 40 artifacts was tallied within a 10 m radius of the feature. No auger testing or excavations were conducted to examine subsurface deposits.

Feature 5 is a stone circle located at the terrace edge of the intrasite drainage on the southern terrace of the site. The feature vicinity corresponds to SAR feature area C. This part of the site has experienced moderate erosion. The feature measures approximately 4.0 m in diameter and is defined by 20 large cobbles spaced from 20 to 100 cm apart (Figure 5.36). The widest gap in the wall stones is 2 m wide in the southeast or upslope part of the ring. The perimeter stones are nearly continuous, and a single interior stone is present. No thermally altered stones were observed inside the ring. One rusty, square meat can found inside the ring (Section 6.2.6.4) and 15 artifacts were collected within a 10 m radius of the feature datum. No subsurface testing was conducted at the feature.

Feature 6 is a spaced stone circle adjacent to ring Feature 5 located on the south terrace adjacent to the intrasite drainage. The feature vicinity corresponds to SAR feature area C. This part of the site is moderately eroded. The feature measures approximately 4.0 m (north-south) by 4.25 m (east-west) and is defined by 19 large cobbles and eight smaller ones clustered towards the northwest. The wall stones were spaced from 10 to 125 cm apart (Figure 5.37). The widest gap in the stones is 1.25 m in the south part of the ring. The perimeter stones are nearly continuous and appear not to be paired. Two stones are present in the northwest interior of the structure, and a dark grayish brown ashy area is located east of these cobbles. Associated artifacts within 10 m of Feature 6 include only seven flakes.

Test Unit 3 is a 1-m^2 pit placed inside ring Feature 6 and excavated to a depth of 20 cm. A stratigraphic profile of the east wall revealed the cross section of the ashy stain and two strata (Figure 5.38). The interior hearth feature is a subrectangular, basin-shaped pit containing very dark grayish brown (10YR 3/2) silty sand with a few burned pebbles and fire-cracked rocks; the feature is intrusive into Stratum I. It measures 30 cm (north-south) by at least 40 cm (east-west) and is at least 6 cm deep.

Figure 5.35 Plan of Cobble Ring Feature 4, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

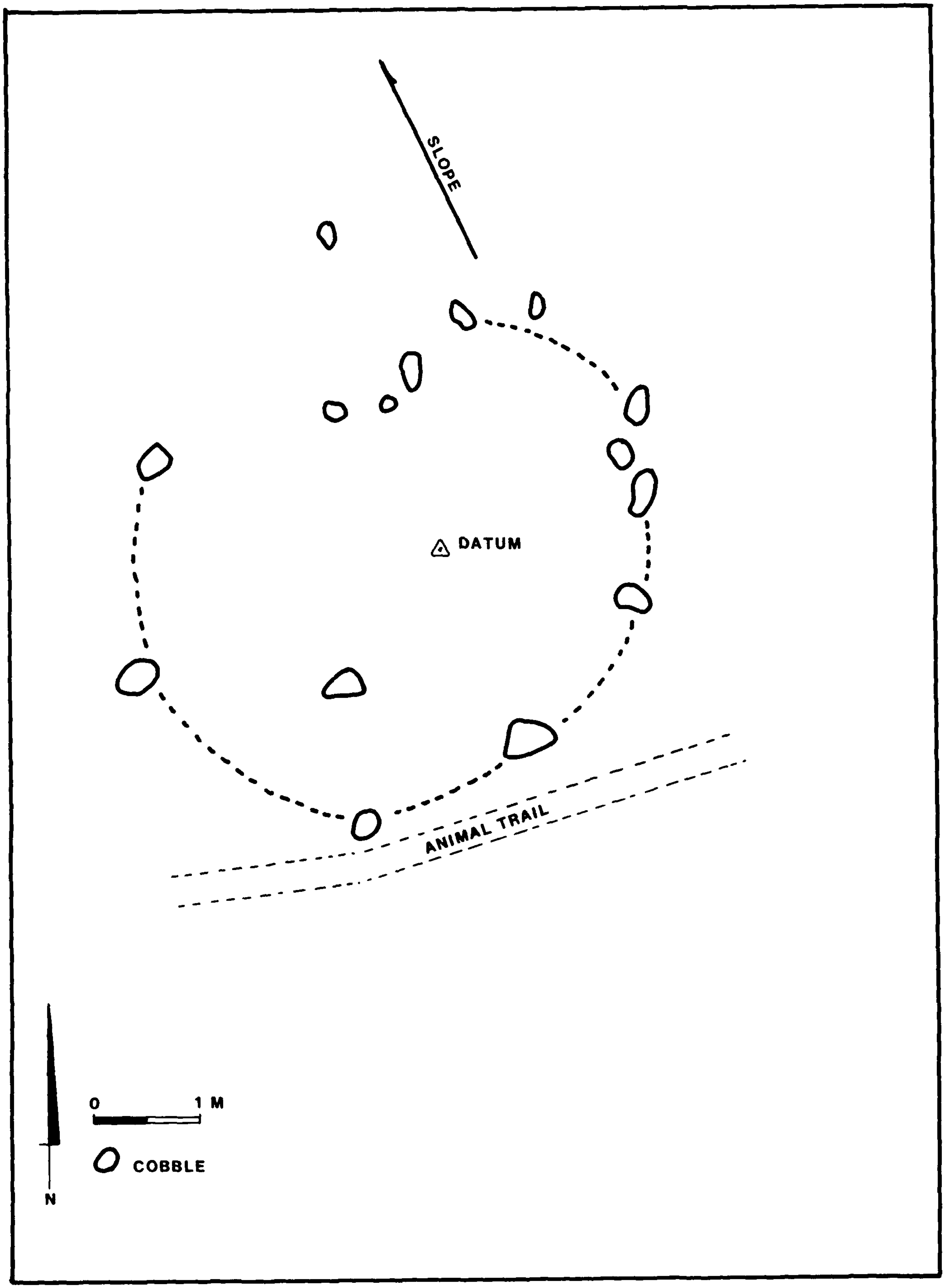


Figure 5.36 Plan of Cobble Ring Feature 5, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

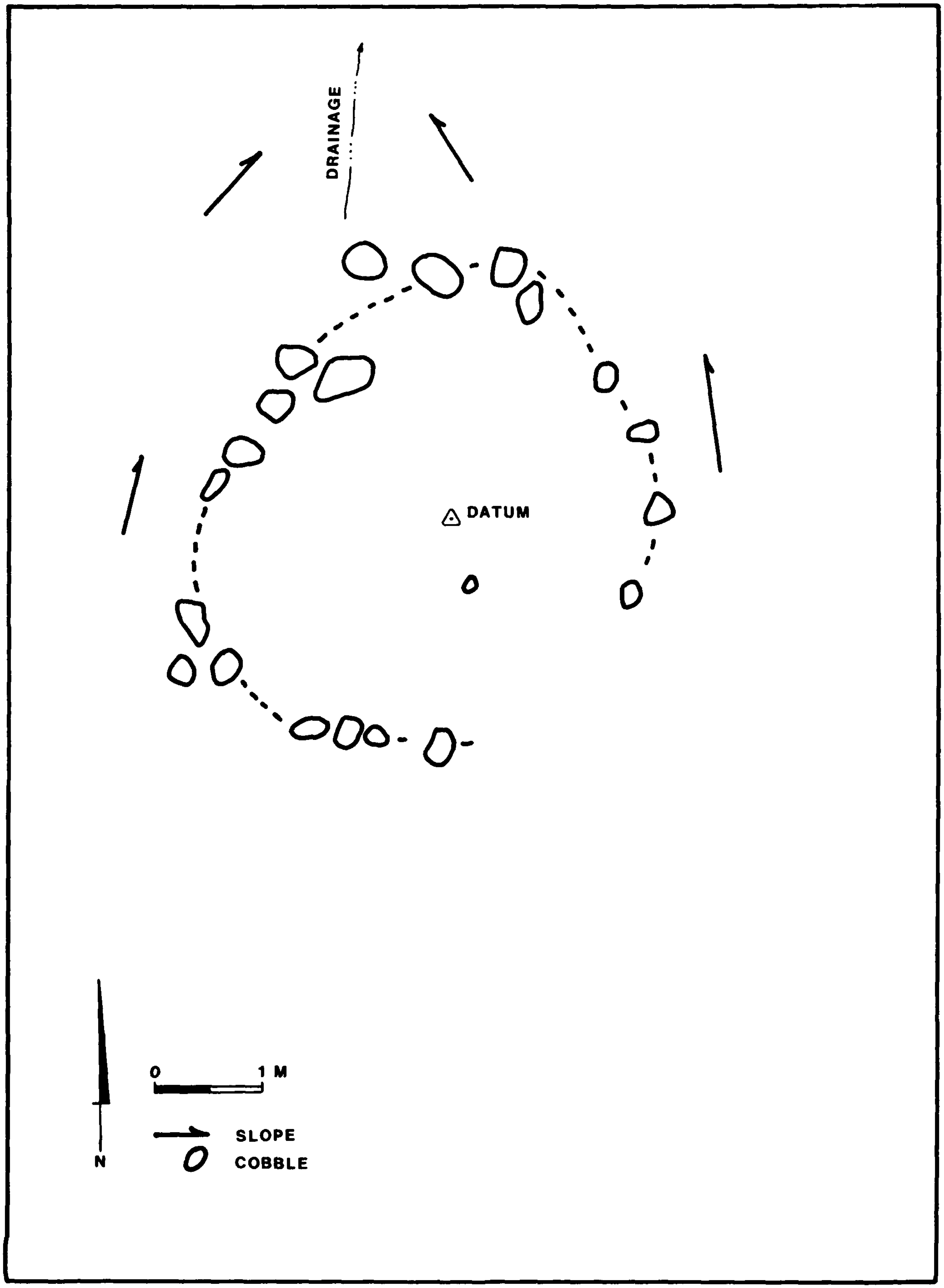


Figure 5.37 Plan of Cobble Ring Feature 6, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

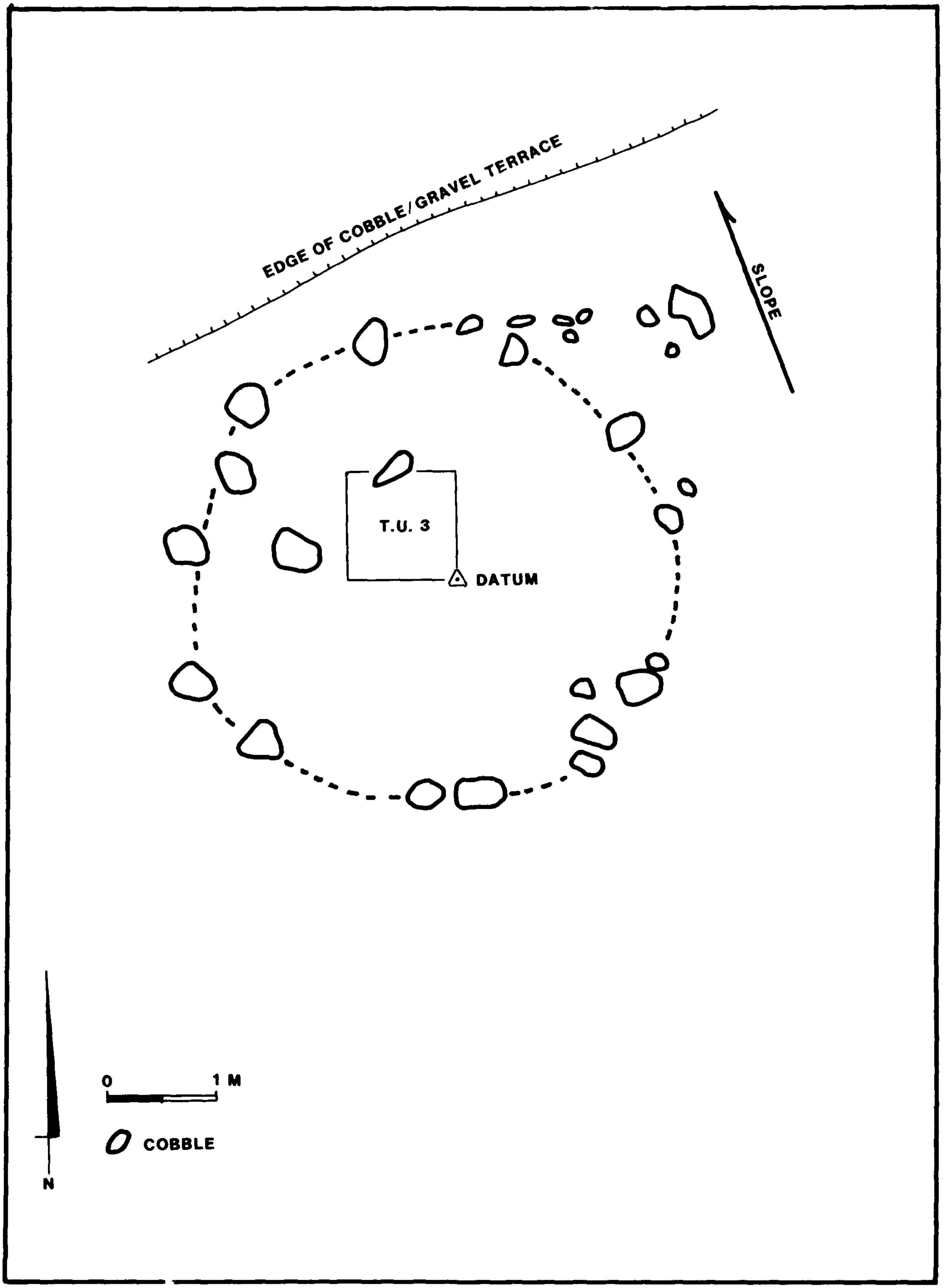
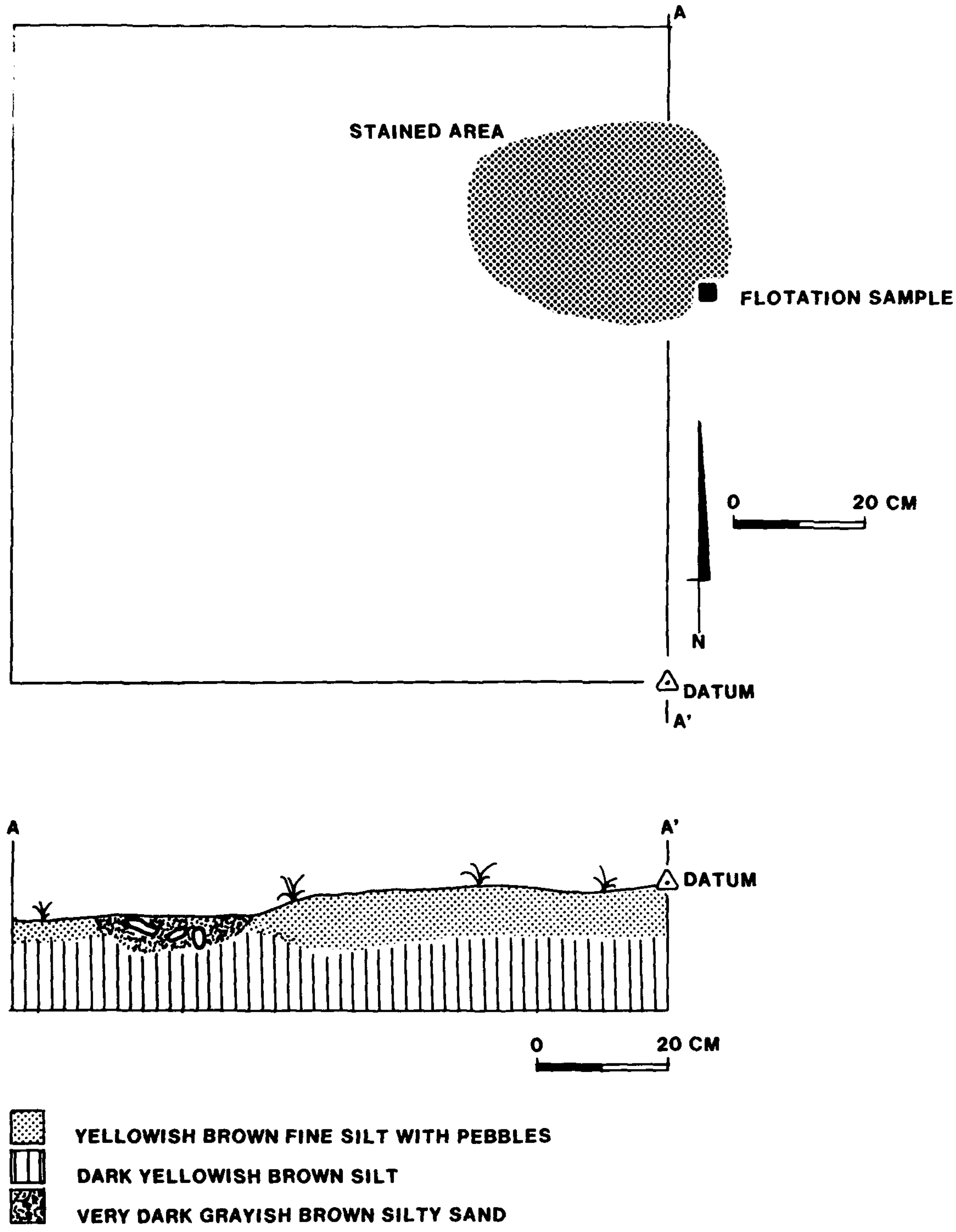


Figure 5.38 Plan and Profile of Test Unit 3 Inside Cobble Ring Feature 6, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Stratum I is an 8 cm thick, moderately compact yellowish brown (10YR 5/4) fine silty loam with some gravel inclusions and fire-cracked rocks up to 5 cm in diameter. No artifacts were found during excavation. The lower boundary is smooth and abrupt. Stratum II is a 12 cm thick, culturally sterile, compact dark yellowish brown (10YR 4/4) silty loam with gravel inclusions.

Feature 7 is a severely eroded spaced stone circle on a terrace lobe near the head of the intrasite drainage divide. The feature vicinity corresponds to SAR feature area E. The feature measures approximately 3.25 m (east-west) by at least 3.0 m (north-south) and is defined by only five large cobbles spaced from 75 to 225 cm apart (Figure 5.39). A gap in the northern (upslope) perimeter stones is about 3.1 m wide and may reflect the removal of cobbles to construct other features. The perimeter stones are not paired, and no large interior stones or fire-cracked rock are present. Subsurface testing was not conducted at this feature, but a 10 m radius collection area recorded 18 artifacts.

Feature 8 is a possible disarticulated spaced stone circle and an unidentified historic feature located in the middle of the south terrace point near the Chama River. The feature vicinity corresponds to SAR feature area C. The historic construction has severely altered the prehistoric portion of the feature. The presence of at least eight large stones and numerous smaller cobbles may denote remnants of a prehistoric structure, even though none of the original configuration is present (Figure 5.40). The historic feature consists of several upright post remnants. Only two upright posts are extant; they are about 2 m tall and spaced about 1 m apart with notching on top and on one side about 15 cm from the base. SAR site forms refer to them as part of an old Forest Service signpost. However, about 5.5 m to the southeast are three other posts chopped off at ground level and aligned north-south. Six meters farther south are two clusters of rocks spaced 2 m apart and aligned east-west; they appear to be stone shims for supporting more posts. A considerable amount of scattered chopped wood tenuously suggests extensions of the feature towards the west. Total dimensions of the structural wooden feature are approximately 12 m (north-south) by at least 7 m (east-west).

In the middle of the historic feature is a 4.5 m long log with an adjacent modern hearth near the north end. Many large stones are scattered northeast of the hearth, and two stones are at either end of the log. Associated artifacts include a rusted, rolled seam, small circular can, a rusted solder-dot can lid, and one aluminum tapioca pudding can (Section 6.2.6.4). This historic complex probably represents a recent campsite over an earlier historic feature.

Feature 15 is a subrectangular spaced stone structure on the western edge of the north terrace situated adjacent to the north site boundary terrace edge. The feature vicinity corresponds to SAR feature area H. This part of the site has been slightly eroded. The feature measures approximately 4.25 m (southwest-northeast) by 4.35 m (southeast-northwest) and is defined by 12 large and three medium-size cobbles spaced from 50 to 175 cm apart (Figure 5.41). The widest gap in the stones is in the northeast part of the feature. The perimeter stones form a singular alignment and no interior stones or fire-

Figure 5.39 Plan of Cobble Ring Feature 7, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

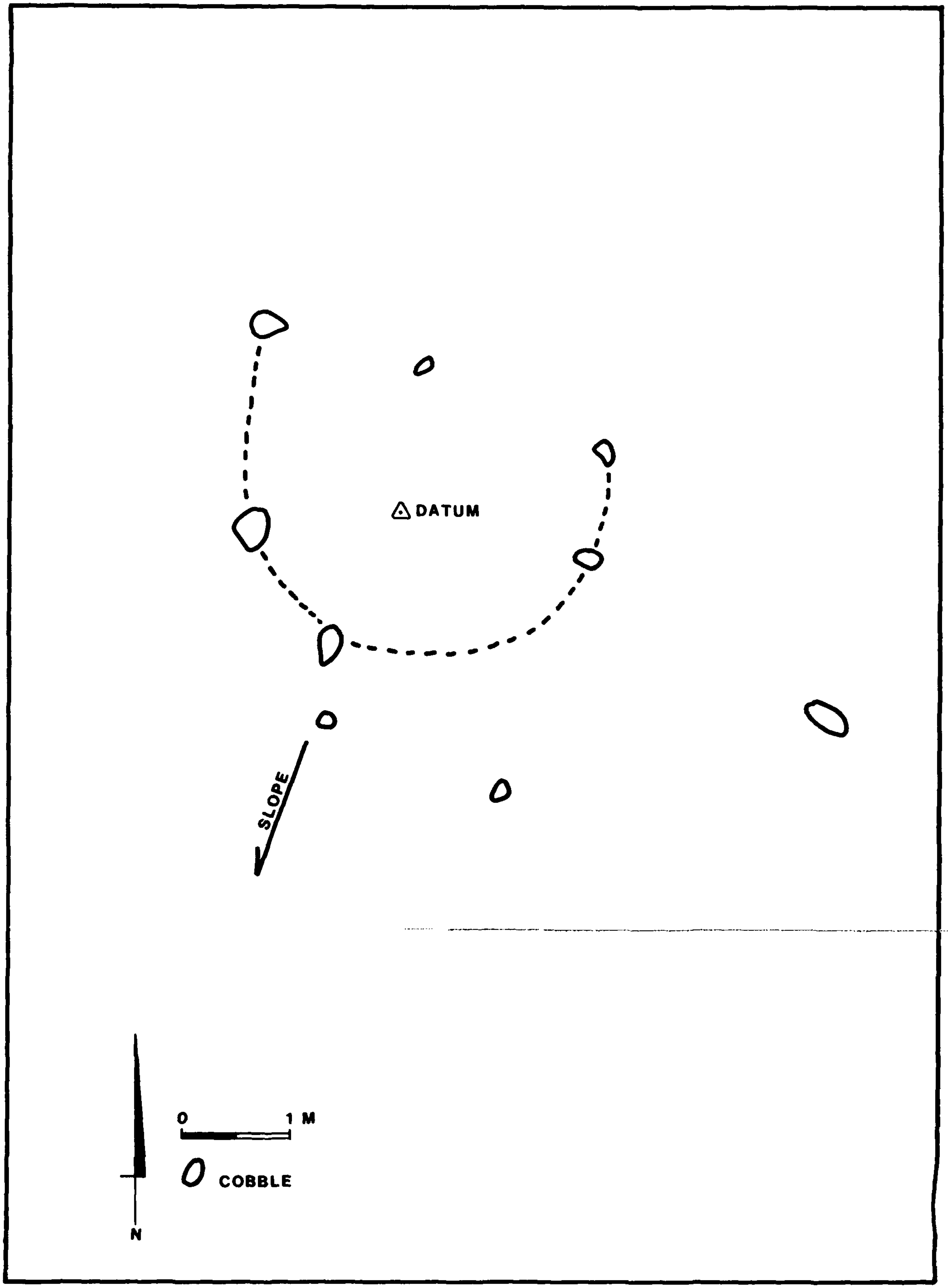


Figure 5.40 Plan of Historic Structure Feature 8, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

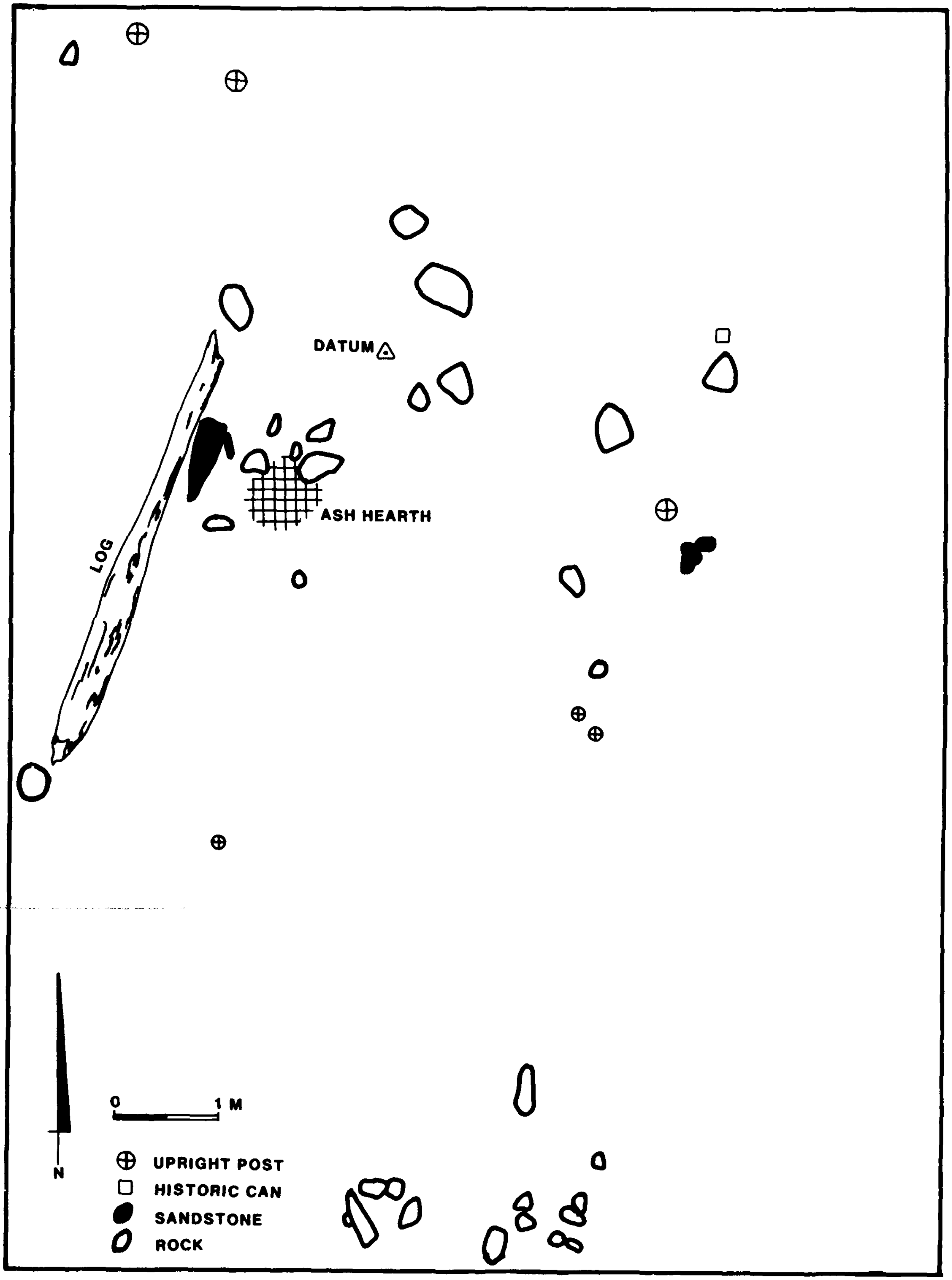
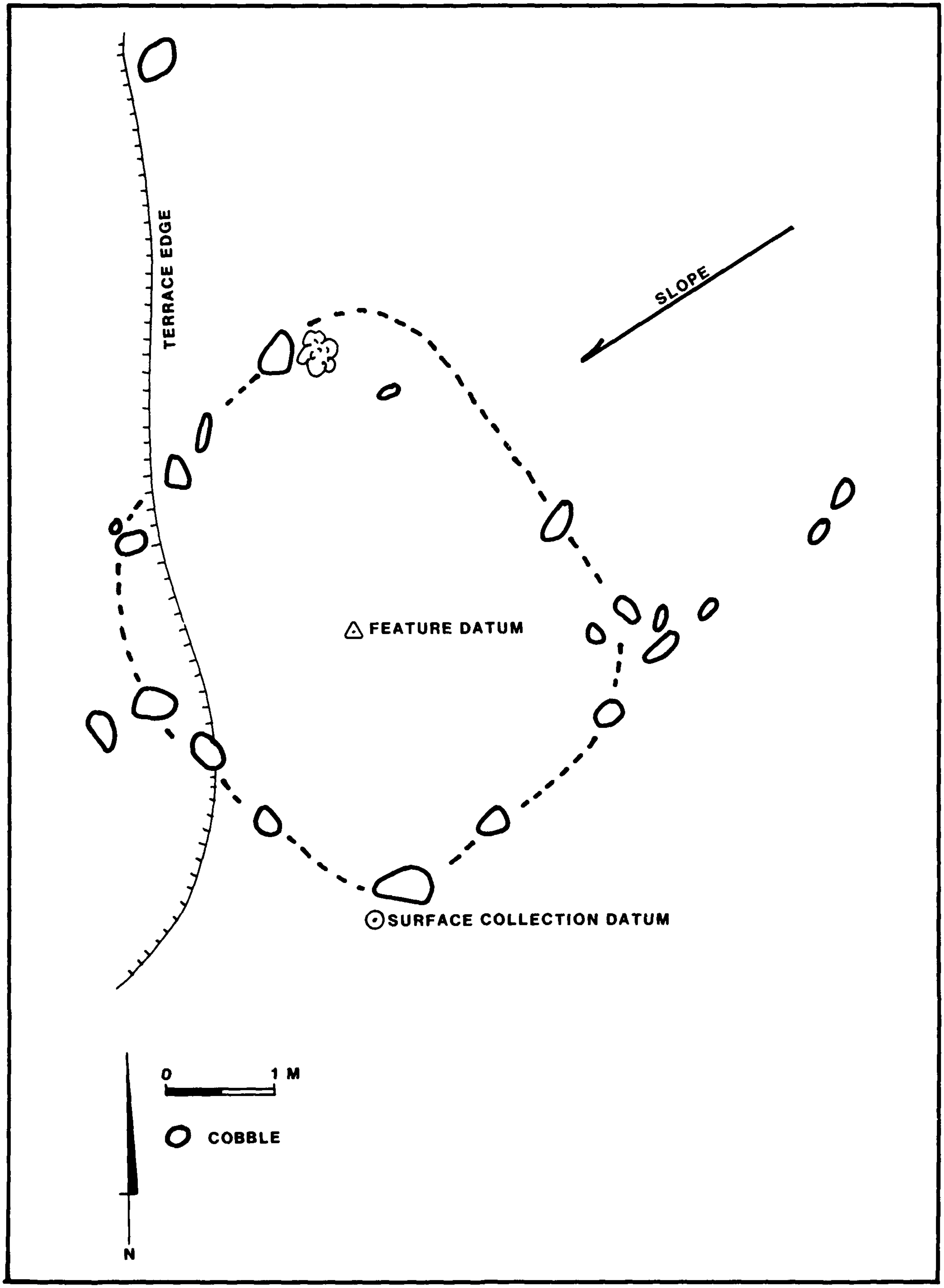


Figure 5.41 Plan of Cobble Ring Feature 15, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



cracked rock is evident from surface indications. Three cobbles form an alignment east of the structure and extend for a distance of 2.5 m. No test excavations were conducted at this feature, but the northwest corner of a 4 x 4 m collection unit was placed 5 m south of the the center of the feature. A total of 58 artifacts was recovered; individual 1-m^2 unit densities ranged from zero to eight items. A 10 m radius circle placed over the ring recorded 143 artifacts from the east half and only six artifacts from the west half of the ring.

Feature 16 is a spaced stone circle on the northwest edge of the north terrace area. It overlooks a side drainage of the north boundary tributary. The feature vicinity corresponds to SAR feature area H, and the SAR site datum stake is located along the east edge of the ring. This part of the site is slightly eroded. The feature measures approximately 4.1 m (north-south) by 4.0 m (east-west) and is defined by 18 large to medium-sized cobbles spaced up to 100 cm apart; a few rocks are abutting each other (Figure 5.42). The widest gap in the stones is in the northeast part of the ring. The perimeter stones are regularly distributed with slight clusters in the west and north. A large, single sandstone slab is present in the middle of the feature, and occasional cobbles are scattered in the southeast part of the ring. No subsurface testing was conducted at this feature. A total of 19 artifacts was recorded within a 10-m radius of the feature.

Feature 17 is a spaced stone circle north of Feature 16 along the north site boundary tributary in the northwest part of the north terrace. The feature vicinity corresponds to SAR feature area H. This site area shows slight erosion. The feature measures approximately 4.5 m (north-south) by 5.0 m (east-west) and is defined by 15 large cobbles spaced up to 150 cm apart (Figure 5.43). There is no single area of widest gap in the ring. The perimeter stones seem to be paired in the western half, but the pattern in the eastern half is not clear. Records do not mention the presence of central cobbles or thermally-altered stones inside the ring. No testing was conducted at the ring. A total or 21 lithic artifacts occurred within a 10-m radius of the feature.

Feature 18 is a spaced stone circle along the north site boundary tributary in the northwest part of the north terrace. The feature vicinity corresponds to SAR feature area H. This part of the site has slight erosion; however, the proximity of the ring to the large natural cobbles on the terrace edge prohibits the definition of the north edge of the ring. The feature measures approximately 4.25 m (north-south) by 3.5 m (east-west) and is defined by about 13 large cobbles spaced from 25 to 150 cm apart (Figure 5.44). The widest gap in the stones is towards the northeast and southeast parts of the ring. The perimeter stones are unpaired. A few scattered cobbles are inside the ring, but all are smaller than the perimeter stones; thus the interior cobbles could be natural occurrences from the terrace edge. Test excavations were conducted at the south edge of this feature, and a 4 x 4 m collection unit was placed over the north part of the feature. A total of 70 artifacts was recovered; individual unit densities ranged from zero to 10 items per m^2. Artifacts tabulated within a 10 m radius of the feature include a total of 116 lithics, 38 of which occurred within the cobble ring.

Figure 5.42 Plan of Cobble Ring Feature 16, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

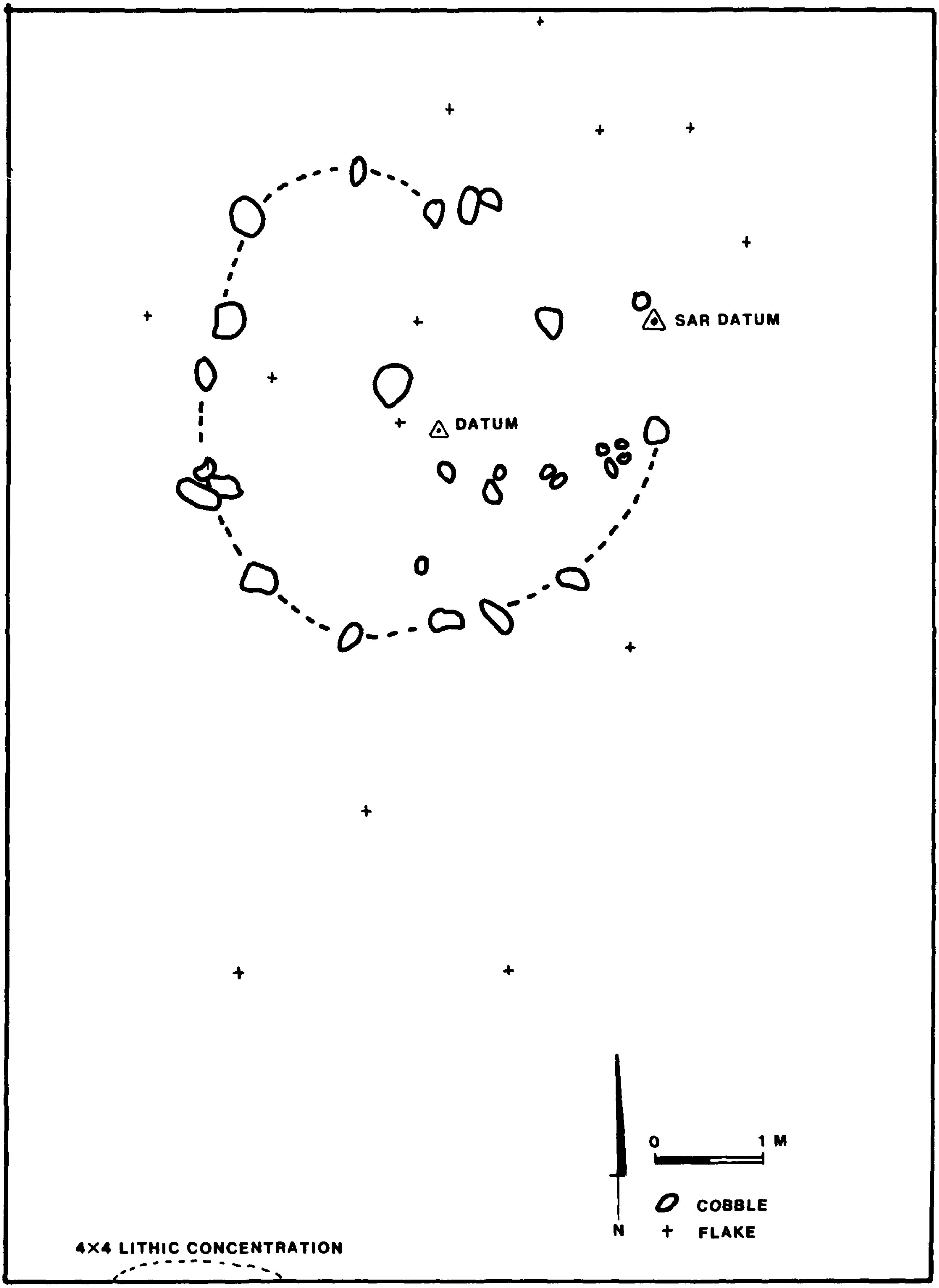


Figure 5.43 Plan of Cobble Ring Feature 17, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

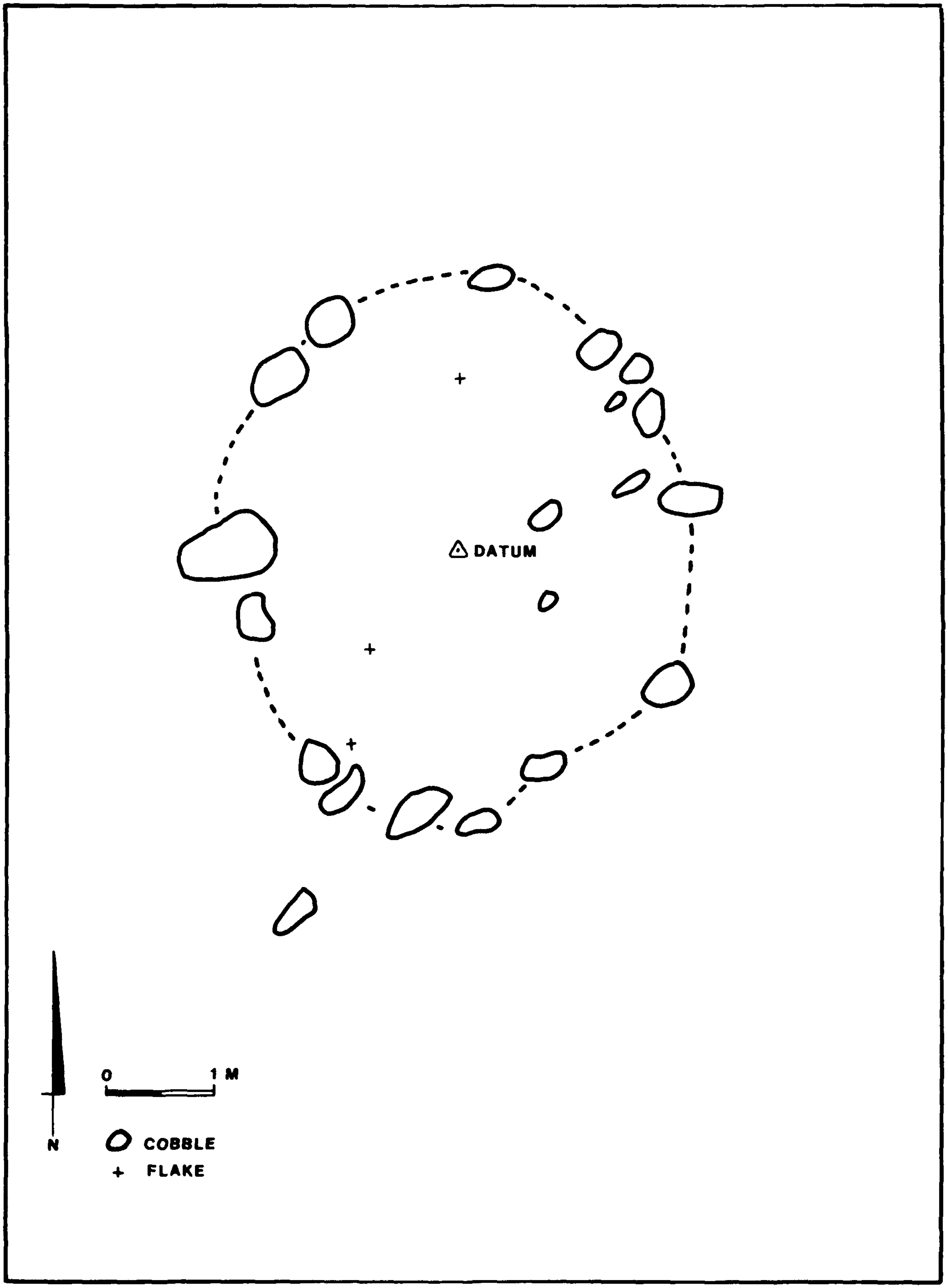
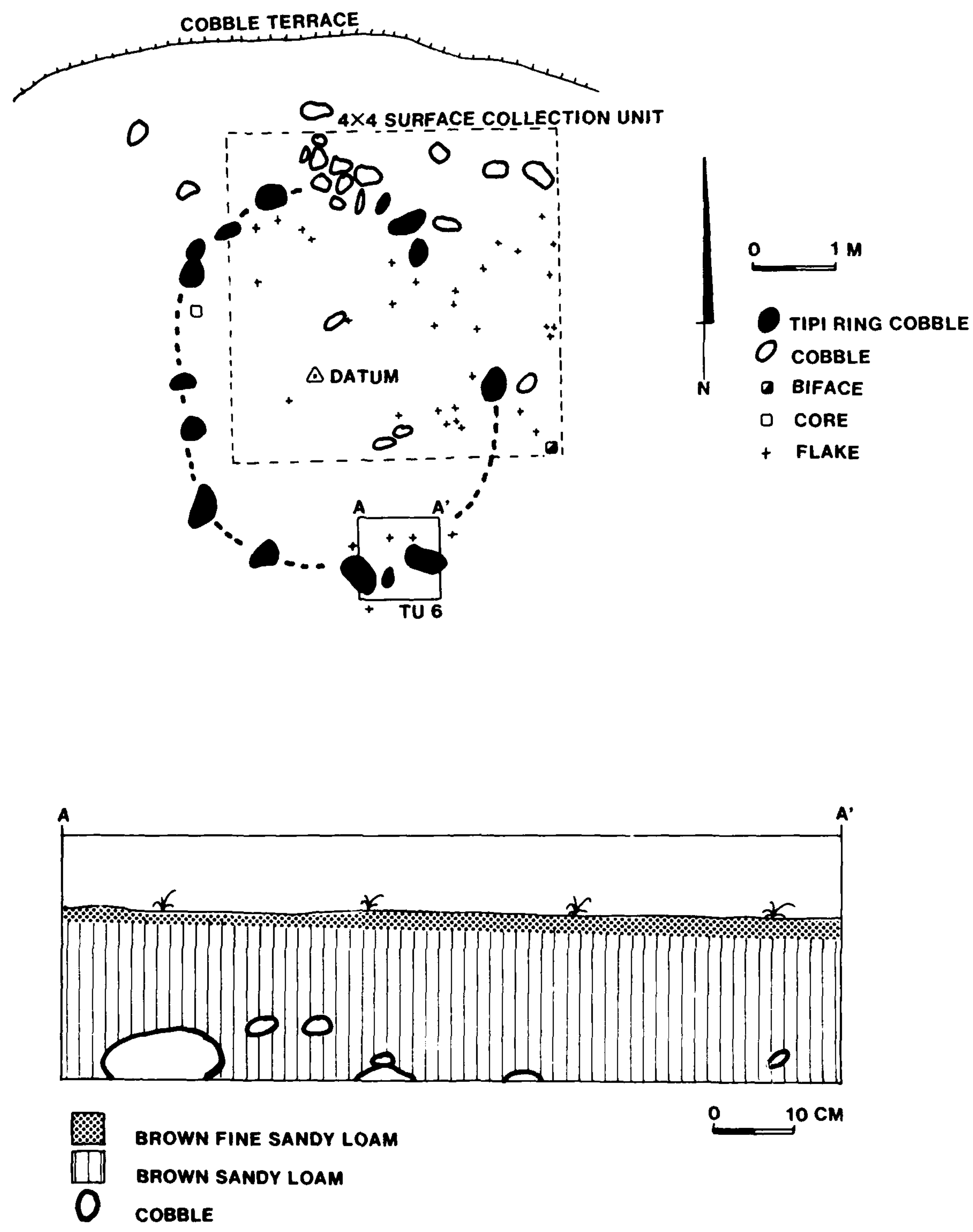


Figure 5.44 Plan of Cobble Ring Feature 18 and Profile of Test Unit 6, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Test Unit 6 is a 1-m^2 pit placed over the south perimeter stones of the ring and excavated to a depth of 20 cm; the north half of the unit was dug to a depth of 30 cm. A stratigraphic profile of the north wall revealed two strata (Figure 5.44). Stratum I is a 3 cm thick, loose brown (7.5YR 5/4) sandy loam with abundant flake and some gravel inclusions. The lower boundary is smooth and abrupt. Stratum II is at least 27 cm thick; it is a compact brown (7.5YR 5/4) sandy loam with abundant gravel to cobble inclusions and contains some cultural materials in the upper 20 cm. The lower part of the stratum represents the Pleistocene age cobble terrace. A total of 6.7 kgs of fire-cracked rock was recovered in the unit; the occurrence of this highly heat-spalled material from a unit straddling the feature may indicate portions of a thermal feature predating the cobble ring.

Feature 28 is an isolated spaced stone circle along the northern edge of the north terrace area. The feature overlooks the north site boundary tributary. The feature vicinity corresponds to SAR feature area G. This part of the site has moderate erosion. The feature is a partial ring which measures approximately 2.25 m (north-south) by 2.5 m (east-west) and is defined by nine large cobbles spaced from 15 to 35 cm apart (Figure 5.45). The largest gap in the stones is over 2 m wide in the north and south parts of the ring. The perimeter stones are probably unpaired, and two sets of paired interior stone are present. No information exists about the presence of interior fire-cracked stones.

Feature 29 is a disturbed, spaced stone circle in the south central part of the north terrace and overlooks the intrasite tributary of the Chama River. The feature vicinity corresponds to SAR feature area F. This area is moderately eroded. The partial cobble circle measures approximately 3.25 m (north-south) by 3.25 m (east-west) and is defined by six large cobbles widely spaced from 180 to 225 cm apart (Figure 5.46). The west wall of the feature may be displaced. The spaced perimeter stones are unpaired, and no interior stones are present. No thermally altered stones occur in the center.

Feature 30 is a small spaced stone circle on the southeastern tip of the north terrace at the juncture of the intrasite drainage and the Chama River. The feature vicinity corresponds to SAR feature area B. This part of the site has undergone moderate erosion. The feature measures approximately 2.1 m (southwest-northeast) by 1.6 m (southeast-northwest) and is defined by five large cobbles spaced from 10 to 165 cm apart (Figure 5.47). The widest gap in the stones is in the west part of the ring. The perimeter stones are solitary alignments which are usually widely spaced. No interior stones or fire-cracked rock is present. Nine flakes occur inside the ring.

Feature 31 is an eroded spaced stone circle northeast of Feature 30 in the southeast portion of the north terrace area. The feature is on the terrace edge overlooking the Chama River. The feature vicinity corresponds to SAR feature area B. This part of the site has experienced moderate erosion. The feature measures approximately 2.75 m (north-south) by 3.1 m (east-west) and is defined by 16 large cobbles spaced from 15 to 100 cm apart (Figure 5.48). The south (downslope) cobbles are eroded out of alignment. Elsewhere, the widest gap in the stones is in the northern part of the ring. The perimeter stones are primarily unpaired, and a few interior stones are

Figure 5.45 Plan of Cobble Ring Feature 28, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

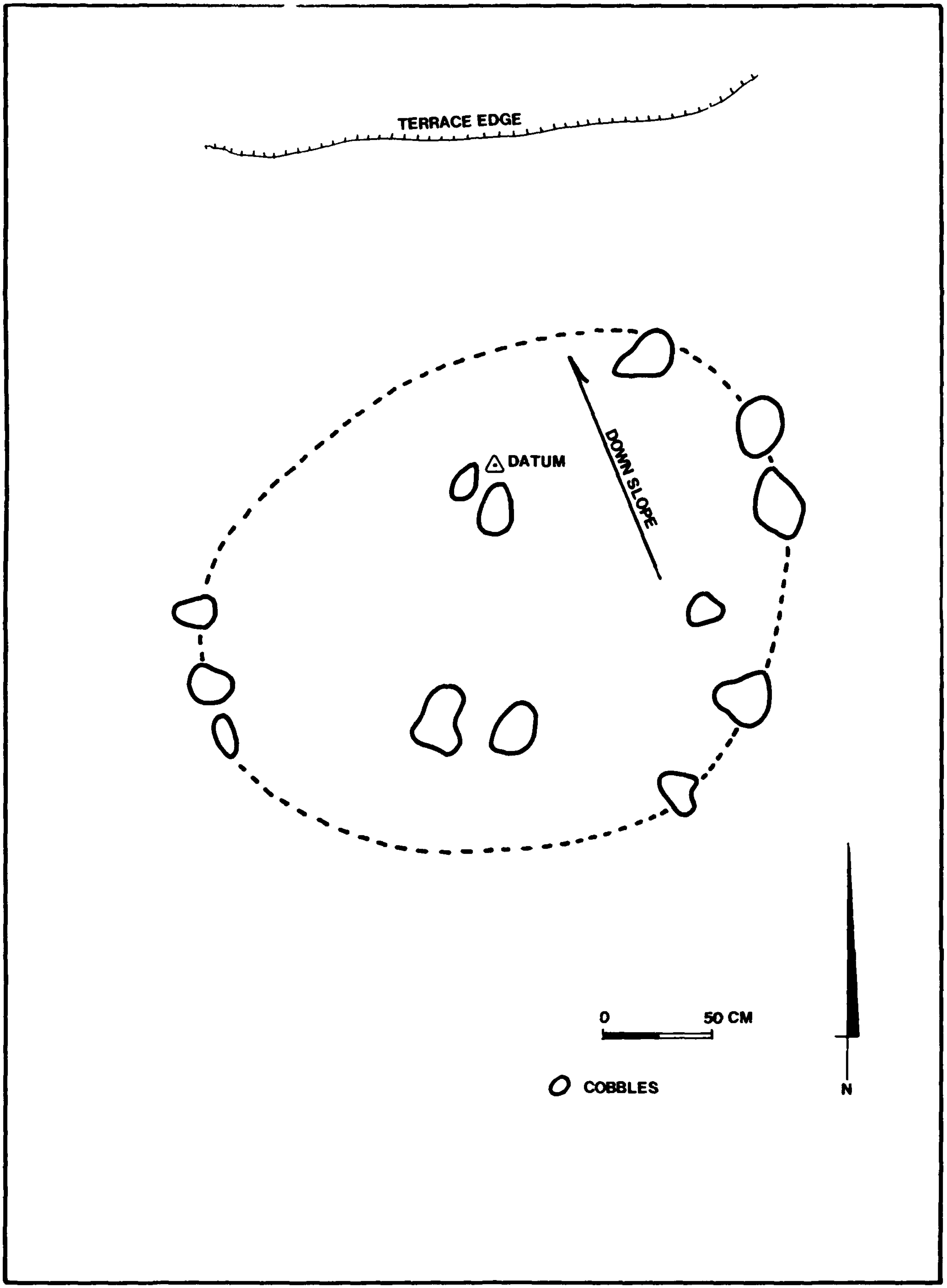


Figure 5.46 Plan of Cobble Ring Feature 29, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

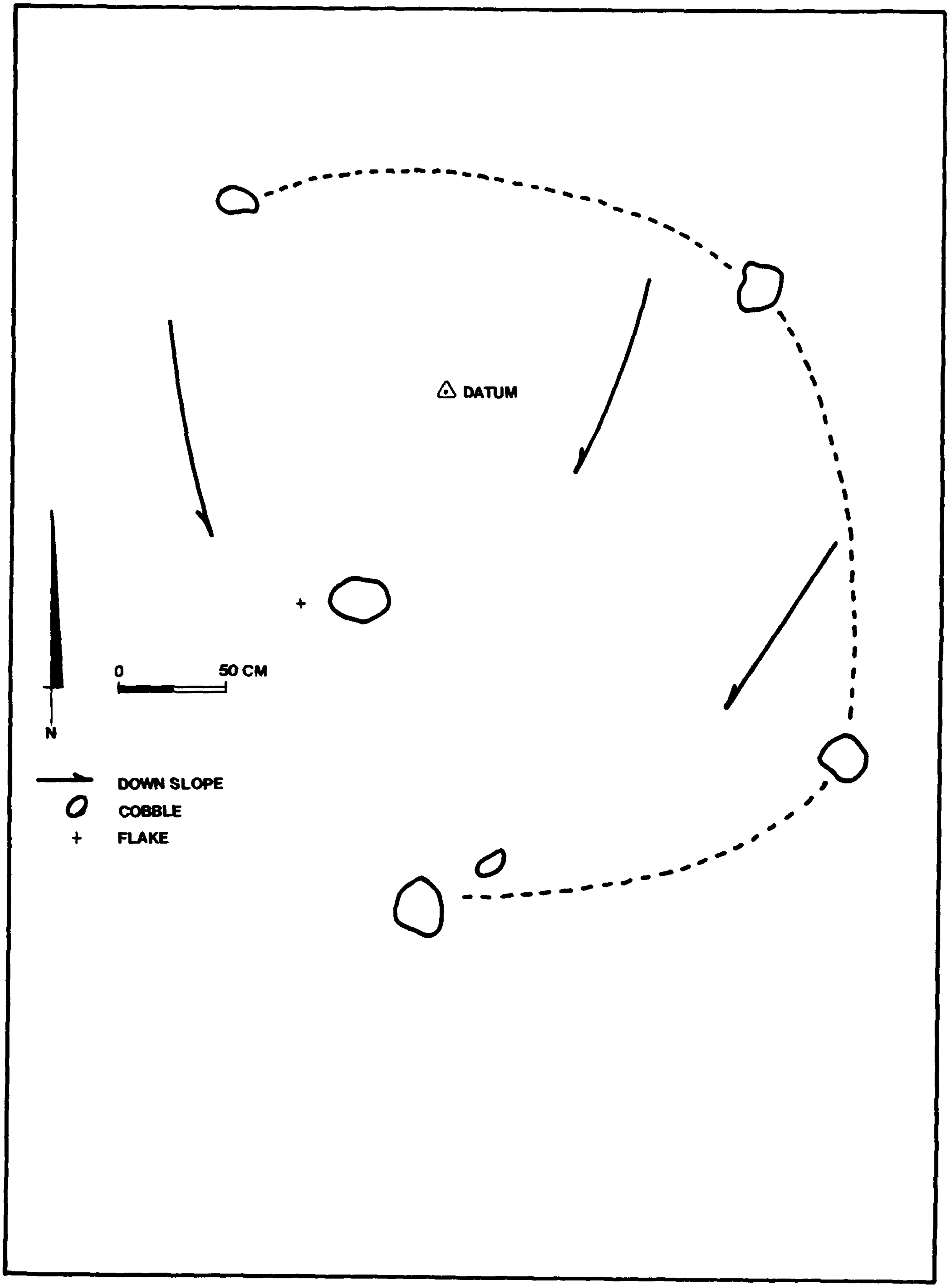


Figure 5.47 Plan of Cobble Ring Feature 30, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

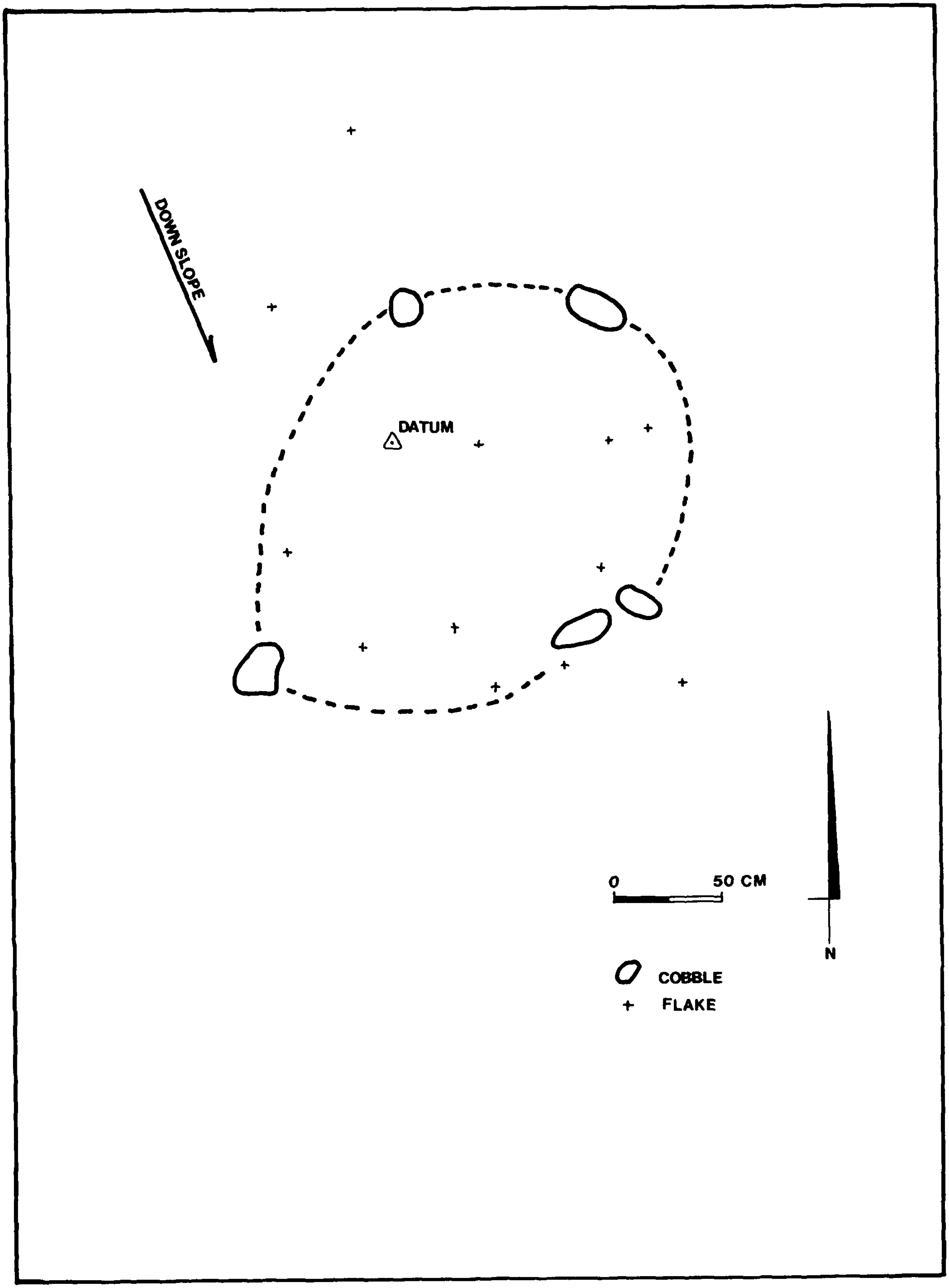
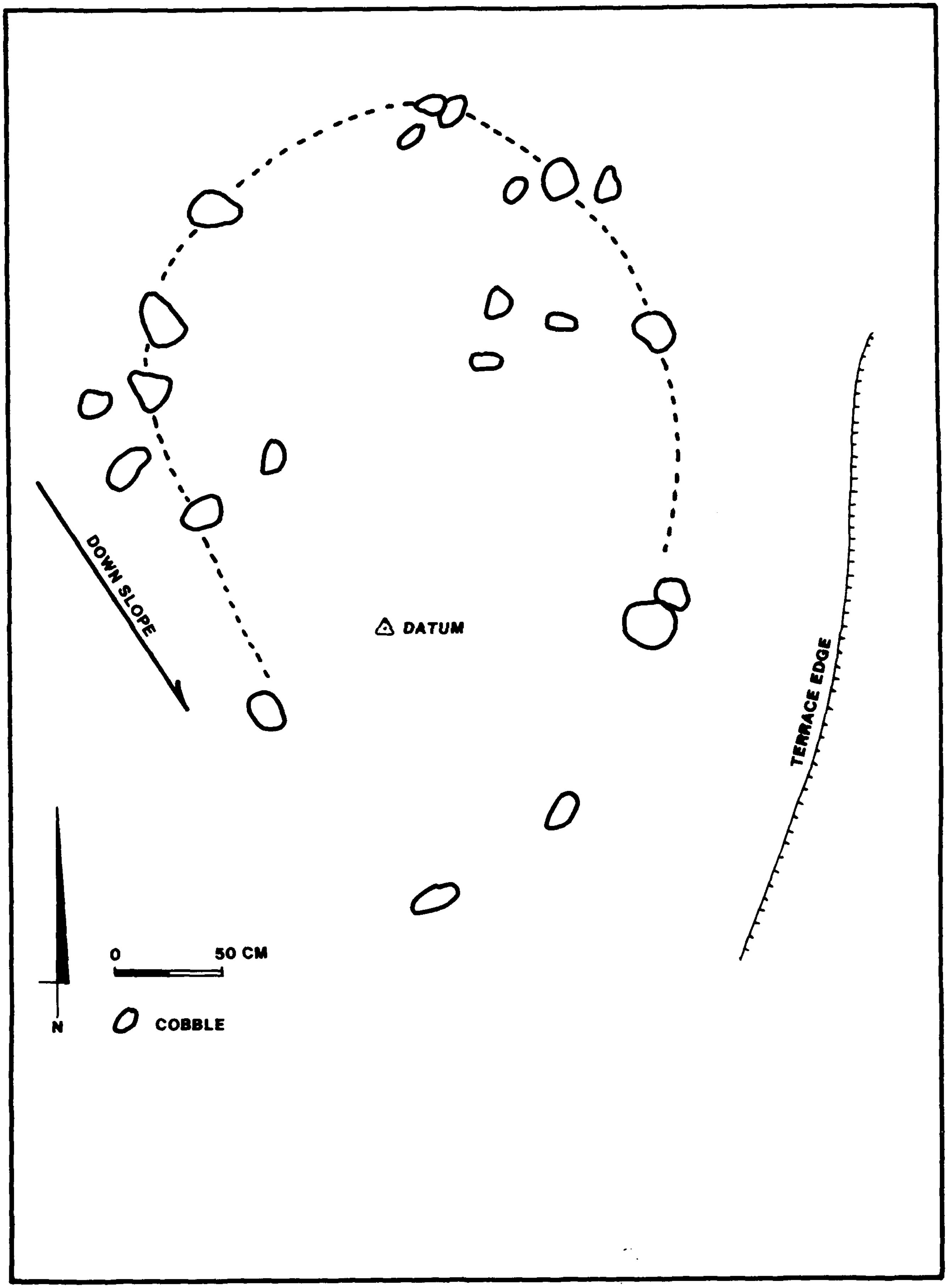


Figure 5.48 Plan of Cobble Ring Feature 31, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



present; however, their occurrence may be due to erosion. Thermally altered stones were not noted in the center.

Feature 32 is a spaced stone circle in the easternmost portion of the north terrace. The site overlooks the Chama River. The feature vicinity corresponds to SAR feature area B. This area has been moderately eroded, and the east wall of the feature closest to the terrace edge has largely eroded away. The feature measures approximately 3.65 m (north-south) by about 3.1 m (east-west) and is defined by 15 large cobbles spaced from 20 to 125 cm apart (Figure 5.49). The perimeter stones are unpaired, and the presence of several interior stones may reflect either centrally placed cobbles or eroded and displaced perimeter stones. No thermally-altered stones were noted inside the feature.

Feature 35 is a severely eroded feature that may have been a spaced stone circle. It is located along a fairly steep slope of a lateral drainage of the intrasite tributary on the north terrace. The feature vicinity corresponds to SAR feature area F. This part of the site has experienced extensive erosion. The feature has no integrity, and definition of the feature is no longer possible. Twenty-seven large sandstone and quartzite cobbles are randomly scattered within a 5.85 m (east-west) by 5.4-m (north-south) area (Figure 5.50). Two eroded gullies bisect the large cobble cluster. Associated materials include two flakes and five pieces of clear glass from a single bottle drop.

Feature 36 is a well-defined spaced stone circle located on rolling terrain at the western end of the north terrace area. The ring overlooks a tributary of the north site boundary drainage. The feature vicinity corresponds to SAR feature areas I or J. This part of the site has slight erosion. The feature measures approximately 4.1 m (north-south) by 4.15 m (east-west) and is defined by 12 large cobbles spaced from 40 to 200 cm apart (Figure 5.51). The widest gap in the perimeter stones is in the western (upslope) part of the ring. The perimeter stones are unpaired, single alignments, and two interior stones are present. No fire-cracked rock was observed inside the feature.

Feature 37 is a spaced stone circle south of Feature 36 in the western end of the north terrace area. This part of the site has broken terrain, and the feature overlooks a tributary of the north site boundary drainage. The feature vicinity corresponds to SAR feature areas I or J. This part of the site has experienced slight erosion. The feature measures approximately 4.4 m in diameter and is defined by 13 large cobbles measuring up to 20 cm in diameter and spaced from 40 to 200 cm apart (Figure 5.52). The widest gap in the stones is in the western part of the ring. The perimeter stones are paired along the northern (downslope) part of the ring but seem to be isolated in the southern edge. Two isolated cobbles occur as interior stones. No thermally altered stones or dark ashy stains were observed in the center.

Feature 41 is the westernmost spaced stone circle located on a relatively high hill on the north terrace. The ring is adjacent to and overlooks a tributary of the northern site boundary drainage. The feature vicinity corresponds to SAR feature areas I or J. This part of the site has

Figure 5.49 Plan of Cobble Ring Feature 32, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

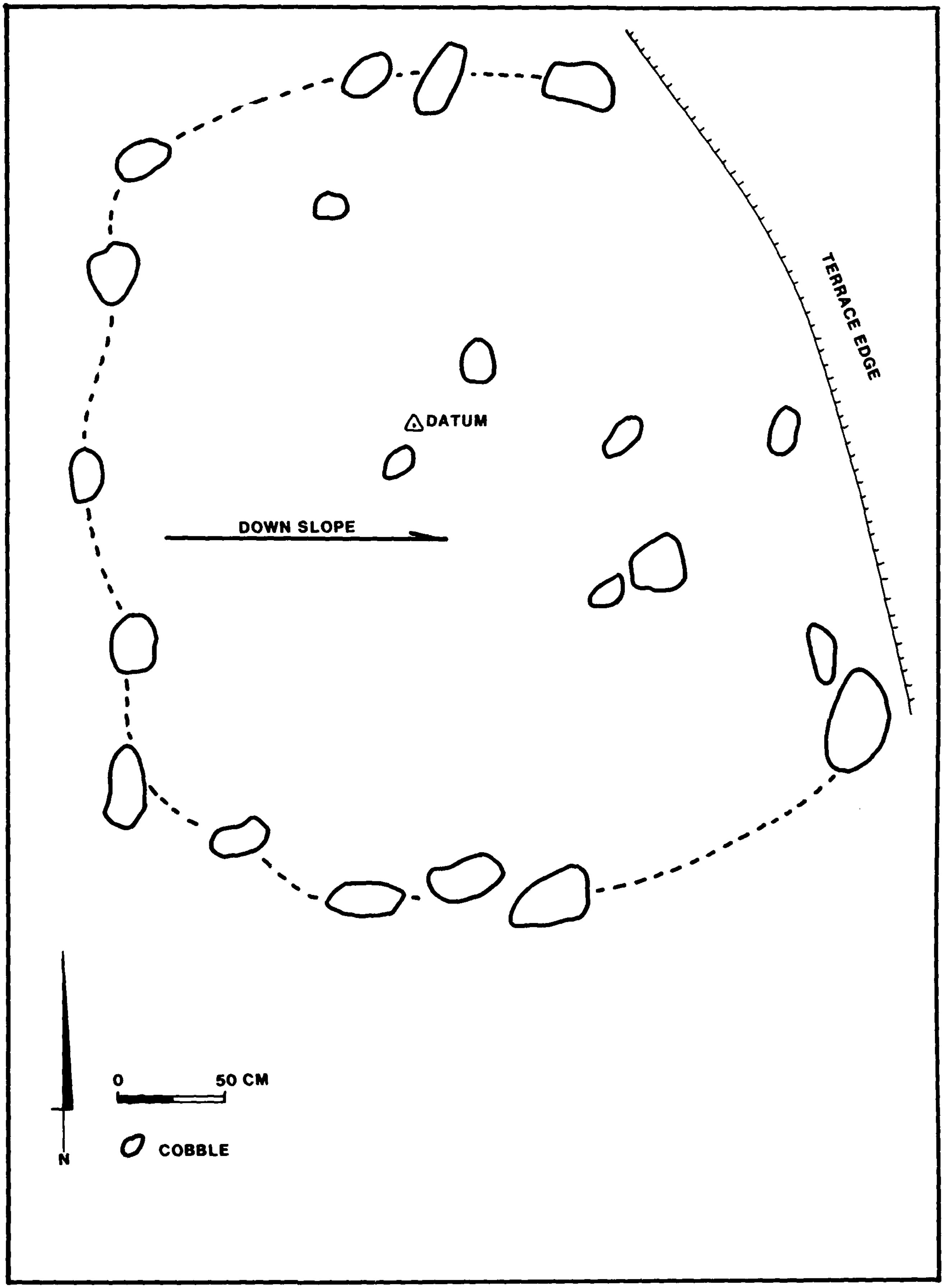


Figure 5.50 Plan of Eroded Structure Feature 35, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

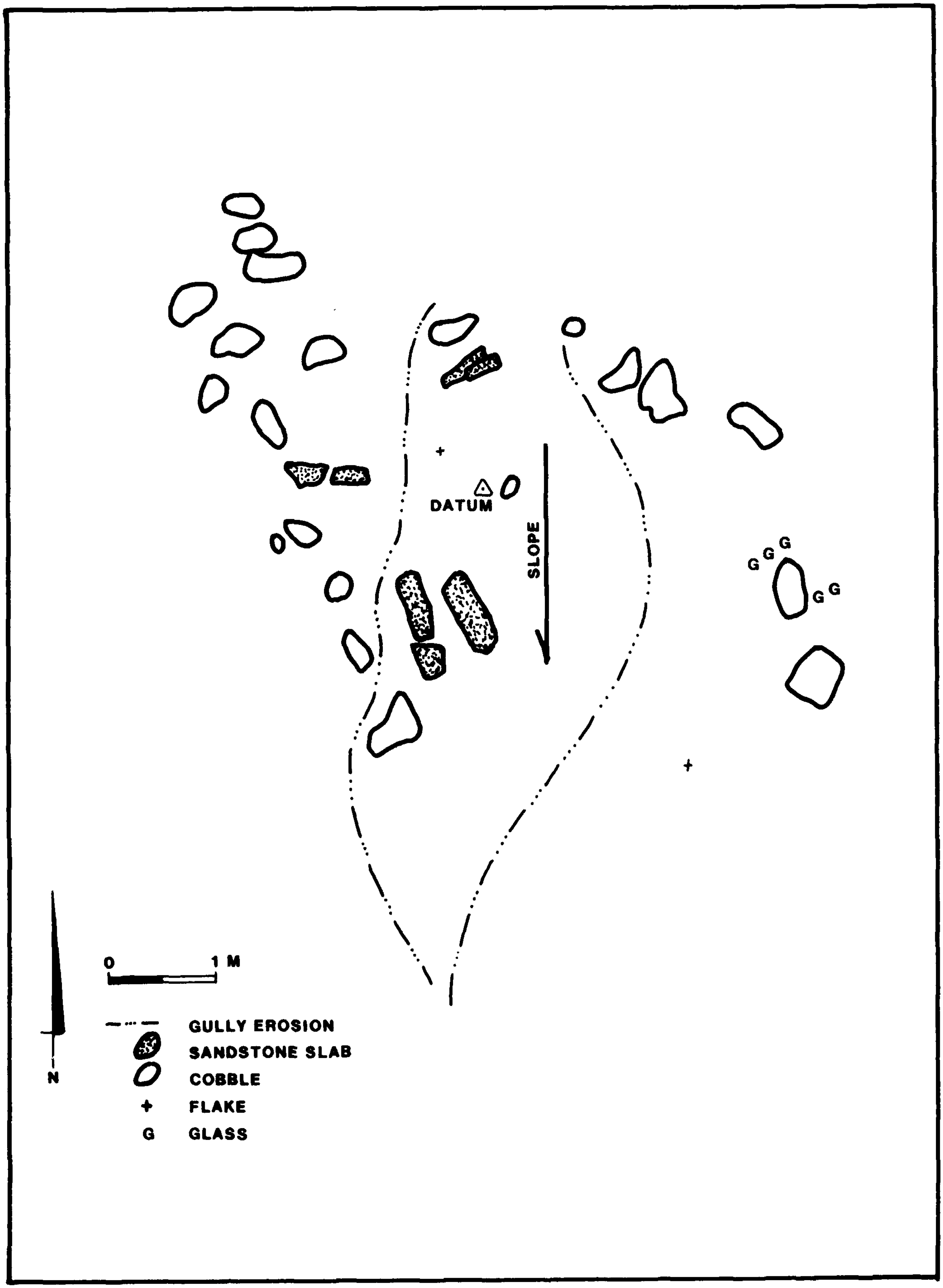


Figure 5.51 Plan of Cobble Ring Feature 36, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

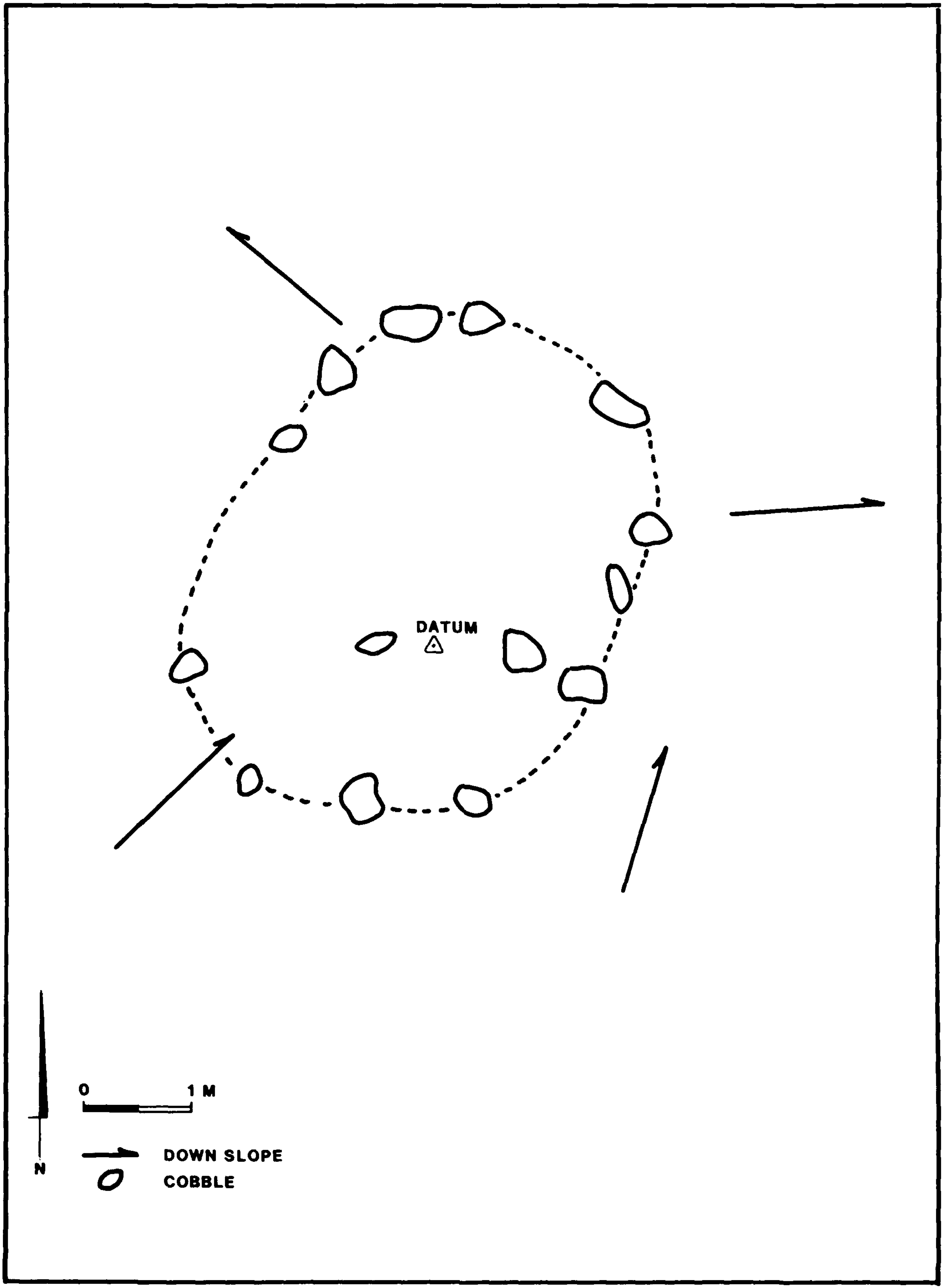
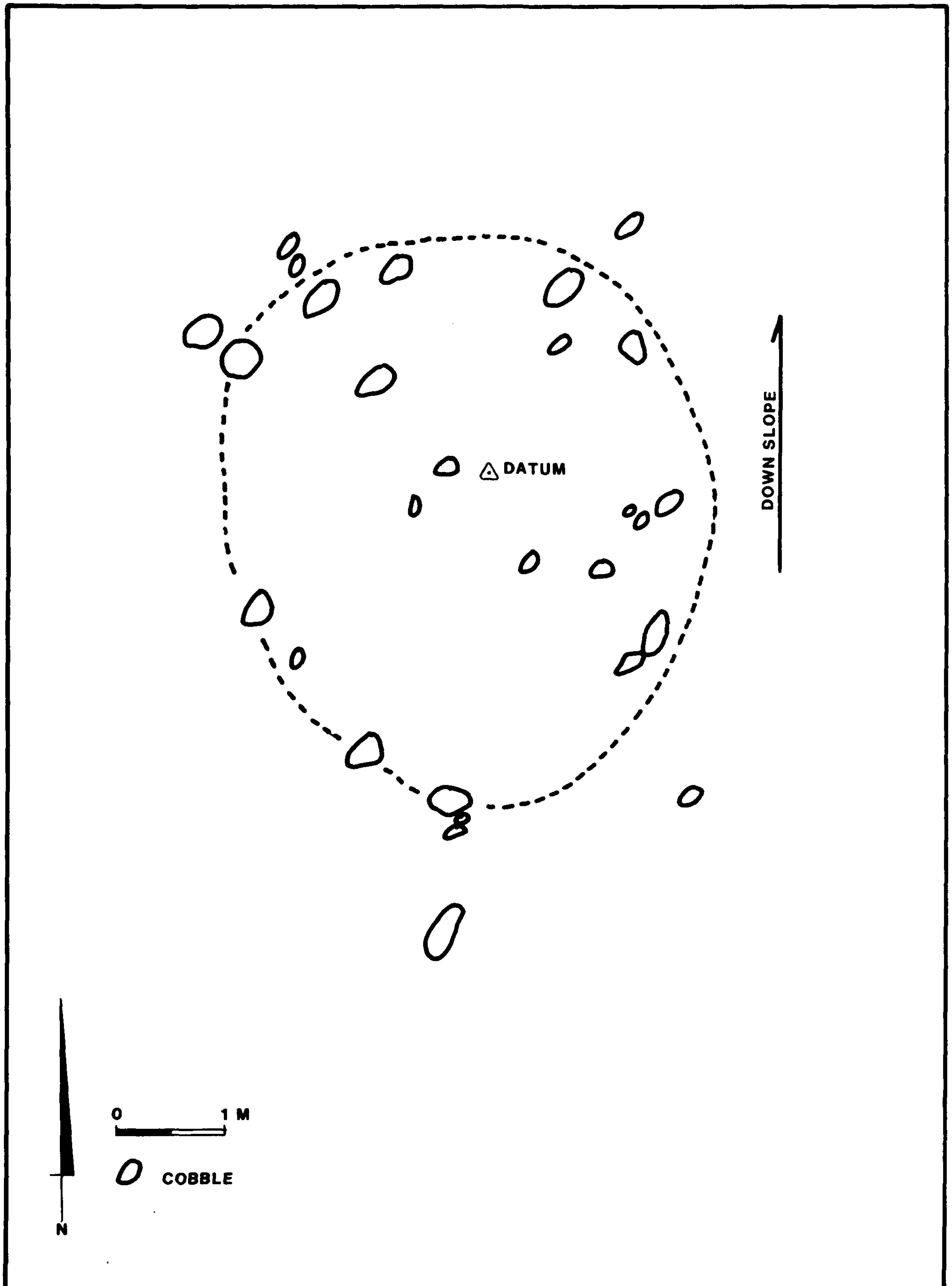


Figure 5.52 Plan of Cobble Ring Feature 37, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



experienced slight erosion, even though the northwest part of the ring is nearly eroded over the terrace edge. The feature measures approximately 4.0 m (north-south) by about 3.25 m (east-west) and is defined by eight large cobbles spaced from 60 to 290 cm apart (Figure 5.53). The widest gap in the stones is in the eastern part of the ring. The perimeter stones are primarily solitary alignment cobbles, but a cluster of three stones occurs near the terrace edge in the northwest part of the ring. A single interior stone is present as is one piece of fire-cracked rock.

Feature 44 is an isolated, severely eroded partially spaced stone circle located south of the centerline ridge of the north terrace. The feature is not near any terrace edges. The location of the feature does not correspond to any of the SAR feature areas. This part of the site has experienced moderate erosion, even though this feature is severely disturbed. The feature measures approximately 4.25 m (east-west); no north-south dimension is available since the south wall is displaced. The feature is defined by five large cobbles in an arc-shaped alignment; two other large and three smaller cobbles are also present inside the arc (Figure 5.54). The largest gap in the stone arc is about 200 cm wide. The perimeter stones form a solitary alignment of single cobbles. The poor structural integrity precludes a determination of whether the associated stones are interior cobbles or merely displaced perimeter stones. No thermally altered stones were noted at this feature.

5.3.4.2 Nonstructural Features

Thermal Features

Feature 9 is a basin-shaped, rock-filled hearth on the east edge of the south terrace within SAR feature area C. Ring Features 3, 4, and 8 are within 30 m to the west and north. The hearth feature has experienced considerable erosion from an adjacent cattle trail. The feature is defined by a basin pit measuring 50 cm (north-south) by 52 cm (east-west) and excavated 17 cm into the substratum. At least 19 large cobbles fill the hearth area for a dispersion index of 73.07 rocks/m^2 (Figure 5.55) . Most rocks are fractured subrounded cobbles which measure up to 18 cm in diameter. Total weight of excavated rock in the feature is 22 kgs. Immediately northeast of the hearth feature was an inverted metate. A pollen sample was collected from soil beneath the metate.

Test Unit 5 is a 1-m^2 pit placed directly over the hearth feature. It was dug to a depth of 20 cm. A 2.5-liter flotation sample of hearth matrix yielded 95 charred goosefoot (*Chenopodum*) seeds (Appendix E). Stratigraphic profiles through the center of the feature and of the west test unit wall show three strata (Figure 5.55). Stratum I is a 7-cm thick, loosely compacted brown (7.5YR 5/4) silty loam which caps the hearth feature. The lower boundary is smooth and abrupt. The stratum represents colluvial deposition which postdates usage of the hearth.

Stratum II is the hearth matrix. It is about 17 cm thick and truncates Stratum III. The matrix consists of a compact very dark gray (10YR 3/1) ash mottled with pale brown (10YR 6/3) silt and abundant fire-cracked subrounded

Figure 5.53 Plan of Cobble Ring Feature 41, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

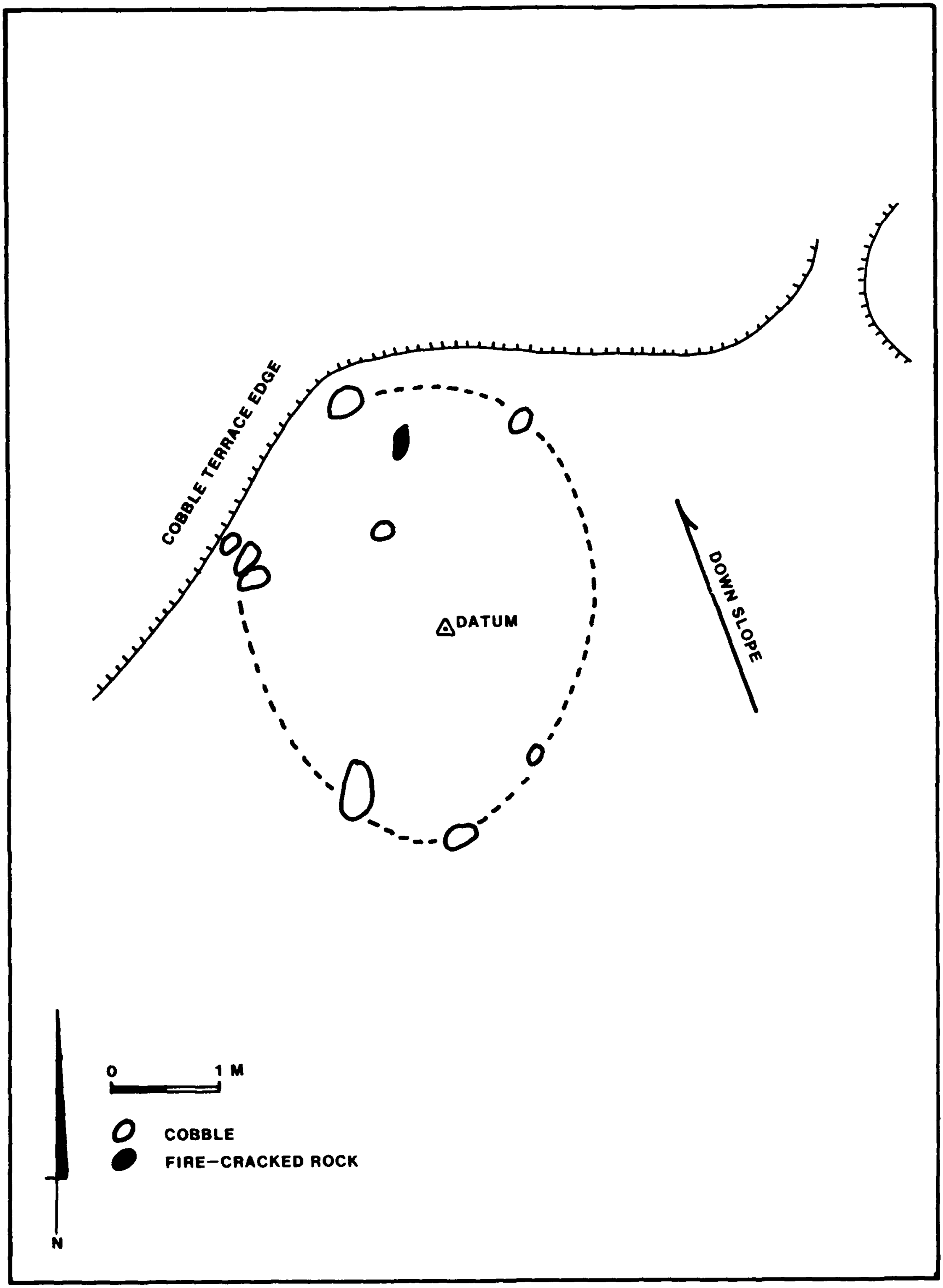


Figure 5.54 Plan of Hearth Feature 44, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

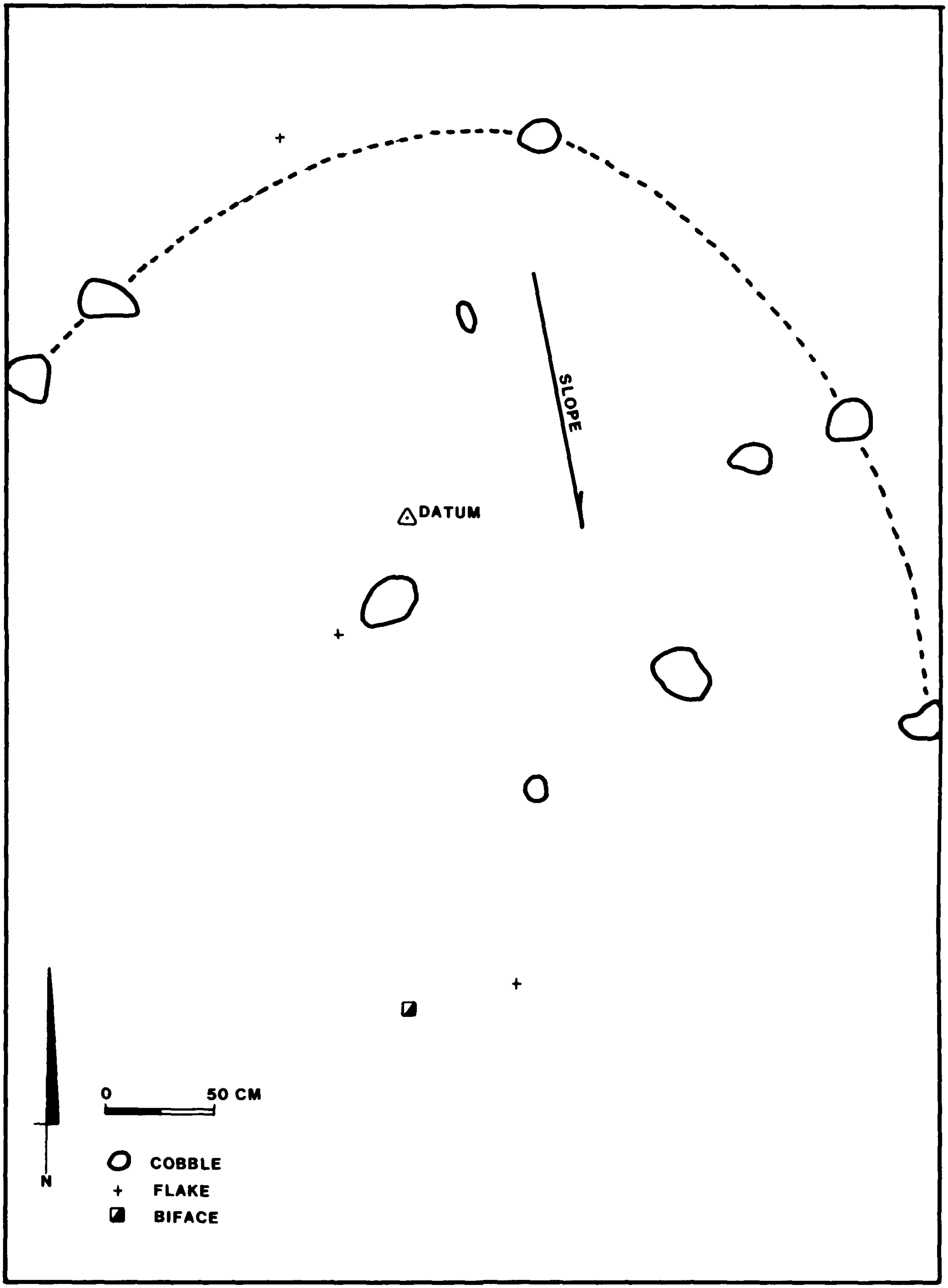
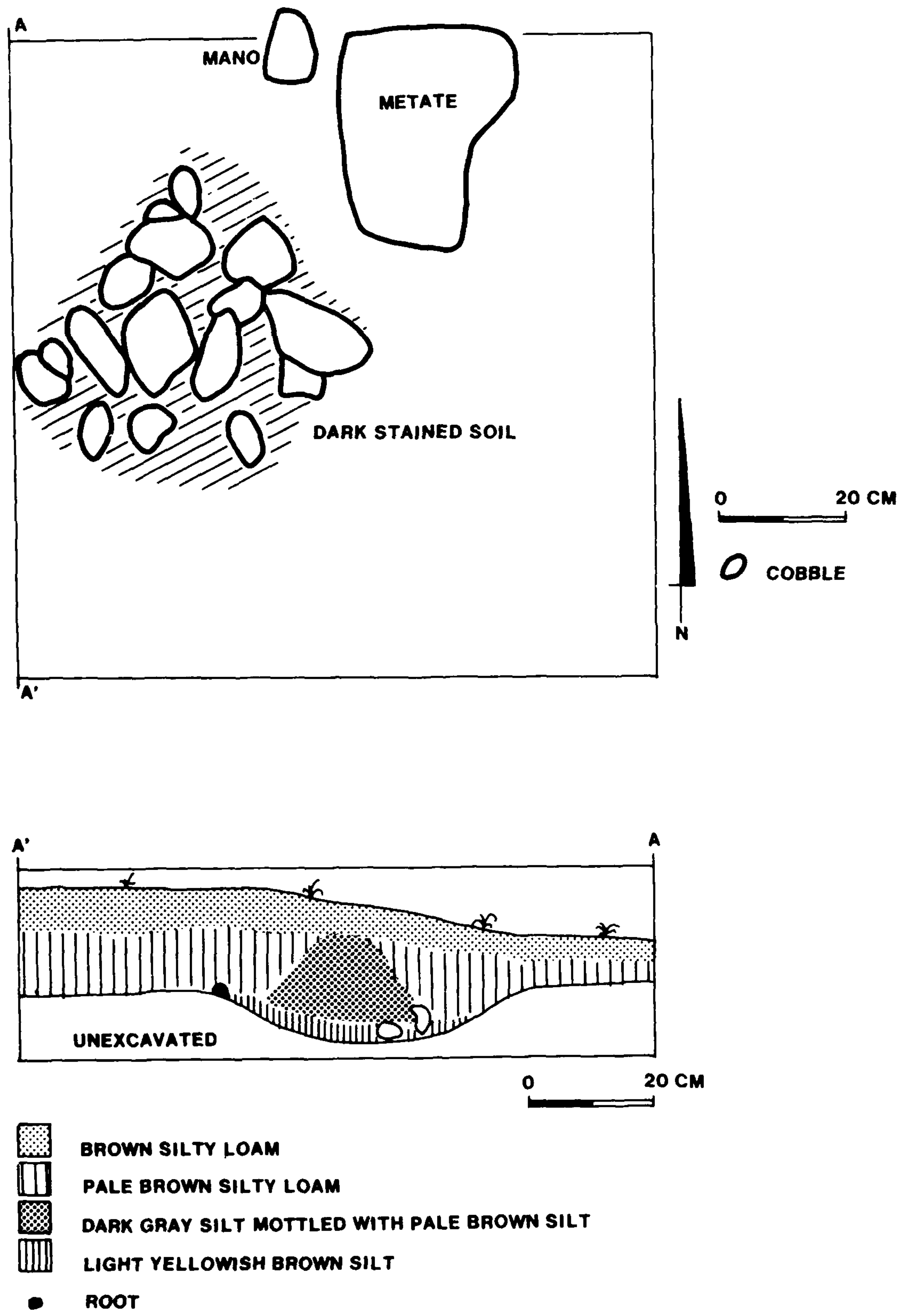


Figure 5.55 Plan and Profile of Hearth Feature 9, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



cobbles. The base of the hearth is light yellowish brown (2.5YR 6/4) highly compacted oxidized silt. The lower boundary is smooth and abrupt.

Stratum III is at least 10 cm thick and is a culturally sterile, very compact pale or light brown (10YR 6/3.5) silty loam. It represents an old substratum capping the Pleistocene terrace.

Feature 12 is a severely eroded fan-shaped fire-cracked rock scatter on a steep slope near the crest of a high hillock on the southern edge of the south terrace area. This part of the site is outside the areas designated by SAR. The location provides a commanding overview of the valley. Other nearby features include hearth Feature 13 and lithic reduction Features 10 and 11. This part of the site has experienced moderate erosion. The feature is defined by approximately 35 cobbles scattered over a 5.25-m north-south by 5.25-m east-west area for a dispersion index of 1.27 rocks/m^2 (Figure 5.56). The upslope portion of the hearth consists of about 20 cobbles clustered within a 1.75-m^2 area. Most rocks are thermally fractured, discolored quartzite cobbles which measure up to 20 cm in diameter.

Two auger holes were excavated in the densest portion of the feature. Both were dug to a depth of 60 cm. Fire-cracked rock was found in the upper 14 cm, but no discolored soil or artifacts were recovered. Three strata were noted in the auger holes. Stratum I (0-14 cm) is a reddish brown fine sandy loam with occasional pieces of cracked rock; Stratum II (14-35 cm) is a light brown fine loam with carbonates; Stratum III (35-60 cm) is brown loam with caliche pebbles. These probes indicate that the feature retains no integrity.

Feature 13 is a scattered rock hearth on the crest of a high hillock along the southwest portion of the south terrace. The locality provides a good overview of the entire site and the south site boundary tributary. Nearby are hearth Feature 12 and lithic reduction Features 10 and 11. This area is moderately eroded. The feature is defined by a concentration of 29 small and large cobbles clustered within a 1.5-m north-south by 1.0-m east-west area for a dispersion index of 19.33 rocks/m^2 (Figure 5.57); some 22 other cobbles are scatterd over a 4.0 m by 4.25 m area. Most rocks are fractured quartzite cobbles which measure up to 20 cm in diameter.

Two auger holes were excavated in the densest portion of the feature. They were dug to a depth of 45-60 cm. Fire-cracked rock was found in the upper 5 to 6 cm, but no discolored soil or artifacts were recovered. Three strata were noted in the auger holes. Stratum I (0-6 cm) is a reddish brown fine sandy loam with occasional pieces of cracked rock; Stratum II (6-45 cm) is a light brown fine loam with carbonates near the top but caliche chunks near the base of this layer; Stratum III (45-60 cm) is a reddish brown sandy loam with caliche pebbles. These probes indicate that no integrity remains at the feature.

Feature 19 is a fire-cracked rock scatter along the mid-ridge line of the north terrace away from any of the terrace edges. Nine other hearth features are located in close proximity on this ridge. This part of the site has experienced minimal erosion. The feature is defined by 20 cobbles clustered within a 2.75-m (north-south) by 2.5-m (east-west) area for a dispersion index

Figure 5.56 Plan of Hearth Feature 12, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

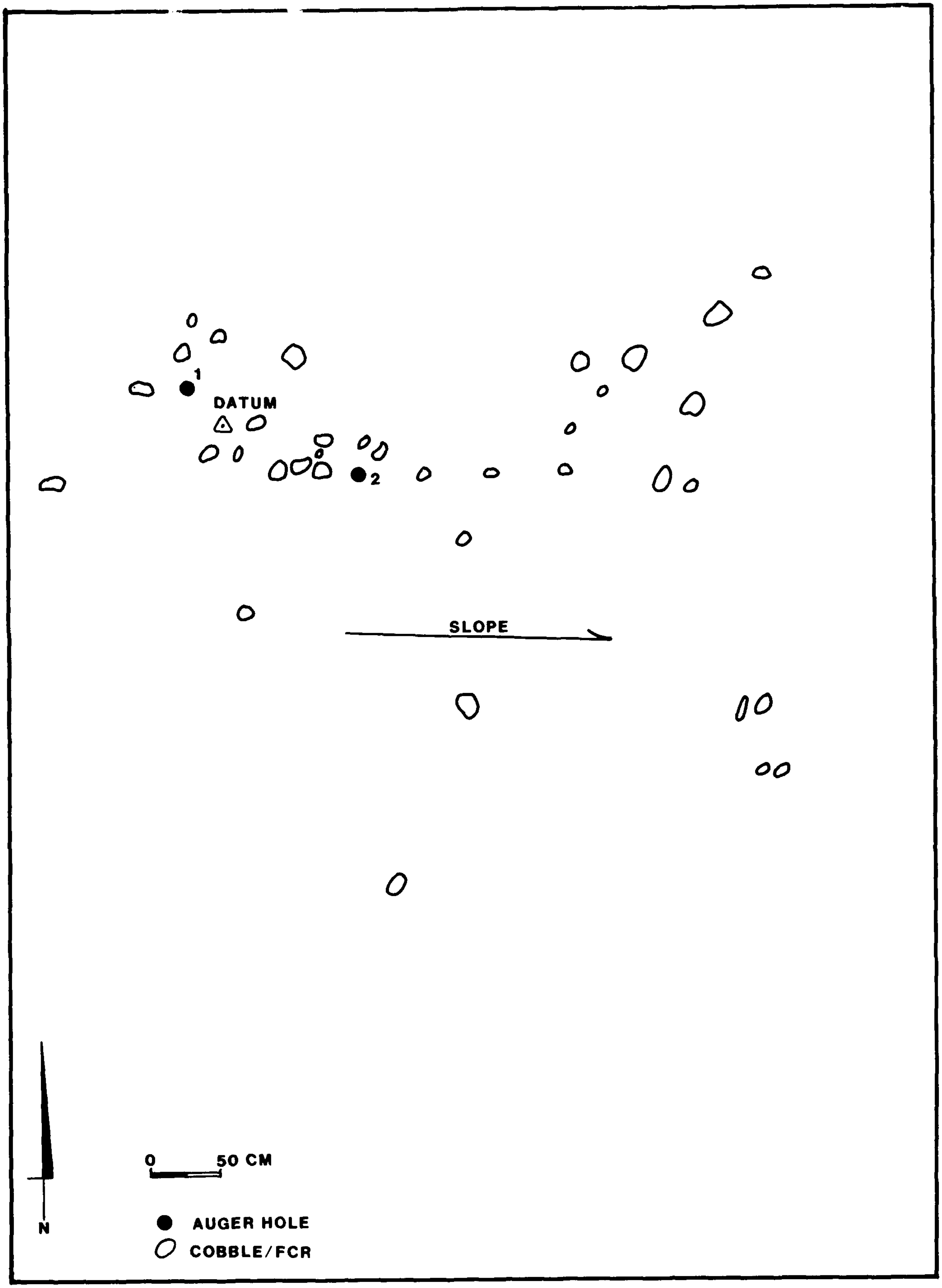


Figure 5.57 Plan of Hearth Feature 13, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

of 2.91 rocks/m^2 (Figure 5.58). Most rocks are thermally fractured cobbles which measure up to 25 cm in diameter. No subsurface testing was conducted at this hearth feature.

Feature 20 is a sparse fire-cracked rock hearth located along the mid-ridge line of the north terrace away from any of the terrace edges. Nine other hearth features are located in close proximity on this ridge. This part of the site has experienced minimal erosion. The feature is defined by 12 small to medium-sized cobbles clustered within a 2.2-m (north-south) by 2.25-m (east-west) area for a dispersion index of 2.42 rocks/m^2 (Figure 5.59). The cobbles measure up to 15 cm in diameter. No ashy soil was observed; however, no subsurface testing was conducted.

Feature 21 is a sparse fire-cracked rock hearth located along the mid-ridge line of the north terrace away from any of the terrace edges. Nine other hearth features are located in close proximity on this ridge. Minor erosion has occurred in this area. The feature is defined by nine angular cobbles clustered within a 0.85-m (north-south) by 0.9-m (east-west) area for a dispersion index of 11.76 rocks/m^2 (Figure 5.60). Most cobbles are fractured and thermally discolored. The tight clustering of the feature suggests some integrity. Associated artifacts include six flakes and one core.

One auger hole was excavated in the feature to a depth of 38 cm. Fire-cracked rock occurred throughout the fill to a depth of 25 cm. The upper 12 cm of the feature consisted of light brown loam, whereas the lower 13 cm was reddish brown (oxidized?) loam. No ashy soil or flecks of charcoal were noted in the core. The substratum (25-38 cm) is a compact brown fine loam without fire-cracked rock. The testing suggested that the feature is largely intact.

Feature 22 is a rock filled hearth located along the mid-ridge line of the north terrace away from any of the terrace edges. Nine other hearth features are located in close proximity on this ridge. This part of the site has experienced minimal erosion. The feature is defined by a concentration of 23 small to large cobbles clustered within a 2.1-m by 1.3-m area for a dispersion index of 8.42 rocks/m^2 (Figure 5.61). Most rocks measure up to 15 cm in diameter. Associated artifacts include two flakes. One auger hole and one test pit were placed on the feature.

The auger hole was excavated in the feature's center to a depth of 38 cm. Fire-cracked rock and charcoal flecks were observed in a dark reddish brown matrix between 10 and 21 cm deep. The overlying stratum was light reddish brown and was devoid of ash or fire-cracked rock. The substratum (21-38 cm) was a compact light reddish brown loam which contains small pebbles. The auger hole suggested that the feature was mostly intact.

Test Unit 7 is a 1 m^2 pit placed in the northern (downslope) portion of the hearth scatter. It was excavated to a depth of 20 cm. A stratigraphic profile of the east wall revealed two strata (Figure 5.61). Stratum I is a 3-cm thick, semi-compact brown (7.5YR 5/4) fine sandy loam. No artifacts and only sparse amounts of fire-cracked rock were recovered. The lower boundary is smooth and abrupt. Stratum II is at least 17 cm thick and is a culturally

Figure 5.58 Plan of Hearth Feature 19, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

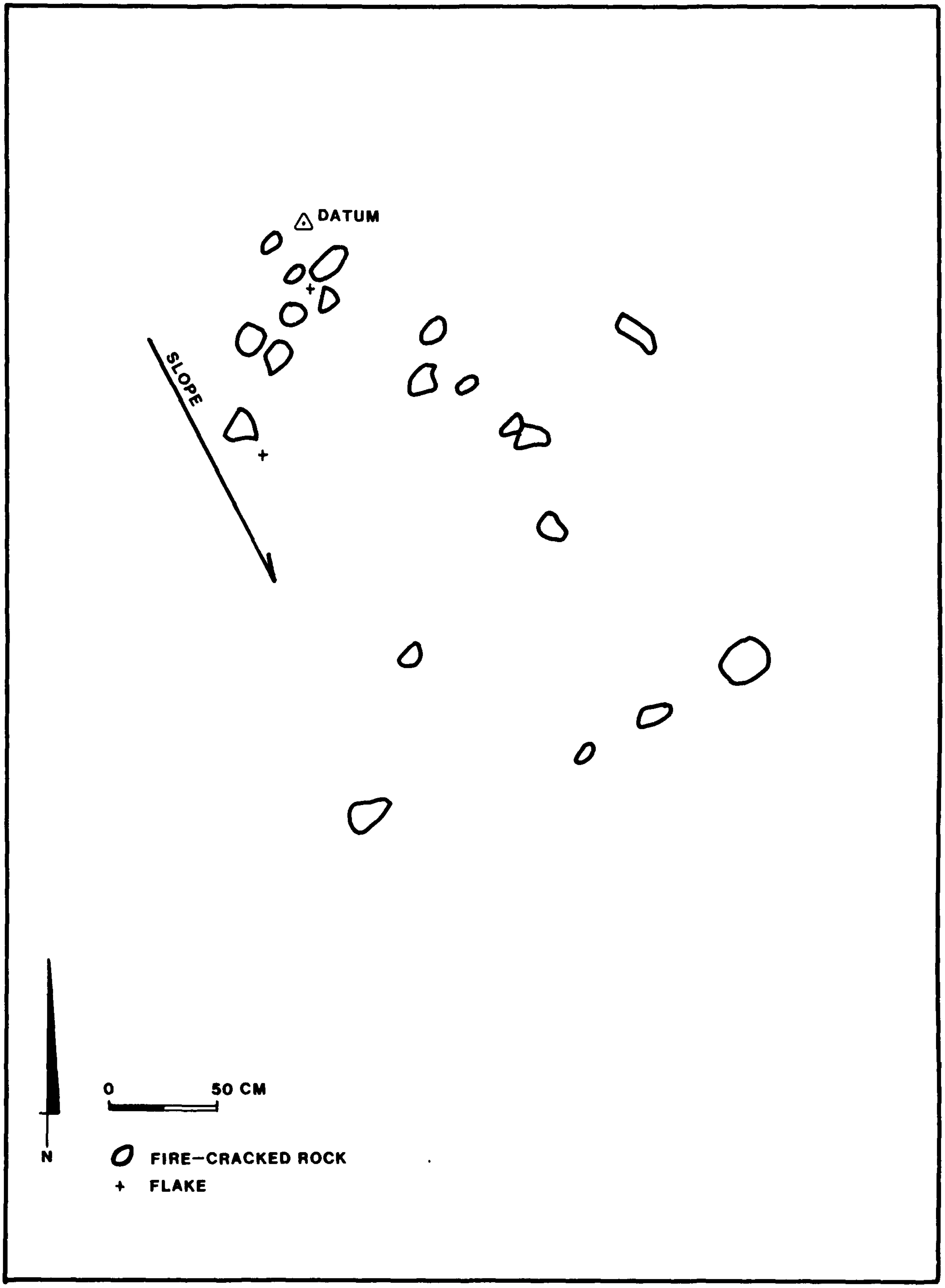


Figure 5.59 Plan of Hearth Feature 20, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

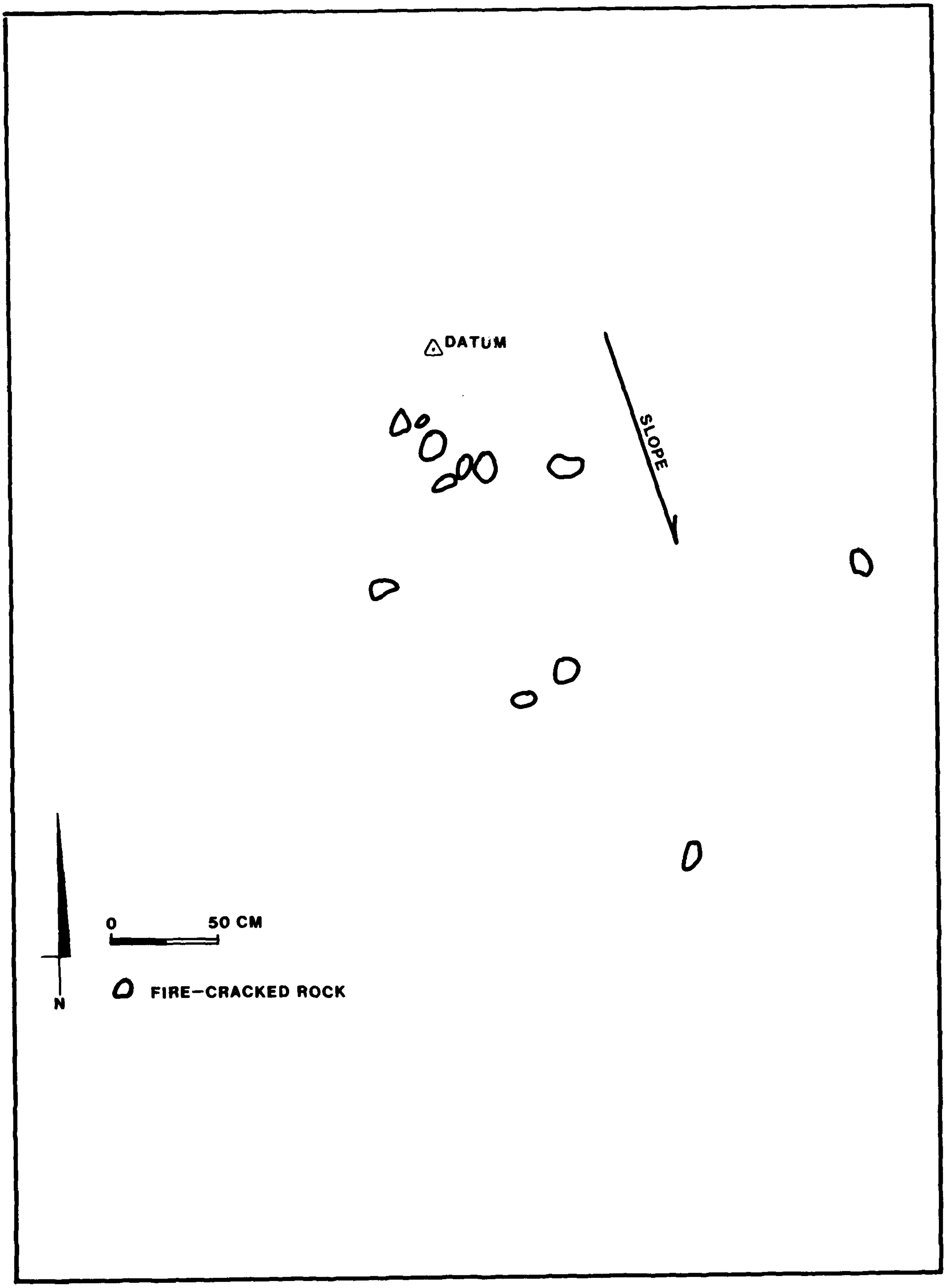


Figure 5.60 Plan of Hearth Feature 21, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

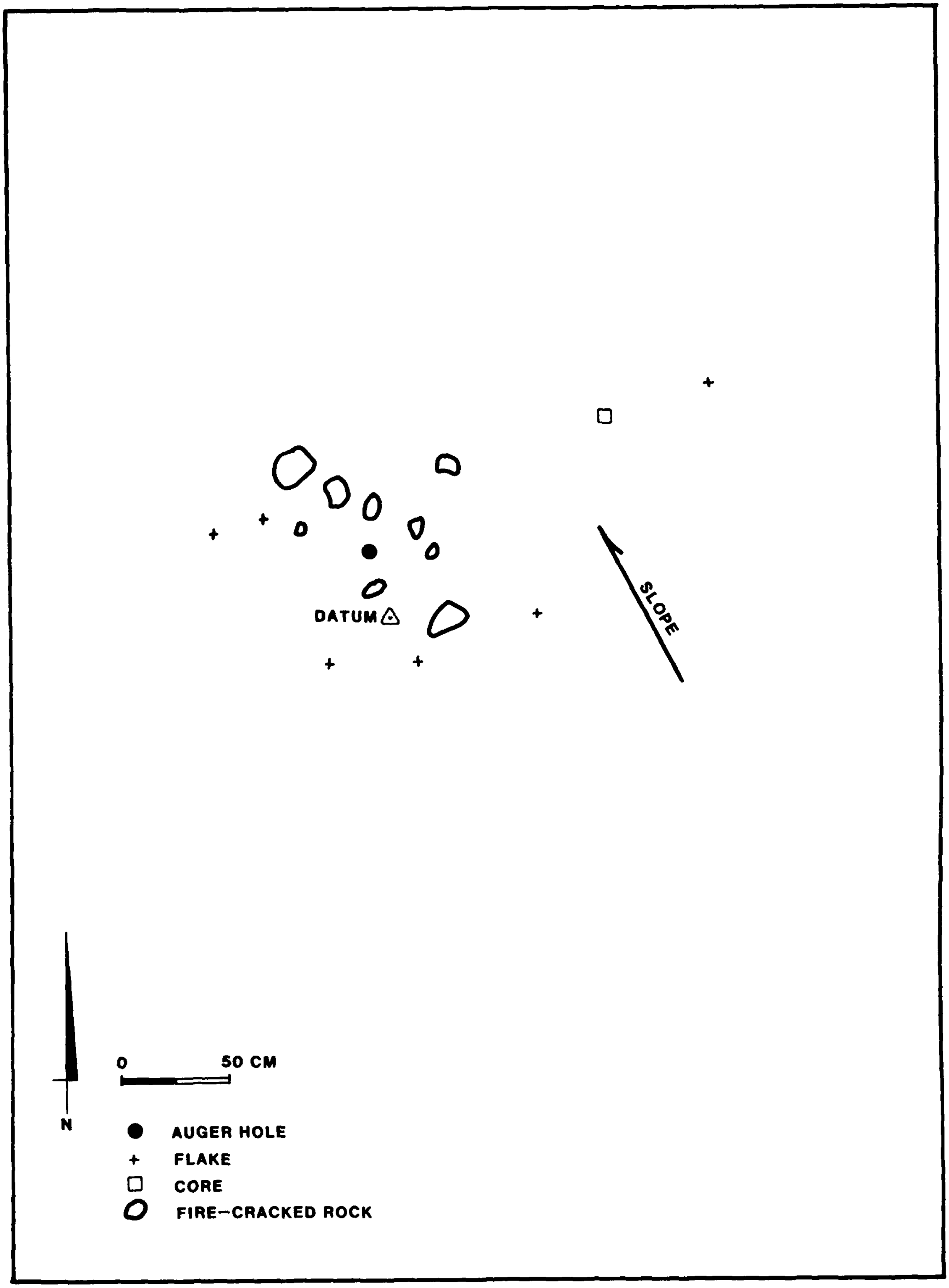
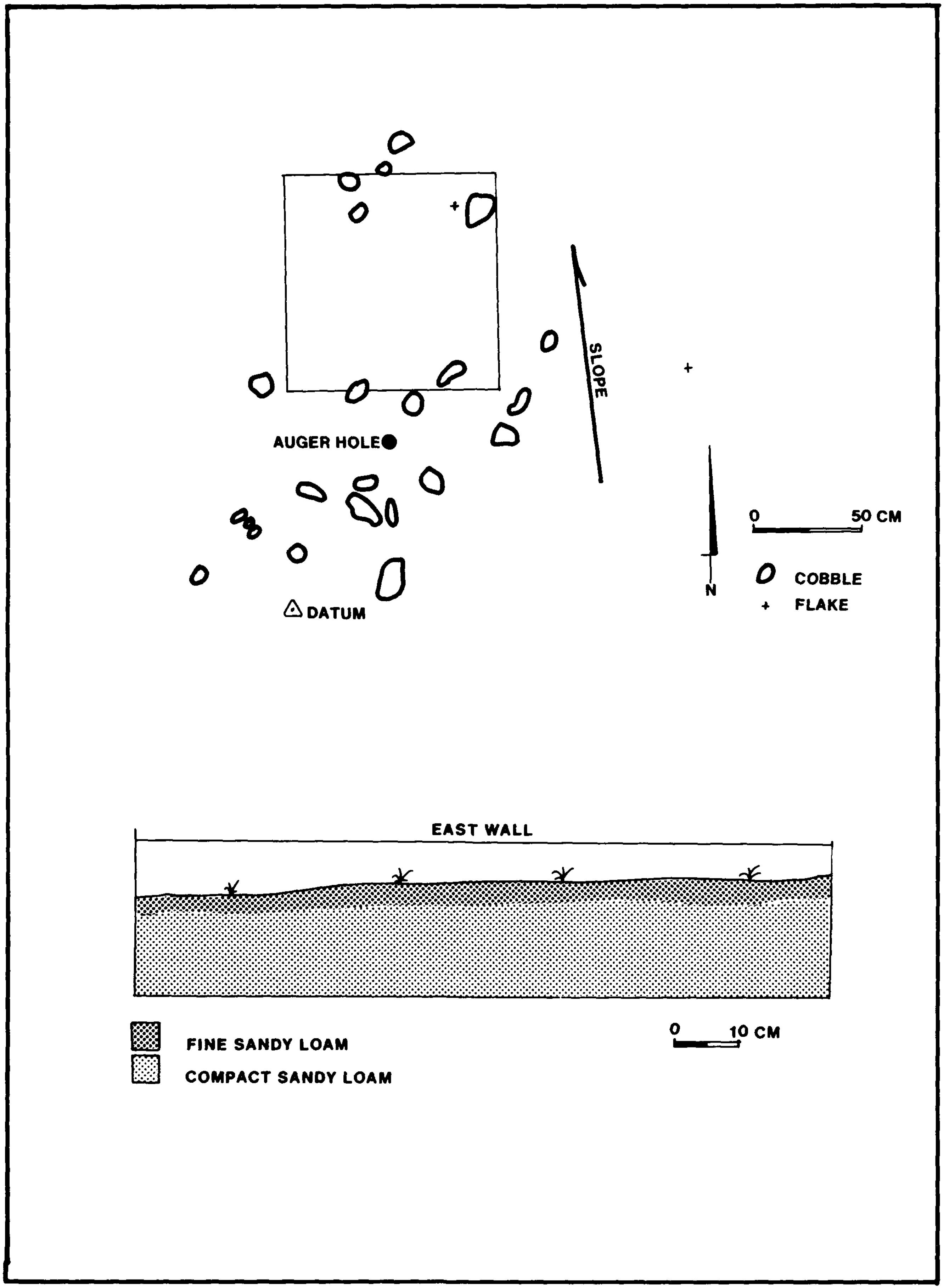


Figure 5.61 Plan and Profile of Hearth Feature 22, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



sterile, compact brown (7.5YR 5/4) silty loam. Total weight of excavated rock in the feature is only 1 kg. The discrepancy between observations from the auger hole and the test unit may be due to the placement of the test unit outside of the feature's subsurface limits. Quite likely, part of the feature is intact, but insufficient time prevented delineation of the hearth.

Feature 23 is the southwesternmost scattered rock hearth in a series of hearths along the mid-ridge line of the north terrace away from any of the terrace edges. Nine other hearth features are located within 35 m to the north and east. This area has experienced minimal erosion. The feature is defined by 14 small to large cobbles clustered within a 1.7-m (north-south) by 2.3-m (east-west) area for a dispersion index of 3.58 rocks/m^2 (Figure 5.62). Associated artifacts include four flakes. One auger hole was placed in the center of the concentration.

The auger hole was excavated to a depth of 38 cm. No subsurface fire-cracked rock was found in the hole, but charcoal flecks were observed in the light brown fine loam which was restricted to the upper 22 cm. The substratum (22-38 cm) was a compact brown loam containing small caliche pebbles. The auger hole suggested that the feature is intact.

Feature 24 is a sparse rock hearth scatter located along the mid-ridge line of the north terrace away from any of the terrace edges. Nine other hearth features are located within 30 m along this ridge. This part of the site has experienced minimal erosion. The feature is defined by 10 cobbles clustered within a 1.25 m by 1.1-m area for a dispersion index of 7.27 rocks/m^2; three other rocks occur downslope within 2 m of the rock cluster (Figure 5.63). Associated artifacts include seven flakes. No subsurface testing was conducted on this feature.

Feature 25 is a sparse fire-cracked rock scatter located along the mid-ridge line of the north terrace away from any of the terrace edges. Nine other hearth features are in close proximity on this ridge. This part of the site has experienced minimal erosion. The feature is defined by 19 cobbles scattered over a 2.2-m north-south by 2.75-m east-west area for a dispersion index of 3.14 rocks/m^2 (Figure 5.64). The angular cobbles measure up to 15 cm in diameter. No artifacts are associated, and no subsurface testing was conducted here.

Feature 26 is a fire-cracked rock scatter located north of the mid-ridge line in the middle of the north terrace area. Hearth Features 27 and 43 are nearby, and ring Features 28 and 44 are within 40 m to the north and south, respectively. Only slight erosion has occurred in this part of the site. The feature is defined by 33 large angular cobbles clustered within a 2.25 m (north-south) by 2.0 m (east-west) area for a dispersion index of 7.33 rocks/m^2 (Figure 5.65). Five flakes are close to the hearth feature. No subsurface augering or testing was conducted. The clustered rocks may indicate a fairly intact hearth feature.

Feature 27 is a scattered fire-cracked rock hearth located north of the mid-ridge line in the middle of the north terrace area. Hearth Features 26 and 43 are nearby, and ring Features 28 and 44 are within 40 m to the north

Figure 5.62 Plan of Hearth Feature 23, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

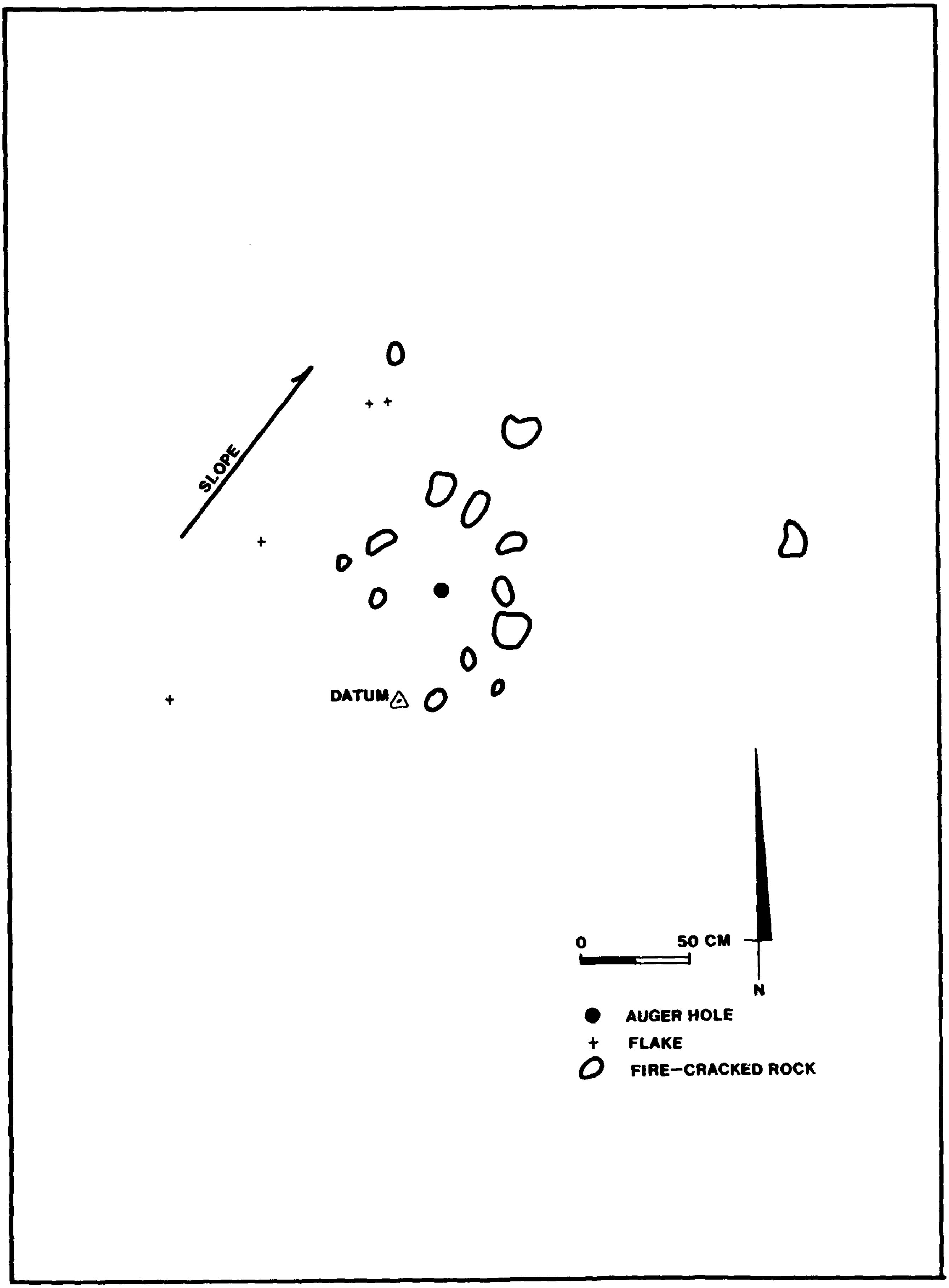


Figure 5.63 Plan of Hearth Feature 24, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

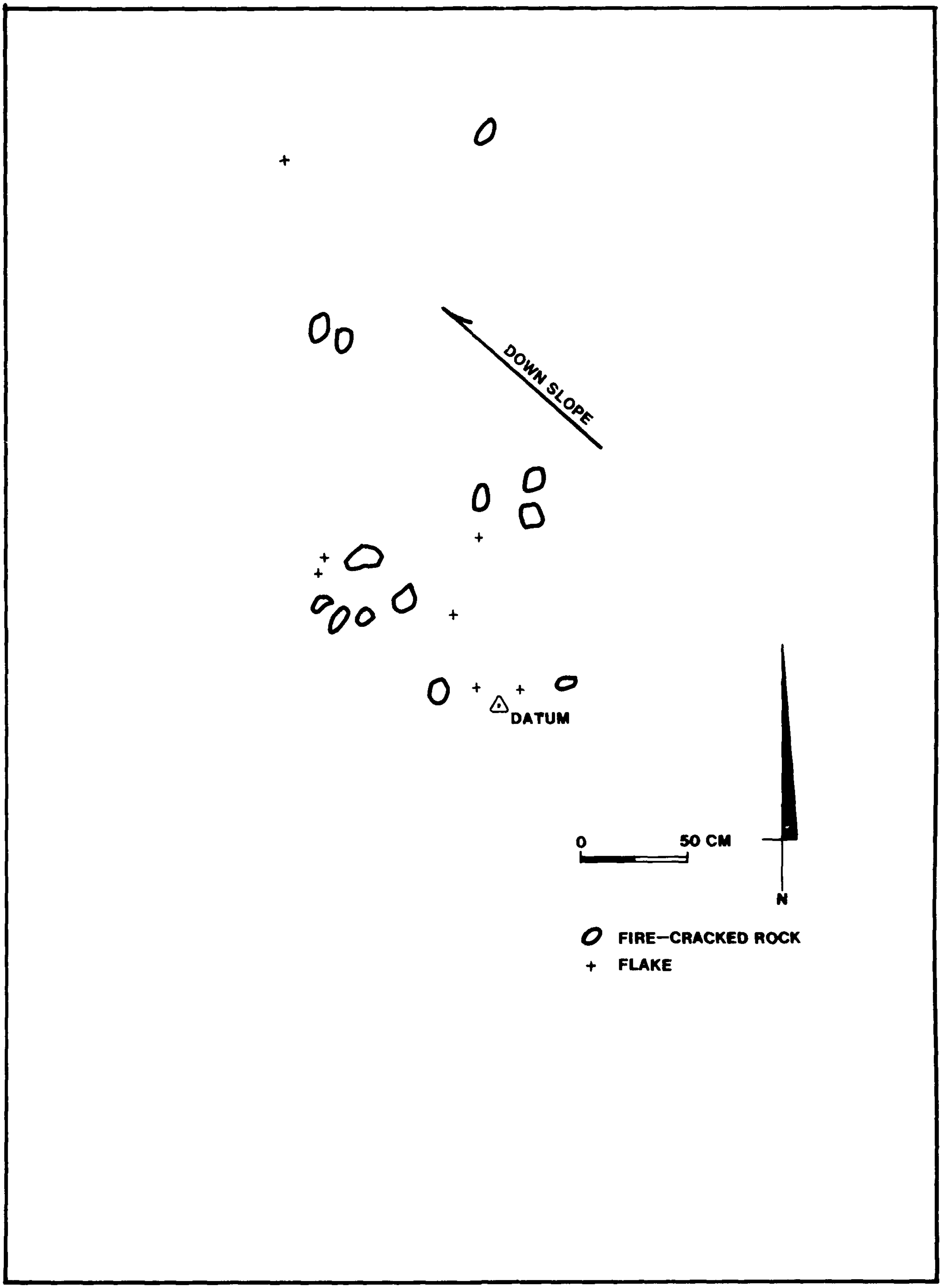


Figure 5.64 Plan of Hearth Feature 25, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

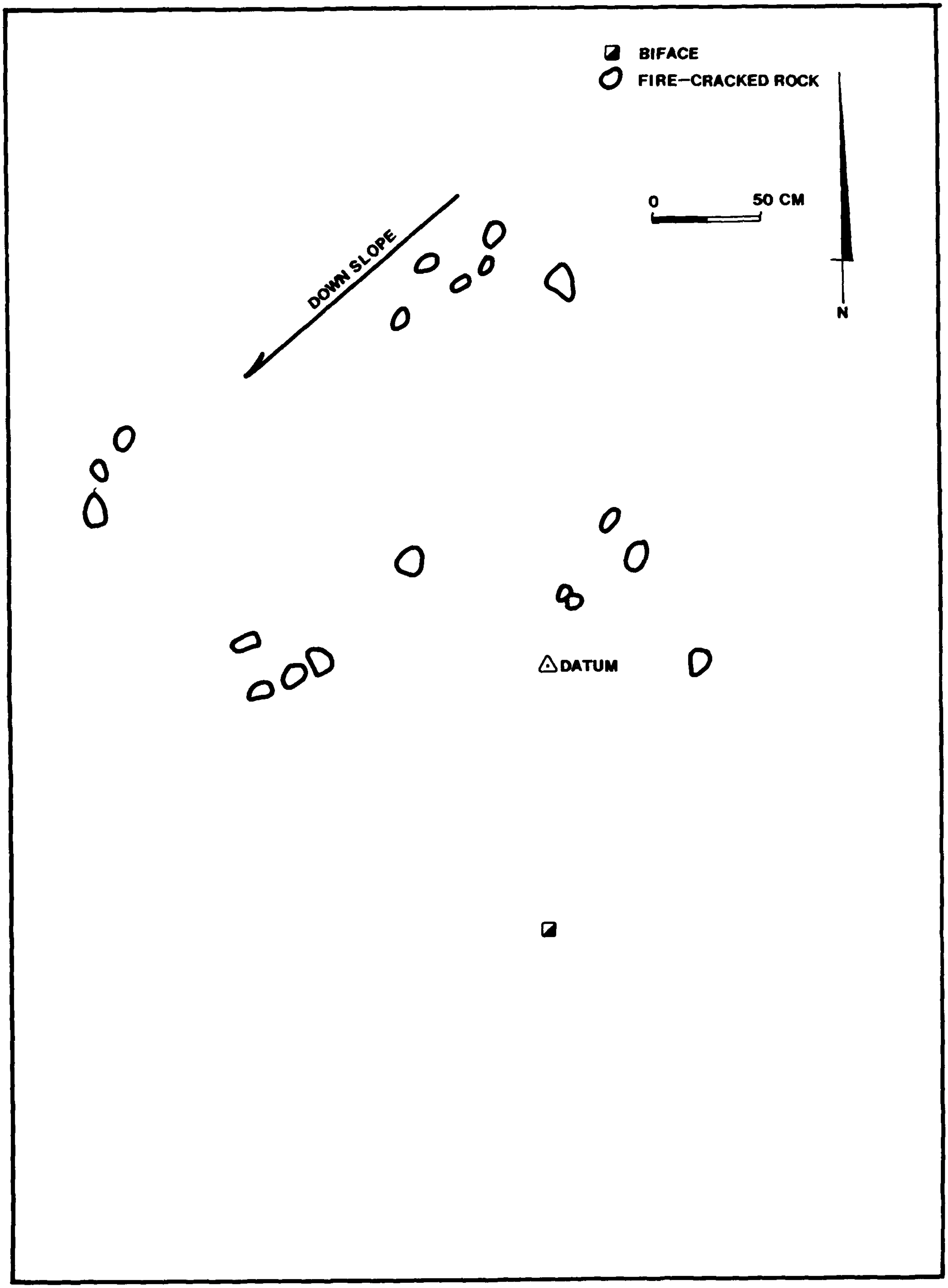
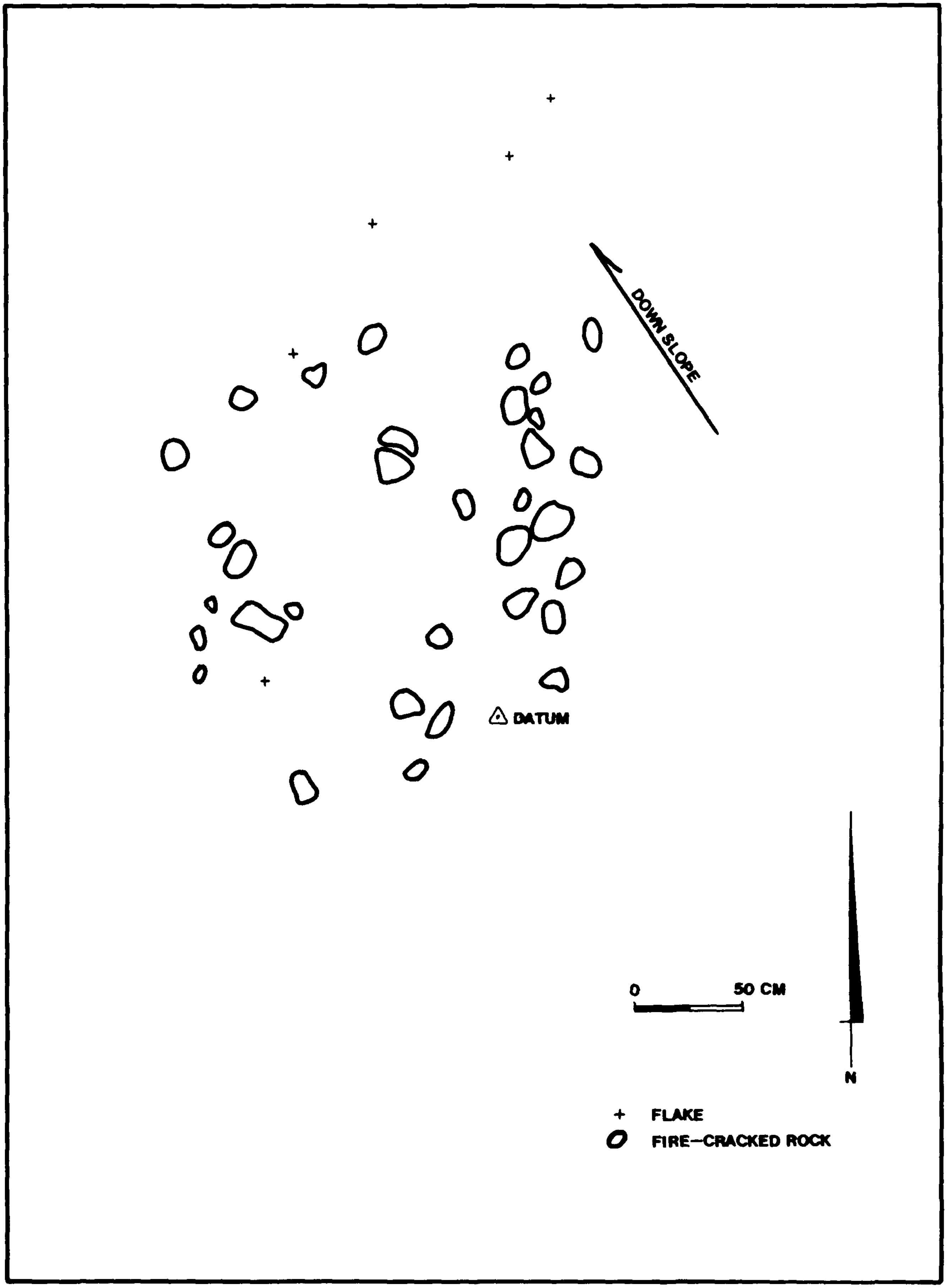


Figure 5.65 Plan of Hearth Feature 26, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



and south, respectively. This area is only slightly eroded. The feature is defined by 29 medium-sized to large cobbles clustered within a 2.65-m (north-south) by 1.75-m (east-west) area for a dispersion index of 6.25 rocks/m^2 (Figure 5.66). Five flakes occur close to the hearth feature. No subsurface augering or testing was conducted. The hearth feature has been deflated and scattered over a wide area.

Feature 33 is a widely scattered fire-cracked rock hearth located along the mid-ridge line of the north terrace away from any of the terrace edges. It is southeast of nine other hearth features located in close proximity on this ridge. This part of the site has experienced moderate erosion. The feature consists of 32 large angular cobbles clustered within a 4.0 m (north-south) by 2.35 m (east-west) area for a dispersion index of 3.40 rocks/m^2 (Figure 5.67). The wide distribution of rocks suggests that the feature is extensively deflated. Associated artifacts include nine flakes. No subsurface testing was conducted on the feature.

Feature 34 is the southeasternmost scattered rock hearth of a series of 10 hearth features along the mid-ridge line of the north terrace. Minimal erosion has occurred in this part of the site. The feature is defined by 32 large cobbles scattered within a 3.2-m (north-south) by 2.9-m (east-west) area for a dispersion index of 3.45 rocks/m^2 (Figure 5.68). An erosional channel bisects the fire-cracked rock feature; no ashy soil matrix was evident in the gully margins. A single flake is the only associated artifact. No testing was conducted on the feature.

Feature 38 is a widely dispersed fire-cracked rock hearth scatter in the high broken terrain in the northwestern portion of the north terrace. Other nearby features include cobble rings 36 and 37 and hearth Feature 39. This site area corresponds to SAR region I or J; it has experienced extensive erosion. This ill-defined feature consists of approximately 41 fire-cracked cobbles scattered within a 3.0-m diameter area for a dispersion index of 4.56 rocks/m^2 (Figure 5.69). Only two flakes are close to the hearth feature. No subsurface augering or testing was conducted. The dispersed rocks may indicate an eroded hearth feature.

Feature 39 is a scattered fire-cracked rock hearth in the high broken terrain in the northwestern portion of the north terrace. Other nearby features include cobble rings 36 and 37 and hearth Feature 38. This site area is slightly eroded and generally corresponds to SAR region I or J. The feature is defined by 63 small to large angular cobbles clustered within a 5.4-m (north-south) by 2.75-m (east-west) area for a dispersion index of 4.24 rocks/m^2 (Figure 5.70). The long axis of the rock scatter is perpendicular to the slope orientation. Most rocks are fractured cobbles which measure up to 30 cm in diameter. Associated artifacts include four flakes. No subsurface testing was conducted on the feature.

Feature 40 is an isolated dense concentration of fire-cracked rock along the mid-ridge line high on the hill in the western part of the north terrace area. Twelve other hearth features are located within 90 m to the east and west. This site locus is slightly eroded. The feature is defined by 21 medium-sized to large cobbles clustered within a 1.5-m (north-south) by 1.75-m

Figure 5.66 Plan of Hearth Feature 27, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

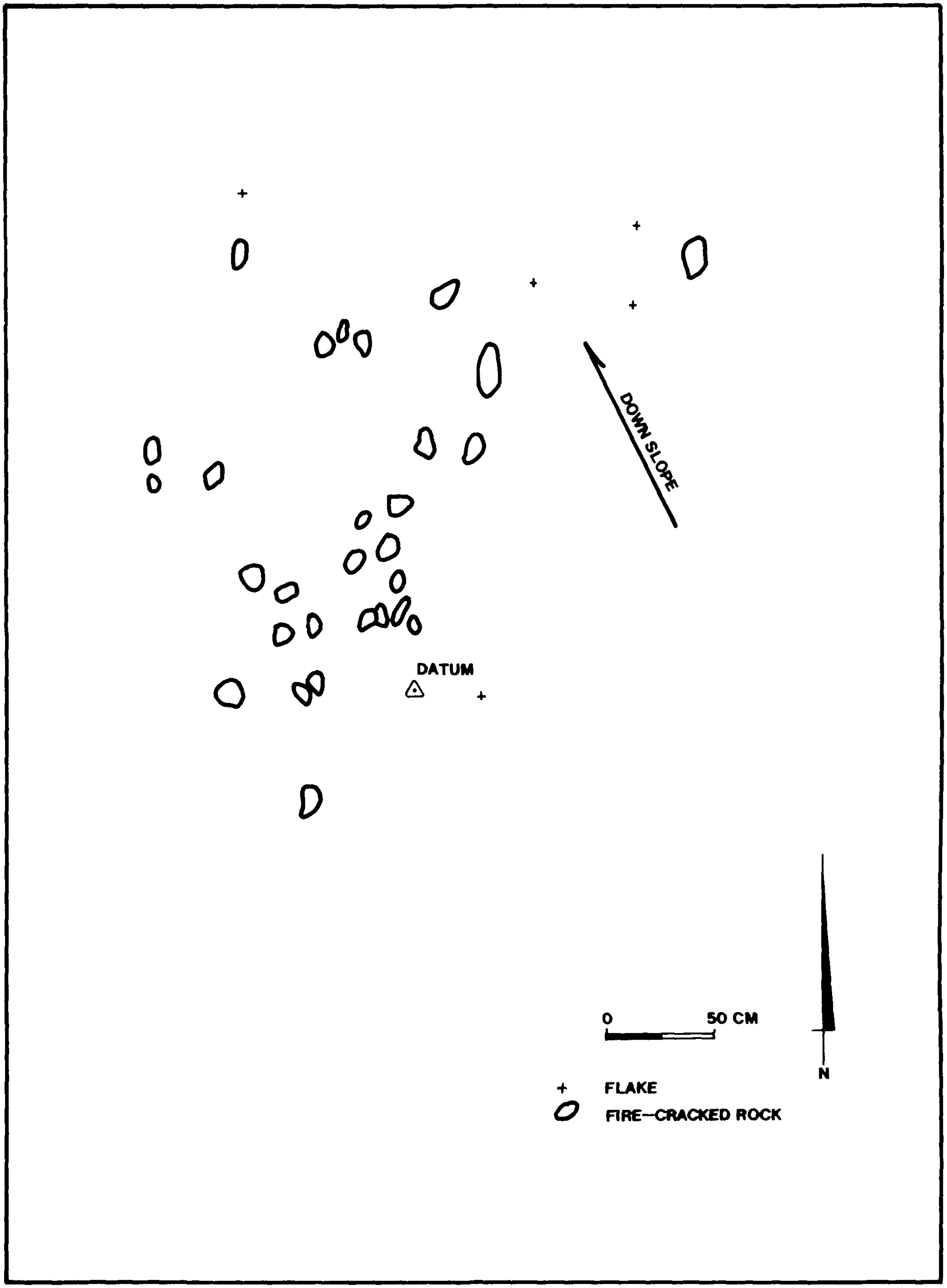


Figure 5.67 Plan of Hearth Feature 33, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

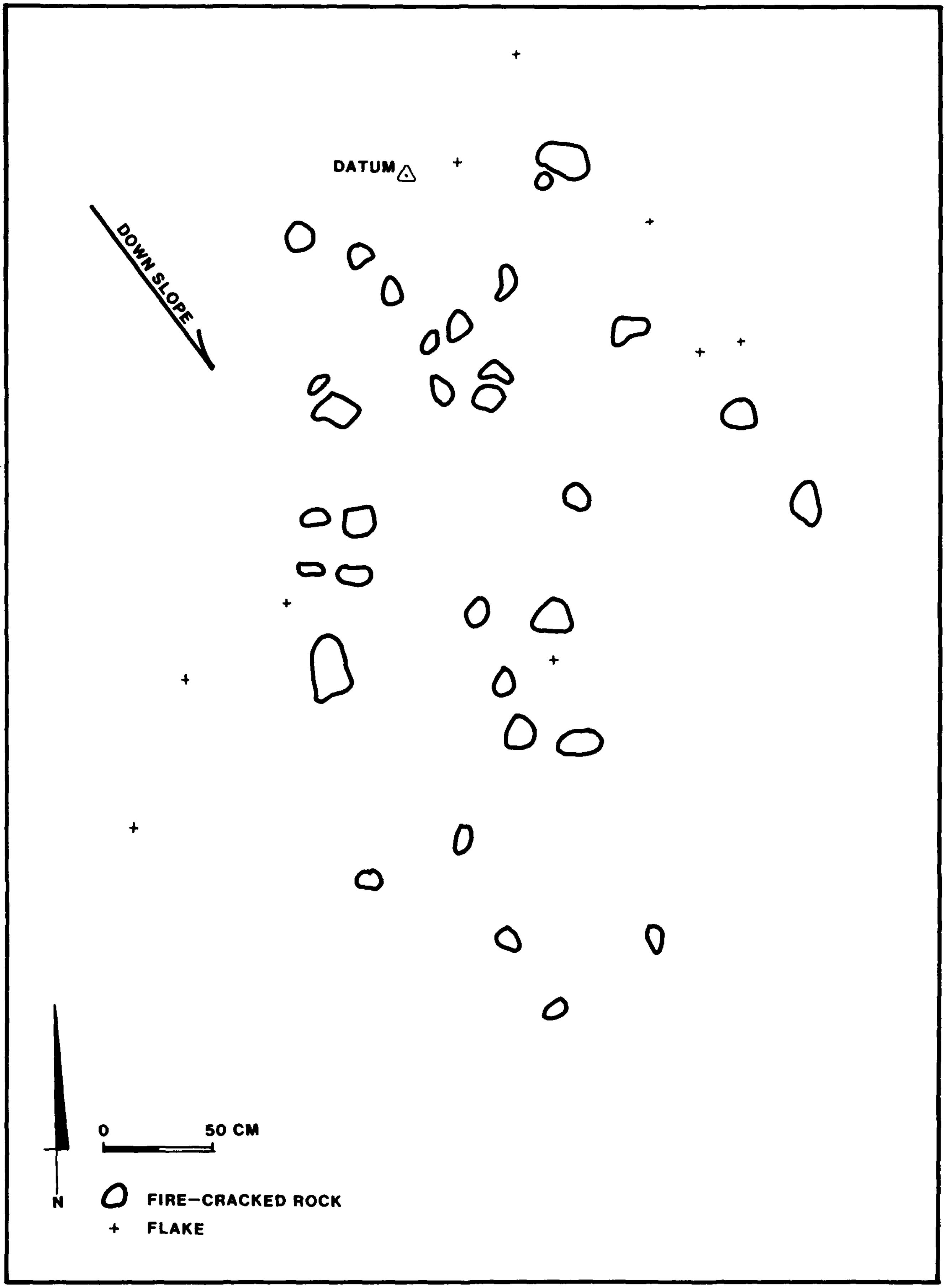


Figure 5.68 Plan of Hearth Feature 34, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

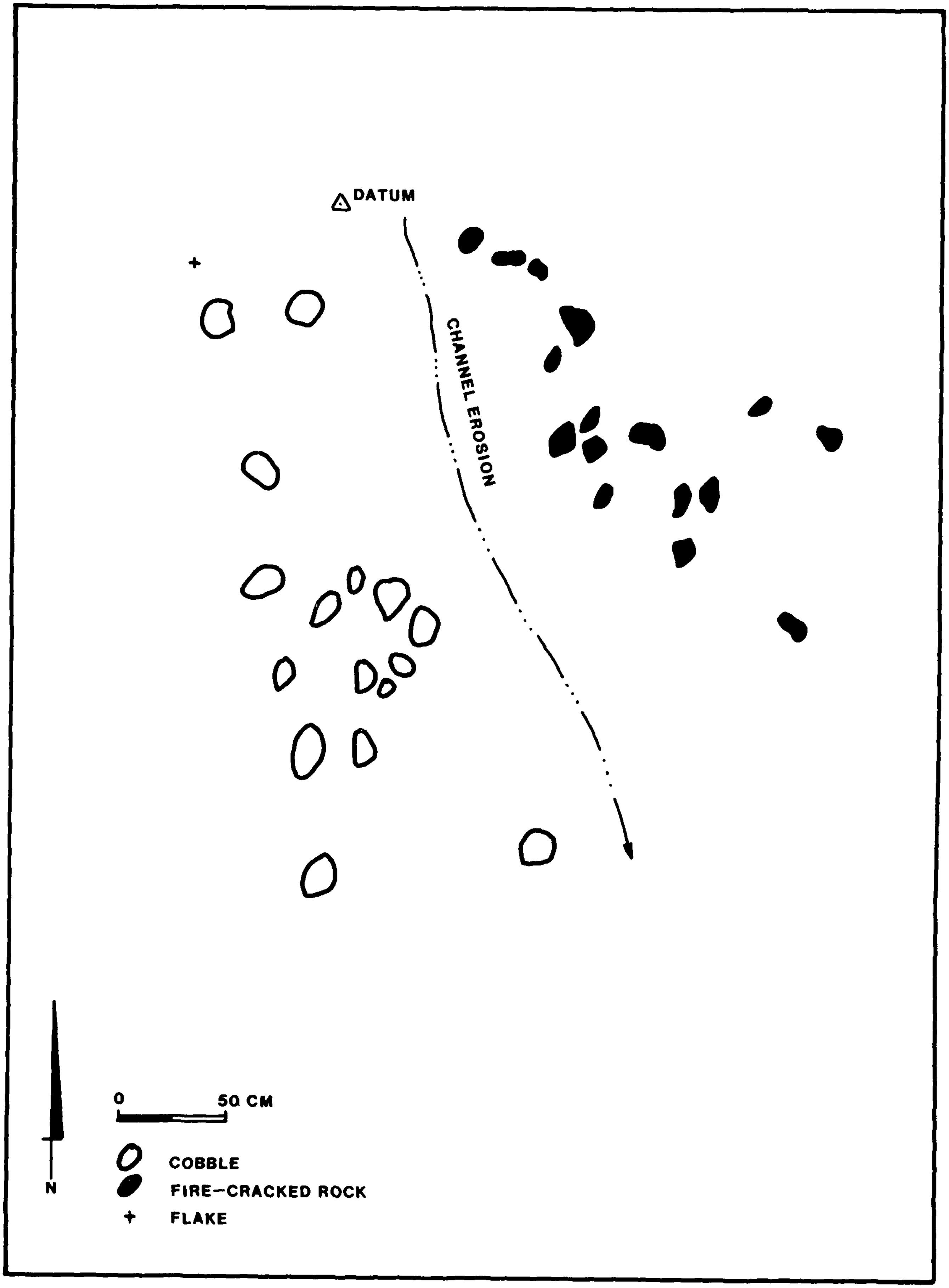


Figure 5.69 Plan of Hearth Feature 38, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

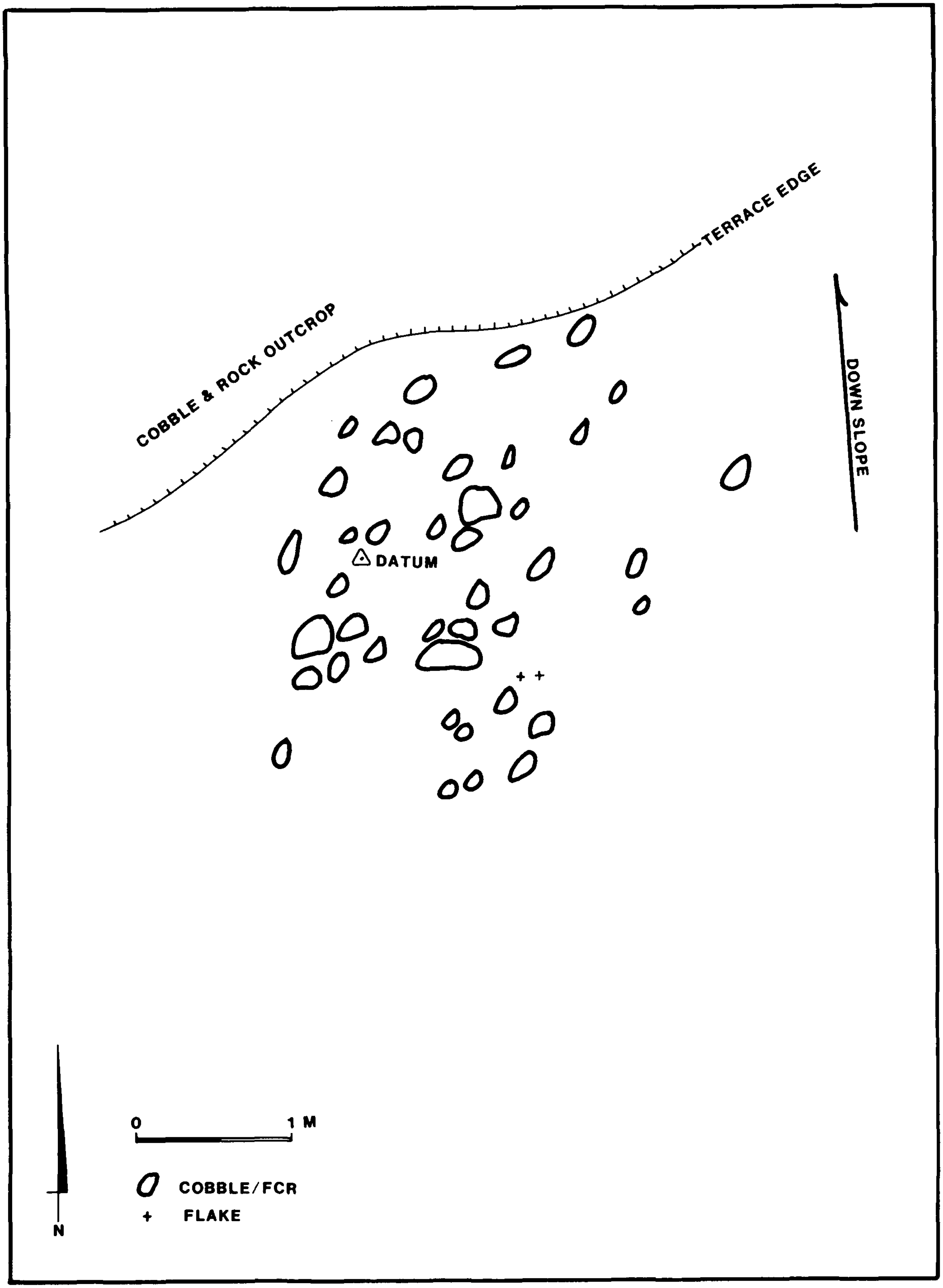
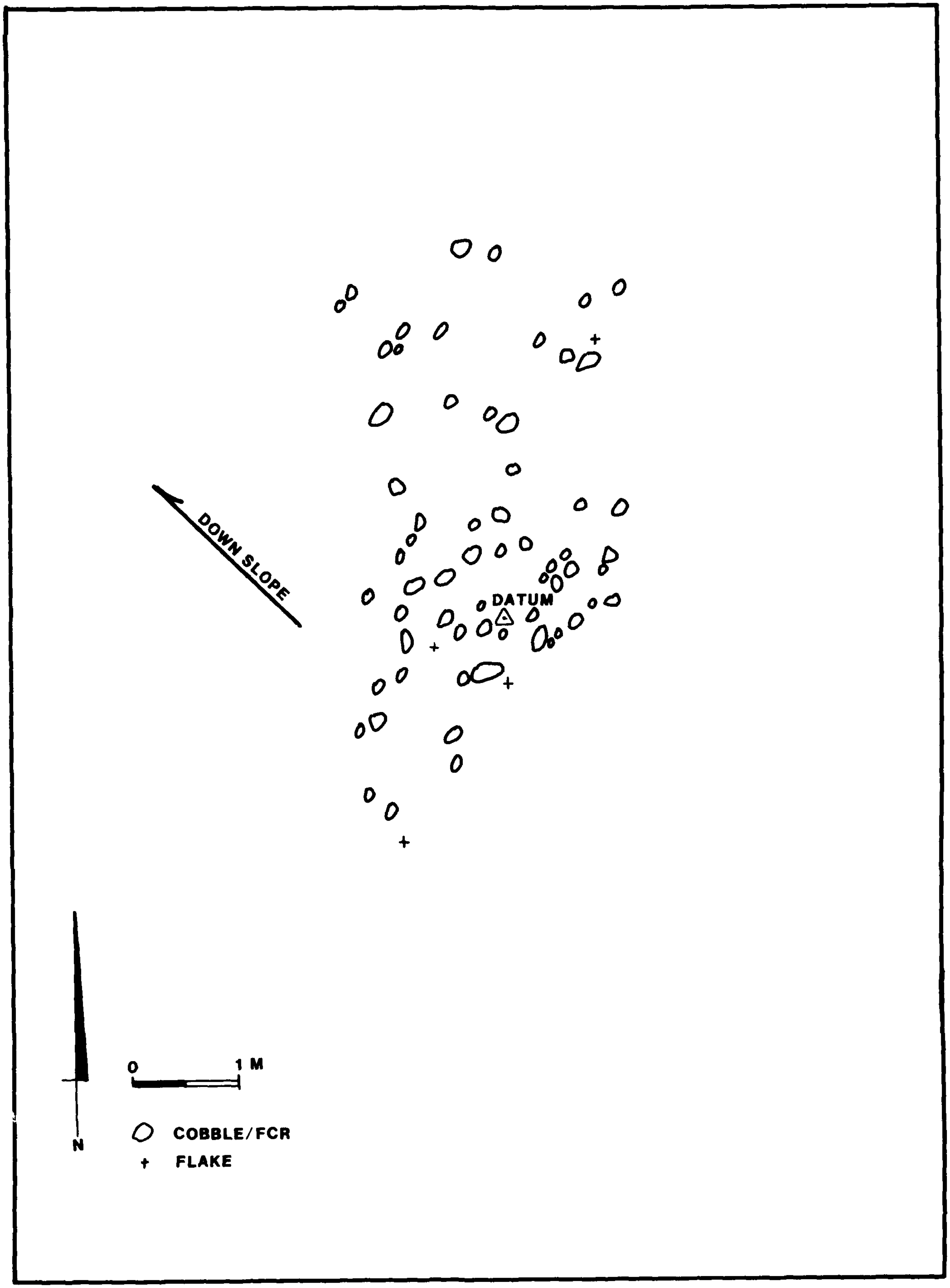


Figure 5.70 Plan of Hearth Feature 39, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



(east-west) area for a dispersion index of 8.0 rocks/m^2 (Figure 5.71). The rocks measure up to 50 cm in diameter. No artifacts are associated with the burnt rock scatter. No testing was conducted at the feature.

Feature 42 is a scattered fire-cracked rock hearth located along the mid-ridge line of the north terrace away from any of the terrace edges. It is the northeasternmost of 10 hearth features located in close proximity on this ridge. This part of the site has experienced minimal erosion. The feature is defined by 19 large cobbles widely scattered within a 2.4-m (north-south) by 2.8-m (east-west) area for a dispersion index of 2.83 rocks/m^2 (Figure 5.72). Only one flake is associated. No testing was conducted on this feature.

Feature 43 is a cluster of fire-cracked rock from a hearth located north of the mid-ridge line in the middle of the north terrace area. Hearth Features 26 and 27 are nearby, and ring Features 28 and 44 are within 40 m to the north and south, respectively. This area has experienced slight erosion. The feature is defined by about 12 large cobbles clustered within a 0.65-m (north-south) by 0.8-m (east-west) area for a dispersion index of 23.08 rocks/m^2 (Figure 5.73). The dense concentration suggests that the feature is mostly intact. No artifacts were observed near the feature, and no subsurface testing was conducted here.

Lithic Reduction Areas

Feature 10 is near the crest of a high hillock on the southern edge of the south terrace area. This part of the site is outside the areas designated by SAR. The high site setting provides a commanding overview of the south site boundary drainage. Other nearby features include hearths 12 and 13 and lithic reduction Feature 11. This part of the site has experienced severe erosion. The feature is a high concentration of lithic debitage and tool fragments mostly of tan quartzite which are dispersed over a steep (24°), south trending slope. A total of 128 artifacts was collected from an area oriented N 19° E which measured 13 m (north-south), parallel to the slope axis) by approximately 11.9 m (east-west, perpendicular to slope axis). Horizontal control was maintained by 13 one-meter wide transects oriented perpendicular to the slope. These transects provide information on the amount of downslope artifact movement but are not well suited for obtaining small-scale artifact density information.

Feature 11 is near the crest of a high hillock on the southern edge of the south terrace area. This part of the site is outside the areas designated by SAR. The lithic scatter locus provides a commanding overview of the south site boundary drainage. Other nearby features include hearths 12 and 13 and lithic reduction Feature 10. This latter lithic scatter is 21.45 m to the southwest. This part of the site has experienced severe erosion. The feature is a high concentration of black quartzite lithic debitage and tool fragments occurring along a steep (16°) southeastern slope of the high terrace. Two cores and 63 flakes, all made of black quartzite, were inventoried but not collected from a 4.5-m (northwest-southeast) by 6.0-m (northeast-southwest) area.

Figure 5.71 Plan of Hearth Feature 40, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

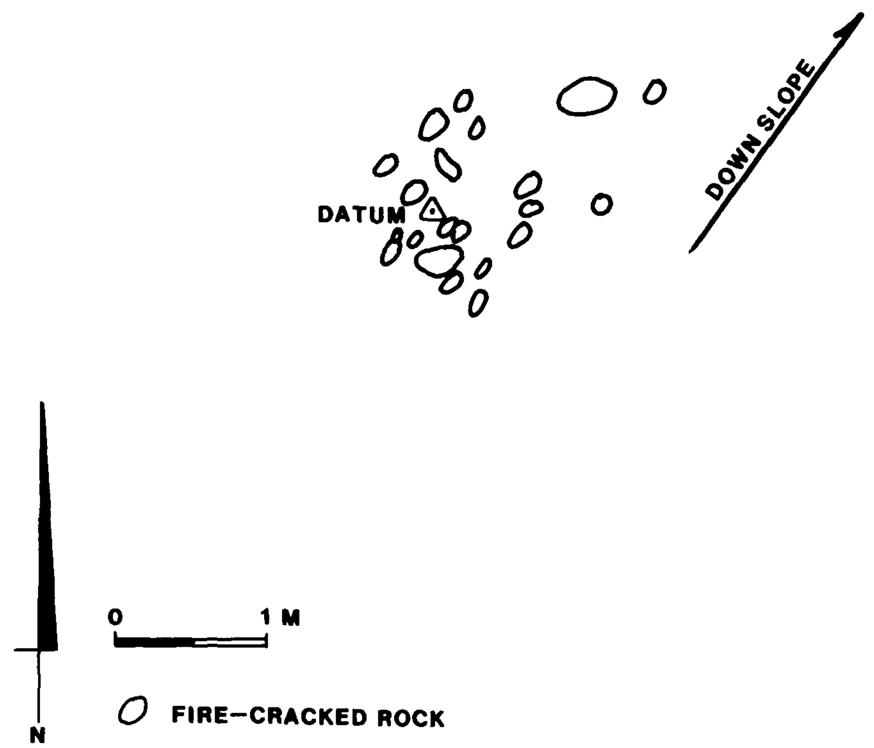


Figure 5.72 Plan of Hearth Feature 42, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

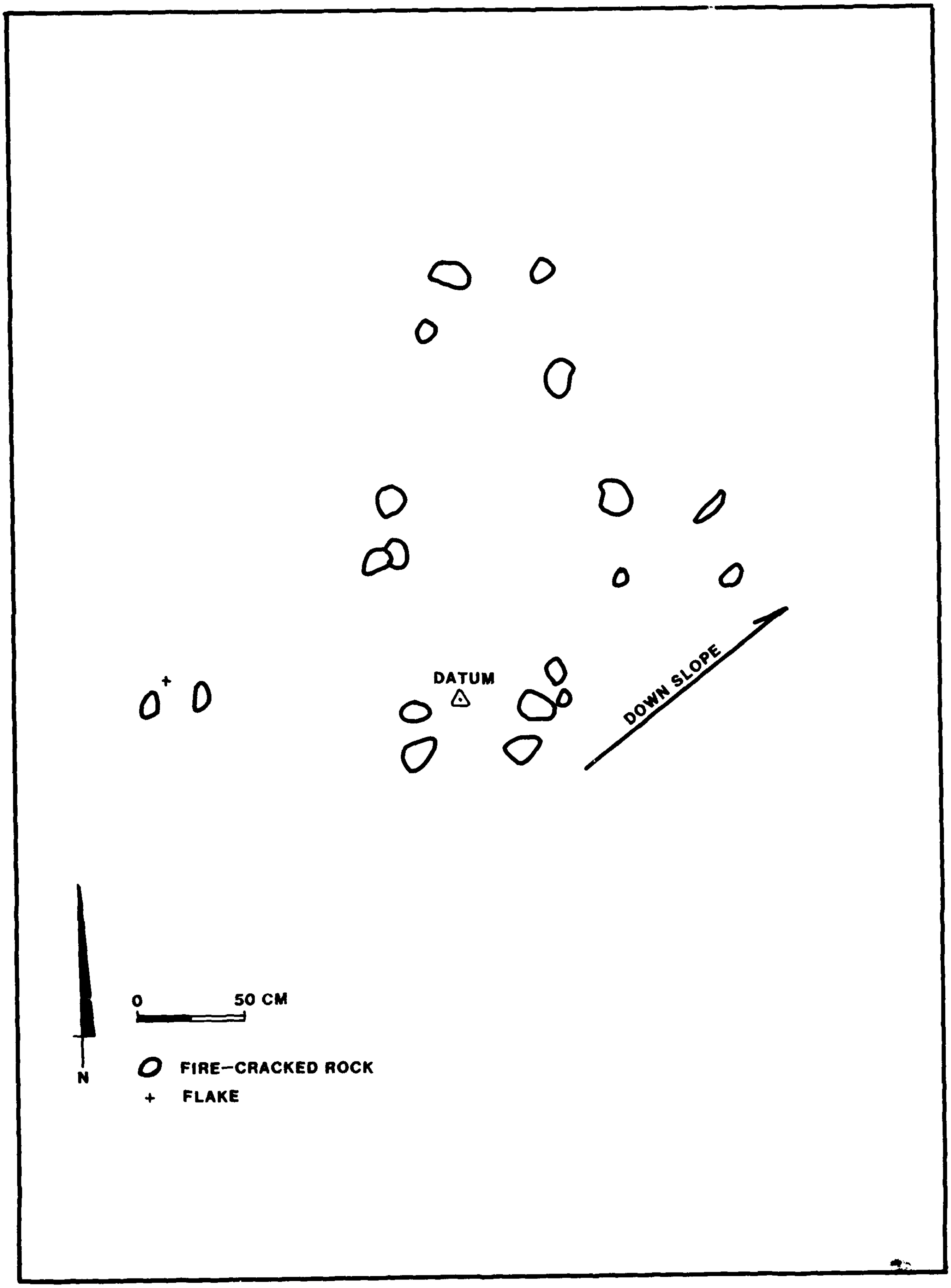
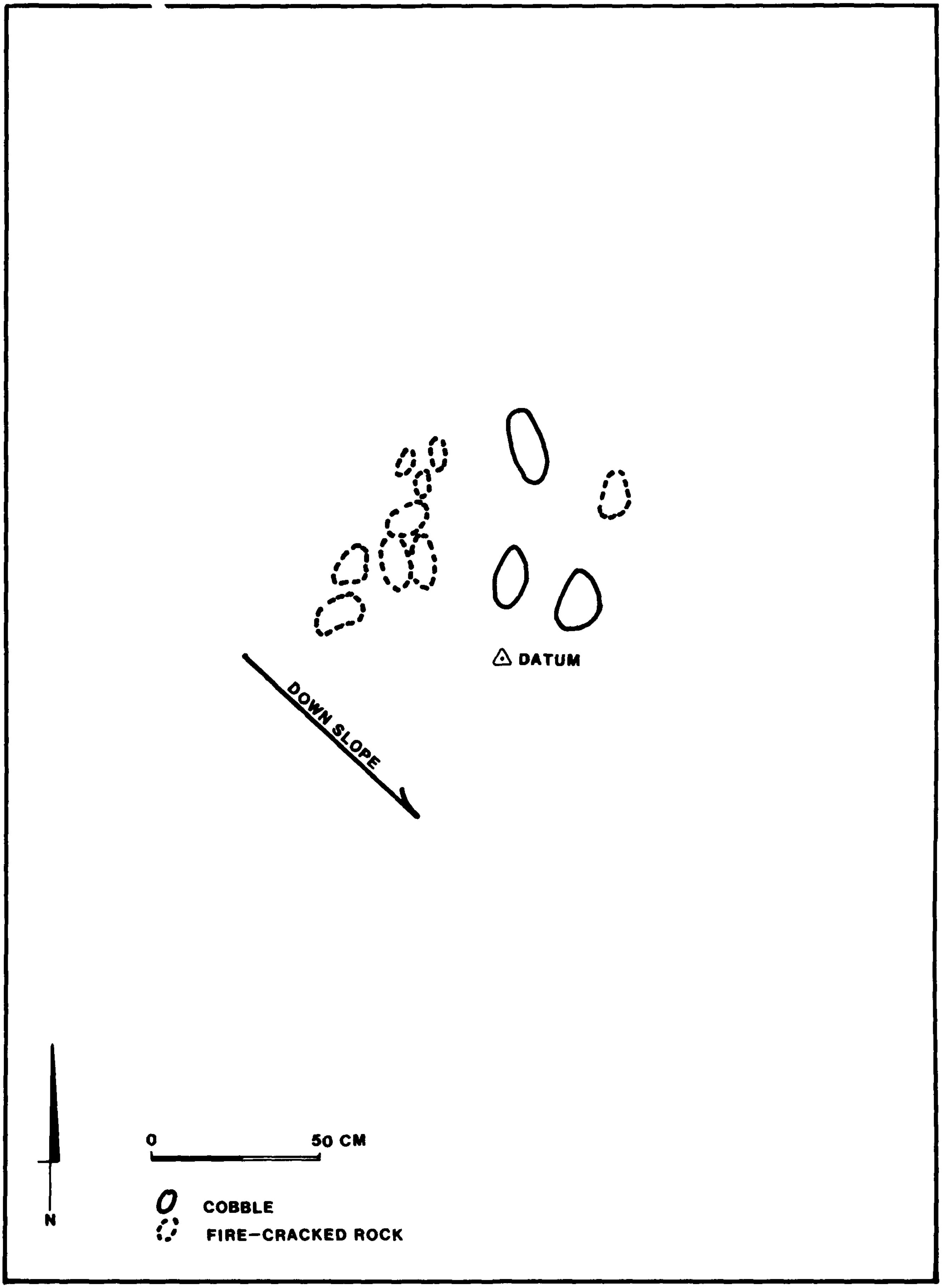


Figure 5.73 Plan of Hearth Feature 43, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



<u>Feature 14</u> is along a high ridge overlooking the south site boundary tributary above the south terrace. Another lithic reduction area occurs 50 m to the west. The Feature 14 area approximately corresponds to SAR feature area D, although the cobble ring reportedly in this area was not found. This part of the site has experienced moderate erosion. One large core and 18 flakes, all made of tan quartzite, were noted in a 2.0-m (east-west) by 2.0-m (north-south) area (Figure 5.74). All materials are believed to be from a single nodule. The observed artifacts were point plotted and collected for technological studies. Material densities ranged from zero to 9 items per m^2.

<u>Lithic Concentration 1</u> was not assigned a feature number. It is in the northeast point of the south terrace area overlooking the confluence of the intrasite tributary and the Chama River. Cobble ring Feature 1 is about 7 m to the west. This part of the site has experienced moderate erosion. A high concentration of lithic debitage and tool fragments from many different material types and the rusty blade to a case knife were noted in an 11.0-m (east-west) by 7.5-m (north-south) area (Figure 5.70). Surface monitoring was conducted within a 4 x 4 m area. A total of 47 artifacts was collected, but material densities ranged from zero to seven items per m^2. The entire collection area was covered with surface cracks around soil peds that were at least 4 cm deep.

Test Unit 4 is a 1-m^2 pit placed adjacent to the southeast corner of Lithic Concentration 1 and excavated to a depth of 20 cm. A stratigraphic profile of the north wall revealed two strata (Figure 5.75). Stratum I is a 6-cm thick, moderately compact, reddish brown (5YR 5/4) fine silty loam with gravel inclusions and some cultural materials. The lower boundary is smooth and abrupt.

Stratum II is at least 14 cm thick and is a compact, reddish brown (7.5YR 5/4) medium coarse silty loam with gravel inclusions. Cultural materials occurred only in the upper portions of the level. The lower boundary is smooth and abrupt. Quite likely, the artifacts represent intrusive materials that fell into cracks.

Another lithic concentration area is present on the northeast point of the north terrace. This locus corresponds to SAR feature area A and consists of a concentration of primarily basalt lithic debitage. Insufficient time was available to document the size, collect a smaple of artifacts, or characterize the technology in this part of the site.

5.3.5 Chronological Sample Proveniences

A total of 14 samples was submitted for special analysis. Two bags of soil from excavated features, and corn cobs from surface contexts were submitted for macrobotanical analysis; in addition, two pollen samples (ancient and modern) were sent for microbotanical analysis to obtain subsistence information. Seven obsidian and two charcoal samples and the corn cobs were submitted to obtain information about the age of samples. The proveniences of these various samples are indicated in Table 5.3. The macrobotanical discussions have been presented in conjunction with the

Figure 5.74 Plan of Lithic Reduction Feature 14, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

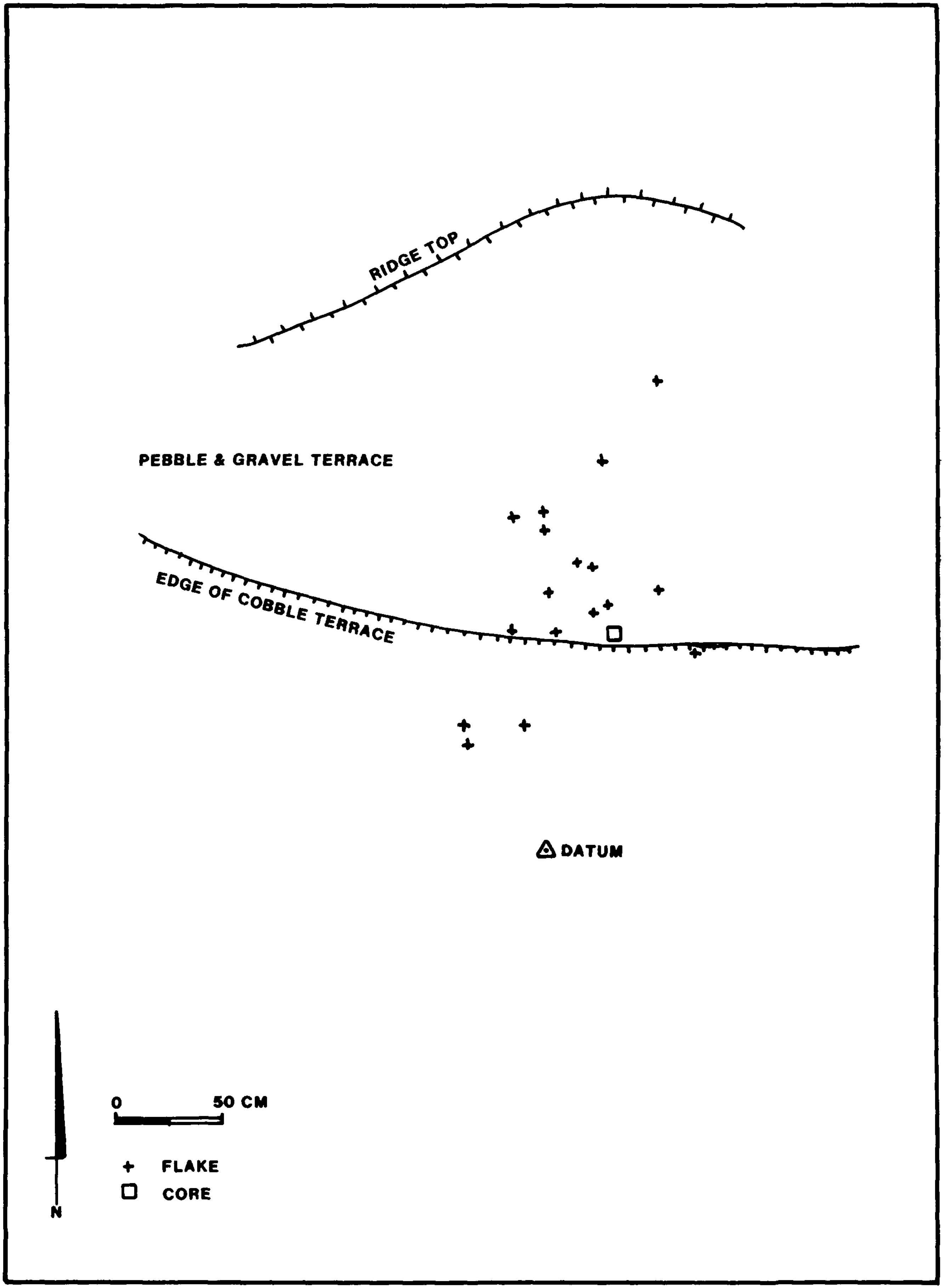
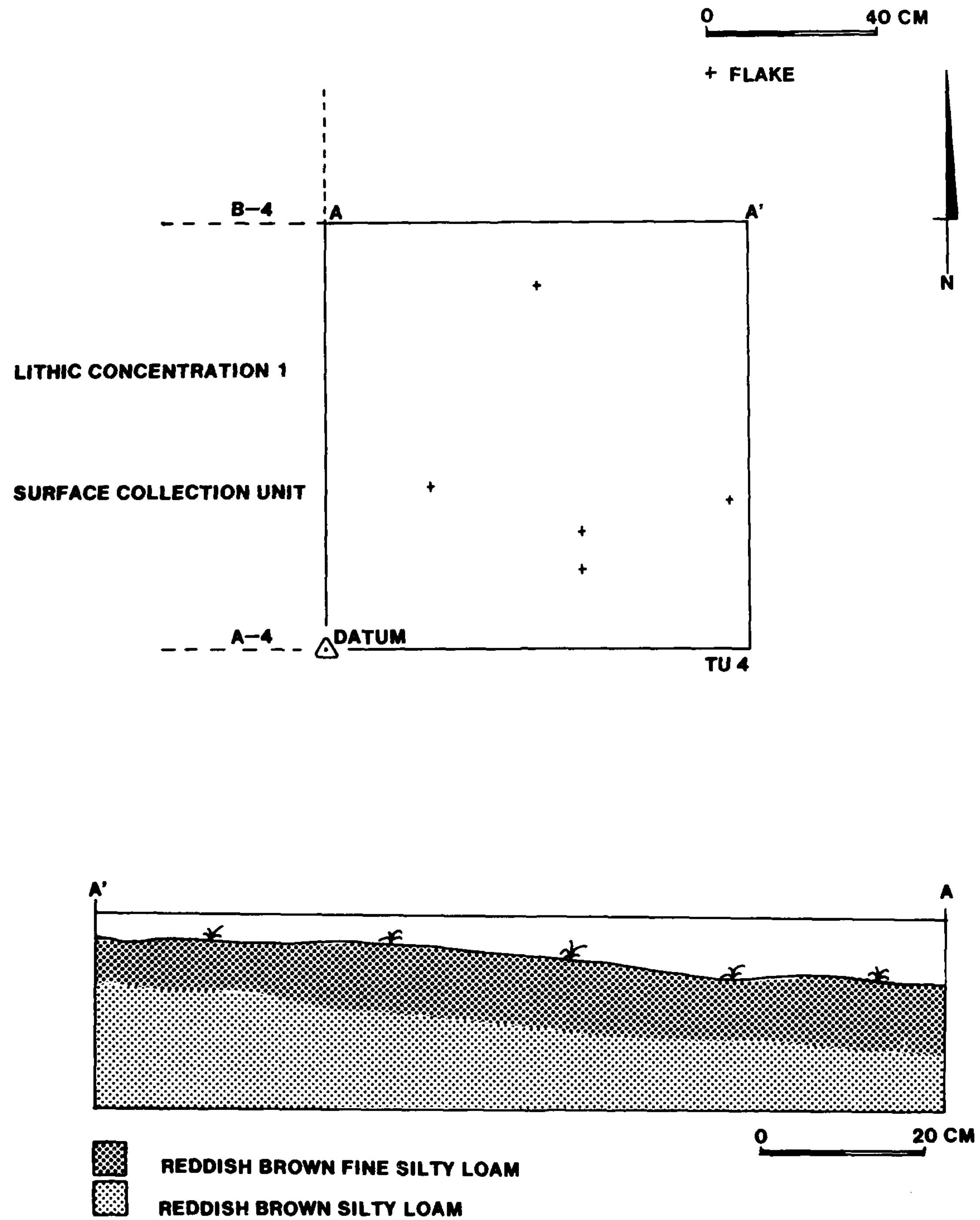


Figure 5.75 Plan and Profile of Test Unit 4 in 4 x 4 m Collection Unit on Tip of South Terrace, LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



previous feature descriptions and are summaried in Appendix E. The chronometric results are discussed in Section 6.2.

Table 5.3 Macrobotanical and Chronometric Sample Proveniences from LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Sample Provenience	Depth	Feature Number	Field Specimen	Sample Type
Macrobotanical Flotation				
Test Unit 2, Level 2	10-15 cm	3	--	Hearth Matrix
Test Unit 5, NW Quad	18-23 cm	9	--	Hearth Matrix
Map Sta. C, 225°, 8.27 m	Surface	--	187	Corn cobs
Microbotanical Pollen				
Test Unit 5, Beneath Metate	ca 15 cm	9	--	Soil with Pollen
Gen. Surface (Pinch Method)	Surface	--	--	Soil with Modern Pollen
Obsidian Hydration Dating Samples				
F-25 Datum, 55°, 34.12 m	Surface	--	175	Point Base
Test Unit 1, Level 1	0-10 cm	2	1	Point Base
F- 5 Datum, 222°, 9.65 m	Surface	--	35	Point
Map Sta. C, 170°, 22.30 m	Surface	--	186	Point Base
F-30 Datum, 165°, 3.55 m	Surface	--	191	Point Base
Test Unit 5, Level 1	0-10 cm	9	1	Flake
Test Unit 4, Level 2	10-20 cm	1 [1]	7	Flake
Radiocarbon Dating Samples				
Test Unit 3, Level 1	0- 6 cm	6	--	Stained Soil
Test Unit 5, Level 2	10-20 cm	9	--	Stained Soil
Map Sta. C, 225°, 8.27 m	Surface	--	187	Corn cobs

1 Lithic Concentration 1.

6.0 ARTIFACT AND CHRONOLOGICAL ANALYSIS

Amy C. Earls, W. Nicholas Trierweiler, and Christopher R. Lintz

This chapter presents the results of the lithic analysis and chronological studies. The lithic analysis consists of descriptive statistics for lithic assemblages from the three sites and for subareas within the sites. The section on chronology includes dates of chronometric samples sent to specialized laboratories and a classification of point types and other atifacts (beads, metal) from the three stone circle sites. Multivariate and detailed spatial analyses are presented in Chapter 7.0. The spatial analyses incorporate data from the chronology section and the feature analysis in Chapter 7.0.

6.1 ARTIFACT ANALYSIS RESULTS

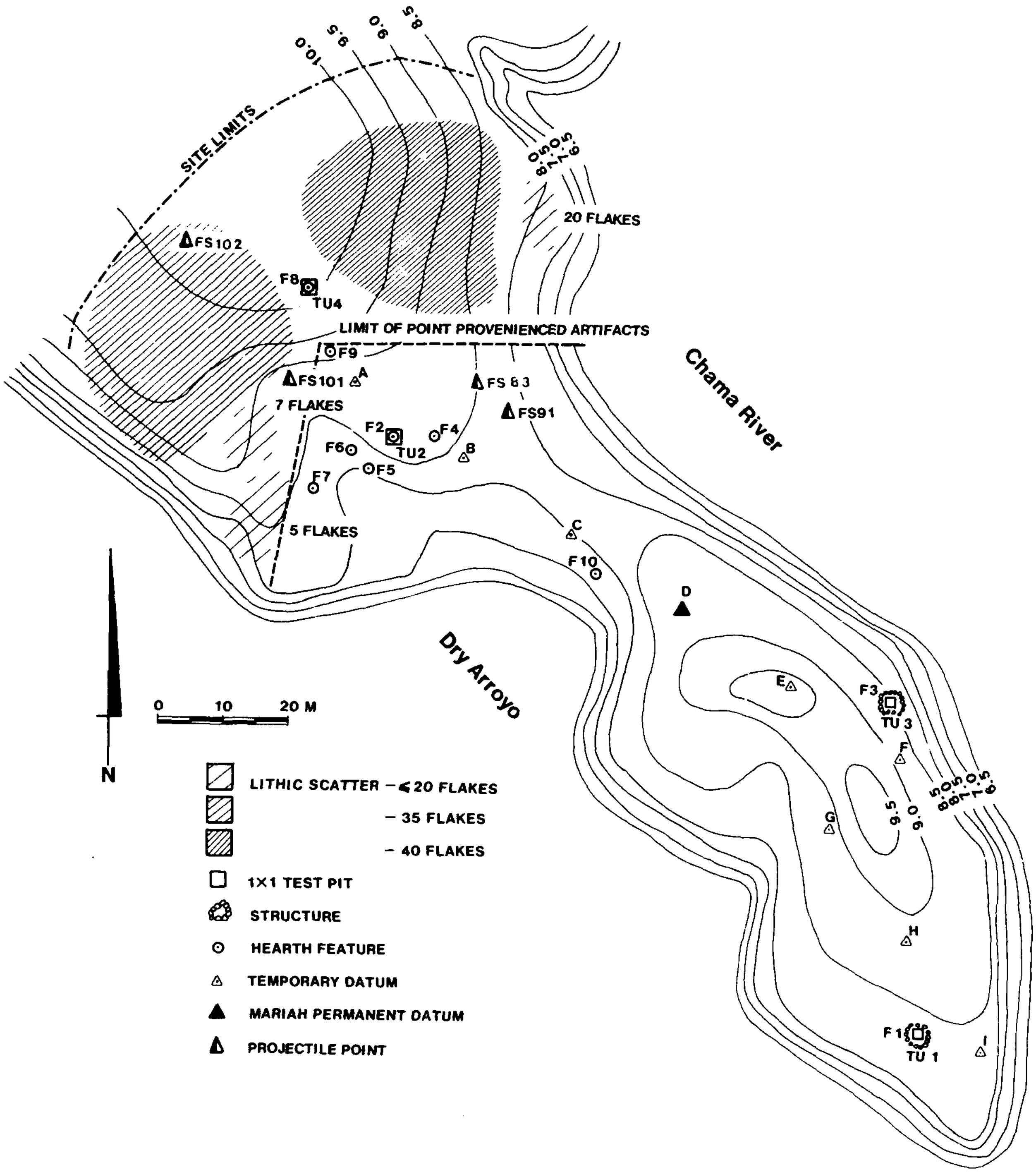
This section presents some results of analysis of the artifact assemblage of each site. For analytical purposes, each site was not only treated as a complete unit, but was also stratified topographically by the major drainages present. Site LA 24517 was stratified into three portions, identified as north, central, and south, while sites LA 24519 and LA 24521 were stratified into two portions each, identified as north and south. It is important to realize that these topographic strata are not based on any cultural attributes of the sites, such as presence of features or artifact types, but are arbitrary distinctions based solely on site physical topography. The sites are discussed in order from north to south.

6.1.1 Site LA 25421

This site occurred on a single ridge and was not subdivided by drainages, as were LA 25417 and LA 25419. Two collection subareas were defined on LA 25421. All artifacts east and south of Feature 9 were point-provenienced. Five acres of differing artifact density were defined in the western portion (see Figure 6.1). Only temporally diagnostic artifacts north and west of Feature 9 were collected. Sampling intensity was greater in the point-provenienced area than in the area north and west of Feature 9, which contained 61% of the site area, 90% of the features, and an estimated 50% of the artifacts. Four of the 10 features (two rings and two hearths) were tested by 1-m^2 units, and six were augered. A total of 34 auger holes was placed in six hearth features in the point-provenienced area of the site. Four test units were excavated, three in the point-provenienced area and one approximately 10 m northwest of the point-provenienclng boundary.

For analytical purposes, the site was arbitrarily divided into two portions at temporary datum D (see Figure 6.1). This division allows differentiation of the cobble ring area, near the terrace point, and the hearth clusters upslope. One of the cobble rings was obsidian dated to the Developmental and Classic Periods, while dates from the hearth area ranged from San Jose Phase (Late Archaic) to Developmental; most dates in the latter area were San Jose and Armijo Phases.

Figure 6.1 LA 25421 Site Map, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



A total of 110 artifacts was collected from both portions of the site; 81 specimens were from the northern half of the site, and the remaining 29 artifacts were from the southern half. Section 6.1.1.1 discusses the complete site assemblage, while sections 6.1.1.2 and 6.1.1.3 examine the assemblages from each half of the site.

6.1.1.1 Entire Assemblage

A total of 110 artifacts was collected, including 106 specimens from the surface and four excavated specimens. Of the 109 lithic artifacts (one was bone), 95% (104) were debitage, and 5% (5) were tools. No cores and no ground stone was present, and all of the tools were projectile points. Of the debitage, 11% (11) was angular debris, 43% (45) was core flakes, 19% (20) was biface flakes, 25% (26) was indeterminate flakes, and 2% (2) was biface preforms (Table 6.1). Tnere were 2.3 core flakes for each biface flake present.

Table 6.1 LA 25421 Frequencies of Lithic Artifact Type, by Material Type, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

	ARTIFACT TYPE							
Material Type	Thin Bif.1	Thin Bif.1	Ang. Deb.	Core Flk.	Bifc. Flk.	Unkn. Flk.	Proj. Pnt.	Total
Black Obsidian	0	0	0	2	0	1	1	4
Grey Obsidian	0	0	0	5	0	6	3	14
Trans. Wht. Chal.	0	1	7	25	17	15	1	66
Opaque Wht. Chal.	0	0	3	2	2	2	0	9
Trans. Brwn. Chal.	0	0	0	1	0	1	0	2
Trans. Blk. Chal.	0	0	0	3	0	0	0	3
Yellow/Tan Chert	0	0	0	1	0	0	0	1
Grn/Wht. Chert	0	0	0	1	0	0	0	1
Conglomerate	0	0	0	1	0	0	0	1
Ortho. Tan Qrtzt.	1	0	0	1	1	0	0	3
Ortho. Orng. Qrtzt.	0	0	0	0	0	1	0	1
Meta. Orng. Qrtzt.	0	0	0	2	0	0	0	2
Meta. Wht. Qrtzt.	0	0	1	1	0	0	0	2
Total	1	1	11	45	20	26	5	109

[1] See Appendix G for distinction between the two biface types.

Lithic material was overwhelmingly chert and chalcedony, distantly followed by obsidian and quartzite. Of all artifacts, 75% (82) were crypto crystalline, 17% (18) were obsidian, 7% (8) were quartzites, and 1% (1) were sedimentary. Since over 95% of the assemblage was debitage, debitage material type proportions are very similar to the site totals given above. Four of the projectile points were obsidian, and one was chalcedony. Of the total sample of obsidian (n=18), 22% (4) was visually classified as Jemez, while 78% (14) was classified as Polvadera.

The proportion of retouched flakes was fairly high, with an overall site value of 12% (13 flakes), and no significant difference existed between the northern and southern portions of the site. Use wear was recorded for 6% (6) of the artifacts on the entire site, although a slightly higher proportion was present in the southern portion of the site than in the northern portion. Of the 82 pieces of cherts and chalcedonies, 44% (36) were heat treated; no difference existed for this value between the two site portions.

Debitage had an average of 10% cortex, while tools had an average of 3% cortex. The assemblage contained no cores.

6.1.1.2 Northern Half

A total of 81 lithics was collected north of site datum D, including 79 specimens from the surface and two excavated specimens. Of this total, 94% (76) was debitage, and 6% (the five projectile points) was tools. Of the debitage, 15% (10) was angular debris, 41% (32) was core flakes, 21% (15) was biface flakes, 21% (17) was indeterminate flakes, and 2% (2) was biface preforms. One of the biface preforms is illustrated in Figure 6.2(A). There were 1.9 core flakes for each biface flake present. Debitage had an average of 16% cortex, while tools had an average of 3% cortex.

Most of the lithic material was chert and chalcedony, distantly followed by obsidian and quartzite. Of all artifacts, 74% (60) were crypto crystalline, 17% (14) were obsidian, 7% (6) were quartzites, and 1% (1) were sedimentary. This distribution was very highly correlated with that for debitage material because of the high proportion of debitage. Four of the projectile points were obsidian, and one was chalcedony. Of the total sample of obsidian (n=14), only one specimen (7%) was visually classified as Jemez, while the other 13 (93%) were classified as Polvadera.

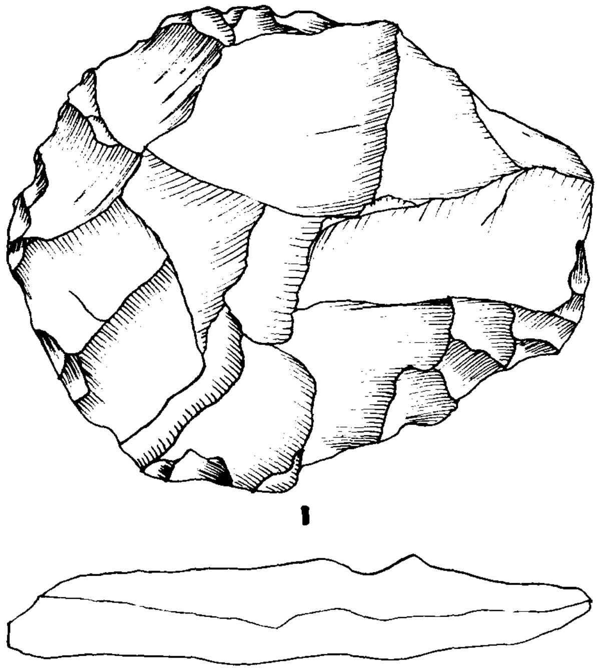
Use wear was present on only 4% (3) of the artifacts, and retouch was present on 12% (10) of the artifacts. Of the 60 pieces of cherts and chalcedonies, 43% (26) were heat treated.

6.1.1.3 Southern Half

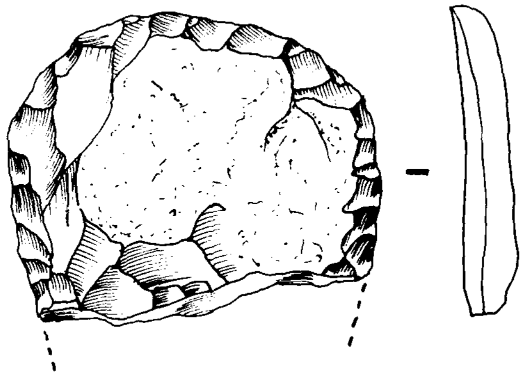
A total of 29 lithics was collected from the southern half of the site. This sample is the smallest of any of the seven site subareas and may be inadequate for reliable statistical analysis.

The sample included 27 specimens from the surface, and two excavated specimens. All of the lithics were debitage; there were no tools, cores, or ground stone. Only 3% (1) of the debitage was angular debris, while 47% (13) was core flakes, 17% (5) was biface flakes, 32% (9) was indeterminate flakes, and 3% (1) was biface preforms. These values were not significantly different from those occurring on the northern half of the site considering the small sample size from the southern portion. There were 3.0 core flakes for each biface flake present. The debitage had an average of 5% cortex.

Figure 6.2 Formal Tools and Debitage from LA 25421, LA 25417 and LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



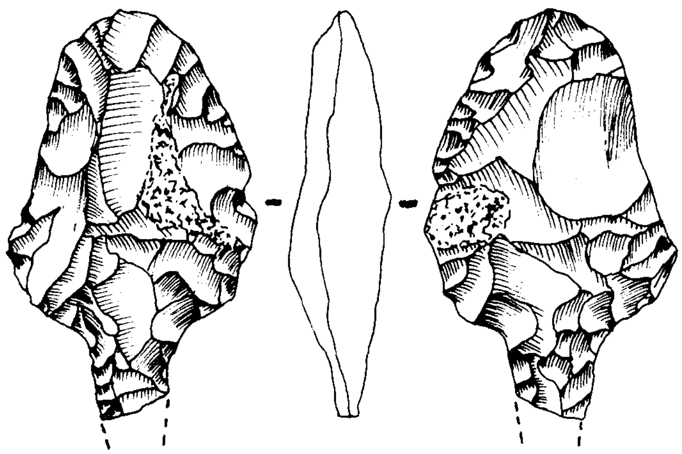
A



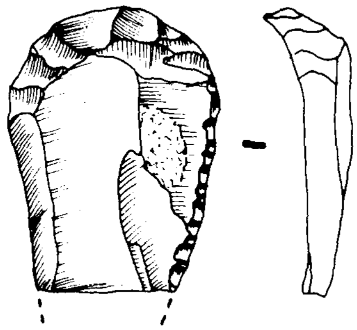
B

LA 25417 FS 237 Scraper
Datum A, 53°, 21.80 m

LA 25421 FS 61 Biface Preform
Datum B, 151°, 15.70 m



C



D

FS 67 Drill
F8, 137°, 12.45 m

LA 25419

FS 181 Scraper
F16, 205°, 18.70 m

Distribution of lithic materials closely mirrored that for the northern half of the site. Over 79% (22) were chert or chalcedony, 14% (4) were obsidian, and 7% (2) were quartzites. Of the small sample of obsidian (n=4), three (75%) were visually classified as Jemez, while only one (25%) was classified as Polvadera.

Use wear and retouch were both present on 11% (3) of the artifacts. Of the 22 pieces of cherts and chalcedonies, 10 (45%) were heat treated.

6.1.1.4 Summary

There were no significant differences between the northern and southern halves of the site for any of the monitored lithic attributes. No formal statistical tests of difference were performed because of the small sample size from the southern portion, but the two portions appear similar in relative proportions of lithic materials, of artifact modifications. Major differences are that all of the tools occurred in the northern half of the site, and that very few artifacts were associated with the two cobble rings. Intensity of occupation was apparently greater on the northern, upslope, portion of the site; most activity here appears to have occurred during the San Jose and Armijo Phases of the Late Archaic (3,000-800 B.C.), although later activity is indicated by one Developmental Period obsidian date. The only dates on the southern portion of the site indicate Developmental and Classic period use of cobble ring Feature 3.

6.1.2 Site LA 25417

For purposes of artifact analysis, LA 25417 was divided arbitrarily into northern and southern portions (Figures 6.3 and 6.4). Three subareas for sampling purposes, however, were defined during field work on LA 25417. The north terrace point measured 10,403 m^2 or 32% of the site area and contained one cobble ring, two hearths, and one lithic concentration. An approximately 30-m radius circular surface collection unit was placed in the lithic concentration. Surface artifacts from the north point terrace tip, in the vicinity of Features 3 and 4, were point-provenienced in a circular surface collection unit with a radius of approximately 13.5 m centered on Test Unit 4 datum. Approximately 3,401 m^2 or 33% of the northern subarea was collected. Three (100%) of the two hearth and one ring features and none of the lithic concentration were tested with 1-m^2 units. No features were augered.

To the south across an arroyo, the central point measured 8,536 m^2 or 36% of the site area and contained three cobble rings, a hearth, and two lithic concentrations. Surface artifacts in and around two of the cobble rings were point-provenienced. Adjacent Features 6 and 7 were collected with one 10 m radius unit. A 4 x 4 m surface collection unit was placed in each of the lithic concentrations. Eleven percent (959 m^2) of the surface area of this subarea was collected. Auger holes were placed in two cobble rings. Three 1-m^2 test units were situated in one of the rings with good potential for chronometric samples, and one 50-cm^2 test unit was situated in one of the lithic concentrations. One of the features and 50% (one) of the lithic concentrations in this subarea were tested with excavation squares.

Figure 6.3 LA 25417 Site Map, North Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

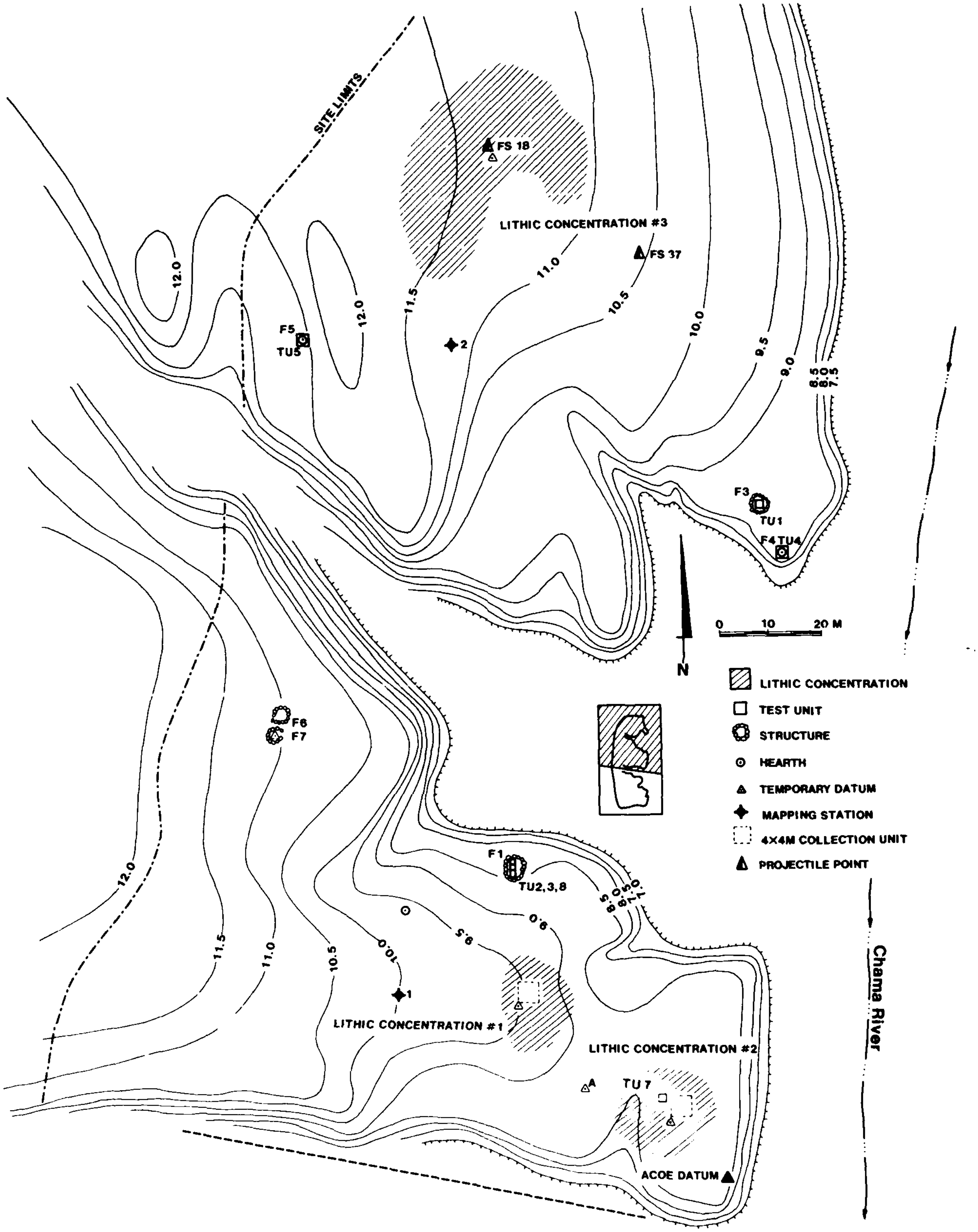
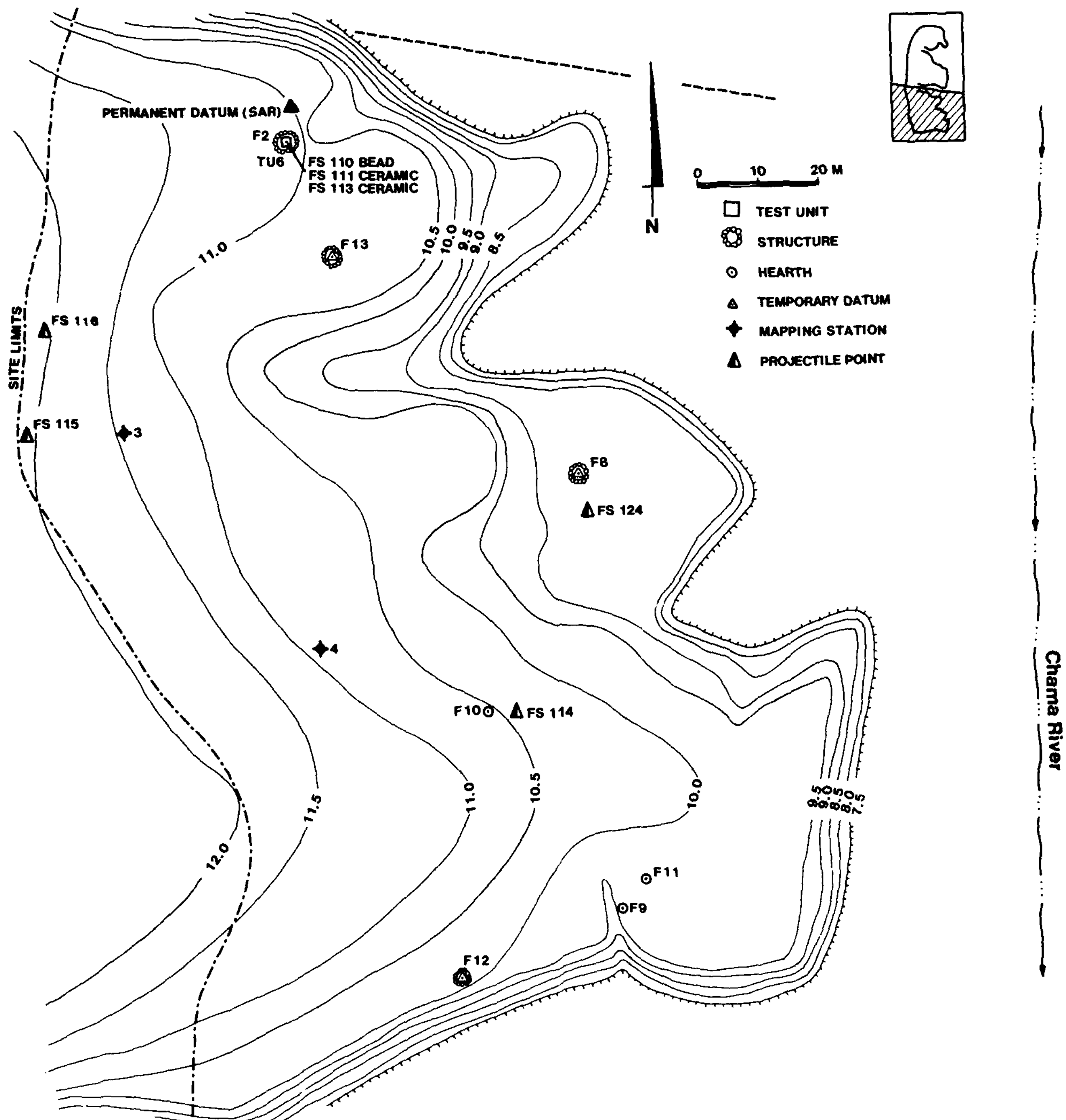


Figure 6.4 LA 25417 Site Map, South Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Farther south, across another arroyo, the south point of the site measured 13,583 m^2 or 42% of the total site area and contained four cobble rings and three hearths on the surface. Artifacts from the surface of two cobble rings were point-provenienced in two circular collection units with radii of approximately 10 m. Approximately 628 m^2 (5%) of the subarea surface was collected. Seventy-one percent (five) of the seven features were tested. Four features (two hearths and two cobble rings) were augered. One test unit was placed in a cobble ring.

Surface collection and testing intensity varied over LA 25417. Both surface collection and testing sample intensity were greatest in the northern subarea. Fifteen percent of the site surface was collected. Overall, 88% of the eight cobble ring features, 67% of the six hearth features, and 33% of the three lithic concentrations were tested.

A total of 440 artifacts was collected from all portions of the site; 99 specimens (22%) were from the northern lobe of the site, 258 specimens (59%) were from the center portion, and 83 artifacts (19%) were from the southern lobe. Section 6.1.2.1 discusses the complete site assemblage, while sections 6.1.2.2 through 6.1.2.4 examine the assemblages from each of the three ridge areas.

6.1.2.1 Total Assemblage

The total of 440 artifacts included 411 specimens from the surface and 29 excavated specimens (Table 6.2). Of the total lithic sample, 96% (414) of the artifacts were debitage 3% (12) were tools, and 1% (4) were cores. The sample of flaked tools included six projectile points, two end scrapers, one chopper, one graver, and a maul. There was also a single two-hand mano present. Ten nonlithic artifacts were collected, including six ceramic sherds, three beads, and an unidentified metal strip (these are described in Sections 6.2.5 and 6.2.6). Of the lithic debitage, 11% (47) was angular debris, 29% (118) was core flakes, 23% (93) was biface flakes, 35% (146) was indeterminate flakes, and 2% (10) was biface preforms. There were 1.3 core flakes for each biface flake present.

Lithic material was predominantly cryptocrystalline chalcedony and chert, followed by approximately equal fractions manufactured from obsidian and quartzite. However, proportions varied significantly among the three portions of the site (see Sections 6.1.2.2-6.1.2.4). For the 430 lithics, 50% (213) were cherts and chalcedonies, 28% (118) were obsidian, 22% (95) were quartzites, and 1% (4) were sedimentary. Since the lithic artifacts were over 96% (414) debitage, the distribution of material for debitage closely mirrored that for the entire assemblage. However, tools were preferentially manufactured from obsidian, with 55% (6); 36% (4) of the tools were chert/chalcedony, 9% were rhyolite (1), and no tools were made of quartzite. Of the total sample of obsidian (n=118), only eight specimens (7%) were visually classified as Jemez, while the remaining 110 specimens (93%) were classified as Polvadera.

Of the 213 pieces of cherts and chalcedonies, 39% (83) were heat treated. This proportion is lower than that occurring on the other two sites and is due primarily to the low proportion of heat treatment on the central portion of the site. Use wear was noted on 7% (32) of the lithics, although this also varied significantly among site subareas (see below). Retouch was present on 7% (30) of the artifacts.

Table 6.2 LA 25417 Frequencies of Artifact Type, by Material Type, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

	ARTIFACT TYPE																	
Material Type	Sing. Core	Mult. Core	Thin Bif.1	Thin Bif.2	Ang. Deb.	Core Flk.	Bif. Flk.	Unkn. Flk.	Chppr.	Proj. Pnt.	End Scrpr.	Grvr.	Maul	2-Hnd. Mano	Sherd	Bead	Unkn. Metal	Total
Black Obsidian	0	0	0	0	2	1	2	2	0	1	0	0	0	0	0	0	0	8
Grey Obsidian	0	1	3	0	8	21	27	44	0	5	0	0	0	0	0	0	0	110
Rhyolite	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Transluc. Wht. Chal.	0	2	1	1	16	40	25	44	0	0	1	1	0	0	0	0	0	131
Opaque Wht. Chal.	0	0	1	0	4	7	5	3	0	0	0	0	0	0	0	0	0	20
Transluc. Brn. Chal.	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	4
Opaque Red Chert	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	4
Yellow/Red Chert	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
Yellow/Tan Chert	1	0	1	0	5	7	5	6	0	0	0	0	0	0	0	0	0	25
Silicified Wood	0	0	1	0	2	3	1	2	0	0	0	0	0	0	0	0	0	9
Grn./Wht. Chert	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Jasper	0	0	0	0	0	2	6	7	0	0	1	0	0	0	0	0	0	16
Welded Chert	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Siltstone	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Limestone	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Conglomerate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ortho. Tan Qrtzt.	0	0	0	1	5	27	18	35	0	0	0	0	0	0	0	0	0	86
Ortho. Orange Qrtzt.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Meta. Orange Qrtzt.	0	0	0	0	1	2	0	2	0	0	0	0	0	0	0	0	0	5
Meta. Fn. Wht. Qrtzt.	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3
Ceramic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Metal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	1	3	8	2	47	118	93	146	1	6	2	1	1	1	6	3	1	440

Cores had an average of 25% cortex, and debitage had an average of 6% cortex. However, flaked tools had a surprisingly high average of 17% cortex. This was due to a few tools (including the maul and the chopper) having a very high amount of cortex, and thereby weighting the small total sample of tools.

6.1.2.2 Northern Portion

A total of 99 lithics was collected from the northern portion of the site, including 86 from the surface and 13 excavated artifacts. Of the total sample, 96% (95) were debitage, and 4% (4) were tools. The tools were two projectile points, an end scraper, and a graver. No ground stone was present. Of the debitage, 10% (9) was angular debris, 35% (33) was core flakes, 19% (18) was biface flakes, 33% (31) was indeterminate flakes, and 4% (4) was biface preforms. There were 1.8 core flakes for each biface flake present.

Lithic material was predominantly cryptocrystalline chalcedony and chert, followed distantly by obsidian, with a very low proportion of quartzite. Of the 99 artifacts, 76% (75) were cryptocrystalline, 20% (20) were obsidian, and 4% (4) were quartzites. Of the total sample of obsidian (n=20), only one (5%) was visually classified as Jemez, while the remaining 19 pieces (95%) were classified as Polvadera.

Use wear was present on 20% (20) of the artifacts, significantly more than on the other portions of the site. Retouch was present on 11% (11) of the artifacts, again more than on the other portions of the site. Of the 75 pieces of cherts and chalcedonies, 56% (42) were heat treated.

Debitage had an average of 8% cortex, while tools had an average of 3% cortex. There were no cores.

6.1.2.3 Central Portion

A total of 258 lithic artifacts was collected from the central portion of the site, including 247 from the surface and 11 excavated. Of the total sample, 98% (252) was debitage, and 1% (3) each was tools and cores. The two tools included an end scraper (Figure 6.2B) and the maul. A single piece of unidentified tabular metal was collected, and no ground stone was present. Of the debitage, 13% (32) was angular debris, 24% (61) was core flakes, 24% (59) was biface flakes, 37% (94) was indeterminate flakes, and 2% (6) was biface preforms.

There were equal amounts of core flakes and biface flakes. By contrast, on the other two portions of the site, this ratio was approximately 1.9 core flakes for each biface flake. This pattern suggests that while core reduction and biface reduction both occurred on all portions of the site, relatively more biface reduction occurred on the central portion of the site.

The distribution of lithic material was also significantly different from the other two portions of the site. Instead of cherts and chalcedony being dominant, lithic material was fairly equally distributed among chalcedony/chert, obsidian, and quartzite. Of the total lithics, 34% (87) were cryptocrystalline, 30% (77) were obsidian, 35% (90) were quartzites, and 1% (2) were sedimentary (one item was rhyolite). The relatively high proportions of both quartzite and obsidian are distinct from the northern and southern portions of the site. These reflect the fairly homogeneous quartzite scatter in Lithic Concentration 1 and the obsidian scatter in Lithic Concentration 2 (see Figure 6.3). Of the total sample of obsidian (n=77), only three specimens (4%) were visually classified as Jemez, while the remaining 74 specimens (96%) were classified as Polvadera.

Retouch was present on 6% (15) of the artifacts. Use wear was present on only 4% (10) of the artifacts. This proportion is significantly lower than on the other portions of this site and reinforces the conclusion that relatively more lithic reduction as opposed to lithic use occurred on the central portion of the site. Of the 87 pieces of cherts and chalcedonies, only 18 were heat treated (21%), the lowest proportion on any of the three sites or seven site portions.

Cores had an average of 33% cortex, and debitage had an average of 5% cortex. The end scraper had 0-33% remaining cortex, while the maul had 67-99% cortex.

6.1.2.4 Southern Portion

A total of 83 artifacts was collected from the southern portion of the site, including 78 from the surface and five from test pits. Of the total sample, 80% (66) was debitage, 6% (5) was tools, 1% (1) was cores, 1% (1) was ground stone, and 12% (10) was nonlithic. The five lithic tools included a chopper and four projectile points (one with two burin spalls removed; see Section 6.2.1), and the ground stone was a two-hand mano. The nonlithic artifacts included six ceramic sherds and three glass beads (described in Sections 6.2.5 and 6.2.6). Of the lithic debitage, 9% (6) was angular debris, 36% (24) was core flakes, 24% (16) was biface flakes, and 31% (21) was indeterminate flakes. This portion of the site had no biface preforms. There were 1.9 core flakes for each biface flake present.

Proportions of lithic material were very similar to those found on the northern portion of the site but were distinct from the central lobe. Lithics were mostly chalcedony and chert, followed distantly by obsidian, with a very low proportion of quartzite. Of the total sample of lithics, 62% (51) were cryptocrystalline, 24% (20) were obsidian, 1% (1) were quartzites, and 1% (1) were sedimentary.

While overall proportions of lithic material were similar to the northern lobe of the site, the proportion of Jemez-appearing obsidian occurred in a higher proportion than on the other parts of the site. Of the total sample of obsidian (n=20), 20% was visually classified as Jemez, while 80% was classified as Polvadera.

Use wear was recorded for 10% (8) of the artifacts, and retouch was present on 7% (6). Of the 51 pieces of cherts and chalcedonies, 44% (22) were heat treated.

Debitage had an average of 7% cortex. Of the five flaked tools, the four projectile points had no cortex, while the single chopper had 67-99% cortex, for an average of 17% cortex. The single core had no remaining cortex.

6.1.2.5 Summary

In general, the lithic assemblages of the northern and southern lobes of the site appear more similar to each other than either does to that of the central lobe. This pattern is noticeable in both the artifact reduction trajectories and in the distributions of lithic materials.

On both the northern and southern portions, there were nearly twice as many core flakes as biface flakes, while in the central portion the ratio of core flakes to biface flakes was nearly equal. Perhaps as a consequence of this reduction activity, the central portion had an extremely low percentage of lithics with evidence of use wear. However, for the site as a whole, this was counterbalanced by the unusually high proportion of use wear occurring on the northern lobe.

Similarly, in the central portion, quartzite is the dominant lithic material, whereas it occurs in very minor proportions on both the northern and southern portions. Further, the proportion of heat treated chalcedony was significantly lower in the central portion of the site than in the northern or southern portion.

The preponderance of the lithic assemblage from the northern portion of the site is from Lithic Concentration 3 and its vicinity, which produced San Jose and Armijo Phase obsidian and point cross dates (discussed in Section 6.2). The other collection unit from this lobe included the Feature 3 cobble ring and the Feature 4 hearth on the terrace tip; a flake excavated from Feature 3 dated to the Developmental Period. Similar lithic assemblages from the southern lobe also included materials from areas back from the terrace edge dating to the San Jose and Armijo Phases. The other major collection unit on the southern portion was from Feature 8, a cobble ring nearer the terrace edge, which contained a point and sherd cross-dated to the San Jose/Armijo/En Medio Phases and the Coalition Period, respectively. A small amount of surface and subsurface lithics was also collected from the Feature 2 cobble ring, which produced a Developmental Period obsidian item and beads and sherds dating to the 1800s.

On the central lobe, which had a lithic assemblage characterized by a nearly equal proportion of core and biface flakes, collections were from Lithic Concentrations 1 and 2 and cobble ring Features 6 and 7, all four removed from cobble ring Feature 1, which produced the San Jose Phase and Classic and Historic Period dates.

The central portion of the site had a high proportion of biface flakes indicating tool manufacture and a consequently low proportion of use wear. Most of these materials are from the probable knapping stations, Lithic Concentrations 1 and 2. The former was predominantly quartzite which may have lowered the proportion of heat treatment by reducing the proportion of cryptocrystalline material. Unfortunately, neither of these concentrations produced dates, making it uncertain if they relate to the San Jose Phase, or Classic and Historic Period dates from the Feature 1 cobble ring. The high proportion of use wear occurs on the northern terrace and is probably associated with San Jose and Armijo Phase occupation.

The evidence supports the multicomponency of site occupation and the difficulty of associating artifacts with cobble rings. As with LA 25421, there is a tendency for San Jose and Armijo Phase occupations to be located away from the terrace edge, while Developmental and Classic (and Coalition and Historic) Period occupations are nearer the terrace edge, which is where the cobble rings are also located.

6.1.3 SITE LA 25419

For analytic purposes, LA 25419 was divided into two subareas, north and south of a central arroyo (Figures 6.5 and 6.6). The southern half of the site measured 21,131 m^2 (or 33% of the site area) and contained a cluster of seven cobble rings near the terrace edge overlooking the Rio Chama and along the central arroyo, as well as an additional historic feature and disturbed cobble ring, three hearths, and three lithic reduction areas along the southern ridge. A 4 x 4 m surface collection unit was placed in a lithic concentration at the edge of the point. Additional feature-based surface collection units were placed around three cobble rings (two collected in a single unit) and on two lithic reduction areas. The cobble ring collection units had 10 m radii. The lithic reduction areas were 12 x 13 m and 7 x 5 m. Four percent (835 m^2) of the south half of the site was collected. Two hearths were augered. Test units were placed on five features, consisting of three rings, one hearth, and one lithic reduction area.

The northern half of the site measured 43,774 m^2 (or 67% of the total site area) and contained 14 cobble rings and 16 hearths. Two 4 x 4 m surface collection units were placed near cobble rings. Only 0.1% (32 m^2) of the northern half was collected. Auger holes were placed in three hearths. Thirteen percent of the northern half features were tested. Three hearths were augered. Two 1-m^2 test units were placed, one in a cobble ring and one in a hearth.

Both surface collection and testing intensity were greater on the southern half of the site. Surface collection intensity was relatively low, from 0.1-4%. Testing intensity varied considerably from 13% to 50%. The southern half warranted more intense work because it contained a cluster of seven cobble rings or remnants. The largest cobble ring cluster of similar spacing on the northern half of the site had only four rings.

A total of 459 artifacts was collected from the site: 167 specimens (36%) from the northern lobe of the site and 292 artifacts (64%) from the southern lobe. Section 6.1.3.1 discusses the complete site assemblage, while sections 6.1.3.2 and 6.1.3.3 examine the assemblages from each of the two ridge areas.

6.1.3.1 Entire Assemblage

The total of 459 artifacts included 431 specimens from the surface and 28 excavated specimens. Of the total, 90% (414) were lithic debitage, 6% (25) were

Figure 6.5 LA 25419 Site Map, North Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

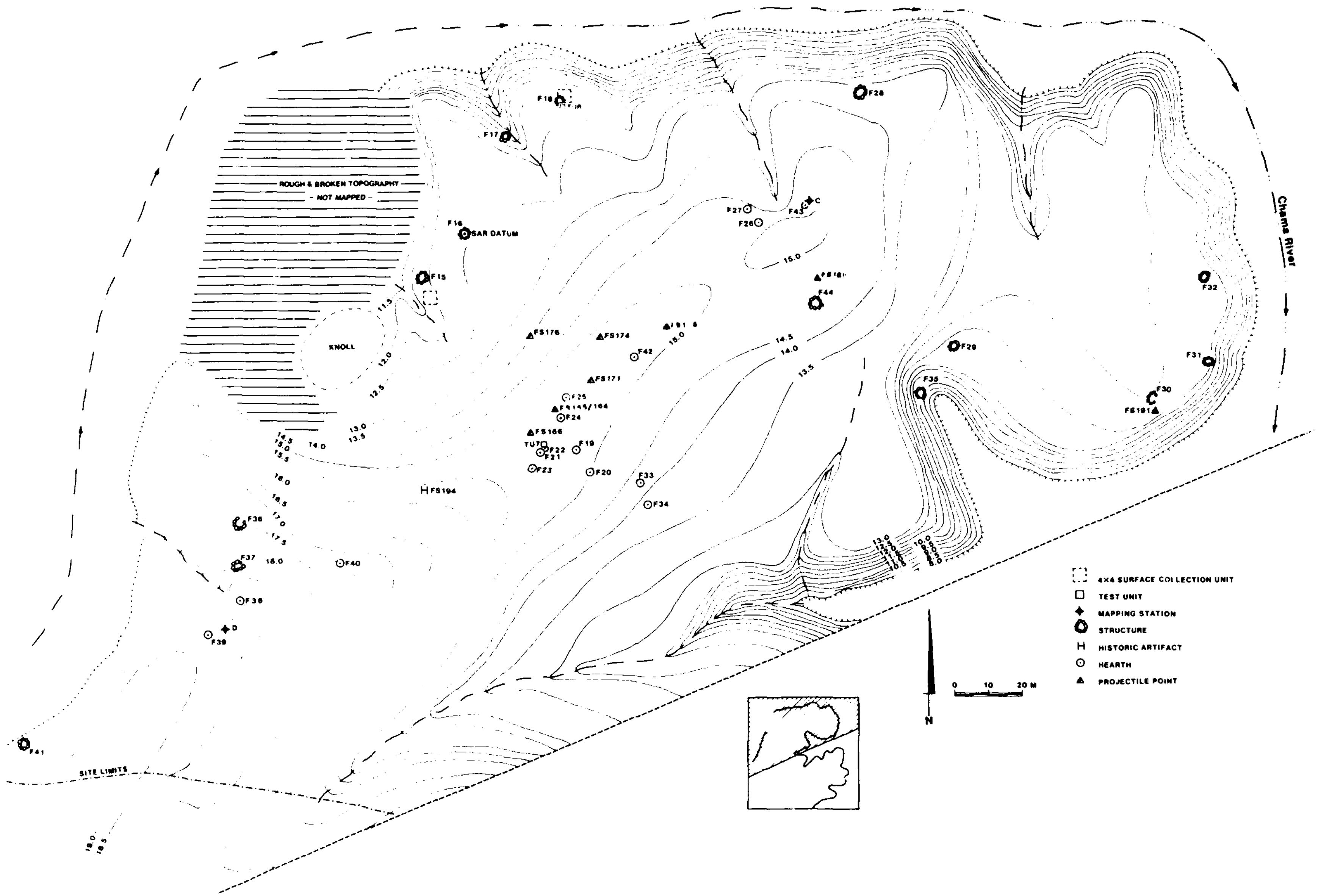
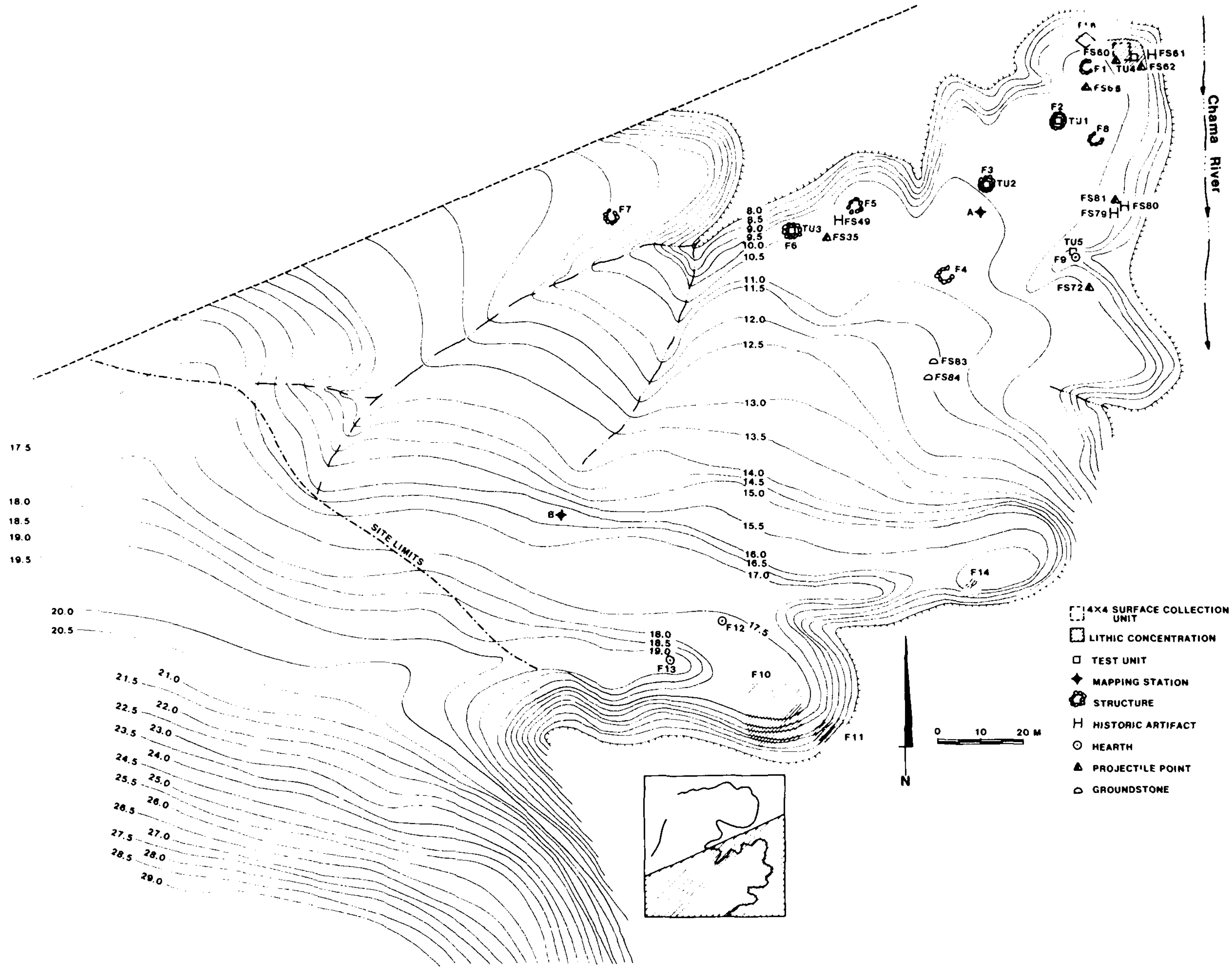


Figure 6.6 LA 25419 Site Map, South Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



tools, 2% (10) were cores, 1% (5) were ground stone, and 1% (5) were metal (Table 6.3). The tools included 17 projectile points, three end scrapers (one illustrated in Figure 6.2D), two notched scrapers, a gunflint, a chopper, and a drill (Figure 6.2C). The ground stone included three metates, a two-hand mano, and a one-hand mano. The metal artifacts included four tin cans or can lids and one knife blade. Of the debitage, 26% (108) was angular debris, 30% (125) was core flakes, 20% (82) was biface flakes, 21% (87) was indeterminate flakes, and 3% (12) was biface preforms (one illustrated in Figure 6.7C). There were 1.5 core flakes for each biface flake present.

Lithic material was predominantly chert and chalcedony, followed closely by quartzite, with obsidian ranking a distant third. Of the total 454 lithics, 49% (223) were cryptocrystalline cherts and chalcedonies, 37% (167) were quartzites, 13% (58) were obsidian, and 1% (5) were sedimentary (one item was basalt). This distribution was highly correlated with the material types of debitage. However, material of flaked tools was disproportionately obsidian (42% or 10 items), with quartzite tools being relatively rare (8% or 2 items). The fraction of tools made of chert and chalcedony (50%) was similar to that for debitage. Of the total sample of obsidian (n=58), 24% (14) was visually classified as Jemez, while 76% (44) was classified as Polvadera.

Use wear was present on 8% (36) of the artifacts, and retouch was present on 7% (32 items). Both these values are similar to those for each portion of the site separately. Of the 340 pieces of cherts and chalcedonies, 62% (211) were heat treated, but this proportion varied considerably between the northern and southern lobes of the site.

For the site as a whole, cores had an average of 18% cortex, debitage had an average of 8% cortex, and tools had an average of 2% cortex. There was no difference in this pattern between the two portions of the site.

6.1.3.2 Northern Portion

A total of 167 lithic artifacts was collected, including 158 from the surface and nine from excavated test pits. One tin can lid was also collected. The distribution of lithic artifact types showed little variation from the overall assemblage. On the northern portion, 1% (2) were cores, 90% (150) were debitage, and 9% (15) (one with two burin spalls-- see Figure 6.8C, and one with three burin spalls-- see Figure 6.8D) were tools. The tools were eleven projectile points, three end scrapers, and a chopper. No ground stone was present; one tin can was collected.

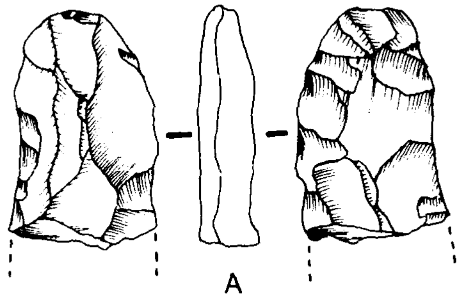
Of the lithic debitage categories, 20% (30) were angular debris, 17% (25) were core flakes, 27% (41) were biface flakes, 32% (47) were indeterminate flakes, and 5% (7) were biface preforms (one of these is illustrated in Figure 6.7A). The ratio of core flakes to biface flakes was 0.6:1, suggesting that more biface reduction occurred in this portion of the site than in the southern portion.

Lithic material was overwhelmingly chert and chalcedony, followed distantly by obsidian, with a very low proportion of quartzite. Of the total of 167 lithics, 84% (140) were chert or chalcedony, 11% (18) were obsidian, 4% (6) were

Table 6.3 LA 25419 Frequencies of Artifact Type, by Material Type, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

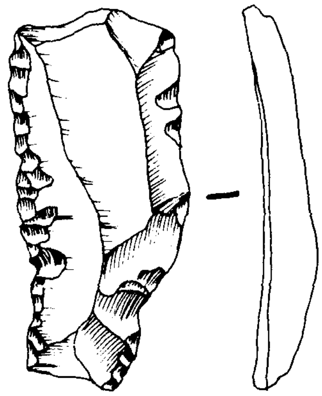
	ARTIFACT TYPE																					
	Test Cob.	Sngl. Core	Mult. Core	Thck. Bif.1	Thin Bif.1	Thin Bif.2	Ang. Deb.	Core Flk.	Bifc. Flk.	Unkn. Flk.	Chppr.	Proj. Pnt.	Drill	End Scrpr.	Notch. Scrpr.	Gun Flint	Metate	1-Hand Mano	2-Hand Mano	Mtl. Knif.	Can	Total
Black Obsidian	1	0	0	0	0	0	2	1	6	1	0	2	0	0	1	0	0	0	0	0	0	14
Grey Obsidian	0	0	0	2	3	0	2	6	9	15	0	6	0	0	1	0	0	0	0	0	0	44
Black Basalt	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Transluc. Wht. Chal.	0	0	4	0	4	3	39	29	40	50	0	6	1	1	0	1	0	0	0	0	0	178
Opaque Wht. Chal.	0	0	0	0	0	0	4	7	4	0	0	0	0	1	0	0	0	0	0	0	0	16
Transluc. Brn. Chal.	0	0	0	0	0	0	2	1	1	4	0	0	0	0	0	0	0	0	0	0	0	8
Transluc. Blk. Chal.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Opaque Red Chert	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Yellow/Tan Chert	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3
Grn./Wht. Chert	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Jasper	0	0	0	0	0	0	2	3	2	0	0	0	0	0	0	0	0	0	0	0	0	7
Welded Chert	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	4
Other Chert	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Siltstone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Fine Sandstone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	4
Ortho. Tan Qrtzt.	1	1	2	0	0	0	41	65	18	12	0	1	0	0	0	0	0	0	0	0	0	141
Ortho. Orange Qrtzt.	0	0	1	0	0	0	6	8	1	4	0	0	0	0	0	0	0	0	0	0	0	20
Meta. Fin. Wht. Qrtzt.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Meta. Crs. Blk. Qrtzt.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Meta. Fin. Blk. Qrtzt.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Meta. Crs. Wht. Qrtzt.	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Metal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	5
Total	2	1	7	2	7	3	108	125	82	87	1	17	1	3	2	1	3	1	1	1	4	459

Figure 6.7 Formal Tools and Debitage from LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



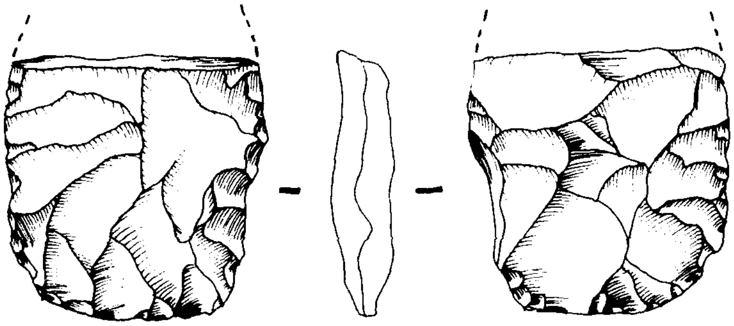
A

FS 190 Biface Preform
Mapping Station C



B

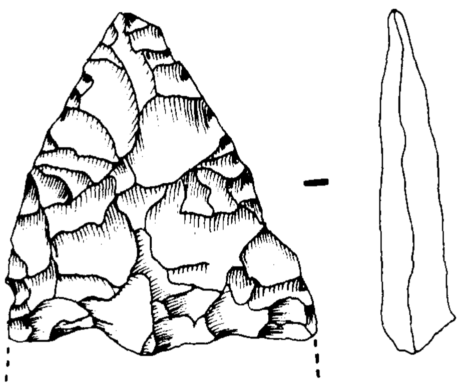
FS 66, Side Scraper
F8, 78°, 11.55 m



C

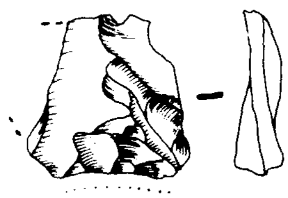
FS 100 Biface Preform

F18, Collection Unit A-4



D

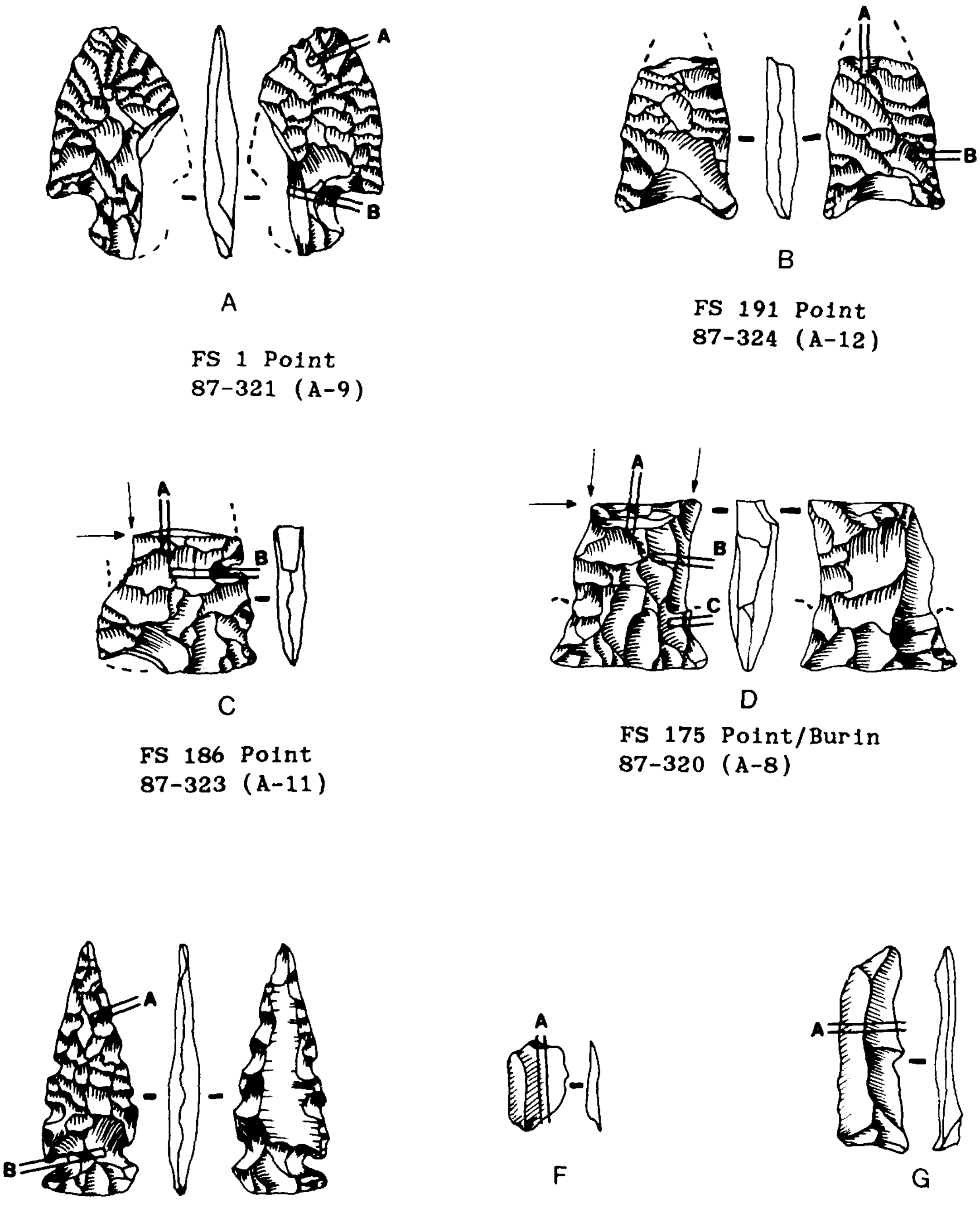
FS 70 Biface Preform
F8, 173°, 22.85 m



E

FS 50 Notched Scraper
Lithic Conc., Collection Unit D-1

Figure 6.8 Obsidian Projectile Points and Artifacts Submitted for Hydration Dates from Site LA 25419, Abiquiu Reservoir Cobble



A

FS 1 Point
87-321 (A-9)

B

FS 191 Point
87-324 (A-12)

C

FS 186 Point
87-323 (A-11)

D

FS 175 Point/Burin
87-320 (A-8)

E

FS 35 Point
87-322 (A-10)

F

FS 7 Flake
87-326 (A-14)

G

FS 1 Flake
87-325 (A-13)

quartzites, 1% (1) were basalt, and 1% (1) were sedimentary. Of the total sample of obsidian (n=19), 28% (5) was visually classified as Jemez, while 72% (14) was classified as Polvadera.

Use wear was present on 6% (10) of the artifacts, and retouch was present on 8% (13). Of the 141 pieces of cherts and chalcedonies, 78% (110) were heat treated. This proportion of heat treated chalcedony/chert is the highest of the three sites and all seven site subareas.

Cores had an average of 17% cortex, debitage had an average of 3% cortex, and tools had an average of 3% cortex.

6.1.3.3 Southern Portion

A total of 292 artifacts was collected from the southern portion of the site, including 273 from the surface and 19 from excavated test pits. Of these 3% (9) were cores, 91% (264) were debitage, 3% (10) were tools, 2% (5) were ground stone, and 1% (4) were nonlithic. The tools were six projectile points, a side scraper (Figure 6.7B), a notched scraper (Figure 6.7E; dots show retouched notch), a drill, and a gunflint. The ground stone included three metates, a one-hand mano, and a two-hand mano. Also present were three tin cans/can lids and the metal knife.

Of the debitage, 29% (78) was angular debris, 38% (100) was core flakes, 16% (41) was biface flakes, 15% (40) was indeterminate flakes, and 2% (5) was biface preforms (one illustrated in Figure 6.7D). There were 2.4 core flakes for each biface flake present.

Lithic material was characterized by an unusually high proportion of quartzite, followed distantly by chert and chalcedony, with obsidian ranking a distant third. Of the total lithic artifacts, 56% (161) were quartzite, 29% (83) were chert or chalcedony, 14% (40) were obsidian, and 1% (4) were sedimentary. This distribution is in distinct contrast to that found on the northern portion of the site and is in fact more similar to the distribution observed on the middle portion of site LA 25417.

Of the total sample of obsidian (n=40), 24% (10) was visually classified as Jemez, while 76% (30) was classified as Polvadera. Both portions of the site have relatively high proportions of Jemez obsidian.

Use wear was present on 9% (26) of the artifacts, and retouch was present on 7% (20). Of the 84 pieces of cherts and chalcedonies, only 34% (29) were heat treated. This proportion is significantly lower that the proportion found on the northern lobe of the site.

Cores had an average of 18% cortex, debitage had an average of 9% cortex, and tools had an average of 1% cortex.

6.1.3.4 Summary

The northern lobe of the site contained a multitude of dates and a relatively high proportion of tools; many of these were point-provenienced on the stable ridge down the center of the north terrace. Most of the artifacts not collected from the ridge were from 4 x 4 m collection units near Feature 15 and 18 cobble rings.

The lithic assemblage from the northern portion of the site was characterized by a high proportion of biface flakes and chert or chalcedony material. The percentage of heat treatment was very high. Proportions of Polvadera to Jemez obsidian and of retouch and use wear were very similar.

Only three points are believed to be associated with cobble ring occupation on the northern portion of the site. These are a point cross-dated to the very broad Bajada through En Medio Phases near Feature 18 and an obsidian point dated to the En Medio Phase and cross-dated to the Bajada through San Jose Phases near the Feature 30 cobble ring. A point near the Feature 44 cobble ring south of the central ridge produced En Medio Phase obsidian dates and San Jose Phase through Developmental Period cross dates that may relate to use of this cobble ring. The more precise obsidian dates suggest use of two of the three dated cobble rings during the En Medio Phase. All but one of the dated points from the central ridge are too broadly cross-dated to be useful. The exception is a point indicating an En Medio Phase obsidian date. The only other chronometric date is a Classic Period C-14 date on an uncharred corn cob.

On the southern half of the site, on the other hand, there was a high proportion of core flakes and quartzite due to the large number of flakes collected from lithic concentration Features 10 and 14. Like the central portion of LA 25417, this part of LA 25419 contains knapping stations that are undated. The low proportion of heat treatment reflects the high percentage of quartzite and the somewhat lower percentage of tools when compared to the northern half.

The dated assemblage on the south terrace point indicates considerable Developmental Period occupation, with much of the evidence based on obsidian dates. There is also good evidence for Coalition, Classic, and Historic Period occupations. Cobble ring related dates number eight and include four chronometric Developmental dates and one Classic chronometric date. Point cross dates are more variable, as expected, and include late dates from the En Medio Phase to Classic Period. Finally, the gunflint and case knife suggest an 1800s date.

6.1.4 Comparison of Sites

The following is a comparison of the lithic assemblages from the three sites. The seven site subareas are the basic units for comparison, since more restricted proveniences contain too small a sample size. Feature based artifact associations are discussed in Chapter 7.0. Discussion compares percentages of artifact and material types, heat treatment, cortex, use wear, and retouch. These percentages are presented in Table 6.4; frequencies were given above in the text.

Tool percentages vary much less than debitage. They range from 0% to 9%, with the 0% reflecting the small LA 25421 sample. The highest percentage is from the LA 25419 northern half and reflects the large number of tools exposed on the stable central ridge. Other artifact types range from 0% to 4%, except for the 7% sherds on the southern portion of LA 25417, which is an artificially high number and represents only two vessels.

Table 6.4 Artifact Assemblage Characteristics from Three Sites, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

		LA 25417				LA 25419			LA 25421		
		Site	North	Central	South	Site	North	South	Site	North	South
Frequency											
Sample	Total	440	99	258	83	459	167	292	110	81	29
	Surface	411	86	247	78	431	9	19	106	79	27
	Excavated	29	13	11	5	28	158	273	4	2	2
Percentage											
Artifact	Debitage	94	96	98	82	90	89	91	95	94	1.00
	Tool	3	4	1	6	6	9	3	5	6	00
	Core	1	00	1	1	2	1	3	00	00	00
	Groundstone	>1%	00	00	1	1	00	2	00	00	00
	Metal	>1%	00	>1%	00	1	1	1	00	00	00
	Glass	>1%	00	00	4	00	00	00	00	00	00
	Ceramic	1	00	00	7	00	00	00	00	00	00
Debitage	Angular Debitage	11	10	13	9	26	20	29	11	15	3
	Core Flake	29	35	24	39	30	17	38	43	41	47
	Biface Flake	23	19	24	20	20	27	16	19	21	16
	Unknown Flake	35	33	37	31	21	32	15	25	21	32
	Preform	2	4	2	00	3	5	3	2	2	3
	C. Flake B. Flake	1.3	1.8	1.0	1.9	1.5	0.6	2.4	2.3	1.9	3.0
	Whole Core Flake	65	76	54	79	64	56	66	60	53	77
	Whole Biface Flake	48	67	41	56	46	41	51	60	67	40
	Whole Unknown Flake	9	16	5	14	2	00	5	4	6	00
Material	Chert/Chalcedony	49	76	33	62	49	83	28	75	74	79
	Obsidian	26	20	32	24	13	11	14	17	17	14
	Quartzite	22	4	35	1	36	4	55	7	7	7
	Sedimentary	1	00	1	1	1	1	1	1	1	00
	Non-lithic	2	>1%	>1%	12	1	1	1	00	1	00
	Jemez	7	5	4	20	24	28	23	22	7	75
	Polvadera	93	95	96	80	76	72	77	78	93	25
	Heated Chert	39	56	21	44	62	78	34	44	43	45
	Unheated Chert	61	44	79	56	38	22	66	56	57	55
	Wear	7	20	4	10	8	6	--	6	4	11
	Retouch	7	11	6	7	7	8	--	12	12	11
Cortex	Average Cores	25	NA	33	00	18	17	18	NA	NA	NA
	Average Debitage	6	8	5	7	8	3	9	10	16	5
	Average Tools	17	3	50	17	2	3	1	3	3	00

Debitage ranges from 80% to 100%. The 100% debitage assemblage from the small sample of 29 items from the southern half of LA 25421 probably relates to the small sample size. The 80% debitage on the southern portion of LA 25417 reflects the predominance of piece-plotted tools in the assemblage and the absence of lithic concentrations. The relatively low 89-91% debitage on LA 25419 is a result of the variety of artifact types on the site, which, in turn, reflects both a long period of occupation and the presence of stable land surfaces, particularly on the central ridge of the northern half and the two lithic concentrations on the high ridge on the southern portion of the southern half. Angular debris ranges from 3% on the southern half of LA 25421 to 29% on the southern half of LA 25419. The latter percentage includes the two lithic concentrations (Features 10 and 14) on the south high ridge. Core to biface flake ratios range from 0.6:1 on the northern half of LA 25419 to 3:1 on the northern half of LA 25421. All core to biface flake ratios are greater than 1:1 except the 0.6:1 ratio, which indicates a collection with a large proportion of tools. The southern half of LA 25419 has the highest ratio (2.4:1) outside of the anomalous LA 25421 sample. Unknown (usually broken) flakes range from 15% to 37%. Preforms vary from 0% on the southern portion of LA 25417 to 5% on the northern half of LA 25419. Again, the former percent reflects the small LA 25421 sample, and the latter confirms the importance of biface reduction (high percent of tools, high core to biface flake ratio) on the northern half of this site.

Material types are quite variable over the seven site subareas. Cryptocrystalline materials (chert and chalcedony) range from a low of 28% on the southern half of LA 25419 to a high of 83% on the northern half of this site; again, the distinction represents the high proportion of homogeneous lithic concentrations collected from the southern half and the high proportion of biface reduction on the northern half. Also notable are the low (34%) proportion on the central portion of LA 25417, related to collection of two homogeneous lithic concentrations, and the similarity on the two halves of LA 25421. Obsidian percentages differ most on LA 25417, where the central portion containing the obsidian Lithic Concentration 2 has a 30% figure; the obsidian percentages on all parts of this site are at least seven percentage points higher than for any other site subarea. Small sample sizes on LA 25421 account for the marked differences in Jemez and Polvadera proportions. The proportions on the two portions of LA 25419 are very close (23-28% Jemez and 72-78% Polvadera). The proportions on the northern and central portions of LA 25417 resembled each other more closely than the Jemez and Polvadera proportions on the southern portion. Quartzite percentages were highest on the central portion of LA 25417 (35%) and the southern half of LA 25419 (55%); both areas contained Dakota quartzite lithic reduction concentrations.

The average cortex percentage for cores did not apply to LA 25421, was very close for the two portions of LA 25419, and varied from 0% on the southern portion of LA 25417 (based on only one core) to 33% (three cores) on the central portion (no cores were found on the northern portion). Average percent cortex on debitage ranges from 3% to 16%. The percentages on the three portions of LA 25417 (5-8%) are quite close, indicating a preponderance of interior flakes. The percentages on LA 25419 (3-9%) are more variable than those on LA 25417. The percentages on LA 25421 are probably not affected by sample size, since the small southern half percentage of debitage cortex is similar to the percentage from other subareas. The 16% percentage on the northern half of LA 25421 may reflect a real difference in reduction stage from the southern half debitage, with more decortication flakes present on the northern half. The high cortex percentages on tools are inflated by the inclusion of tools such as choppers and mauls which are typically relatively unshaped tools.

Heat treatment percentage varies according to the proportion of cryptocrystalline cherts and chalcedonies. The heat treatment figure varies from 21%-78%. The 21% on the middle portion of LA 25417 reflects the low chert/chalcedony and high quartzite percentages; heat treatment was not recorded on quartzite items. The heat treatment percent is very similar on LA 25421's northern and southern halves (43-45%). The low percent (34%) on the southern half of LA 25419 reflects the high proportion of quartzite, while the high percent (78%) on the northern half reflects the predominance of biface reduction.

Use wear percentages range from 4% to 20%. Percentages on the two portions of LA 25419 only varied from 6-9%. The percentages from the two halves of LA 25421, at 4-11%, are more variable than those on LA 25419. The greatest variability was on LA 25417, with 4% on the central portion, 10% on the southern portion, and 20% on the northern portion. Variability in use wear proportions does not appear to correlate with intensity of occupation on any of these sites.

Retouch percentages were very similar on the LA 25419 and LA 25421 subareas, being slightly higher on the latter (11-12%) than on the former (7-8%). The range is similar on all site subareas. The 6-7% on the central and southern portions of LA 25417 contrasts with the 11% on the northern portion. As with use wear proportions, retouch prevalence does not appear to correlate with intensity of occupation (see Section 6.2.7).

6.2 CHRONOLOGY

This section begins with a discussion of chronometric sample dates. The three kinds of samples submitted, in order of number of dates, were obsidian hydration (26 cuts on 16 specimens from all three sites), C-14 (six samples from all three sites), and archaeomagnetic (one sample from LA 25417).

6.2.1 Obsidian Hydration

The successful application of obsidian hydration dating involves four steps: measurement of the archaological hydration rim, chemical characterization of the obsidian type, development of an induced hydration rate on obsidian similar to that of the artifact type, and measurement of soil temperature at the archaeological site. The process of hydration is controlled by the diffusion of atmospheric moisture into the artifact. The diffusion rate of the hydration rim is dependent on the obsidian composition and the thermal environment to which it was exposed (Stevenson and Scheetz 1989). Thus, the rim development can be influenced by rapid temperature fluctuations at ground surface, particularly solar exposure, forest fires, proximity to a hearth, and the like. Erosion can remove parts of the rim. Artifacts that are rapidly buried produce more reliable dates because of less exposure to temperature fluctuation.

In order to measure the hydration rim, a standard petrographic thin section 30 micrometers thick is prepared. The rim is identified and measured under microscopic examination of at least 1,000 power. Chemical characterization can employ either semiquantitative, nondestructive analysis or more accurate fully quantitative trace element analysis using x-ray fluorescence or neutron activation analysis. The induced hydration rate development initially was estimated using associated radiocarbon and tree-ring dated samples (Stevenson and scheer 1989).

Christopher Stevenson has been working on an induced hydration approach since 1976. This method hydrates samples from certain obsidian flows as elevated temperature under steam pressure for periods of up to three years. Induced hydration rates then are fitted to estimated soil temperature for the site (Stevenson and Scheer 1989). In the Abiquiu study, the induced hydration method was used for estimating archaeological hydration rate (in um^2/1000 years), and site soil temperatures were extrapolated from air temperature records for the reservoir area. It should be recognized that the resulting obsidian dates assume that estimates of archaeological hydration rate and site soil temperature are correct. As additional cross checks on these estimates are performed and the method is improved, reported dates are expected to approximate more closely the actual dates of archaeological manufacture of obsidian items.

Selection of obsidian specimens for dating was based on the following guidelines. First, the laboratory required a minimum size of 0.5 g for nondestructive, semiquantitative compositional analysis. Specimens from hearths were avoided, as the laboratory's experiments indicate the hydration rim disappears at temperatures greater than 350° C. Emphasis was placed on selecting specimens from each site, particularly those from subsurface contexts. Unfortunately, subsurface obsidian was recovered only rarely. Subsurface items were given the highest priority; second priority was given to finished tools, particularly diagnostic points. Multiple thin sections or cuts were made on many of the finished tools, which were likely to have been recycled. The sample from the 18 obsidian items on LA 25421 included two points and one flake, the latter from the subsurface. The sample from the 118 obsidian items on LA 25417 comprised six items, three points and three flakes; two of the flakes were from a test pit in a cobble ring. The sample from the 58 obsidian pieces on LA 25419 consisted of seven items, five points and two flakes; the flakes were from two different subsurface contexts. The flake from Feature 9 on LA 25419 was located in a hearth but exhibited no evidence of surface crazing indicative of heating; because there was a C-14 sample from this hearth, it was decided to send the specimen for dating as a cross-check.

The results of the obsidian hydration measurement and sourcing study are given in Appendix A. Dr. Christopher Stevenson of Archaeological & Historical Consultants, Inc. provided 21 dates on the Polvadera obsidian specimens sourced by Dr. Richard Hughes. (Note that the obsidian reports include four items and eight dates from another study; site and FS numbers facilitate distinguishing the two samples.) In this study, unlike Mariah's previous work at Abiquiu Reservoir (Bertram et al. 1987), an induced hydration rate for Polvadera samples was available. As a result, the laboratory reported dates for Polvadera specimens. Since no such rate is yet available for Cerro del Medio obsidian, however, these dates were estimated by Mariah using the 8.81 um^2 hydration rate for Polvadera and converting Cerro del Medio measurements to Polvadera equivalents. Calculations are given below.

Source	Hydration Rate (um^2/1000 years)	Rind Thickness
Polvadera	8.81	$\sqrt{8.81} = 2.968$
Cerro del Medio	4.35	$\sqrt{4.35} = 2.086$ 2.086/2.968 = 0.703

In order to express the Cerro del Medio rind thickness as a Polvadera equivalent, the calculations below were used.

Source	Polvadera Equivalent
Polvadera	t_p
Cerro del Medio	t_c (1/0.703) = t_c (1.422)

Based on these hydration factors, estimated maximum age for Polvadera equivalent rind measurements is given by the following formula.

$$\text{years B.P.} = t_p^2\ (1000/V_p)$$

$$= t_p^2\ (1000/8.81)$$

$$= t_p^2\ (113.51)$$

The formula can be used to estimate age as follows. If a Polvadera rim width measures 3.52 um, then simply square the rim width (=12.39) and multiply by 113.51. The resulting age estimate is 1406 years B.P. The standard deviation in years is obtained by multiplying the standard deviation of the rim width (based on known measurement error factors) by the B.P. date, dividing by the measured rim width, and doubling the result. For a Cerro del Medio specimen with a rim width of 3.28 um, one can obtain the Polvadera equivalent by multiplying by 1.422 (=4.66). Square the result (=21.72) and multiply by 113.51 to obtain a B.P. date of 2465. (This age may then be halved and a rough standard deviation of ± 100 years estimated as in this report.)

As Bertram (1987) notes, the Cerro del Medio obsidian ages, when compared with well-dated point types of different types of obsidian, appear to be on the order of twice as old as for other obsidian sources. In Bertram's data set, for example, Cerro del Medio side-notched dart points dated 3370-4735 B.P. while the same type manufactured of Polvadera obsidian dated 2012-3068 B.P. Corner-notched dart points of Cerro del Medio dated 3454-3918 B.P., while Polvadera dated 1773-1841 B.P. and Obsidian Ridge dated 1501 B.P. Finally, corner-notched arrow points of Cerro del Medio dated 3500-3761 B.P., while Polvadera points of the same type dated 835-1636 B.P. and Obsidian Ridge dated 1353 B.P. (Bertram 1987:5-59; standard deviations ignored in above date ranges because not available for each data set). The Cerro del Medio ages derived from the above formulae for the cobble ring specimens were then halved in order to determine estimated age B.C./A.D. This practice seems justified by the small sample size in the present study and consequent importance of each date and by a case in the present study where it produces a stratigraphically correct date (LA 25417, Feature 3) and fairly good agreement with nearby surface artifacts of Polvadera obsidian. Only eight hydration rims on five items are identified as Cerro del Medio. These are FS 91 (two cuts) from LA 25421; FS 89, FS 115 (two cuts), and FS 1 from LA 25417, and FS 191 (two cuts) from LA 25419.

The resulting obsidian dates are provided in Table 6.5. Laboratory numbers (e.g., 87-351) correspond to different cuts. When rind thickness was variable, sometimes two readings are reported (e.g., Table 6.5, 87-328). Standard deviations for Polvadera dates are given in Appendix A. No standard deviations were calculated for Cerro del Medio dates because these are considered rough estimates with deviations probably on the order of 100-200 years.

The obsidian dates show some evidence of reuse of obsidian. Recycling was examined on artifacts for which more than one cut was made or more than one rind thickness was read. Table 6.6 provides laboratory numbers for the multiple cuts, a brief description of the artifact including macroscopic evidence of wear or retouch, and the obsidian date range based on one standard deviation from the mean date (for Cerro del Medio specimens, the range is given as the derived estimate ± 100 years), and notes whether or not the date ranges overlap. Where dates of different cuts or rind readings overlap, the differences in rind thickness are attributable to measurement errors or insignificant rind attrition. Differences in rind thickness are probably indicative of recycling only when the date ranges do not overlap. By this classification, three of the 11 artifacts with multiple readings do not indicate any evidence of recycling.

Eight obsidian artifacts show evidence of recycling. Table 6.6 should be compared with Figures 6.8 and 6.9 to compare dates with cut locations on the artifacts. Obsidian point fragments that were not dated are discussed in Section 6.2.4. The figures are labelled with the laboratory number of the first obsidian cut (if there were multiple readings taken). The artifacts are a point and a flake from LA 25421, a point from LA 25417, and four points and one flake from LA 25419.

The LA 25421 point (87-327 and 87-362) shows no evidence of macroscopic wear and produced two B.C. dates. The 1320 B.C. mean date is on a rounded, reworked tip (the original tip is missing). Some 700 years later, the side notches at the haft were flaked, possibly for use as a knife or cutting tool. A flake from the same site reflects unidirectional dorsal lateral retouch. The reading from this retouched edge indicates the initial production step plus a period of retouch/resharpening about 600 years later, in A.D. 1322.

Table 6.5 Obsidian Hydration Dates from Three Cobble Ring Sites, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Ahc Lab No.	FS No.	Provenience	Artifact Type	Source [1]	Cut Location	Date Range	Figure Number
LA 25421							
87-327	91	Datum B 45°, 1.60 m Surface	Point Base	CdM	A	1420-1220 B.C. [2]	6.9A
87-362	91	Datum B 45°, 1.60 m Surface	Point Base	CdM	B	570-370 B.C. [2]	6.9A
87-328	1	Feature 3	Flake	P	A	A.D. 1306-1338 A.D. 636-714	6.9B
87-329	101	Datum A 268°, 10.30 m Surface	Biface	P	A	A.D. 374-442	6.9C
87-352	101	Datum A 268°, 10.30 m Surface	Biface	P	B	A.D. 322-392	6.9C
LA 25417							
87-314	89	Feature 2 Datum 76°, 6.5m Surface	Flake	CdM	A	A.D. 617-817 [2]	6.9F
87-315	18	Lithic Conc. 3 356°, 2.3 m Surface	Serrated Point Tip	P	A	2433-2263 B.C.	6.9D
87-316	115	Mapping Station 4 306°, 63 m Surface	Point Fragment	CdM	A	2299-2099 B.C. [2]	6.9I
87-351	115	Mapping Station 4 306°, 63 m Surface	Point Fragment	CdM	B	1828-1628 B.C. [2]	6.9I
87-317	2	Feat. 3 10-20 cm BS	Flake	P	A	A.D. 803-861	6.9H
87-318	1	Feat. 3 0-10 cm BS	Flake	CdM	A	A.D. 905-1105 [2]	6.9G
87-319	114	Mapping Station 4 110°, 34 m Surface	Biface	P	A	2418-2194 B.C.	6.9E
87-359	114	Mapping Station 4 110°, 34 m Surface	Biface	P	B	2518-2346 B.C.	6.9E
LA 25419							
87-320	175	Feat. 25 55°, 34.12 m Surface	Point/Burin	P	A	63 B.C.-A.D. 15	6.8D
87-360	175	Feat. 25 55°, 34.12 m Surface	Point/Burin	P	B	5 B.C.-A.D. 107	6.8D

AD-A209 239 ANALYSIS OF THREE COBBLE RING SITES AT ABIQUIU 3/4
RESERVOIR RIO ARRIBA COUNTY NEW MEXICO(U) MARIAH
ASSOCIATES INC ALBUQUERQUE NM A C EARLS ET AL. JAN 89
UNCLASSIFIED DACW47-86-D-0002 F/G 5/6 NL

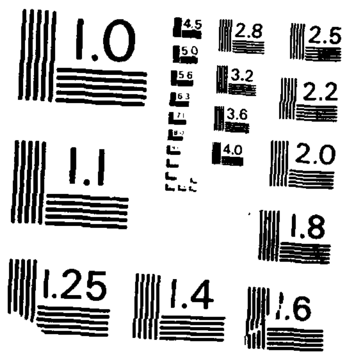


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Table 6.5 (continued).

Ahc Lab No.	FS No.	Provenience	Artifact Type	Source	Cut Location	Date Range	Figure Number
87-361	175	Feat. 25 55°, 34.12 m Surface	Point/Burin	P	C	141-43 B.C.	6.8D
87-321	1	Feat. 2 0-10 cm BS	Point Tip	P	A	A.D. 966-1072	6.8A
87-353	1	Feat. 2 0-10 cm BS	Point Tip	P	B	A.D. 1026-1104	6.8A
87-322	35	Feat. 5 222°, 9.65m Surface	Point	P	A	A.D. 1443-1491	6.8E
87-357	35	Feat. 5 222°, 9.65m Surface	Point	P	B	A.D. 1249-1307	6.8E
87-357	35	Feat. 5 222°, 9.65m Surface	Point	P	B	A.D. 896-938	6.8E
87-323	186	Mapping Station C 170°, 22.30 m Surface	Point Fragment	P	A	457-289 B.C.	6.8C
87-358	186	Mapping Station C 170°, 22.30 m Surface	Point Fragment	P	B	A.D. 261-331	6.8C
87-324	191	Feat. 30 165°, 3.55 m Surface	Point Base	CdM	A	A.D. 77-277 [2]	6.8B
87-356	191	Feat. 30 165°, 3.55 m Surface	Point Base	CdM	B	A.D. 303-503 [2]	6.8B
87-325	1 [3]	Feat. 9 0-10 cm BS	Flake	P	A	A.D. 698-744	6.8G
87-325	1 [3]	Feat. 9 0-10 cm BS	Flake	P	A	A.D. 1085-1185	6.8G
87-326	7	Lithic Conc. 1 10-20 cm BS	Flake	P	A	A.D. 540-622	6.8F

1 CdM = Cedrro del Medio, P = Polvadera.

2 Dates calculated by Mariah Associates, Inc. All other dates provided by Archeological and Historical Consultants Inc.

3 Different item from 87-321 and 87353.

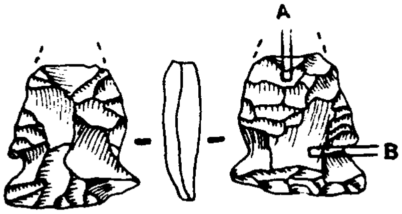
Table 6.6 Recycled Obsidian, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Ahc Lab No.	FS No.	Artifact Type	Date Range [1]	Cut Location	Overlap In Date Range	Figure Number
LA 25421						
87-327	91	Point, no macroscopic	1420-1220 B.C. [2]	(A)	No	6.9A
87-362	91	wear or recycling	570-370 B.C. [2]	(B)	--	6.9A
87-328	1	Medial Flake, Unidir.	A.D. 1306-1338	(A)	No	6.9B
		dorsal lateral retouch	A.D. 636-714	--	--	6.9B
87-329	101	Point, no macroscopic	A.D. 374-442	(A)	Yes	6.9C
87-352	101	recycling or wear	A.D. 322-392	(B)	--	6.9C
LA 25417						
87-316	115	Point, no wear	2299-2099 B.C. [2]	(A)	No	6.9I
87-351	115	or recycling	1828-1628 B.C. [2]	(B)	--	6.9I
87-319	114	Point, no wear	2418-2194 B.C.	(A)	Yes	6.9E
87-359	114	or recycling	2518-2346 B.C.	(B)	--	6.9E
LA 25419						
87-320	175	Point, ground &	63 B.C.-A.D. 15	(A)	Yes	6.8D
87-360	175	flaked wear	5 B.C.-A.D. 107	(B)	Yes	6.8D
87-361	175		141 B.C.-43 B.C.	(C)	No	6.8D
87-321	1	Point, flaked	A.D. 966-1072	(A)	Yes	6.8A
87-353	1	wear	A.D. 1026-1104	(B)	--	6.8A
87-322	35	Point, flaked	A.D. 1443-1491	(A)	No	6.8E
87-357	35	wear	A.D. 1249-1307	(B)	No	6.8E
87-323	186	Point, flaked	457 B.C.-289 B.C.	(A)	No	6.8C
87-358	186	wear	A.D. 261-A.D. 331	(B)	--	6.8C
87-324	191	Point, ground	A.D. 77-277 [2]	(A)	No	6.8B
87-356	191	& flaked wear	A.D. 303-503 [2]	(B)	--	6.8B
87-325	1	Flake, no wear	A.D. 698-744	(A)	No	6.8G
		or recycling	A.D. 1085-1185	--	--	6.8G

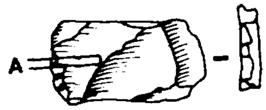
1 Includes 1 standard deviation.

2 No standard deviation available for Cerro del Medio; ± 100 years used as an estimate of probable error.

Figure 6.9 Obsidian Projectile Points and Artifacts Submitted for Hydration Dating from Sites LA 25421 and LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



A

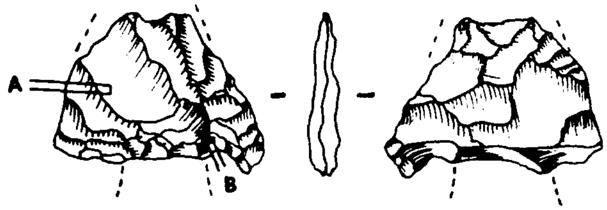


B

FS 91 Point Base
87-327 (A-1)

FS 101 Biface
87-329 (A-3)

FS 1 Flake
87-328 (A-2)

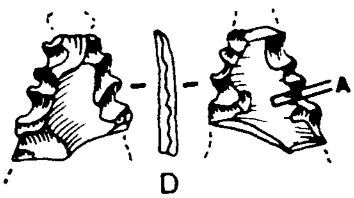


C

LA 25421

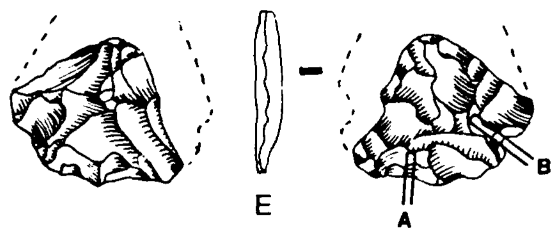
LA 25417

FS 18 Point Tip
87-315 (A-15)

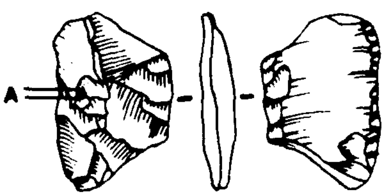


D

FS 114 Biface
87-319 (A-4)

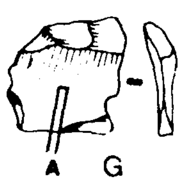


E

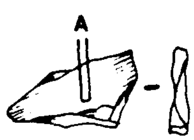


F

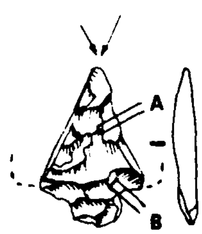
FS 89 Flake
87-314 (A-16)



G



H



I

FS 1 Flake
87-318 (A-5)

FS 2 Flake
87-317 (A-6)

FS 115 Point
87-316 (A-7)

The point from LA 25417 (87-316 and 87-351), with no evidence of macroscopic retouch or wear, has two broken blade edges. These breaks may represent intentional burination. Readings taken above the break on one of the edges and on the haft indicate that the lateral edge finish predates the most recent haft flaking. The difference in these two episodes is estimated at 500 years.

The first point from LA 25419 (87-320), with flaked and ground macroscopic wear, shows no overlap between Cuts B and C. This situation means that the reused medial burin break (Cut A) and haft constriction (Cut C), as well as the medial break and one burin surface (Cut B) are probably contemporaneous. Although the dates for Cuts B and C do not overlap, logically (since A and C and A and B are contemporaneous) the burin break and other edges are all contemporaneous, and the tool was reworked into a burin shortly after breakage.

The second point from LA 25419 (87-322 and 87-357), showing macroscopic flaked wear, has hydration readings indicating three different nonoverlapping date ranges. The oldest dates, A.D. 917 and 1278, are for the side notch, and the most recent date, A.D. 1467, is for the distal lateral edge of the point. This cut was made just above the serrations and may indicate resharpening near the tip.

The third point from this site (87-323 and 87-358), showing macroscopic flaked wear, features two nonoverlapping dates. The older is on the transverse break, and the younger is on the asymmetrical minor side notch. There is a burin spall removed from the lateral edge opposite the notch; this was not dated.

The fourth point from LA 25419 (87-324 and 87-325), showing macroscopic ground and flaked wear, reflects two nonoverlapping dates. The older is for the distal tip break, and the younger is for the constricted haft area along the side.

The flake from this site (87-325), showing no macroscopic evidence of wear or retouch, indicates two different dates--A.D. 721 and 1135--on one cut. These dates are compared with C-14 dates from the same feature in Section 6.2.2.

Patterns of recycling in the Abiquiu Reservoir lithic assemblage confirm earlier (Bertram et al. 1987) indications that obsidian "debris" was intensively reused, with intervals between new flaking or resharpening episodes as long as 700 years. Although the obsidian sample sent for hydration measurement was primarily composed of points, two of the flakes that were dated had particularly great hydration rim differences of 400 and 700 years. The flake from LA 25421 was retouched about 700 years later, while the hydration difference on the flake from LA 25419 may reflect some loss of hydration due to heat from a hearth. There is a moderate trend for haft/notch dates to be later than lateral edge and tip breakage dates, possibly indicating that some items were used as projectiles, then hafted or rehafted for use as a knife or cutting tool.

6.2.2 C-14

Six C-14 samples were dated. Their proveniences were one from LA 25421 (Feature 2), two from LA 25417 (Feature 1B and 1A), and three from LA 25419 (Feature 9, Feature 6, and near Mapping Station C). All dates are for subsurface contexts except for the corn cob (TX 5896) on the northern half of LA 25419. Table 6.7 provides uncorrected and corrected C-14 dates from the first consensus calibration (Klein et al. 1982). Copies of University of Texas at Austin Radiocarbon Laboratory specimen data sheets are reproduced in Appendix B.

Reported C-14 dates use the 5568 (Libby) half-life and are corrected for the C-13/C-12 ratio. Past concerns about "too recent" dates on corn are relevant here because one of the C-14 dates from LA 25419 is on an uncharred corn cob lacking kernels. For example, at the McIvor site in Ontario, Lowdon (1969) noted that charred corn gave dates 150 years or so younger than those from wood charcoal. The collector assumed that the different materials dated were living contemporaneously, e.g., that there was not an "old wood" problem. It was thought that isotopic fractionation caused the young corn dates. Using modern corn samples, a 2.94% C-14 enrichment was estimated, which would result in an age 235 years younger than its actual age (Lowdon 1969). However, a more recent study by Creel and Long (1986) used corn from tree-ring dated Southwestern sites to conclude that corn does produce dates as accurate as wood when C-14 dates are not adjusted or normalized to nonfractionated values and that short term fluctuations in atmospheric C-14 have not had an effect of more than $\pm$ 24-40 years except in high latitudes. Because dates were few and from widely spaced proveniences, no dates were averaged.

The single date (2515-1870 B.C.) on fine, dispersed charcoal from a slab-lined hearth (Feature 2) on LA 25421 confirms a Late Archaic occupation at this site. Unfortunately, there was no organic matter sufficient for dating on the cobble ring portion (terrace edges) of this site.

The two C-14 dates from LA 25417 are from two features (1A and 1B) in the center of cobble ring Feature 1. These dates are stratigraphically correct, with the intact wood charcoal contents of a firepit basin dating later than fine, dispersed charcoal underlying a fire-cracked rock concentration beneath the basin. The wide span of the dates, 2390-1775 B.C. and A.D. 1320-1425, was unexpected, however, and may cast doubt on the association of at least the earlier date with the cobble ring feature.

The three C-14 dates from LA 25419 are relevant to both cobble ring and non-cobble ring associated materials. The 3875-3370 B.C. date is for fine, dispersed charcoal in a hearth (Feature 9) located on a stable land surface upslope from the cobble rings at the terrace edge on the southern half of the site. The A.D. 655-1010 date is for fine, dispersed charcoal occurring in the center of a cobble ring (Feature 6) at the north terrace edge on the southern half of the site. The A.D. 1265-1655 date is for an uncharred corn cob lying on the surface of a ridge along the center of the northern half of the site. This ridge produced many different point types and contains many hearths; it appears to be a stable land surface experiencing little erosion or deposition during Holocene times. A description of this cob was provided by Mollie S. Toll and is given in Table 6.8. The C-14 date confirms a late prehistoric/ protohistoric date for the corn (i.e., 480 $\pm$ 130 B.P. [TX 5859]).

Table 6.7 Corrected and Uncorrected C-14 Dates, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Univ. of Texas-Austin Lab. No.	Provenience	Date B.P.	Corrected Date
	LA 25421		
5856	Feature 2, 20-23 cm BS (very fine charcoal)	3700±90	2515-1870 B.C.
	LA 25417		
5848	Feature 1B, 0-10 cm BS (charcoal	550±50 -21.7±0.2 ppm [1]	A.D. 1320-=1425
5857	Feature 1A, 30-40 cm BS (very fine charcoal)	--	2390-1775 B.C.
	LA 25419		
5858	Feature 9, 10-20 cm BS (very fine charcoal)	840±80	3875-3370 B.C.
5859	Feature 6, 0-6 cm BS (very fine charcoal)	1160±60	A.D. 655-1010
5896	225°, 8.27 m from Mapping Station C (uncharred corn cob)	480±130 -9.8 ppm [1]	A.D. 1265-1655

1 ppm = parts per million.

Table 6.8 Morphometrics of an Unburned Corn Cob, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

LA 25419, 225^{o} and 8.27 m from Mapping Station C, September 1987.

Number of rows: 8
Cross-section: circular, slightly compressed
Cob diameter: 19.2 mm
Cob length (incomplete): 117 mm
Rachis: 7.5 mm
Cupule width: 8.0 mm
Cupule height: 4.1 mm

Though eight-rowed corn is most common in Basketmaker assemblages, cobs with this low row number are found in varying low frequencies in Anasazi and even historic Rio Grande pueblo corn assemblages. Cob and cupule proportions are on the high side for anything as early as Basketmaker corn, especially given the elevation and northern latitude.

Mollie S. Toll
Castetter Laboratory for Ethnobotanical Studies
Department of Biology
University of New Mexico
Albuquerque, New Mexico 87131
277-3348, or 989-7316 (Santa Fe)

November 5, 1987

6.2.3 Archaeomagnetic Dates

One archaeomagnetic sample was taken on the rim of an oxidized firepit basin in the center of Feature 1 on LA 25417. The sample was dated by Dr. Jeffrey Eighmy at the Archaeometric Laboratory at Fort Collins, Colorado (see also Appendix C). The sample produced a large alpha 95, resulting in a large plotted area on the curve and an imprecise date. Because of the imprecision of the sample and the spotty nature of the recent portion of the paleomagnetism curve, the date can only be estimated as pre-A.D. 1870-1970. However, despite the date's imprecision, it is clear from the curve (Figure 6.10) that the sample falls well outside the A.D. 1400 range suggested by the radiocarbon dated contents of this firepit. The resulting date provides the only evidence (beside the knife blade, ceramics, and beads) of nineteenth century use of one of the cobble rings.

6.2.4 Point Type Dates

Points are morphologically complex artifacts whose size and shape are influenced by their intended piercing, cutting, and hafting functions as well as the technological aspects of tipping projectiles, and the aerodynamics and intended ballistic impact of the entire spear-dart-arrow shaft. Studies have demonstrated that beyond these general technological and functional considerations, some of the morphological variability reflects culturally determined stylistic patterns, which change or evolve through time. The study of projectile point forms as temporal markers can, by extension, be used to delineate culture affiliations.

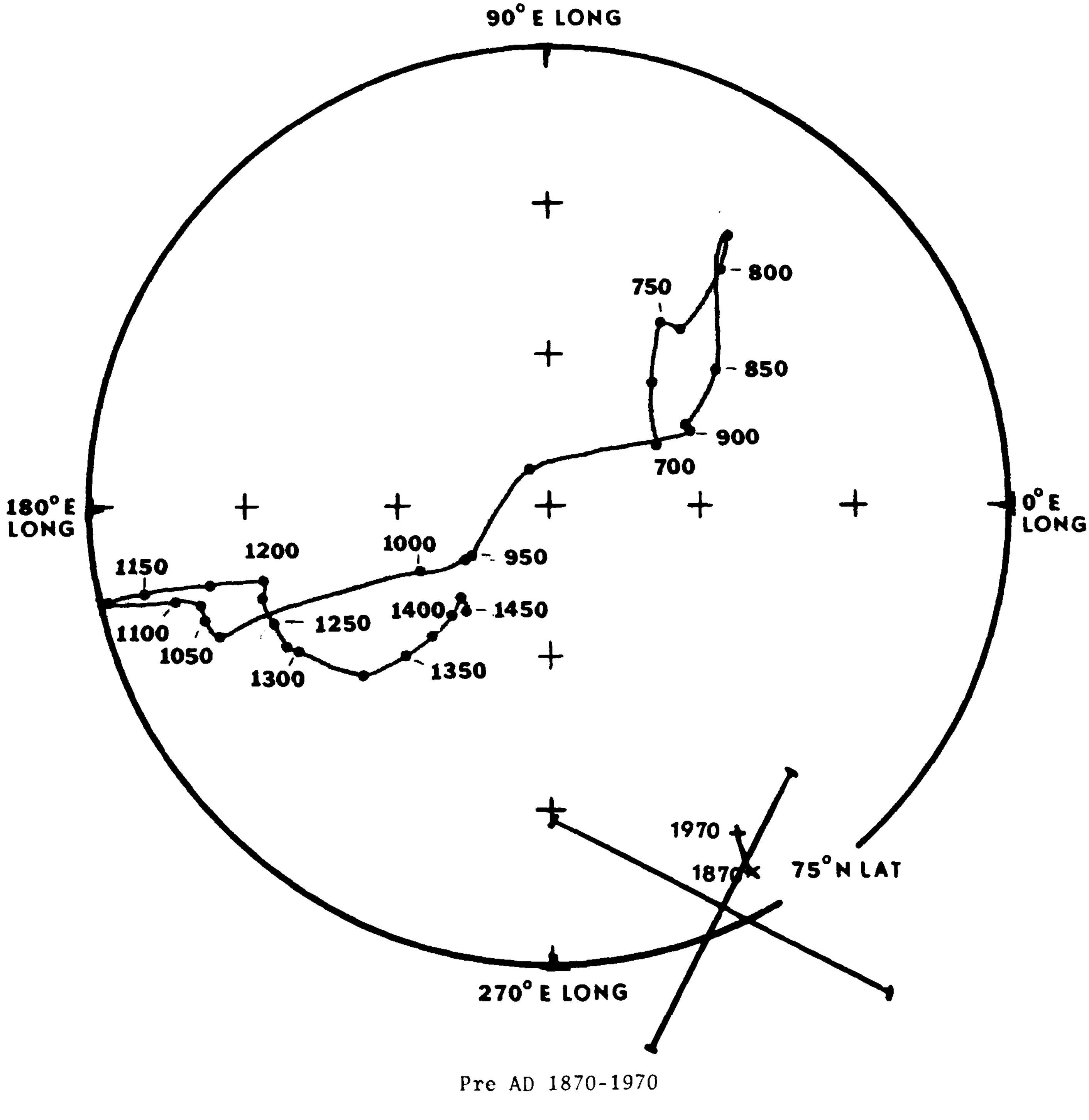
This section delineates the age of the Abiquiu projectile points in three steps. First, attributes and variables for the projectile points from the project are tabulated as a means of characterizing their form. Second, the Abiquiu specimens are cross-dated by comparing them to dated specimens in adjacent regions. This comparative step places the projectile points in a cultural historical context and provides preliminary age estimates for the various point shapes. The third step evaluates the age estimates derived from cross dates with the results of obsidian hydration dates obtained from select obsidian points. This final step is critical in assessing the adequacy of the cross-dating methods for artifact types in the Abiquiu region.

6.2.4.1 Selected Point Attributes and Variables

The Abiquiu projectile point sample consists of 28 specimens. Five specimens are from LA 25421, six are from LA 25417, and 17 are from LA 25419. The total point collection includes three complete specimens, 12 proximal fragments, four medial fragments, two lateral fragments, and seven distal fragments. The fragmentary condition of almost 90% of the points hinders projectile point description and classification. The lateral and distal point fragments are particularly difficult to deal with since most of the crucial attributes are missing.

The complex morphology of points mandates critical analytical observations. In this study, the morphology attributes used to characterize the Abiquiu specimens follow a modified terminology of Anderson (1985). The specific

Figure 6.10 Plot of Sample LA 25417-1 VGP with the Current Master Southwest BGP Curve, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



Pre AD 1870-1970

curve used: SWCV187

terminology for portions of projectile points and the range of attribute variation are graphically defined in Figures 6.11 and 6.12. Although numerous variables have been used to characterize points from other regions, only five were selected: point length, width, thickness, stem width, and weight. These variables are generally consistent with the critical measurements used to technologically delineate spear/dart points (>9 mm haft width) from arrow points (<9 mm haft width).

The morphology of the 28 points is characterized in Table 6.9. This table provides for each point a listing of FS numbers, intrasite provenience, identified portion, specific shape attribute codes, select metric variables, material type identifications, brief annotations, and references to select illustrated specimens. The attribute codes and metric variables refer to observations delineated in Figure 6.11. Metric variables were not provided for missing attributes due to substantial breakage; however, in cases where minor damage has minimally affected the dimensions of the specimen, the remaining measurement was provided in parentheses. In addition, the notation "S" or "B" following the width variable denotes that the widest portion of the point occurred at the shoulder or base.

The points display a wide range of morphological and metric variation (Figure 6.13; this figure includes obsidian points not submitted for hydration dating and nonobsidian points). This tremendous range of variation coupled with small sample size precludes the independent development of morphological "types", since many specimens are unique. Several generalizations are nevertheless possible. The dominant point attributes include biconvex cross sections; dull to very sharp points; straight or occasionally convex blade edges; abrupt or weakly barbed shoulders; a wide range of stem forms dominated by expanding, slightly expanding, straight and basal flanged forms; and straight to convex base shapes. Blade edge serration was relatively common, with either continuous or spaced serration patterns present on seven of 24 specimens. Blade edge serration occurred infrequently at LA 25421 and LA 25419, but four of five specimens with remaining blade edges from LA 25417 were serrated. The widest dimension of the points may occur at either the shoulder or the base, with the former location being slightly more common. Three projectile points from LA 25417 and LA 25419 show burin spalls.

The tremendous range of morphological variability among this class of artifacts may reflect 1) a poorly developed or generalized stylistic cultural template, 2) a wide range of functionally different hafted cutting and piercing tools, 3) a wide range of lost/discarded implements from various stages of resharpening/use, 4) examples from multiple occupations on a stable land surface, 5) the prehistoric curation or collection of specimens from regional sites which represent a wide temporal span, or 6) any combination of the above. The comparison and cross-dating of similar point forms from a larger region provide data for assessing the relative number of components at these three sites.

6.2.4.2 Comparisons and Cross-Dating

The cross-dating of the Abiquiu points was accomplished by comparing the recovered specimens with defined types and dates established for adjacent regions. Regions include northwestern New Mexico (Irwin-Williams 1973), the

Table 6.9 Projectile Point Attributes, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Site/FS Number	PROVENIENCE: Test Unit Datum	Dist. (CM)	Bearing (o)	Level	Feature	Portion	ATTRIBUTES (1,2): CS	TP	BE	ShS	StS	TS	BS	SE	Length (mm)	Width (mm)	Thick-Ness (mm)	Haft Width (mm)	Weight (g.)	Material Type	Figure	Comments
LA 25421																						
FS 101	Temp A	1030	268	0	--	Distal	BC	ND	ST	WB	ND	ND	ND	NA	--	27.6 S	4.8	13.8	--	Obsidian	6.9C	--
									CV													
102	Temp A	3555	307	0	--	Medial	BC	ND	ST	ND	ND	ND	ND	CT	--	--	4.3	--	--	Obsidian	6.13B	--
83	Temp B	1340	7	0	--	Proximal	PC	ND	ST	AB	ST	RN	CV	NA	--	17.9 S	4.4	16.2	--	Obsidian	6.13C	preform ?
91	Temp B	160	45	0	--	Proximal	BC	ND	ST	AB	BF	RN	ST	NA	--	17.6 B	5.2	17.1	--	Obsidian	6.9A	--
27	Temp E	1780	236	0	--	Proximal	BC	ND	ND	AB	SX	ND	ST	NA	--	--	3.9	14.3	--	Chalced.	--	asymmetrical
LA 254[illegible]																						
FS [illegible]	Temp B	230	356	0	--	Medial	PC	ND	ST	ND	ND	ND	ND	CT	--	--	3.0	--	--	Obsidian	6.9D	--
37	Temp B	3450	123	0	--	Medial	BC	ND	ST	AB	ND	ND	ND	CT	--	(14.9)S (3)	4.8	10.8	--	Obsidian	--	preform ?
124	Fea 8	640	174	0	--	Proximal	BC	ND	ST	AN	ST	PT	ST	CT	--	17.1 S	5.8	14.9	--	Obsidian	6.13A	--
114	Map 4	3400	110	0	--	Distal	BC	ND	CV	WB	ND	ND	ND	NA	--	19.4 S	3.9	(11.5)	--	Obsidian	6.9E	--
115	Map 4	6300	306	0	--	Proximal	ND	ND	ND	ND	SX	RN	CV	ND	--	--	3.2	6.[illegible]	--	Obsidian	6.9I	burin spall
116	Map 4	7000	320	0	--	Distal	PC	ND	ST	ND	ND	ND	ND	CT	--	(24.2)S	5.[illegible]	--	--	Obsidian	--	--
LA 25419																						
FS 1	Test 1	N 23	E 55	[illegible]	2	Lateral	BC	DU	CV	WB	EX	PT	CV	NA	(33.8)	--	4.9	17.1	--	Obsidian	6.8A	--
60	L.[illegible] 1	0	0	0	--	Proximal	BC	ND	ND	AB	EX	PT	ST	ND	--	--	5.0	14.3	--	Chert	6.13E	--
186	Map [illegible]	2230	170	0	--	Proximal	BC	ND	ST	SL	BF	RN	ST	NA	--	22.6 B	3.9	21.[illegible]	-	Obsidian	6.8C	burin spall
35	Feat [illegible]	965	222	0	--	Complete	PC	VS	ST	WB	BF	PT	CV	SP	36.7	13.1 B	4.4	8.3	1.3(4)	Obsidian	6.[illegible]F	arrowpoint
[illegible]2	Feat [illegible]	[illegible]060	33	0	--	Distal	BC	DU	ST	ND	ND	ND	ND	NA	--	--	6.6	-	--	Quartzite		--

Table 6.9 (continued).

Site/FS Number	Test Unit Datum	Dist. (CM)	Bearing (o)	Level	Feature	Portion	CS	TP	BE	ShS	StS	TS	BS	SE	Length (mm)	Width (mm)	Thick-Ness (mm)	Haft Width (mm)	Weight (g.)	Material Type	Figure	Comments
	PROVENIENCE						ATTRIBUTES (1,2)															
65	Feat 8	1335	349	0	--	Lateral	PC	ND	ST	NA	US	PT	ST	NA	(17.3)	--	3.5	--	--	Obsidian	6.13D	arrow point
72	Feat 8	3440	182	0	--	Distal	BC	ND	ST	ND	ND	ND	ND	NA	--	--	6.8	--	--	Obsidian	--	--
4	Test 4	--	--	0-10	18	Distal (5)	BC	ND	ST	ND	ND	ND	ND	CT	--	--	(3.6)	--	--	Chalced.	--	--
105	Feat 18	Unit B-3		0	--	Proximal	BC	ND	ND	ND	SF	PT	NT	ND	--	22.9 B	3.5	10.7	--	Chalced.	6.13J	refit
108	Feat 18	Unit C-4		0	--	Proximal																refit
164	Feat 25	160	210	0	--	Medial	BC	ND	ST	ND	ND	ND	ND	NA	--	--	4.6	--	--	Chert	--	--
165	Feat 25	485	250	0	--	Proximal	BP	ND	ND	NA	ST	RN	CV	NA	--	25.9 B	4.2	--	--	Obsidian	--	--
166	Feat 25	1490	225	0	--	Complete	BC	ND	ST	AB	CF	PT	NT	NA	(28.2)	18.8 S	3.6	12.4	1.3	Chalced.	6.13H	--
171	Feat 25	910	58	0	--	Proximal	BC	ND	ST	EB	EX	PT	ST	NA	--	(50.4)S	8.5	22.7	--	Basalt	6.13I	--
174	Feat 25	2030	30	0	--	Distal	BC	ND	CV	WB	EX	PT	CV	NA	(27.1)	--	4.3	11.2	--	Chalced.	6.13F	--
175	Feat 25	3412	55	0	--	Proximal	ND	ND	ND	ND	BF	PT	ST	ND	--	22.5 B	6.9	17.4	--	Obsidian	6.8D	burin spall
176	Feat 25	2099	330	0	--	Complete	PC	VS	CV	WB	EX	PT	ST	CT	(18.1)	13.7 S	3.3	6.6	0.7	Chalced.	6.13G	arrow point
191	Feat 30	355	165	0	--	Proximal	BC	ND	ST	AN	SC	PT	CC	NA	--	17.5 B	5.3	15.2	--	Obsidian	6.8B	grnd stem/ base

(1) Note: Abreviations for point attributes indicated in Figure 6.3.

(2) Point Attribute Heading Abbreviations:

CS - Cross section StS - Stem shape Broadest width: B - Base S - Shoulder

TP - Tip TS - Tang shape BE - Blade edge BS - Base shape

ShS - Shoulder shape SE - Serrations

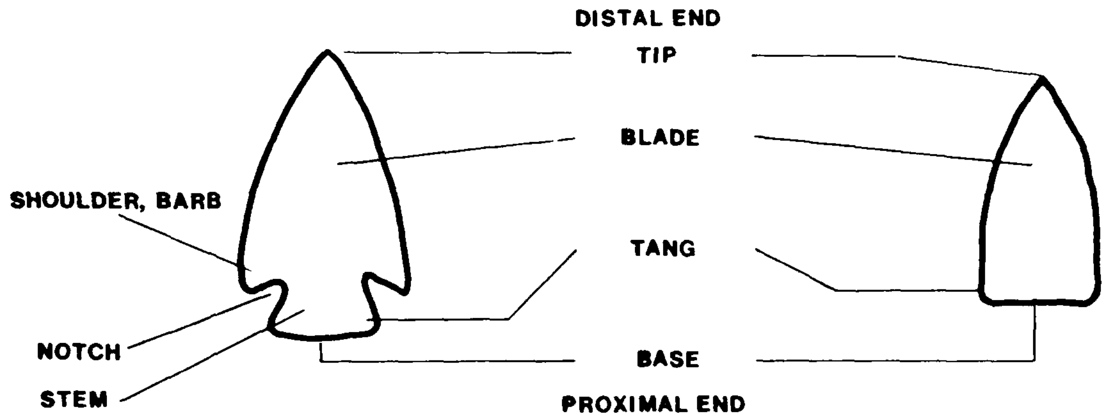
(3) Variables in parentheses "( )" are approximately complete dimensions.

(4) Thin unhafted biface

(5) Weight excludes hydration cut.

Figure 6.11 General Morphological Attributes and Measured Variables of Projectile Points, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

A. TERMINOLOGY



B. MEASUREMENTS

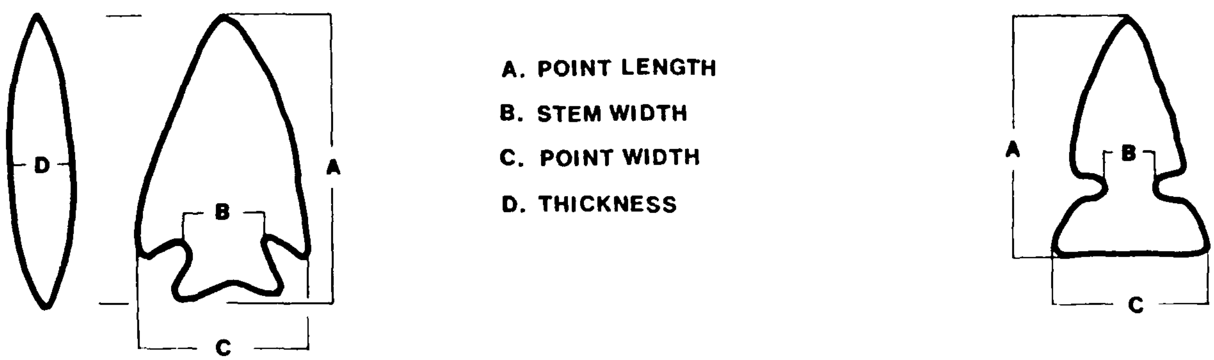
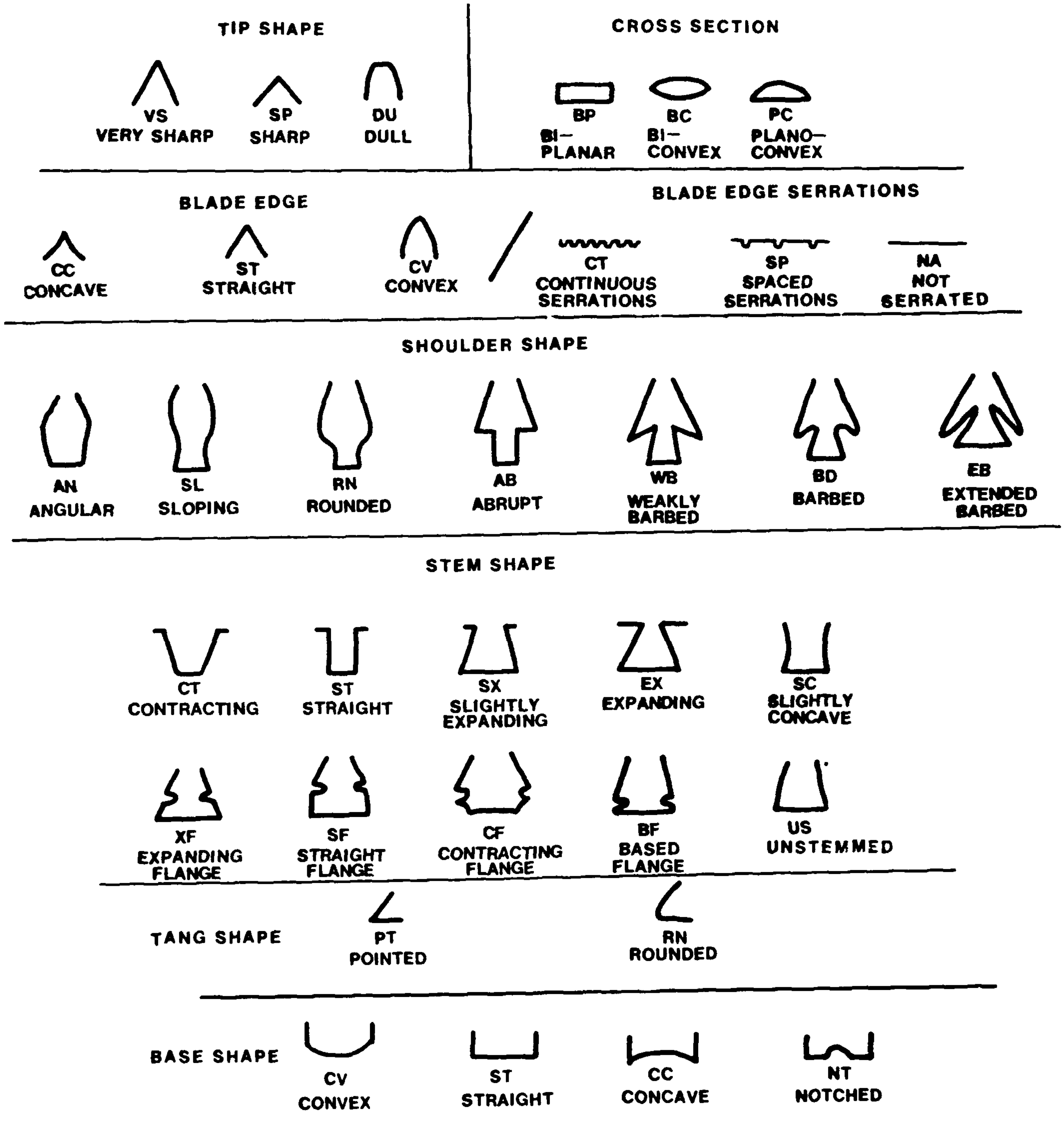


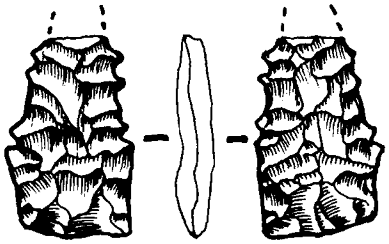
Figure 6.12 Projectile Point Attributes, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



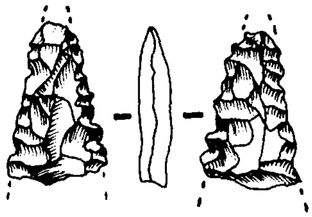
ND NO DATA (BROKEN/MISSING)

NA NOT APPLICABLE (NEVER WAS)

Figure 6.13 Projectile Points from LA 25417, LA 25421 and LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

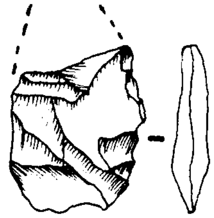


A
FS 124
LA 25417 F8, 174°, 6.4m



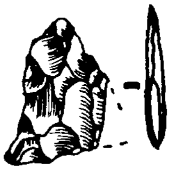
B
FS 102
Temp Datum A, 307°, 35.55 m

FS 83
Temp Datum B, 7°, 13.40 m

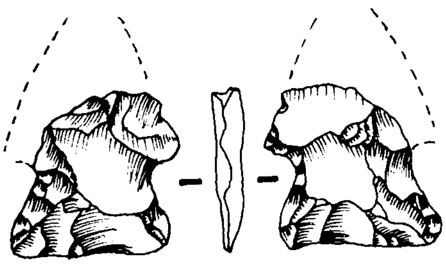


C LA 25421

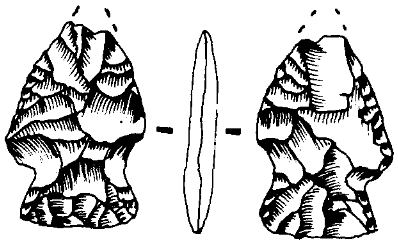
LA 25419



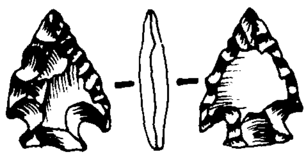
D
FS 65
F8, 349°, 13.35 m



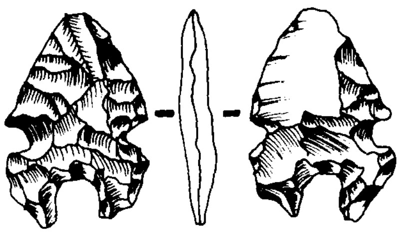
E
FS 60
Lithic Conc. 1, A-1



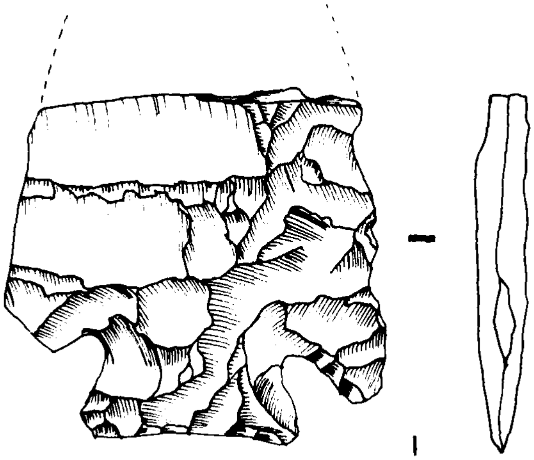
F
FS 174
F25, 30°, 20.3 m



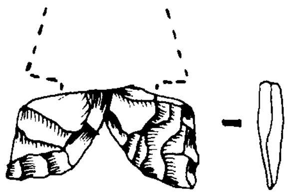
G FS 176
F25, 33°, 21.0 m



H
FS 166
F25, 225°, 14.9 m



I
FS 171
F25, 58°, 9.1 m



J
FS 105/108
F18, B-3

northern Rio Grande (Thoms 1977), Abiquiu Reservoir (Lord and Cella 1986, Schaafsma 1976), and southeastern Colorado (Anderson 1985). The Colorado study was included because it contained a substantial data base (628 specimens) and was developed independently of the other Southwestern sequences. Although the distance between Abiquiu Reservoir and southeastern Colorado may affect the cross-dating procedure, general trends are evident between the two areas. The following is a discussion of underlying assumptions, methods, and results of the cross-dating procedure.

Assumptions

The basis for using cross-dating to date artifacts in a region is based on a number of assumptions about cultural systems and the dynamics of those systems. Other assumptions underlie the methodological procedures involved in artifact classification and comparison.

The use of chipped stone artifacts for cross-dating is hampered by attempts to create relatively static morphological types from single examples produced from a dynamic process. Since flint-knapping is a "subtractive" manufacturing process, the resulting morphology of a point may reflect a series of complex processes perhaps involving one or more linear manufacturing trajectories. Simply restated, sometimes objects break and are discarded before they reach their "finished" form, or extensive use of completed tools engenders wear or resharpening that further modifies the final form. Any knapping errors which could not be overcome during manufacture or maintenance are also reflected in the morphology of the tool. Considerable variation can occur in chipped stone artifacts made or used by a single individual during the same period that were designed to have the same morphology. To complicate the process, slight variation may arise from idiosyncratic knapping skills of different manufacturers or may occur in the replication of a specific form over a considerable period of time; subtle changes may reflect stylistic modifications in the mind of the maker.

Archaeologists have no knowledge of the maker's intent and must infer activities from technological or wear damage patterns evident on individual objects. The tool typologies are developed and imposed on artifacts by archaeologists. The classification of artifacts often entails a multivariate approach which ultimately defines or pigeonholes objects into discrete (and hopefully replicable) types from the prehistoric technological and temporal dynamic systems. The significance of slight variation, at some point, becomes critical. How much variation can occur before two objects are placed in separate types/varieties? Often, the assemblage size and chance occurrence of recovered artifacts available for study heavily influence the structure of tool classification schemes and the delineation of types.

After the typology has been created, chronological ages must be assigned to specific types. To do this, the provenience and context of specimens relative to dated samples must be evaluated, since only the obsidian hydration method directly dates chipped stone obsidian artifacts. Most absolute chronometric methods rely on feature samples dated by tree-ring analysis, radiocarbon, archaeomagnetism, or other chronometric methods. The contextual association of points to these dated features must be critically evaluated. Few archaeological projects obtain a sufficiently broad suite of absolute dates in direct association with points to permit firm contextual correlation of all artifact types. More commonly, the association of materials is inferred by evaluating the stratigraphic context of the recovered points and the dated feature. Under worst case situations, archaeologists may erroneously infer single component utilization of a site based on the sparcity of material remains, and assume that all points (including those lacking stratigraphic context) are associated with dates, no matter how great the distance between the dated feature and the recovery locus for the classified artifact. Under such circumstances, the artifact type may be erroneously dated.

Because artifact styles may have one or more periods of popularity, the tight contextual association of a point form to a dated feature still does not indicate the temporal range of popularity. The associated date must be used in conjunction with associated dates from other features to delineate the temporal range of common usage. The problems associated with dating style origins and extinctions are overwhelming. Thus time ranges reflect considered approximations.

In order to increase the number of specimens and types associated with dated contexts, a wide body of literature must be consulted. Some synthetic typological studies have already been compiled which have correlated specific forms to established ages for specimens over broad areas. Often such studies inadequately discuss the specimen-specific provenience and contextual problems. The range of point ages is strengthened when numerous dated sites consistently yield the same tool forms. One danger arises from extrapolating the age of point styles developed in a distant region to the local project. Extreme distance increases the possibility that cultural factors have impeded the transmission of styles. This cultural lag means that dates assignable from one region may not necessarily be contemporaneous with similar forms in another region. Despite the problems inherent with cross-dating, the method has been widely used.

Methods

The method of developing cross dated age estimates for the 28 projectile points relied on comparing the recovered specimens with illustrations of types from previous projectile point sequences developed for northwestern New Mexico (Irwin-Williams 1973), for the northern Rio Grande (Thoms 1977), for Abiquiu Reservoir (Schaafsma 1976, Lord and Cella 1986, Bertram et al. 1987) and for the western Plains region (Anderson 1985). After corresponding point types were tentatively recognized, the projectile point descriptions were consulted, if available, to ensure that the morphology and dimensions of the specimens were comparable. In some instances, similar point styles were found, but the recovered specimens did not precisely match the illustration or description in every detail. Such specimen types bearing a strong resemblance are indicated in Table 6.10 within parentheses if they did not precisely match the illustrated or described types.

Once the point styles were delineated, the corresponding age estimates of specimens in various sequences were obtained (Table 6.10). Isolated dates based on only one report are shown in brackets. An examination of estimated age ranges reveals considerable agreement in beginning and end dates for select point Table

Table 6.10 Age Estimates of Abiquiu Reservoir Projectile Points Using Cross Dating and Obsidian Hydration Methods, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Site/FS Number	Irwin-Williams (1973) Schaafsma (1976)	Thoms (1977)	Lord & Cella (1985)	Bertram et al. (1987)	Anderson (1985)	Cross Date Time Span	Obsidian Hydration Dates	Lab Number	Figure
LA 25421									
FS 27	----	----	----	----	----	----	----	----	--
91	Armijo	T-7	(10)	----	P-88	[3000]/1800 BC - AD 400 [1400]	1420-1220 BC(1)	87-327A (A-1)	6.9A
	1800-800 BC	3000-500 BC	1500 BC-AD 400	----	AD 1000-1400		570- 370 BC(1)	87-327B	
83	San Jose/Armijo	T-9	(10)	----	P-9	3300 - 500 BC	----	----	6.13C
	3000-800 BC	3000-500 BC	1100 BC-AD 500*	----	3300-2800 BC				
101	En Medio	T-17, 18, 21	(06, 12)	----	----	3200/1000 BC - AD 400	AD 374-442	87-329A (A-3)	6.9C
	800-400 BC	1000BC-AD 400	3200 BC-AD 400	----	----		AD 322-392	87-329B	
102	(Armijo)	Unidentified Serrated, Medium Small Dart Point			----	1800 - 800 BC	----	----	6.13B
	1800-800 BC								
LA 25417									
FS 18	(Armijo)	Unidentified Serrated Medium Sized Dart Point			----	(1800 - 800 BC)	2433-2263 BC	87-315 (A-15)	6.9D
	(1800-800 BC)								
37	(Armijo)	Unidentified Serrated Medium Sized Dart Point			----	(1800 - 800 BC)	----	----	--
	(1800-800 BC)								

Table 6.10 (continued)

Site/FS Number	Irwin-Williams (1973) Schaafsma (1976)	Thoms (1977)	Lord & Cella (1985)	Bertram et al. (1987)	Anderson (1985)	Cross Date Time Span	Obsidian Hydration Dates	Lab Number	Figure
114	----	Unidentified Large Dart Point		----	----	No Estimate	2418-2194 BC 2518-2346 BC	87-319A (A-4) 87-319B	6.9E
115	----	Unidentified Large Dart Point		----	----	No Estimate	2299-2099 BC (1) 1828-1628 BC (1)	87-316A (A-7) 87-316B	6.9I
116	----	Unidentified Large Dart Point		----	----	No Estimate	----	----	--
124	San Jose/Armijo 3000-800 BC	----	12A 3200- 1300 BC	---- ----	P-19 3000-500 BC	3200 - 500 BC	----	----	6.13A
LA 25419									
FS 1	----	T-17 1000 BC-AD 400	08 3000-400 BC	----	P-22 1000 BC-AD 700	[3000]/1000 BC - AD 700	AD 966-1072 AD 1026-1104	87-321A (A-9) 87-321B	6.8A
4	----	Unidentified Large Dart Point		----	----	No Estimate	----	----	--
35	En Medio 800 BC-AD 400	(T-36) AD 600-1300	(04) AD 500-1000	---- ----	P-88 AD 1000-1400	800 BC - AD 1400	AD 1443-1491 AD 1249-1307 AD 896- 938	87-332A (A-10) 87-322B 87-322B	6.8E

Table 6.10 (continued)

Site/FS Number	Irwin-Williams (1973) Schaafsma (1976)	Thoms (1977)	Lord & Cella (1985)	Bertram et al. (1987)	Anderson (1985)	Cross Date Time Span	Obsidian Hydration Dates	Lab Number	Figure
60	En Medio	T-20	06A	----	P-31	1000 BC-AD 1000	----	----	6.13E
	800 BC-AD 400	1000 BC-AD 400	1000 BC-AD 400	----	1000 BC-AD 1000				
62	----	Unidentified Large Dart Point		----	----	No Estimate	----	----	--
65	----	Preform	----	----	P-51	AD 800-1750	----	----	6.13D
					AD 800-1750				
72	----	Unidentified Large Dart Point		----	----	No Estimate	----	----	--
105/	(Bajada)	T-28	11	27018-12	P-47	4800 - 300 BC	----	----	6.13J
108	4800-3200 BC	4000-500 BC	4000-500 BC	3200-2300 BC	3000-300 BC				
164	----	Unidentified Large Dart Point		----	----	No Estimate	----	----	--
165	----	Thin Biface Preform		----	----	No Estimate	----	----	--
166	(Bajada)	T-28	11	27018-12	P-49	4800 BC-AD 1000	----	----	6.13H
	4800-3200 BC	4000-500 BC	4000-500 BC	3200-2300 BC	3300 BC-AD 1000				

Table 6.10 (continued)

Site/FS Number	Irwin-Williams (1973) Schaafsma (1976)	Thoms (1977)	Lord & Cella (1985)	Bertram et al. (1987)	Anderson (1985)	Cross Date Time Span	Obsidian Hydration Dates	Lab Number	Figure
171	----	T-22 1000 BC-AD 400	----	----	(P-28) (500 BC-AD 1150)	1000 BC-AD 1150	----	----	6.13I
174	En Medio 800 BC-AD 400	(T-14, 23) 1500 BC-AD 400	(06D) 1000 BC-AD 400	----	(P-30) 500 BC-AD 600	1500 BC-AD 600	----	----	6.13F
175	Armijo 1800-800 BC	T-7 3000- 500 BC	(06A) 1000 BC-AD 500	Fig. 5D ----	(P-29, 34) 2000 BC-AD 1000	[3000]/2000 BC - AD 1000	63 BC-AD 15 5 BC-AD 107 141 - 43 BC	87-320A (A-8) 87-320B 87-320C	6.8D
176	Trujillo AD 400-600	(T-32) AD 300-850	04 AD 500-1000	----	P-63 AD 500-1400	AD 300 - 1400	----	----	6.13G
186	(Armijo) 1800-800 BC	(T-17) 1250- 500 BC	----	----	(P-35) 3000 BC-AD 1000	3000 BC - AD 1000	457-289 BC AD 261-331	87-323A (A-11) 87-323B	6.8C
191	(Bajada/San Jose) 4800-1800 BC	T-3 7000-2000 BC	(13) 4000-2000 BC	Fig. 6A Fig.(5D)	P-1 6500-5900 BC	7000 - 1800 BC	AD 77-277 (1) AD 303-503 (1)	87-324A (A-12) 87-324B	6.8B

(1) Cerro del Medio obsidian; all others are from Polvadera source. ( ) Closest resemblance. [ ] Isolated date from one report.

(2) *Obsidian hydration dates*

styles. This age congruence is not a result of independently validated chronologies, as much as it reflects the perpetuation by Schaafsma (1976), Thoms (1977), and to some extent Lord and Cella (1986) of age estimates from the Oshara Tradition sequence. The tremendous influence of the Oshara Tradition data in formulating chronological sequences thoughout northern New Mexico may be unwarranted and certainly requires closer examination.

The Oshara Tradition is based on data derived from a six-year Anasazi Origins Project focused on the Arroyo Cuervo region of northwestern New Mexico (Irwin-Williams 1973). Six sequential phases spanning the Archaic through Basketmaker Periods have been delineated. The salient characteristics of site distributions, material content and age estimates have been briefly delineated for each phase, but to date little primary information is available to objectively assess specific details for most of the sequence (cf. Irwin-Williams and Tompkins 1968). Select projectile point styles and other tools regarded as "representative" of each phase are illustrated by a single photograph (Irwin-Williams 1973), but no formal point typology exists for the entire sequence which provides fundamental descriptions, quantifications, or discussions about the range of variation. The provenience and context of projectile point styles remain unknown, as do specific chronometric dates used to delineate the age of the phases. Although the Oshara Tradition is one of the few cultural constructs spanning the entire Archaic Period with readily definable attributes, the characteristics of each phase cannot be evaluated.

Despite these drawbacks, subsequent researchers have utilized general projectile point styles depicted for the Oshara Tradition in order to derive temporal and cultural assignments of other materials. Thus, the heterogeneous point styles assigned to a phase automatically became lumped together and assumed the name of that phase (cf. Schaafsma 1976). Typological studies by Thoms (1977) formally defined a series of types, but the temporal ranges were primarily based on the original Oshara age estimates for phases. Subsequent analyses have refined and built on these studies, but the independent assessment of the regional chronology using obsidian hydration has only been initiated within the past five years (Lord and Cella 1986, Bertram et al. 1987, Bertram 1987).

An examination of Table 6.10 indicates that between 13 and 16 of the 28 recovered projectile points were tentatively correlated with types listed in the sequences developed by Irwin-Williams (1973) Schaafsma (1976), Thoms (1977), Lord and Cella (1986), and Anderson (1985). Since a small original sample size restricted the correlation of only four specimens in the Bertram (1987) sequence, no further discussion of this data set is warranted. The perpetuation of the chronological sequences, as discussed above, has resulted in fair agreement in the age assessment of points for the Irwin-Williams (1973) and Thoms (1977) sequences. The Lord and Cella (1986) sequence frequently uses similar time ranges, but the occasional use of obsidian hydration data has resulted in some refinements. The point sequence developed by Anderson (1985) is more conservative in reflecting longer age estimate ranges, but nevertheless reflects greater divergence from the age estimates of the other schemes.

Correlation of these various schemes suggests that all four identifiable points from LA 25421 are cross-dated to ca. 3000 B.C. - A.D. 400 and tentatively reflect Middle-Late Archaic Period (Armijo and En Medio Phases) occupations.

Similarly, the three identified points from LA 25417 are cross dated to ca. 3200/1800-800 B.C. and probably relate to the Armijo Phase of the Late Archaic Period. The 12 identifiable points from LA 25419 are cross dated primarily to 4800 B.C. - A.D. 1000, even though there are single examples of points that could extend the range of occupations from 7000 B.C. to A.D. 1750. These age ranges are regarded as tentative since they are based exclusively on the ages of cross-dated point styles. The reliability of these estimates using obsidian hydration is evaluated in the next section.

6.2.4.3 Chronological Evaluation

Ten of the projectile points were directly dated by obsidian hydration methods (Section 6.2.1, Appendix A). Eight of these 10 points were classifiable and thus were used to derive cross-date estimates (Table 6.10). The obsidian hydration results for these specimens were employed to independently evaluate the validity of the estimated age ranges provided by the cross-dated methods. Table 6.10 shows that the concurrence of correct cross-dated age estimates and the obsidian hydration dates for each scheme is as follows: the Irwin-Williams (1973) Oshara sequence: 2 of 7 (29%); Thoms' northern Rio Grande sequence: 3 of 7 (43%); Lord and Cella's (1986) Abiquiu Reservoir sequence: 3 of 6 (50%); and Anderson's (1985) western Plains sequence: 4 of 6 (66%) correct. The higher incidence of Anderson's (1985) correct estimates may be due to the large sample size, the detailed comparisons, and the longer time span attributed to many styles. Although the concurrence for individual schemes is low (especially for those specifically designed for northwestern New Mexico), only three of eight specimens yielded obsidian hydration dates beyond the age estimate ranges of all schemes. These data support other preliminary studies which caution against relying too much on using only projectile point morphology for determining strict temporal and cultural affiliations (Lord and Cella 1986, Bertram et al. 1987, Bertram 1987). Nevertheless, the obsidian dates and cross dates confirm that the points reflect multiple periods.

The obsidian hydration dates on projectile points span over three and a half millennia. The sample of dated points is too small to delineate trends. Based primarily on single examples the following temporal patterns are tentatively identified:

1) The discrepancy in obsidian hydration dates for haft elements and broken tips often spans 200 to 500 years and reflects either considerable recycling/reuse of earlier point forms, or consistent damage of lost/discarded specimens a few hundred years after deposition.

2) Blade edge serrations may span the past 5,000 years and be a poor chronological indicator. Relatively thin points with continuously serrated blade edges date as early as 2433-2263 B.C. and elongated side-notched arrow points (haft elements <9 mm) with discontinuous serrated edges were made at least by A.D. 1249-1500.

3) Observation by Bertram (1987) that medium and large dart points and elongated arrow forms persist into the Developmental Period is supported by the present data.

4) The point styles (size and shape) delineated for phases of the Oshara Tradition frequently exceed the suggested temporal range for the phase. This suggests that the original phase age estimates are in error, or that multiple point styles co-occur and persisted for a longer duration than originally thought. This study has shown that the Oshara Tradition classification strongly needs to be reexamined, expanded, or refined. Because of assumptions made in estimating the correct hydration rate, the obsidian dates from this study cannot in themselves directly change the Oshara classification. They can be used, however, in conjunction with similar studies using different dating methods and different obsidian hydration rate estimates to refine the classification for the Abiquiu area.

6.2.5 Aboriginal Ceramics

A total of eight potsherds was collected, and three others were observed in the field during the 1987 field work. These sherds were examined and assigned to three types by Charles Carrillo. Petrographic analysis was conducted by Dr. Betty Garrett (Appendix D). Three of six observed sherds were collected from a site north of and distinct from LA 25421, and five sherds were found near two cobble rings at LA 25417. This section describes the three pottery types and discusses their inferred ages.

6.2.5.1 Plainware

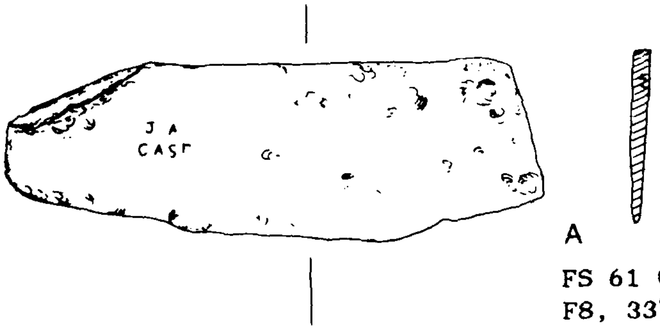
Three dark gray plainware sherds were picked up along the Piedra Lumbre Grant-U.S. Forest Service fence line, approximately 347^{o} and 90 m north of Datum A at LA 25421. Two body and one rim sherds were collected. The rim is direct with a rounded lip (Figure 6.14C). The sherds have a thickness of 5.7 mm, and the interiors are smudged. Macroscopic examination indicated that these sherds have a granular, sandy surface which appeared to have been floated. Traces of mica were visible on the surface, but its presence was accentuated from the floated surface finish. The temper macroscopically appears to be biotite and feldspar (Charles Carrillo, 1988 personal communication). Petrographic analysis indicated that the dominant aplastic inclusions are quartz-mica schist (Appendix D).

These sherds could be classified as Carnue Plain (Dick 1968), heavily striated (Kidder and Shepard 1936:326), or Manzano Coarse (Hurt and Dick 1946:281). Carnue Plain is described as semi-polished on the interior, with parallel polishing marks prominent, exteriors scraped and/or wiped, and the pull of the temper grains over the surface producing coarse to fine striae (Dick 1968:85). Colors range from reddish brown to black, and globular bodies are the most common form (Carrillo 1987c). Charles Carrillo (1988 personal communication} identifies the sherds to a more generic gray Tewa utility ware which frequently dates between A.D. 1450 and 1700.

6.2.5.2 Smeared Indented Corrugated

A single body sherd (FS 156) identified by Charles Carrillo as smeared indented corrugated was found near cobble ring Feature 8 at LA 25417. The sherd

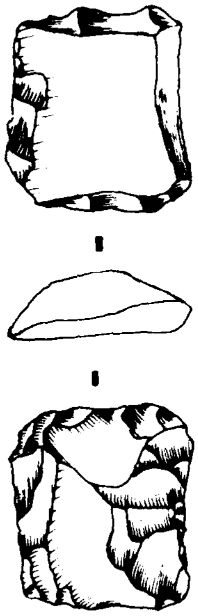
Figure 6.14 Aboriginal Ceramics, and Historic Artifacts, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



A

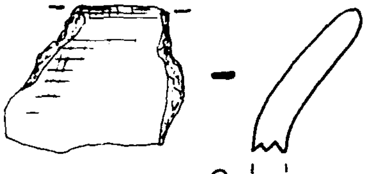
FS 61 Case Knife
F8, 33°, 24.05 m

LA25419



B

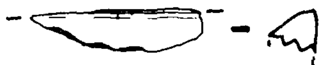
FS 64 Gunflint
F8, 356°, 20.40 m



C
Plainware Rim

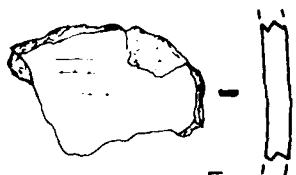
Site North of LA 25421

LA 25417



D

FS 2 Chacon Micaceous Rim
F2, TU6, 0-10 cm



E

FS 1 Chacon Micaceous Sherd
F2, TU6, 5 cm

was destroyed during petrographic analysis and is consequently not illustrated. It has a thickness of 4.6 mm and is not smudged. Macroscopic examination suggested that it was tuff tempered with some biotite; the petrographic report confirms that it has basaltic rock fragment temper with a few quartz sand grains (Appendix D).

This pottery is ubiquitous and cannot be assigned to a specific type. The pottery is not well dated or described for this region. Usually the estimated dates begin ca. A.D. 1200-1300, but the type could have continued into later protohistoric periods (Charles Carrillo, 1988 personal communication).

6.2.5.3 Chacon Micaceous Plainware

One rim sherd (Figure 6.14D) and three body sherds (the largest is illustrated in Figure 6.14E) were recovered from surface and excavated contexts within cobble ring Feature 2 at LA 25417. All are part of a single micaceous vessel. The rim sherd (Figure 6.14D) has a distinctive square lip which probably indicates trimming of excess clay with a knife (Charles Carrillo, 1988 personal communication). Sherd thicknesses range from 3.7 to 3.8 mm. All have smudged blackened interiors. The sherds have a floated surface with fine, raised striations. The dense micaceous clay is probably from the La Madera or Petaca area of the Sangre de Cristo Mountains. Petrographic analysis indicates that the aplastic inclusion is a quartz-mica schist (Appendix D).

These sherds are identified as Chacon Micaceous primarily on the basis of the distinctive squared rim, the paste, temper, and surface treatment. This undecorated ware very much resembles Cimarron Micaceous except that it is not made from micaceous clay. The slip or float is micaceous, however, and the temper is a crushed micaceous schist (Carrillo 1987a:300). The technology is attributed to Apachean origin, although this late ware does not have the deep striations characteristic of the earlier Apachean wares (e.g., Ocate Micaceous [Gunnerson 1987]). Carrillo (1988 personal communication) believes that these technological change and that Chacon Micaceous reflects production for market demands by the Hispanic populations. The major differences between the Apachean and Hispanic pottery is that Hispanic potters tend to wipe the rim with a rag which leaves a rounded rim, and that their pots have a single loop handle used to remove cooking pots from corner fireplaces. Replication studies have shown that micaceous pots tolerate higher temperatures, resist thermal shock, tend not to get overly hot near the neck portion, and are easier to clean than earthen vessels tempered with sand or crushed rock (Charles Carrillo, 1988 personal communication).

Because of a growing consensus that southern Athabaskan ceramics derived from both Pueblo and Plains village sources, the 1985 Southern Athabaskan Ceramics Conference renamed Jicarilla Apache wares as Sangre de Cristo Micaceous wares. The Cimarron Micaceous and Ocate Micaceous type names have been retained (Baugh and Eddy 1987:797). Bill Buckles (1988 personal communication) supports the omission of ethnic labels, noting that widespread pottery trading and distribution may have served to make ethnic labels meaningless.

Chacon Micaceous was used during the eighteenth and ninteenth centuries. This type was terminated when a company purchased the lands containing the distinctive clay source to mine biotite and other minerals during the late 1800s (Charles Carrillo, 1988 personal communication).

6.2.6 Historic Artifacts

A small amount of historic artifacts was recovered from two of the Abiquiu Reservoir sites. Three glass beads and a metal band/strap were recovered from LA 25417, and four metal can parts, a knife blade, and a gunflint were found on LA 25419. In addition, one aluminum pull-top can and five clear glass sherds were observed at LA 25419; these latter items are recent and are discussed in Chapter 5.0. The collected materials are described and the chronometric potential is discussed for each class of artifacts. The provenience of these historic materials is provided in Table 6.11.

6.2.6.1 Glass Beads

Three glass beads of different styles were found inside cobble ring Feature 2. The description of these beads follows the format and terminology developed by Harris and Harris (1967). The Harris bead morphology classification employs terminology widely used by the French during the early eighteenth century (Thwaites 1959:143). Harris and Harris employ the following bead diameter gradation as a size scale for classifying historic trade beads: 0-2 mm is extra small; 2-4 mm is small; 4-6 mm is medium; and over 6 mm is large.

Two specimens (FS-110 and Flotation Sample 1) are small, donut-shaped, opaque glass, turquoise or sky blue beads which measure 3.6 mm in diameter. They appear to have been made by the hollow rod (stretched glass rod) method; the rounded edges indicate they were tumbled. The beads conform to Harris type 79 (sky blue) or 140 (turquoise).

The third specimen (FS-3) is one end of a medium sized, olive (biconical) shaped, opaque black bead with a surface that tapers from 3.7 mm to in excess of 4.8 mm. It has a spiral groove near the tip end, which suggests that it was manufactured by the mandrel-wound (wire wrapped) method. The bead conforms to Harris type 108, and also Good (1972) Type 38.

A chronometric study of 106,354 glass trade beads from Wichita Indian sites in Texas and Oklahoma (A.D. 1700-1850) has provided age ranges for beads similar to those found at Abiquiu Reservoir (Harris and Harris 1967). Harris donut-shaped bead type 79 first appears on Wichita sites by A.D. 1740 and is common throughout the duration of occupation; Harris type 140 occurs after ca. A.D. 1820. The olive-shaped bead, type 108, occurs on Wichita sites between A.D. 1767 and 1820. Similar olive types have also been reported from Kaskaskia Village, Illinois (A.D. 1703-1832); Fort Michilimackinac, Michigan (A.D. 1715-1781); and Conesoga, Tennessee (before A.D. 1838; Good 1972). Most of the terminal dates reflect the date of site abandonments, rather than the manufacturing discontinuation of the bead forms. Based on these date ranges, the glass trade beads from Abiquiu possibly date from A.D 1740 to 1880.

Table 6.11 Provenience of Historic Artifacts, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Artifact Class/ Site Number	Field Specimen	Provenience
Glass Beads		
LA 25417	FS-3	Feature 2. T.U. 6; 20 cm N/110 cm E, 5 cm bs
LA 25417	Sample 1	Feature 2. T.U. 6; 0-5 cm, Level 1
LA 25417	FS-110	Feature 2. Temp Datum 2, 354 degrees, 4.10 m, surface
Gunflint		
LA 25419	FS-64	Datum F-8,356 degrees, 20.4 m, surface
Knife Blade		
LA 25419	FS-61	Datum F-8, 33 degrees, 24.05 m, surface
Metal Cans		
LA 25419	FS-49	Datum F-5, 237 degrees, 4.80 m, surface
LA 25419	FS-79	Datum F-8, 164 degrees, 16.90 m, surface
LA 25419	FS-80	Datum F-8, 160 degrees, 16.05 m, surface
LA 25419	FS-194	Datum F-40, 48 degrees, 33.35 m, surface
Metal Strip		
LA 25417	FS-246	Feature 1, T.U. 2, NW corner, surface

6.2.6.2 Gunflint

A single gunflint was found near Feature 8 at site LA 25419. Flintlocks fired projectiles by means of sparks struck by a flint, held in a cock or hammer, against a hard steel battery or frizzen. The pan beneath the frizzen held the priming powder which fired the weapon (Russell 1962). It is a rectangular piece of chipped Pedernal chert which measures 24.7 x 27.6 x 10.6 mm. The specimen has steep beveling along all edges on the ventral face, and the two faces are relatively planar (Figure 6.14B). One edge is slightly concave and displays extensive battering, which presumably occurred when the flint struck the frizzen or battery. The use of Pedernal chert suggests that replacements were locally manufactured for economic or convenience factors.

Flintlocks were used from the mid-seventeenth century until they were replaced by paper or metallic cartridges (Russell 1962, Barnes 1980). Major drawbacks to the use of gunflint weapons involved the short life span and, with some flint types, the high incidence of misfires. The 1861 U.S. Army Ordnance Manual (Mordecai 1861) identifies three gunflint sizes for military service muskets, rifles, and pistols. Table 6.12 provides the range of standard gunflint sizes specified by the U.S. Army Ordnance Manual and measured from the Francis

Bannerman collection purchased from U.S. Army stores. Although the locally made gunflint does not strictly adhere to government specifications, the width dimension (not subjected as is the length dimension to resharpening) suggests that the flint was used in a musket. The ordnance manual also notes that a good musket flint will last for more than 50 fires; flints were issued to the troops in a proportion of one flint to 20 rounds (Russell 1962:237). Presumably, gunflints could last longer than 20 rounds; however, under military engagements, flint replacement was more expedient than constant resharpening of worn-out flints.

Table 6.12 Standard Sizes of Gunflints based on the 1849 U.S. Army Ordnance Manual and a Sample of Measured Flints Purchased by Bannerman from U.S. Army Stores (Smith 1960:48), Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

		Length (mm)	Width (mm)	Thickness (mm)
Musket	U.S. Specifications:	30.5 - 38.1	27.5 - 28.7	6.6 - 8.4
	Bannerman:	27 - 35	24 - 31	5 - 11
Rifle	U.S. Specifications:	24.9 - 30.5	20.3 - 22.4	5.1 - 7.4
	Bannerman:	25 - 29	20 - 25	4 - 9
Pistol	U.S. Specifications:	23.6 - 27.7	21.3 - 23.3	5.3 - 6.9
	Bannerman:	21 - 26	18 - 22	5 - 9

Although paper or metallic cartridges first appear ca. 1845, their widespread adoption took considerable time, during which gunflints were still in use. Extensive evolution of metallic cartridges occurred during the Civil War, and by 1866 and 1867, center prime cartridges were developed. Although employing self-contained cartridges was undoubtedly preferred over weapons utilizing gunflints, the older weapons were frequently used, particularly in rural areas, until the latter part of the nineteenth century. The estimated age of the gunflint specimen is probably bracketed between A.D. 1650 and ca. 1870 or 1880.

6.2.6.3 Knife Blade

An extensively corroded knife blade was recovered near Feature 8 at LA 25419. The specimen is from a clasp knife broken at the tip and near the shank or handle. The name "JA/CASE" is stamped into the side of the blade and identifies the company that manufactured the knife. Dimensions on the broken specimen are 7.04+ x 2.29 x 0.20 cm. The distal end of the blade back has been extensively battered, and the opposing edge is blunted (Figure 6.14A). It appears as if the knife was used in conjunction with a hammer or axe for precision cutting of some dense materials, such as splitting wood, or punch-cutting metal.

Clasp knives were a frequently sought trade item because of their versatility. Case knives have been continuously manufactured since the 1840s (Frank Shofner, 1988 personal communication; Ferguson 1974). The company was founded in 1847 by W.R. Case, who learned knife making from his brother-in-law, R.N. Platt, who had a cottage industry knife company in Little Valley, New York, beginning ca. 1820. The Case Knife Company moved to Bradford, Pennsylvania, in the 1860s where it was family owned for about 100 years. No chronometric information is available from the damaged condition of the blade; the "JA" may refer to either Jean or Andrew J. Case, second generation members of the knife making firm. Jean Case became a top salesman as a young man; he was said to be the first man ever to carry a line of cutlery samples west of the Mississippi River (Ferguson 1974:47). This artifact thus postdates 1840.

6.2.6.4 Metal Cans

Four corroded can parts were collected from LA 25419; another, more recent can was noted but not picked up at the same site. Three collected cans and one observed can were from the northeast point of the southern site area (near Features 5 and 8). The collected specimens from Features 5 and 8 consisted of one small, cylindrical, internally crimped seam "4 oz" size (2-11/16-inch diameter by 2-3/16-inch length) can with an attached lid; one short, rectangular, crimped seam can with a lid which resembles a "fish tin"; and the lid of a solder dot can that was approximately an 8-oz container (slightly less than 3 inches in diameter). Jagged edges on all three cans suggest that they had been cut open with a knife. The fourth can observed at Feature 8 but not collected was an aluminum pull-top type tin with a tapioca pudding paper label. The fifth, collected near Feature 40 in the northwest part of the northern site area, is the lid from a No. 2 can size (slightly less than 3-7/16-inch diameter). This lid has a smooth, albeit slightly sinuous symmetrical cut near the rim which suggests that it had been opened using some device similar to the military issued P-38 opener. The different method of opening the can and the spatial distance between the two areas with corroded cans probably indicate separate components.

Crimped seam cans were developed in 1869, became popular in the middle 1880s, and were widely accepted after 1903. The solder dot method of sealing cans was developed ca. 1856 and was generally replaced by the sanitary can which was developed ca. 1904 and widely used after 1922. Some products, such as condensed milk, use solder dot cans to the present (Busch 1981, Fontana and Greenleaf 1962, Intermountain Antiquities Computer System 1986). Thus, the corroded cans may date from the mid-1880s through the 1920s. The aluminum pull-top can with paper label is believed to be less than five years old.

6.2.6.5 Metal Strip

A single corroded iron strip or band was found inside cobble ring Feature 1 at LA 25417. It measures 7.4 x 2.0 x 0.1 cm thick. The specimen is slightly bent, and the break at one end appears to have been made at a fold. It bears no modification or cut marks. The use of this fairly lightweight band is unknown, but it may have been used to bind bundles of goods. This item may have been discarded scrap once intended for subsequent modification into a point or other artifact. No chronometric information is available for this object.

6.2.6.6 Summary

Chronometric information derived from the historic materials reflects several periods of historic usage. The beads from LA 25417 best date between 1740 and 1880. The gunflint and perhaps the knife may represent the Native American occupation at LA 25419. These items were made from A.D. 1650/1847 to ca. 1880/present; however, the dates for these two artifacts overlap between 1847 and the 1880s. Most of the corroded cans probably date between the 1880s and 1920s; the three cans (and possibly the case knife and gunflint) found on the east tip of the southern part of LA 25419 are probably associated with the unidentified historic corral-like structure (Feature 8). The difference in methods employed to open these three cans and the corroded one from the northwest part of the same site probably indicates separate components. This latter can, which was apparently opened by a P-38 type opener, may be associated with five pieces of clear glass fragments observed at Feature 35 in the same general part of the site. The most recent historic component is reflected by the aluminum tapioca can and a hearth feature located inside Feature 8 at LA 25419, which are believed to have been used within the past five years.

6.2.7 Faunal Remains

Ten bone fragments were found at the three Abiquiu sites, one from LA 25421 and the remainder from LA 25417. The item collected from the vicinity of Temporary Datum G on LA 25421 was a large mammal tooth enamel fragment.

The bone fragments from LA 25417 were excavated from hearth Feature 1B inside ring Feature 1. Found with the hearth contents above an ash layer were a mule deer (*Odocoileus hemionus*) phalange, two large mammal unidentified element fragments, and six unidentified bone fragments. The mule deer phalange was a complete right digit II of an immature or juvenile animal. The bones were unburned and weighed 2.7 g total.

6.2.8 Comparison of Dates from Three Cobble Ring Sites

This section discusses site provenience dates derived from obsidian hydration, C-14, and archaeomagnetic dating. Also discussed are dates of temporally diagnostic artifacts such as points, ceramics, beads, and metal artifacts. No stratigraphic analysis of artifacts and features is possible because of the very low recovery of subsurface materials and the lack of cultural stratification due to erosion. The reader should compare the site maps in Section 6.1 (Figures 6.1, 6.3-6.6) with the schematic chronology maps (Figures 6.15-6.17). The latter are designed to provide a visual representation of both chronometric and cross dates from the sites. Because of multicomponency at these sites, only features directly associated with dated artifacts or samples are assigned to a specific phase or period. The one- to two-letter abbreviations represent Oshara Archaic phases and Anasazi and historical periods. Cross-dated artifacts are enclosed in parentheses, and hyphens connect different phase or period dates or a range of dates on a single artifact. Commas indicate different artifacts in one location. For example, "D-CL" means two chronometric dates (obsidian in this case) on a single artifact. "(S-A)-D" indicates a single point cross-dated to the San Jose and Armijo Phases and obsidian dated to the Developmental Period. "(S-A-E)-S-A" represents a single point cross dated to the

San Jose, Armijo, and En Medio phases with two additional obsidian hydration dates falling into the San Jose and Armijo phases.

6.2.8.1 LA 25421

LA 25421 represents a maximum of five different occupations ranging from Late Archaic phases to the Rio Grande Classic (Figure 6.15). The oldest, San Jose Phase (Late Archaic, 3,000-1,800 B.C.; Irwin-Williams 1973), is represented by a C-14 sample from Feature 2 and three points within a 20-m radius (FS 101, FS 83, and FS 91), all of which are cross-dated to overlap this phase and later phases. The Armijo Phase (1,800-800 B.C.; Irwin-Williams 1973) is represented by an obsidian hydration date on a point tip (FS 91) and the cross dates on this and three other points (FS 102, FS 101, and FS 83) with overlapping cross dates. The En Medio Phase of the Late Archaic (800 B.C.-A.D. 400; Irwin-Williams 1973) is reflected in the two easternmost of these points (FS 83 and FS 91) and, more reliably, by an obsidian hydration date on the side notches of FS 91, the broken tip of which dated to the Armijo Phase. The Developmental Period of the Rio Grande classification (A.D. 600-1200; Wendorf and Reed 1955) is indicated by three obsidian hydration readings, two on FS 101 in the northwest central part of the site and one from a flake in cobble ring Feature 3. Finally, the Rio Grande Classic Period (A.D. 1325-1600; Wendorf and Reed 1955) is represented by a second reading on the flake in Feature 3. Tewa utility sherds from the Piedra Lumbre Grant/U.S. Forest Service fence northwest of the site, about 90 m north-northwest from Datum A on LA 25421, indicate use of a nearby area during this period. If one ignores the cross-dated points, which span the San Jose to En Medio Phases, then chronometrically dated occupation at the site is confirmed for the Armijo and En Medio Phases, as well as the Developmental and Rio Grande Classic Periods. There is no information independent of the cross-dated points for a San Jose Phase occupation. The dates from one of the cobble rings are for Developmental and Rio Grande Classic occupation, while the concentration of hearths and fire-cracked rock upslope indicates dates from San Jose to Developmental occupations.

6.2.8.2 LA 26417

There is evidence of six occupations at LA 25417 (Figure 6.16). Again, the San Jose Phase of the Late Archaic is the earliest occupation. This phase is represented on the northern part of the site by an obsidian hydration reading on FS 18, a point in Lithic Concentration 3. On the central part of the site, the San Jose Phase is indicated by a C-14 date from small, dispersed charcoal beneath a fire-cracked rock concentration in the center of cobble ring Feature 1. On the southern portion of the site, the phase is represented by obsidian hydration readings on the blade edge of point FS 115 and FS 114 (readings on the notch and tip), and by a cross date on point FS 124. The Armijo Phase of the Late Archaic is reflected by cross dates on points FS 18 and FS 37 on the northern part of the site and obsidian hydration on the haft of point FS 115 on the southern part of the site. En Medio Phase occupation is indicated by point FS 124 on the southern part of the site, which is cross-dated to this phase. Developmental Period occupation is represented by two obsidian hydration dates on flakes from cobble ring Feature 3 on the northern half of the site and one obsidian hydration date from a flake from cobble ring Feature 2 on the southern part of the site. Coalition Period occupation (A.D. 1200-1325; Wendorf and Reed 1955) is reflected in a smeared indented corrugated sherd from cobble ring Feature 8 in the southern

Figure 6.15 Dated Occupations at LA 25421, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

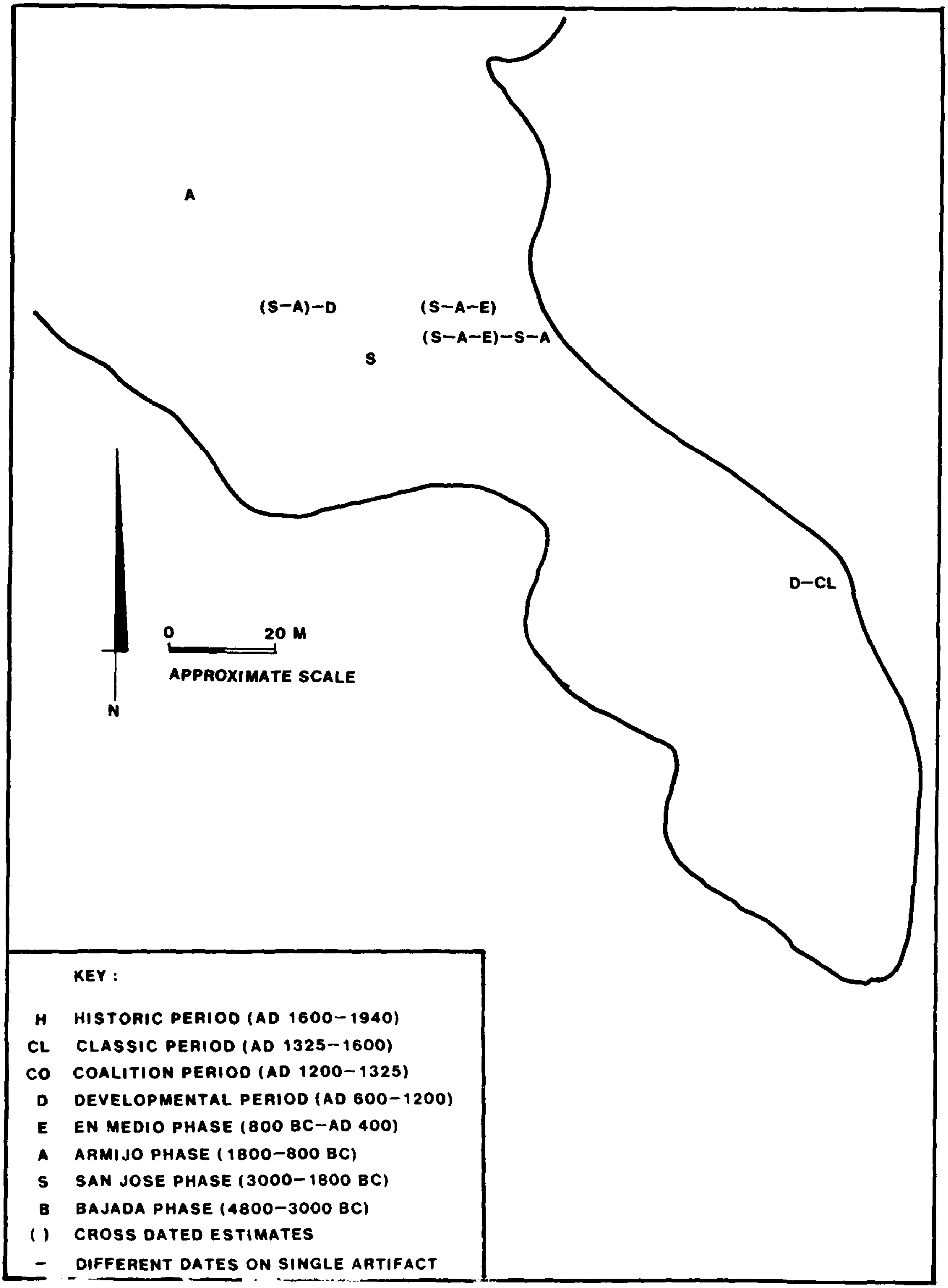
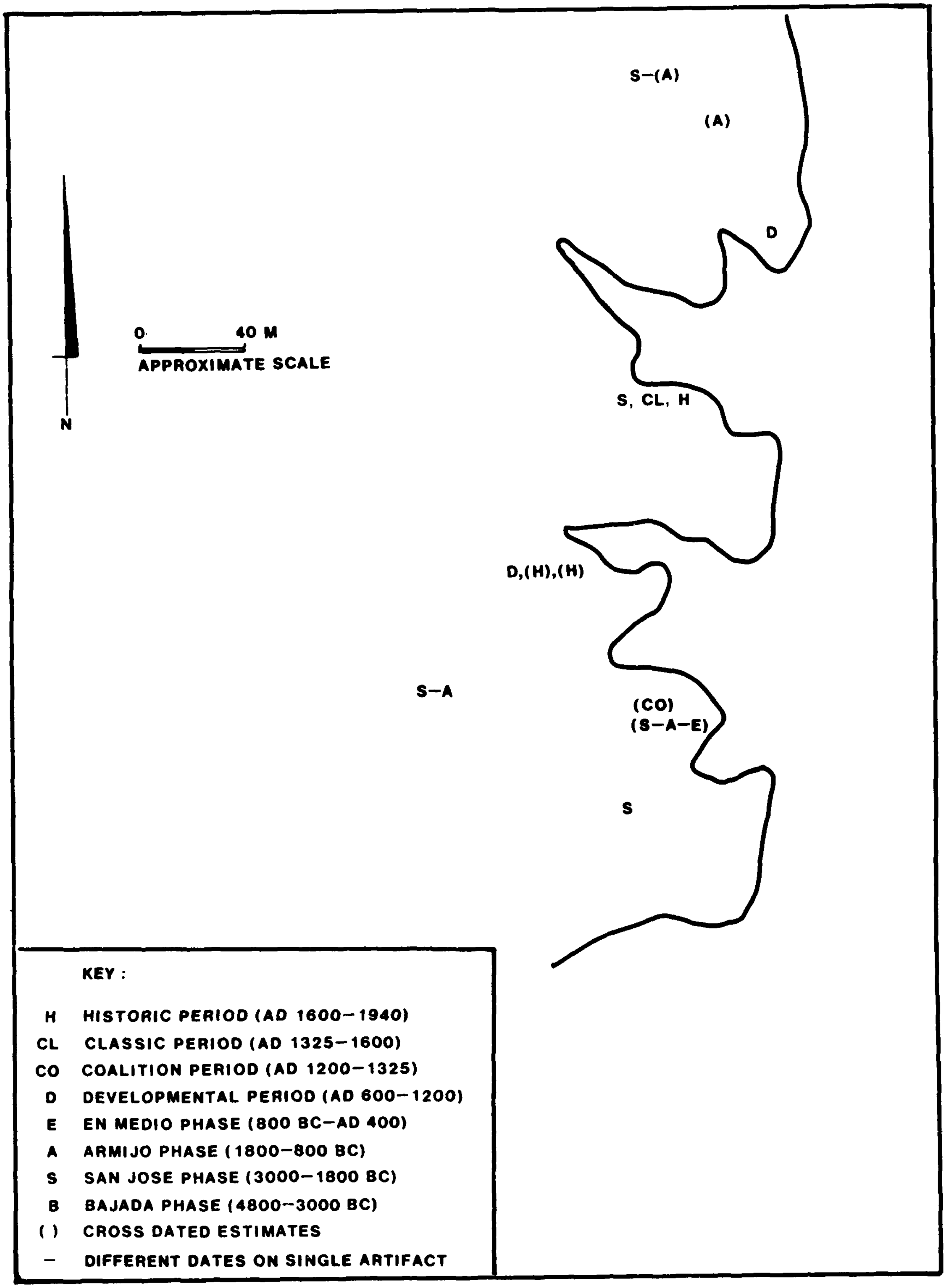


Figure 6.16 Dated Occupations at LA 25417, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



part of the site; this ceramic type is generally dated to the A.D. 1200-1300 period although it may have lasted longer. Rio Grande Classic occupation is indicated by a C-14 date from wood charcoal in a basin firepit in cobble ring Feature 1 in the central portion of the site. Finally, historic occupation is suggested by materials in the southern and central portions of the site. On the south terrace are Chacon Micaceous sherds dated to A.D. 1830-1870 and two different beads dated to A.D. 1740-1880, indicating a probable occupation in the 1800s.

On the central terrace is an archaeomagnetic date for the pre-1870-1970 period from the basin firepit in Feature 1. Because the archaeomagnetic curve for the Historic Period is very incomplete, the archaeomagnetic date falls into the period between the very late protohistoric, considerably later than A.D. 1400, and 1870. The assemblage at this feature is similar to the cobble ring Schaafsma (1978:21-22) excavated at AR-9. That ring contained a central hearth archaeomagnetically dating to the late nineteenth century along with a brass button, pendant, and miscellaneous metal and lithics.

The archaeomagnetic and C-14 dates for the Feature 1 basin firepit are inconsistent. The archaeomagnetic date is consistent with the evidence of the beads and sherds for an 1800s occupation, while the C-14 date is not supported elsewhere on the site. Despite the imprecision of the archaeomagnetic date, it may be more reliable than the C-14 date. The charcoal sample involved was fairly large and contained coal; the latter was removed by floating the sample since coal sinks in water. The C-14 date may be too old because of any remaining coal or because the pinyon or juniper used was "old wood." Dead wood is a fairly common occurrence along the river and tributary terraces. Environmental conditions may enhance greatly the postmortem survivability of wood. Arid, high elevations settings in particular can suppress processes of biodegradation. In a setting such as Abiquiu, much of the fuel wood could have been culled from the supply of dead wood. "The primary implication is that, in cultural contexts associated with cooking or heating, the probability of significant if not considerable built-in age will be very high" (Smiley 1985:130-131). The fact that an uncharred corn cob from LA 25419 was dated 500 years old suggests that some organic remains (<u>not</u> including bone) preserve well in shallow site soils or at the surface of the Abiquiu sites.

The best dated occupations are the possible San Jose Phase Lithic Concentration 3 and the Developmental cobble ring on the northern part of LA 25417, San Jose Phase and historic occupation in the vicinity of Feature 1 on the central terrace, and San Jose Phase and historic occupation on the southern terrace. Dates for LA 25417 are less dependent on cross-dated points than those for LA 25421. Also in contrast to LA 25421 is the relative abundance of cobble ring dates for this site. There are dates on four of the eight cobble rings on the site, although dates for three of these rings indicate multiple occupations. Only the two dates for Feature 3 on the northern portion indicate a single (Developmental Period) occupation. Dates for Feature 1 on the central terrace indicate an A.D. 1800s occupation overlying a San Jose Phase occupation. For Feature 2 and Feature 8, in the southern portion of the site, Developmental, 1800s (Feature 2), San Jose through En Medio Phase, and Coalition Period occupations are indicated. Occupations away from cobble rings, upslope from the terrace edge, are all Late Archaic, and most are San Jose and Armijo Phase occupations.

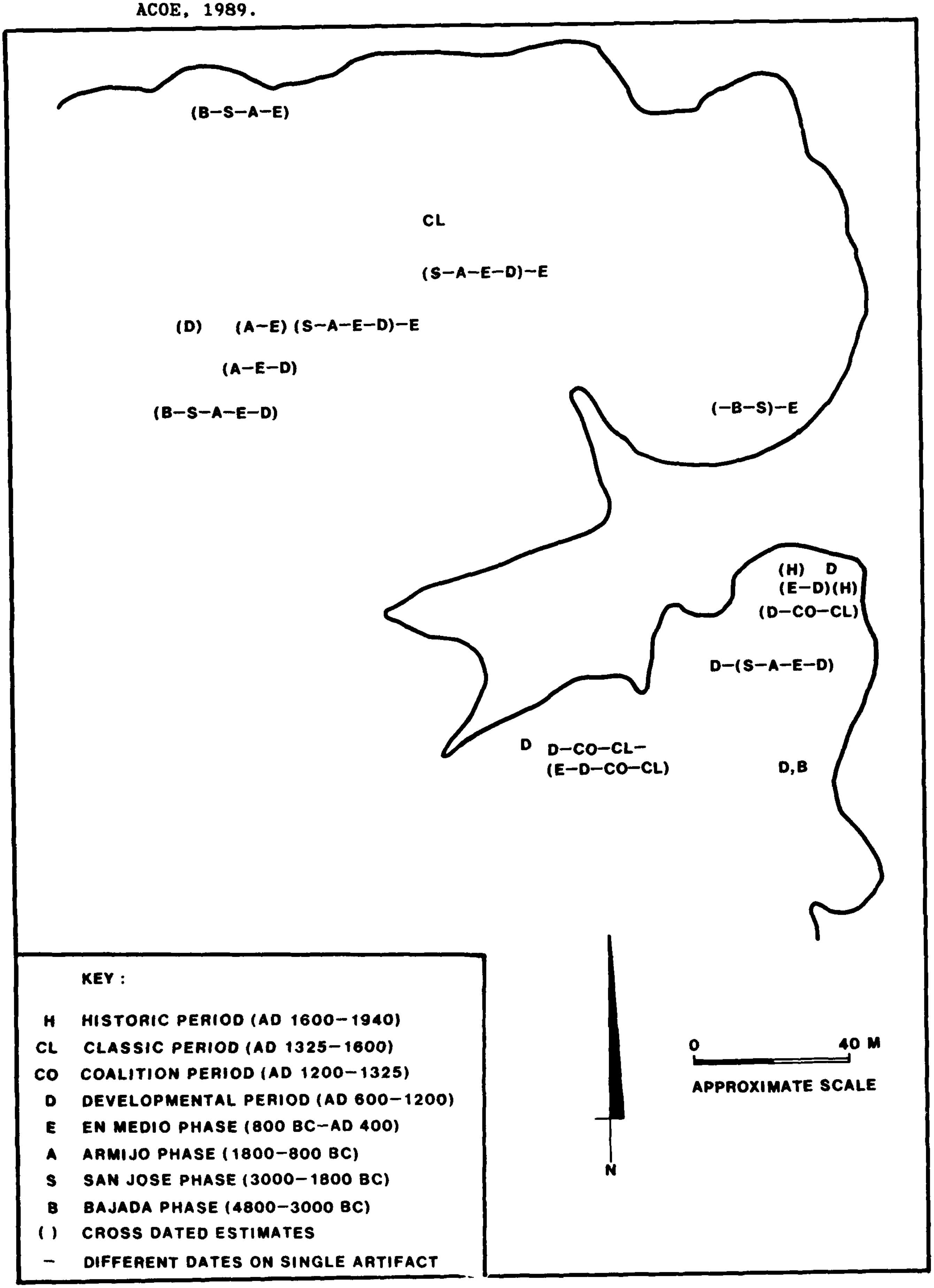
6.2.8.3 LA 25419

There is evidence for seven prehistoric and four historic occupations at LA 25419 (Figure 6.17). The prehistoric occupations on the northern half of the site may begin with the Early Archaic Period, based on point FS 191, cross-dated from 7,000-1,800 B.C.; however, two obsidian dates from the snapped tip and the haft of this point date to the En Medio Phase. Three points on the northern half (FS 105/108, FS 186, and FS 166) are cross-dated to a long range including the Bajada, San Jose, Armijo, and En Medio Phases. Two points (FS 174 and FS 171) are cross-dated to the Armijo and En Medio Phases and later. More reliable evidence for En Medio occupation is found in the obsidian dates on three points (FS 191, FS 175, and FS 186). Developmental dates are present in the form of cross dates on four points (FS 186, FS 175, FS 171, and FS 166) with ranges beginning in the Bajada, San Jose, or Armijo Phases; a better date is from FS 176, which is cross-dated solely to the Developmental Period. The final prehistoric period represented on the northern half of the site is the Rio Grande Classic date on an uncharred surface corn cob on the ridge down the center of this portion of the site. The single tin can on the west portion of the ridge and the clear glass fragments at Feature 35 suggest an early twentieth century occupation. Unfortunately, the majority of the dates for the northern half of the site are from proveniences along this hearth-rich ridge and do not directly date the cobble rings, most of which are along the terrace edge.

Dates for the occupation of the southern half of LA 25419 are limited to the terrace tip; there are no dates available for the lithic concentrations and hearths along the high south ridge. A C-14 sample from hearth Feature 9 dated to the Bajada Phase; obsidian from this provenience dated to the Developmental Period (the latter date may have been affected by heating in the hearth). In contrast to all other site areas discussed, there is only one point cross-dated to the San Jose, Armijo, and En Medio Phases (FS 1); this excavated point was obsidian dated (two readings) to the Developmental Period. The evidence for En Medio occupation is based on a point (FS 35) cross-dated from this phase to the Classic Period but obsidian dated to Developmental to Classic occupations and another point (FS 60) cross-dated to the En Medio through Developmental occupations. There is a good deal of evidence for Developmental occupation: a C-14 date from cobble ring Feature 6, the aforementioned two obsidian readings from Feature 9, one of the obsidian readings from FS 35 point near Feature 5, two obsidian readings from the subsurface point in Feature 2, one reading from a flake in the lithic concentration at the point tip, and cross dates from points FS 60 and FS 65. Point FS 35 has obsidian dates from the Coalition and Classic Periods as well as the Developmental. Point FS 65 is cross-dated from the Developmental to A.D. 1750 period.

There is evidence of three historic occupations on the southern half of LA 25419. The gunflint (FS 64) dates between A.D. 1650 and ca. 1880 and the Case knife between A.D. 1840 and the present; these items were found near the lithic concentration at the point tip and may represent a Native American or Hispanic occupation at LA 25419, most likely between the 1840s and 1880s. The three corroded cans found on the east tip of the southern part of LA 25419 probably

Figure 6.17 Dated Occupations at LA 25419, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



date between the 1880s and 1920s; these cans (and possibly the Case knife and gunflint) are probably associated with the unidentified historic corral-like structure (Feature 8). The most recent historic component is reflected by the aluminum tapioca can and a hearth feature located inside Feature 8 at LA 25419, which are believed to have been used within the past five years.

There are more cobble ring associated dates from the southern half than the northern half of the site. These dates indicate use during Developmental through Classic times. The artifact concentration at the tip of the terrace suggests Developmental use as well as a significant amount of Historic Period use dating to the early to middle 1800s and the late 1800s-early 1900s; the latter occupation is probably related to the upright post feature (Feature 8).

7.0 FEATURE ANALYSIS

Amy C. Earls

This chapter provides analysis of stone circle and fire-cracked rock feature morphology. Based on comparative data from ethnographic, historical, and archaeological studies, the results are compared to known tipi rings and stone boiling features to indicate feature function. Included in the feature analyses are fire-cracked rock scatters and cobble rings that were identified in the field. One fire-cracked rock scatter on LA 25417 was identified but through an oversight was not mapped or recorded. Artifact concentrations were not termed features unless they were composed of only one or two material types and could represent a lithic reduction activity area (e.g., Features 10, 11, and 14 on LA 25419).

7.1 THERMAL FEATURES

Frison (1983) describes pits from Wyoming with large quantities of fire-cracked rock and smothered charcoal and evidence of reuse. The pits are often found on south- and east-facing slopes up to 30°. Attempts to demonstrate unequivocal relationships between stone circles and stone-filled firepits have not been satisfactorily documented. Ethnographically, stone boiling is associated with cooking for immediate consumption and with initial boiling of fresh strips prior to drying. Fauna are rare, indicating that few animals were killed and processed on site or that there was a lack of preservation (Brumley 1983). Large quantities of fire-cracked rock occur at the three cobble ring sites; morphological variability in these is discussed below.

The following variables were examined for thermal features: feature type (slab-lined, fire-cracked rock scatter, or basin), excavated shape, dimensions, number of surface stones, density of fire-cracked rock per square meter, and weight (for excavated features). Thermal features include fire-cracked rock scatters as well as prepared hearths. Both feature types were used in heating or cooking activities. It is difficult to distinguish intact hearths from redeposited hearth contents on the basis of surface indications, however, so the term thermal features has been applied.

Several visually defined analytic units for hearths were identified on the three sites. Categories were based on proximity to cobble rings and on morphological similarity. On LA 25421, Feature 10 was located considerably downslope of the seven other hearth features and was examined separately. On LA 25417, analytic units were Features 1A and 1B; Feature 4, near ring Feature 3; Feature 5; Features 9 and 11; and Feature 10, nearest to ring Feature 8. On LA 25419, units were Feature 9, the solitary non-ring hearth on the low south terrace; Features 12 and 13, on the high south hill; Features 38, 39, and 40 on the upslope portion of the north terrace; Features 26, 27, and 43 on the east end of the axial ridge; and Features 19-25, 33-34, and 42 on the central ridge.

Table 7.1 presents the data for these features. Mean fire-cracked rock density for LA 25421 is 13.33 rocks/m^2, while downslope Feature 10 has a

Table 7.1 Thermal Feature Morphological Attributes, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Site Number	Group	Feature Number	Feature Type	Shape	Dimensions N-S	Dimensions E-W	Number Surface Rocks	Rocks/ sq m	Weight Kgs.	Invest.	Hearth Clusters N	Hearth Clusters Range	Hearth Clusters Mean	Site Mean
LA 25421	1	2	Slab/Rock-filled	Circular	.67	.72	29	60.12	32.0	E (1)	7	2.83 - 32.13	14.53	--
	1	4	Fire-Cracked Rock	Scatter	4.25	5.25	128	5.74	--	A (2)	--	--	--	--
	1	5	Fire-Cracked Rock	Scatter	2.25	2.80	32	3.88	--	A	--	--	--	--
	1	6	Fire-Cracked Rock	Scatter	2.65	2.20	31	5.32	--	A	--	--	--	--
	1	7	Fire-Cracked Rock	Scatter	2.60	4.35	32	2.83	--	A	--	--	--	--
	1	8	Fire-Cracked Rock	Scatter	1.25	.60	13	17.33	12.8	E	--	--	--	--
	1	9	Fire-Cracked Rock	Scatter	1.85	1.50	18	6.49	--	A	--	--	--	--
	2	10	Fire-Cracked Rock	Scatter	1.60	2.25	20	4.90	--	A	1	--	4.90	13.33 (n=8)
LA 25417	1	1A	Rock-filled	Oval	1.30	1.00	(65)	(50.00)	--	E	2	--	(50.00) (3)	--
	1	1B	Earthen Basin	Circular	0.50	.47	0	0.00	--	E	--	--	0.00	--
	-	unnamed	Fire-Cracked Rock	Scatter	--	--	--	--	--	O (4)	--	--	ND	--
	2	4	Fire-Cracked Rock	Scatter	1.62	1.75	22	7.76	13.0	E	1	--	7.76	--
	3	5	Fire-Cracked Rock	Scatter	1.25	.90	33	29.33	51.0	E	1	--	29.33	--
	4	9	Fire-Cracked Rock	Scatter	1.60	1.05	26	15.48	--	A	2	5.93 - 15.48	10.71	--
	4	11	Fire-Cracked Rock	Scatter	1.80	.75	8	5.93	--	A	--	--	--	--
	5	10	Fire-Cracked Rock	Scatter	1.85	2.20	19	4.67	--	O	1	--	4.67	18.86 (N=6)
LA 25419	1	9	Fire-Cracked Rock	Basin	0.50	0.52	(19)	(73.08)	22.0	E	1	--	73.08	--
	2	12	Fire-Cracked Rock	Scatter	5.25	5.25	35	1.27	--	A	2	1.27 - 3.00	2.14	--
	2	13	Fire-Cracked Rock	Scatter	4.00	4.25	51	3.00	--	A	--	--	--	--
	3	26	Fire-Cracked Rock	Scatter	2.25	2.00	33	7.33	--	O	3	6.25 - 23.08	12.22	--

Table 7.1 (continued)

Site Number	Group	Feature Number	Feature Type	Shape	Dimensions N-S	Dimensions E-W	Number Surface Rocks	Rocks/ sq m	Weight Kgs.	Invest.	Hearth Clusters N	Hearth Clusters Range	Hearth Clusters Mean	Site Mean
	3	27	Fire-Cracked Rock	Scatter	2.65	1.75	29	6.25	--	0	--	--	--	--
	3	43	Fire-Cracked Rock	Scatter	0.65	0.80	12	23.08	--	0	--	--	--	--
	4	19	Fire-Cracked Rock	Scatter	2.75	2.50	20	2.91	--	0	10	2.42 - 11.76	4.92	--
	4	20	Fire-Cracked Rock	Scatter	2.20	2.25	12	2.42	--	0	--	--	--	--
	4	21	Fire-Cracked Rock	Scatter	0.85	0.90	9	11.76	--	A	--	--	--	--
	4	22	Fire-Cracked Rock	Scatter	2.10	1.30	23	8.42	1.0	E,A	--	--	--	--
	4	23	Fire-Cracked Rock	Scatter	1.70	2.30	14	3.58	--	A	--	--	--	--
	4	24	Fire-Cracked Rock	Scatter	1.25	1.10	10	7.27	--	0	--	--	--	--
	4	25	Fire-Cracked Rock	Scatter	2.20	2.75	19	3.14	--	0	--	--	--	--
	4	33	Fire-Cracked Rock	Scatter	4.00	2.35	32	3.40	--	0	--	--	--	--
	4	34	Fire-Cracked Rock	Scatter	3.20	2.90	32	3.45	--	0	--	--	--	--
	4	42	Fire-Cracked Rock	Scatter	2.40	2.80	19	2.83	--	0	--	--	--	--
	5	38	Fire-Cracked Rock	Scatter	3.00	3.00	41	4.56	--	0	3	4.24 - 8.00	5.60	--
	5	39	Fire-Cracked Rock	Scatter	5.40	2.75	63	4.24	--	0	--	--	--	--
	5	40	Fire-Cracked Rock	Scatter	1.50	1.75	21	8.00	--	0	--	--	--	9.47 (N=19)

(1) E - Excavated

(2) A - Auger test

(3) ( ) - Number of excavated rocks

(4) 0 - No subsurface testing

considerably smaller mean (4.9) than the seven-member cluster upslope (14.53/m^2). However, Feature 10 would fall well within the range of density for Group 1 (2.83-32.13), the mean for which is considerably inflated by the high density Features 2 and 8, both of which were excavated. The weight of rocks in the two excavated features averaged 22.4 kg. Feature 4 was notable as a very large scatter with many stones but a low density. Feature 2 was notable as a slab and cobble lined and rock filled basin shaped hearth. All other features (only one other was excavated) proved to be scatters with unknown integrity.

On LA 25417, no comparative information is available for the unnumbered hearth in the central portion of the site. Feature 1A was a fire-cracked rock concentration in the center of ring Feature 1 below Feature 1B, a later unlined, circular basin. Since both were subsurface features, no comparative information is available. Feature 4 is associated with the Feature 3 ring on the north section; the mean of 7.76 rocks/m^2 is lower than that for LA 25421 features, indicating a moderate degree of dispersion, possibly due to erosion. Excavated rocks weighed 13 kg, and surface rocks numbered 22. Feature 5, to the west on the north terrace, had a high density of 29.33/m^2, indicating considerably more integrity than for Feature 4. The Feature 9 and 11 cluster on the south terrace edge ranged from 5.93 to 15.48 rocks/m^2, similar to that for Feature 4. Feature 10, possibly associated with the Feature 8 ring, had 4.67 rocks/m^2. While the overall 18.86 figure for this site is inflated by the high density Feature 5, the most similar features are 4, 10, and 11. As two of these are near a cobble ring, they may be associated with ring occupations. Distances are less than 10 m for Features 3 and 4 and approximately 40 m for Features 8 and 10. The evidence is unfortunately tenuous and assumes that rock density is correlated with ring occupation activities.

On LA 25419, all hearths except Feature 9 on the south terrace proved to be scatters of questionable integrity. Feature 9 was a basin-shaped, circular, fire-cracked rock concentration and may be associated with Developmental Period ring Feature 2 or 6. The two hearths on the high south terrace ridge (Features 12 and 13) were both very low density, averaging 2.14 rocks/m^2. Other hearths with densities this low were Features 19, 20, 23, 25, 33, and 34 on the north terrace. The three hearths along the east ridge on the north terrace averaged 12.22 rocks/m^2. These hearths were generally similar to the remainder on the ridge (Group 4), which averaged 4.92 rocks and ranged from 2.42 to 11.76. The three hearths upslope to the southwest of the north terrace (Features 38-40) were also not distinctive, averaging 5.6 rocks. Hearths with density between 4 and 8, identified on LA 25417 as possible ring-associated features, number five (Features 26, 27, 24, 38, and 39). If these features were associated with rings, which can only be tenuously suggested, then Features 26 and 27 might be associated with Features 28 and 44, Feature 24 might associate with Feature 15 or 16 to the northwest, and Features 38 and 39 might associate with Features 36 and 37. While the hearths along the axial ridge could easily be associated with a number of ring features or represent non-ring occupations, the upslope isolation of Features 38 and 39 and proximity to two ring features suggests that these may be associated.

An interesting pattern of fire-cracked rock at the cobble ring sites is its occurrence on ridges; this pattern is true for LA 25421 (all features but Feature 10) and for all hearths on LA 25419 except Feature 9. LA 25419 hearths average 5.94 rocks/m^2. All LA 25417 hearths and Feature 9 on LA 25419 were located on slopes. While Feature 9 had no rocks present on the surface, LA 25417 hearths average 12.63. These differences may merely reflect the greater erosion on sloped surfaces. Again, if the 4-8 rocks/m^2 range represents ring association, then the ridge hearths on LA 25419 may be ring-associated. However, the importance of postdepositional factors of slope exposure of rocks makes the relationship between rock density and slope more reliable than that between rock density and ring association.

7.2 COBBLE RING FEATURES

The cobble ring analysis consists of several steps designed to evaluate whether some or all of the identified stone circle features on LA 25421, LA 25417, and LA 25419 were likely to have functioned as tipi rings and to place these rings into a subsistence settlement context. A perusal of the literature (see Chapter 3.0) indicated that the following variables (Table 7.2) are important for describing cobble ring variability and assessing goodness of fit with ethnographic data.

Table 7.2 Cobble Ring Feature Variables and Recorded Attributes, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Feature Variables	Recorded Attributes [1]
Artifact densities inside and outside of the feature	Artifacts within 10 m
Presence or absence of a central hearth	Fire-cracked rock
Feature size	Interior and Exterior diameters and area in m^2
Course outline	Outline type and stone spacing
Distance from other such features	Grid location
Density of stones per linear meter of circumference	Stones per m circumference
Relation between area and type of course outline	Area in m^2 and outline type
Relation between stone density and type of course outline	Stones per m circumference and outline type
Relation between central fire-cracked rock presence and area	Area in m^2 and outline type
Site structure	Figures and maps
Distance to outside activity areas	Figures and maps
Shape index (longest axis/perpendicular axis)	Shape index

1 From Table 7.3

In order to monitor these variables, 13 attributes were recorded from feature plans and are presented in Table 7.3. Six of the attributes (interior and exterior diameters, area in m^2, circumference in m, number of stones, and number of artifacts within 10 m of the feature) are interval level measurements, and two attributes (shape index and number of stones per m of circumference) are ratios. Both interior and exterior ring diameters were measured. A shape index was derived by dividing the longest dimension by the shortest. Size was calculated using square meters of interior area. Number of stones per linear meter of circumference was calculated by dividing the number of stones by the circumference dimension. The number of artifacts within a 10 m radius was monitored for several cobble rings. Four additional attributes (disturbance, outline type, fire-cracked rock, and unmodified central stones) are nominal or presence/absence level measurements. Disturbance was noted as present or absent based on field observation. Stone outline was placed into nominal categories of isolated, paired, continuous, and scattered. Since this variable showed little diversity, it was not used in the cluster analysis. Three ring interior attributes were recorded: presence/absence of fire-cracked rock and unmodified central cobbles. The latter may have been used as smoke-hole tie-downs. Finally, stone spacing was given as a range.

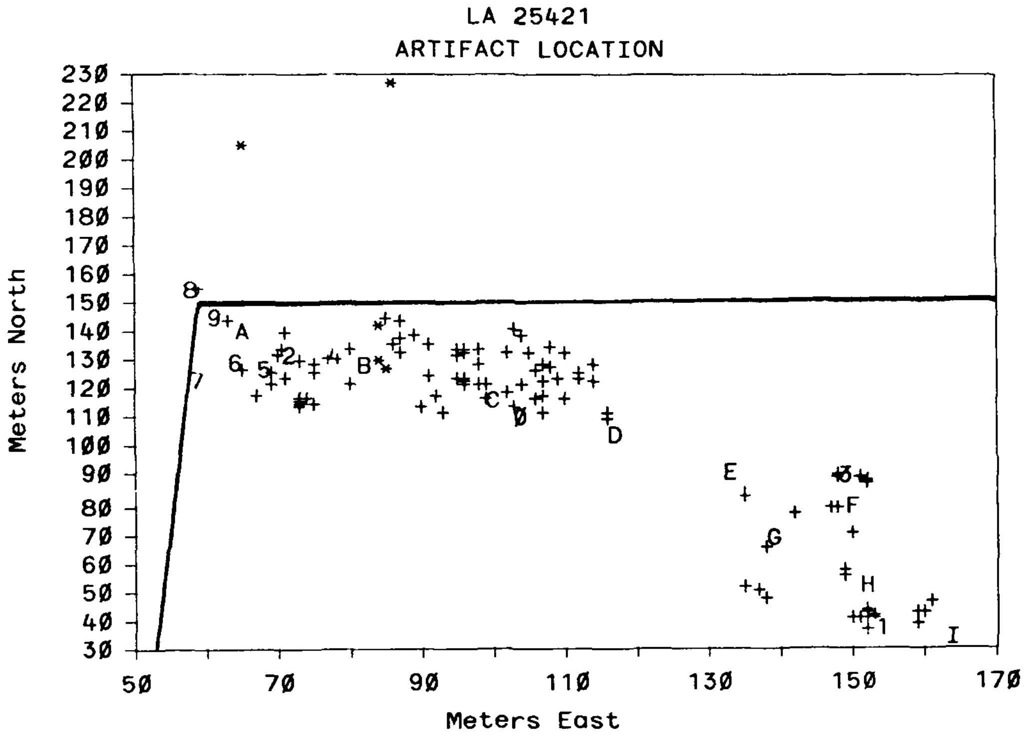
7.2.1 Artifact Distributions

Artifact density within a 10-m radius is presented for eight cobble ring features. Artifact frequencies are given in Table 7.3 and presented graphically on the following figures.

7.2.1.1 LA 25421

For LA 25421, the densities in the vicinity of the two cobble rings, Features 1 and 3, were extremely low. For this reason and because all artifacts south and west of Feature 9 were point-provenienced, all artifact locations are provided. As Figure 7.1 shows, most artifacts are from the northern part of the site. Figure 7.1 should be compared with Figure 7.2 for actual locations; the graphic scale on Figure 7.1 provides considerable locational distortion, with the east-west scale twice as long as the north-south axis. Temporary Datums A-I are shown to aid in orientation. Five artifacts, all debitage, occur within a 10-m radius of Feature 3, and 11 artifacts, all debitage, are within a 10 m-radius of Feature 1; most of these items were Pedernal chert. Cobble rings are approximately 50 m apart. Obsidian from Test Unit 3 in Feature 3 provided Developmental and Classic dates (A.D. 636-714 and A.D. 1306-1338); low artifact densities on the southern portion of the site indicate that use of these features was short-term or involved little knapping, unless activity areas are located upslope, in the fire-cracked rock feature concentrations. One Developmental obsidian date (A.D. 322-442) on a point southwest of Feature 9 does indicate some use of the upslope area during Developmental cobble ring occupation of Feature 3. Figure 7.3 shows the location of Feature 1 on the terrace point, and Figure 7.4 shows excavated slab- and cobble-lined Feature 2 in the hearth concentration upslope.

Figure 7.1 LA 25421 Artifact Location, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



KEY:

+ Debitage
* Tool
# Core
h Historic/Recent
^ Ground Stone
= Ceramic
o Cobble
● Fire-cracked Rock

Figure 7.2 LA 25421 Site Map, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

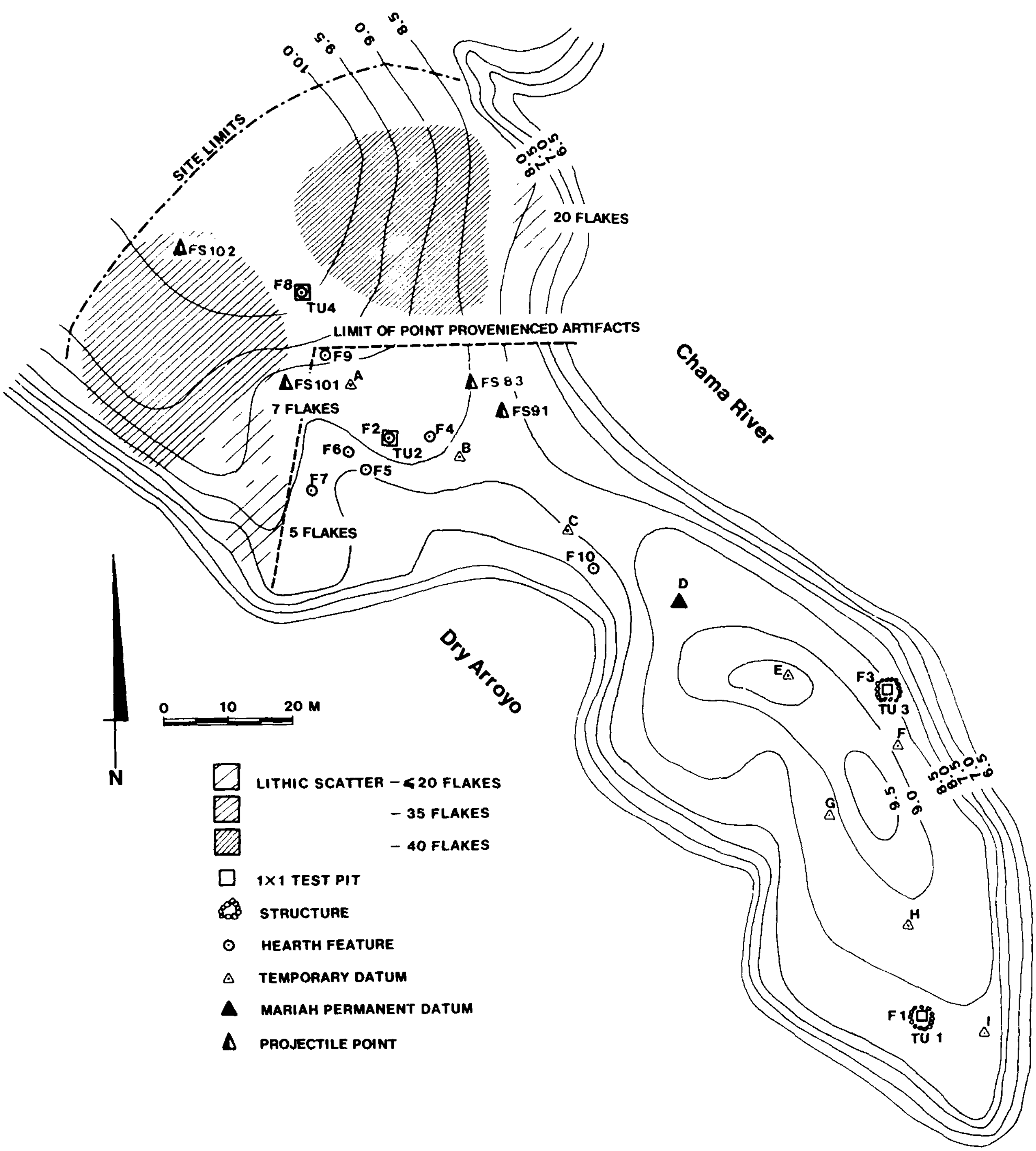


Figure 7.3 LA 25421, Feature 1, TU1, Facing Northeast (arrows mark ring cobbles), Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

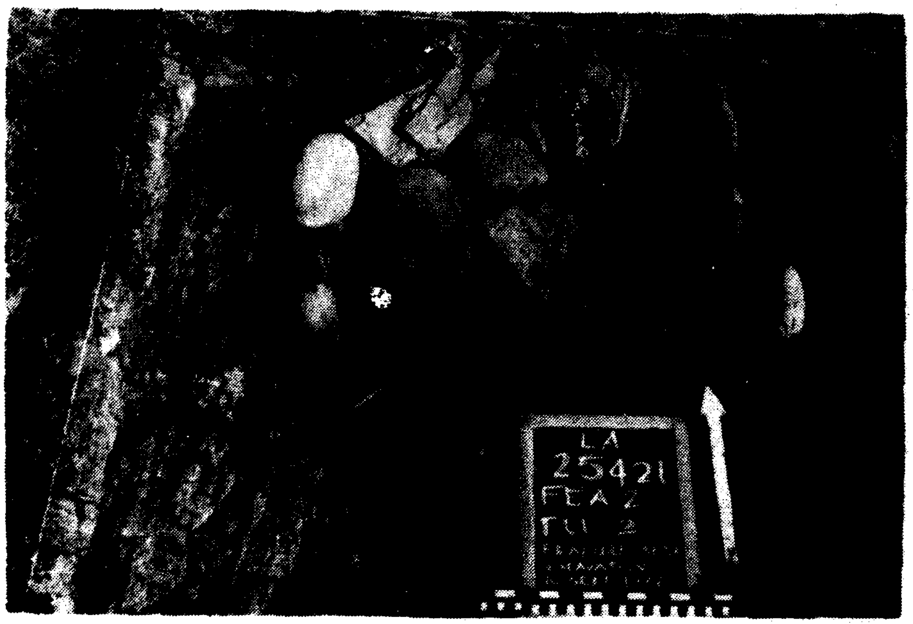


Figure 7.4 LA 25421, Feature 2, TU2, After Excavation, Showing Cobble and Slab Lining, Facing North, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

7.2.1.2 LA 25417

Artifact distributions on LA 25417 are provided for three cobble ring areas: Feature 3 and associated fire-cracked rock Feature 4, adjacent cobble ring Features 6 and 7, and Feature 8. Figure 7.5 shows 28 artifacts, all debitage and most Pedernal chert, within a 10-m radius of Feature 3 (see also Figures 7.6 and 7.7). The Feature 4 hearth is also within this radius. Although the hearth proved to be deflated and provided no datable samples (Figure 7.8), its proximity to the Feature 3 ring indicates a probable association. Unfortunately, such spatial associations may not be reliable, as shown by the San Jose Phase date on a fire-cracked rock concentration in the center of Feature 1, dated by C-14 to the Classic (A.D. 1320-1425) and by archaeomagnetic samples to the Historic Period (pre-A.D. 1870-1970). Figure 7.9 shows the test units in the center of Feature 1 from which all three samples were derived. Subsurface obsidian (A.D. 803-861) from the test unit in Feature 3 indicates a Developmental Period occupation. The density of artifacts is higher than for the two cobble rings on LA 25421, although the presence of debitage only is similar to the pattern on LA 25421. A slightly longer term occupation or larger cores may be indicated. As with the majority of cobble rings on all three sites, Feature 3 occurs near the terrace edge and, fortunately for interpretation, is distinct from Lithic Concentration 3 to the northwest. While the lithic concentration to the northwest produced San Jose Phase (2433-2263 B.C.) dates, materials here may also relate to the cobble ring occupation.

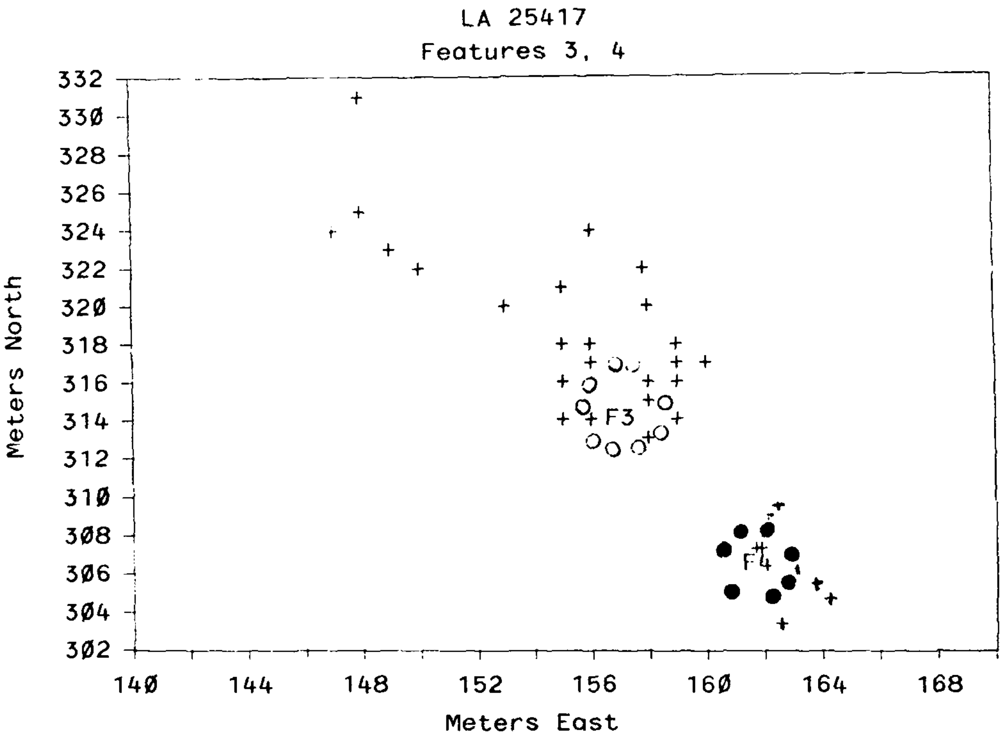
Features 6 and 7 on LA 25417 were surrounded by very few artifacts. Figure 7.10 shows that only seven artifacts, all debitage, were associated with the two features. Again, the evidence indicates an extremely short term occupation or a predominance of non-knapping activities.

Feature 8 on the south portion of LA 25417 shows a density similar to that on Features 3 and 4. Figure 7.11 shows 30 artifacts within a 10-m radius of the feature center. These artifacts were predominantly Pedernal chert and include, in addition to debitage, an obsidian point, a core, a sherd, and a piece of ground stone. The higher density may indicate a slightly longer-term occupation or more concentration on knapping activities than for Features 1 and 3 on LA 25421 and Features 6 and 7 on LA 25417. The variety of artifacts supports longer-term or a number of intermittent short-term occupations at this feature. Unlike Feature 3 on LA 25417, the nearest hearth to Feature 8 is about 40 m away. A point near this hearth (Feature 10), however, was obsidian dated (2418-2194 B.C. and 2518-2346 B.C.) to the San Jose Phase, which was the cross-dated age of the point south of Feature 8. The ceramic on the feature, however, indicates a Coalition Period occupation. As with Feature 3 on LA 25417, Feature 8 is isolated from other cobble ring features. Spacing of cobble rings on this site averages 52 m, similar to the SAR statement that tipi rings were 50 m apart (although only two were identified at that time) and similar to the distance on LA 25421.

7.2.1.3 LA 25419

Artifact distributions are presented for three cobble ring features (Feature 3 and adjacent Features 5 and 6) on the south half of LA 25419.

Figure 7.5 LA 25417, Cobble Ring Feature 3 and Fire-Cracked Rock Feature 4, Abiqiui Reservoir Cobble Ring Study, ACOE, 1989.



KEY:

+ Debitage
* Tool
# Core
h Historic/Recent
^ Ground Stone
= Ceramic
o Cobble
● Fire-cracked Rock

Figure 7.6 LA 25417 Site Map, North Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

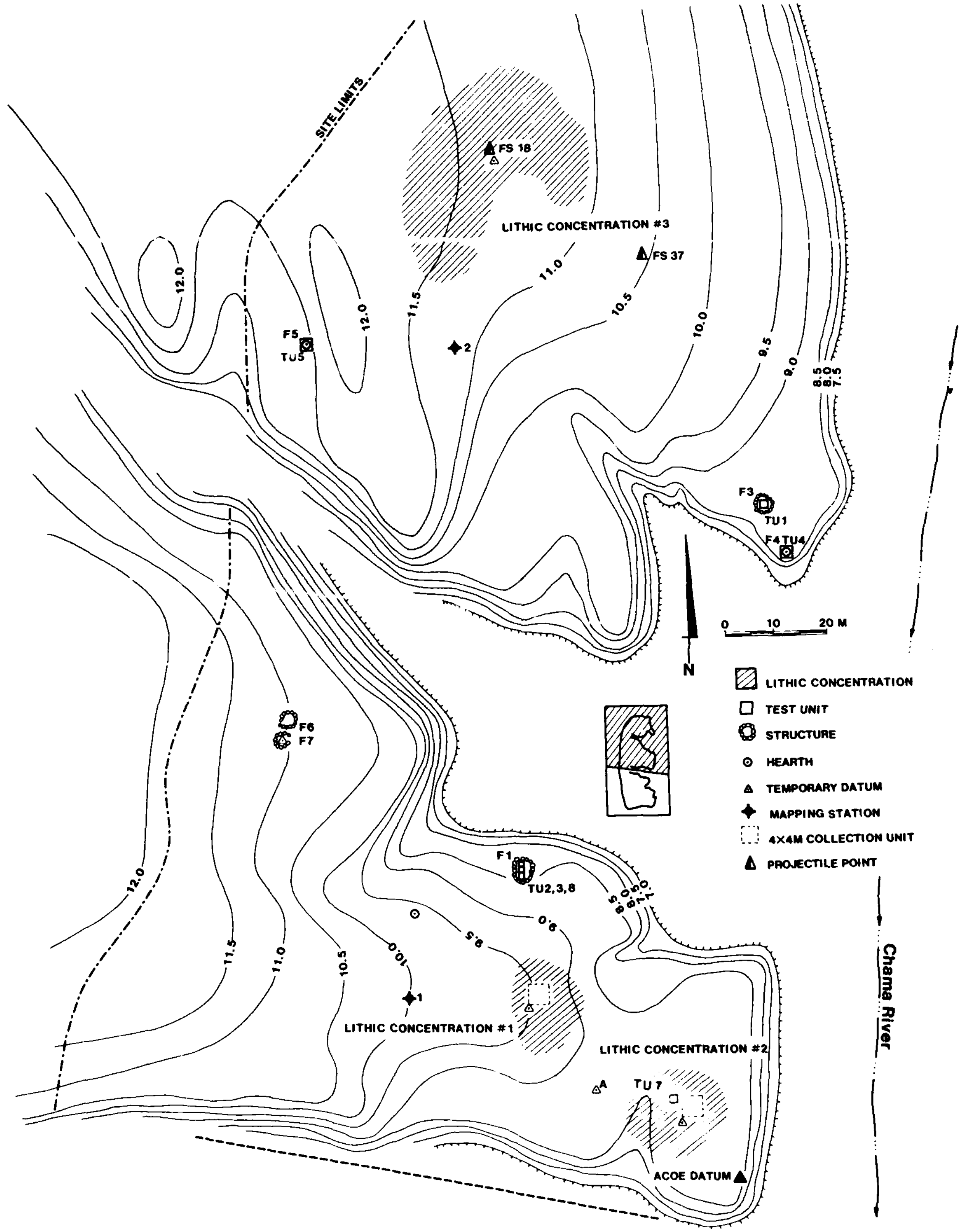
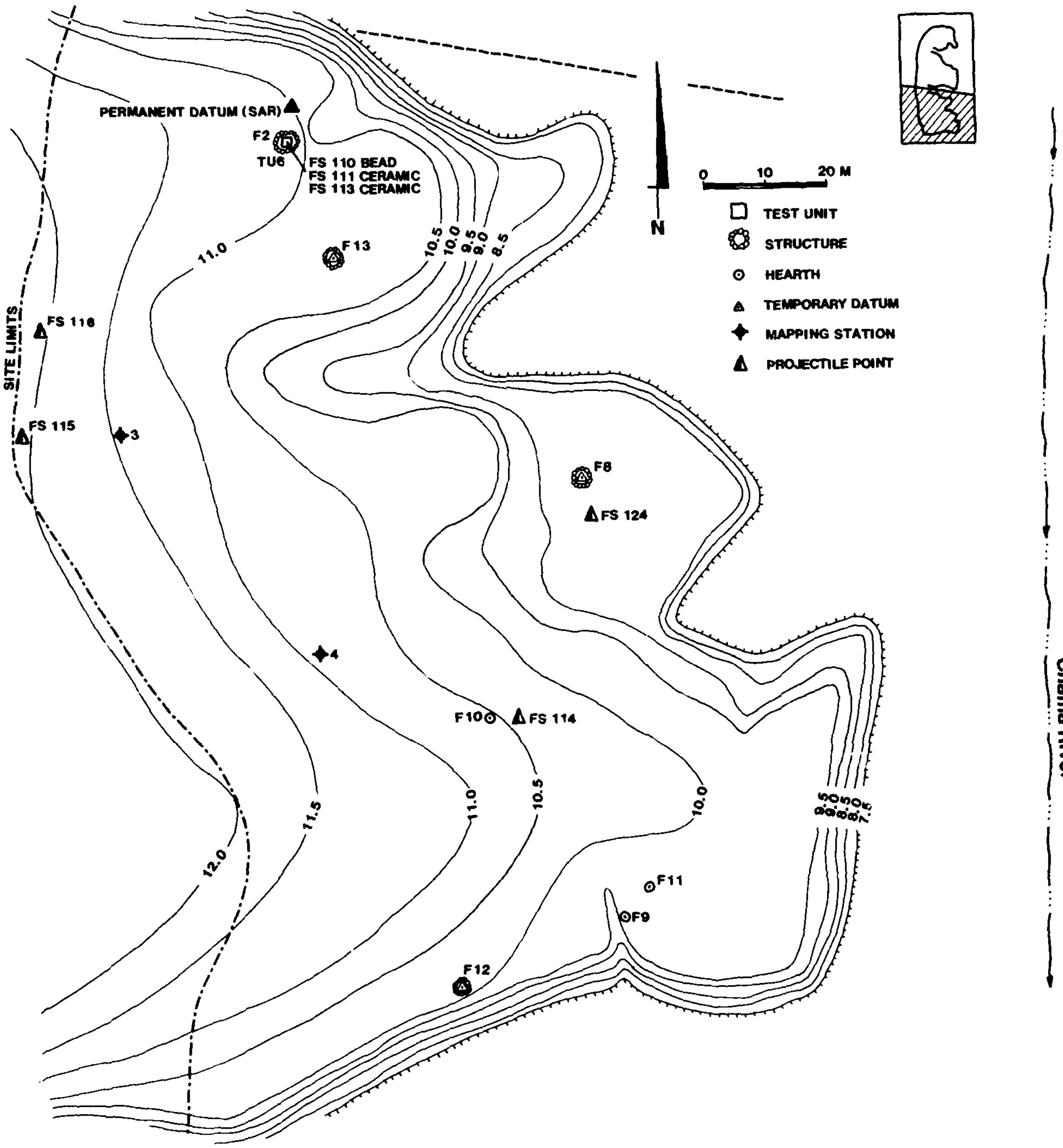


Figure 7.7 LA 25417 Site Map, South Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



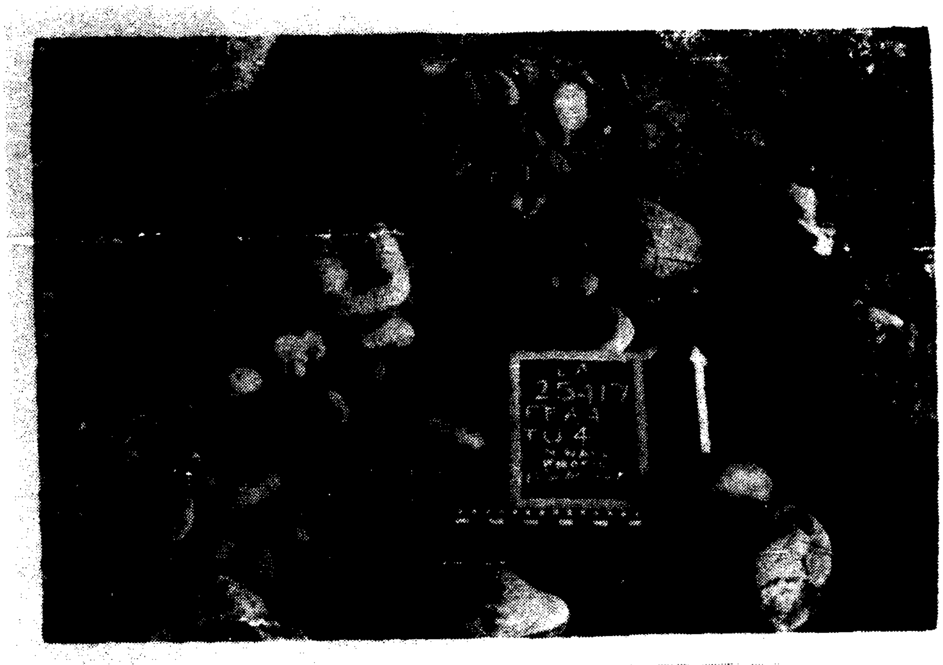
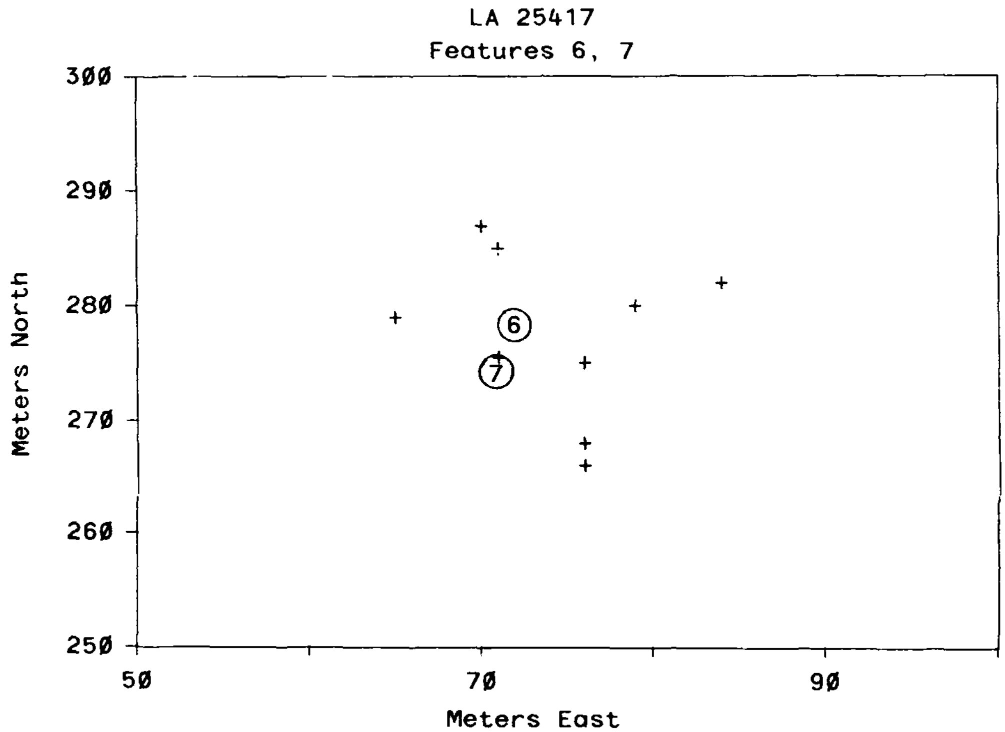


Figure 7.8 LA 25417, Feature 4, TU4 after Excavation Showing Relation to Cobble Terrace, Facing North, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Figure 7.9 Feature 1, TU 2 and 3, Showing Site Setting, Cerro Pedernal in Background, Facing Southeast (arrows mark ring cobbles), Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Figure 7.10 LA 25417, Cobble Ring Features 6 and 7, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



KEY:

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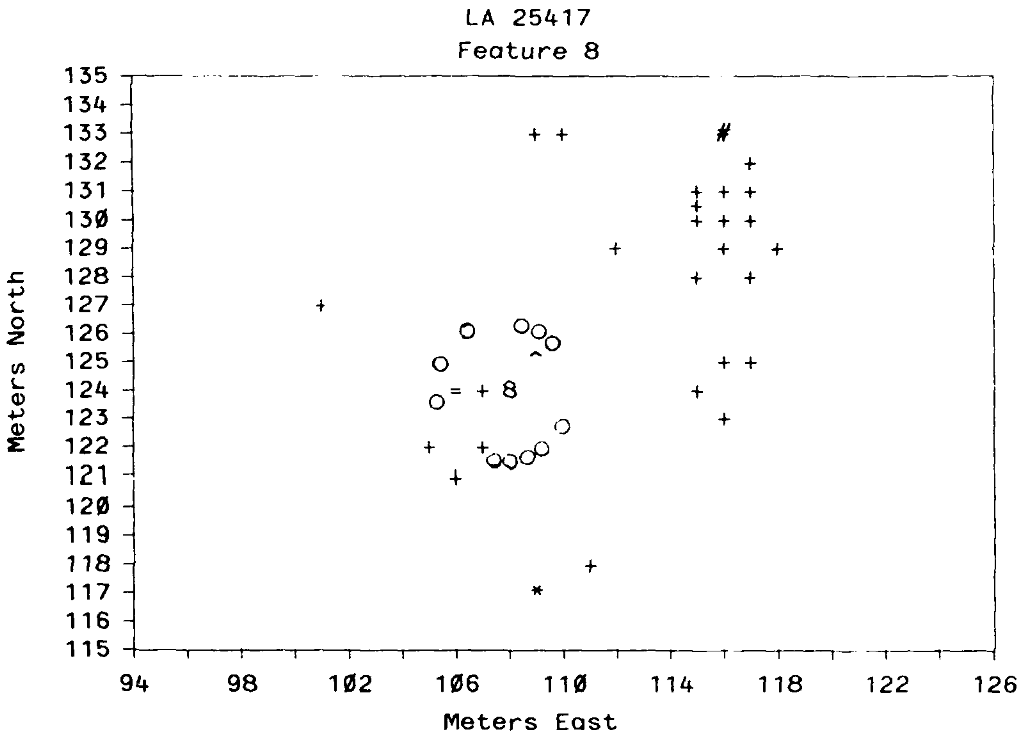
h Historic/Recent
^ Ground Stone
= Ceramic
o Cobble
● Fire-cracked Rock

Figure 7.11 LA 25417, Cobble Ring Feature 8, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



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- # Core
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- ^ Ground Stone
- = Ceramic
- o Cobble
- ● Fire-cracked Rock

Figure 7.12 shows 36 artifacts associated with Feature 3, including one piece of ground stone and 35 pieces of debitage. This density is comparable to that on Features 3 and 8 on LA 25417 (see also Figures 7.13 and 7.14). The artifact variety is very low, more similar to that of Feature 3 than to Feature 8. A moderately short term occupation may be indicated. No dates were derived from this feature. Dates on Features 2 (cobble ring; A.D. 966-1072 and A.D. 1026-1104) and Feature 9 (hearth; A.D. 698-744 and A.D. 1085-1185), both within 30 m of this feature, are obsidian dated to the Developmental Period (although a C-14 date on the hearth was Bajada Phase). Figure 7.15 shows Feature 2, and Figure 7.16 shows Feature 9 during excavation. The hearth is closer to Feature 3 than to either Feature 4 or 8 but could be associated with either (or none).

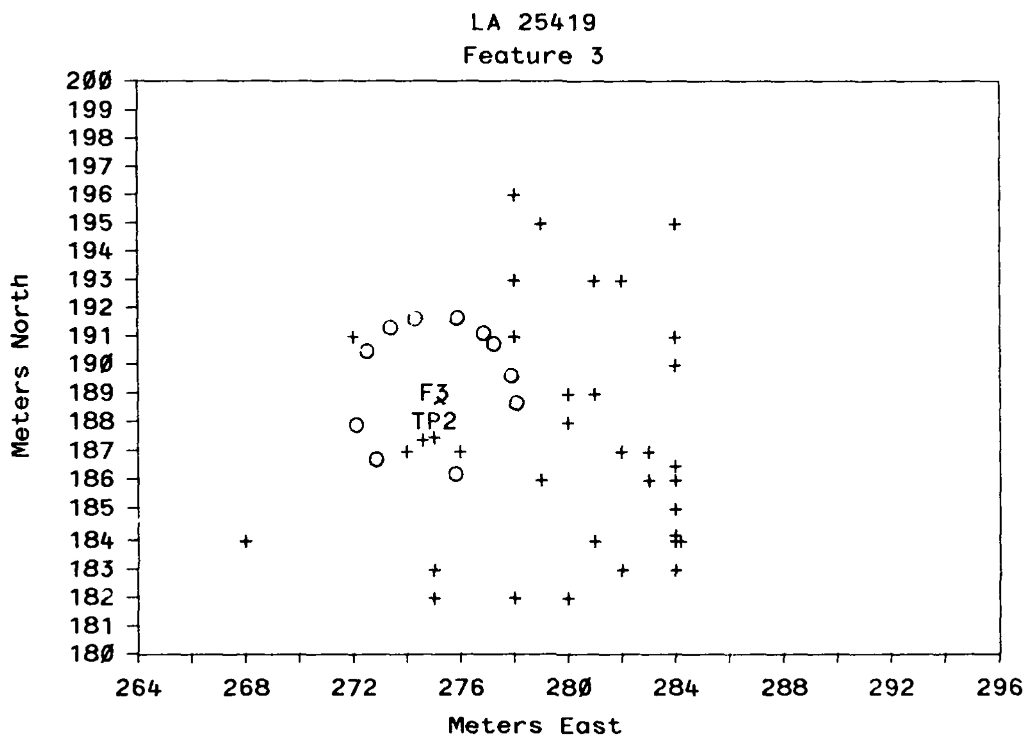
Finally, artifact distributions around paired Features 5 and 6 are shown in Figure 7.17. Only three artifacts, two pieces of debitage and one point, are associated with Feature 6. Fourteen artifacts, including the point and a core, are associated with Feature 5. The 10-m radii overlap, however, so that the point and one piece of debitage could be associated with either feature. These distributions are low, comparable to those on LA 25421, which was thought to be a short-term occupation. The point was obsidian dated to the Classic and Coalition Periods (A.D. 1249-1307 and A.D. 1443-1491), while a C-14 date (A.D. 655-1010) from a test unit in Feature 6 showed an earlier Developmental Period occupation. There are no clear dated associations with other features on the southern half of the site. In contrast with the other two sites, where cobble rings averaged 50 m to the nearest ring, the average distance on the southern half of LA 25419 was a much closer 17 m, perhaps indicating contemporaneity of occupation of at least some of these features, probably during the Developmental Period. A cluster analysis on distance between rings (a K-means cluster on x and y coordinates) was performed but proved to be less informative than visual inspection, since the simple distance cluster did not take into account topographic variation and formed clusters across major breaks such as arroyos.

7.2.2 Feature Morphology

This section discusses attributes of cobble rings on the three sites. Attributes focused on are ring diameters and area in m^2, shape index, artifact frequency within 10 m, number of stones and stones per m of circumference, presence of interior fire-cracked rock, and unmodified cobbles. Attribute data are summarized in Table 7.3. On LA 25421, interior areas of the two cobble rings are very close (6.6 m^2 and 6.7 m^2). Feature 3 is more nearly circular and has more perimeter stones than Feature 1. Feature 3 stones are paired, while Feature 1 stones are isolated. Only Feature 1 contains fire-cracked rock in the center; no other central stones are present in either feature.

On LA 25417, areas of cobble ring interiors range from 4.25 m^2 on seriously disturbed Feature 13 to 20.23 m^2 on Feature 2 on the southern portion of the site. When site subareas are considered, the northern portion (one ring only) is 10.18 m^2, the central portion averages 10.44 m^2, and the southern portion (omitting disturbed Feature 13) is 18.81 m^2. The southern portion features are more consistent than those on the central portion in a

Figure 7.12 LA 25419, Cobble Ring Feature 3, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



KEY:

- \+ Debitage
- * Tool
- \# Core
- h Historic/Recent
- ^ Ground Stone
- = Ceramic
- o Cobble
- ● Fire-cracked Rock

Figure 7.13 LA 25419 Site Map, North Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

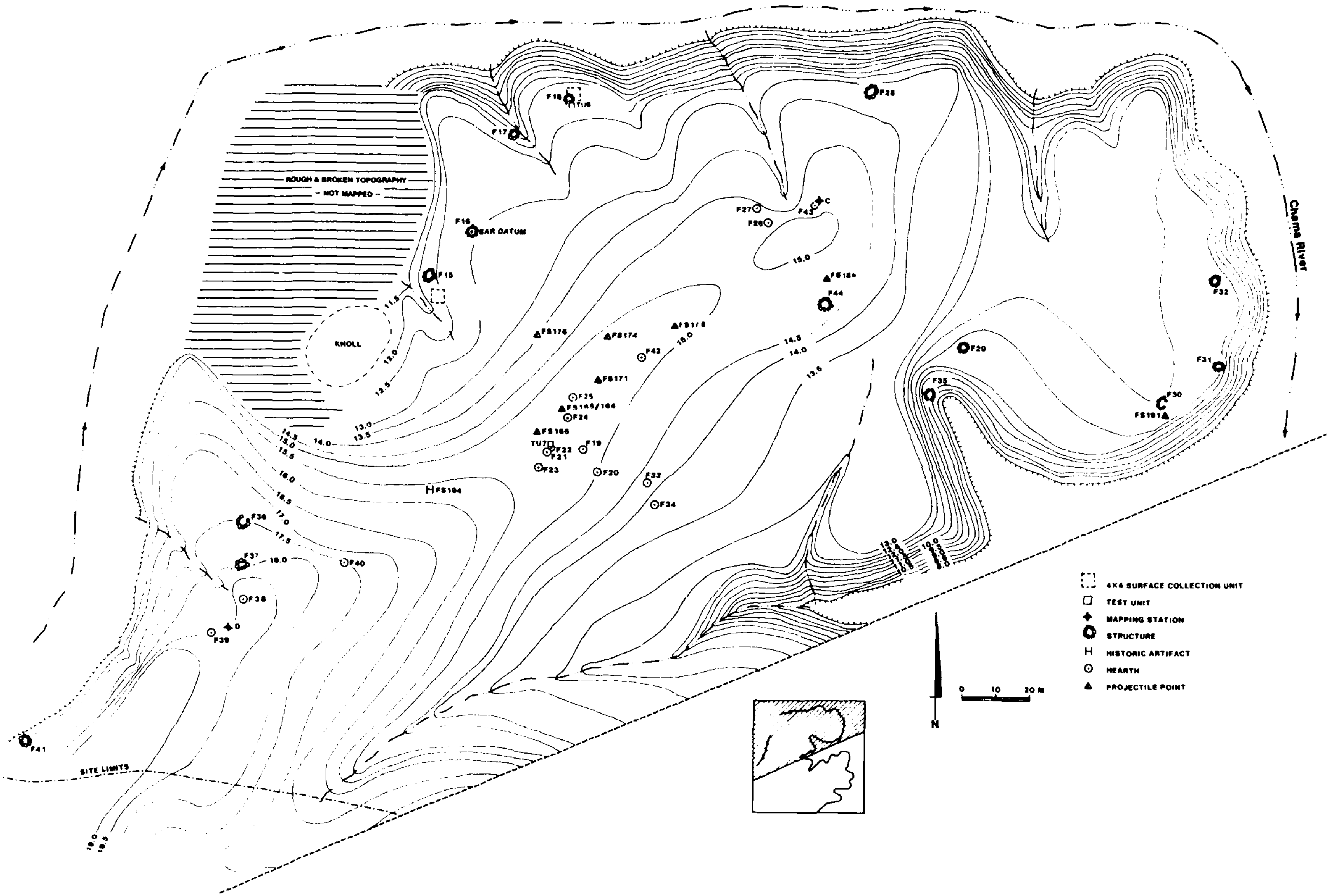


Figure 7.14 LA 25419 Site Map, South Half, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

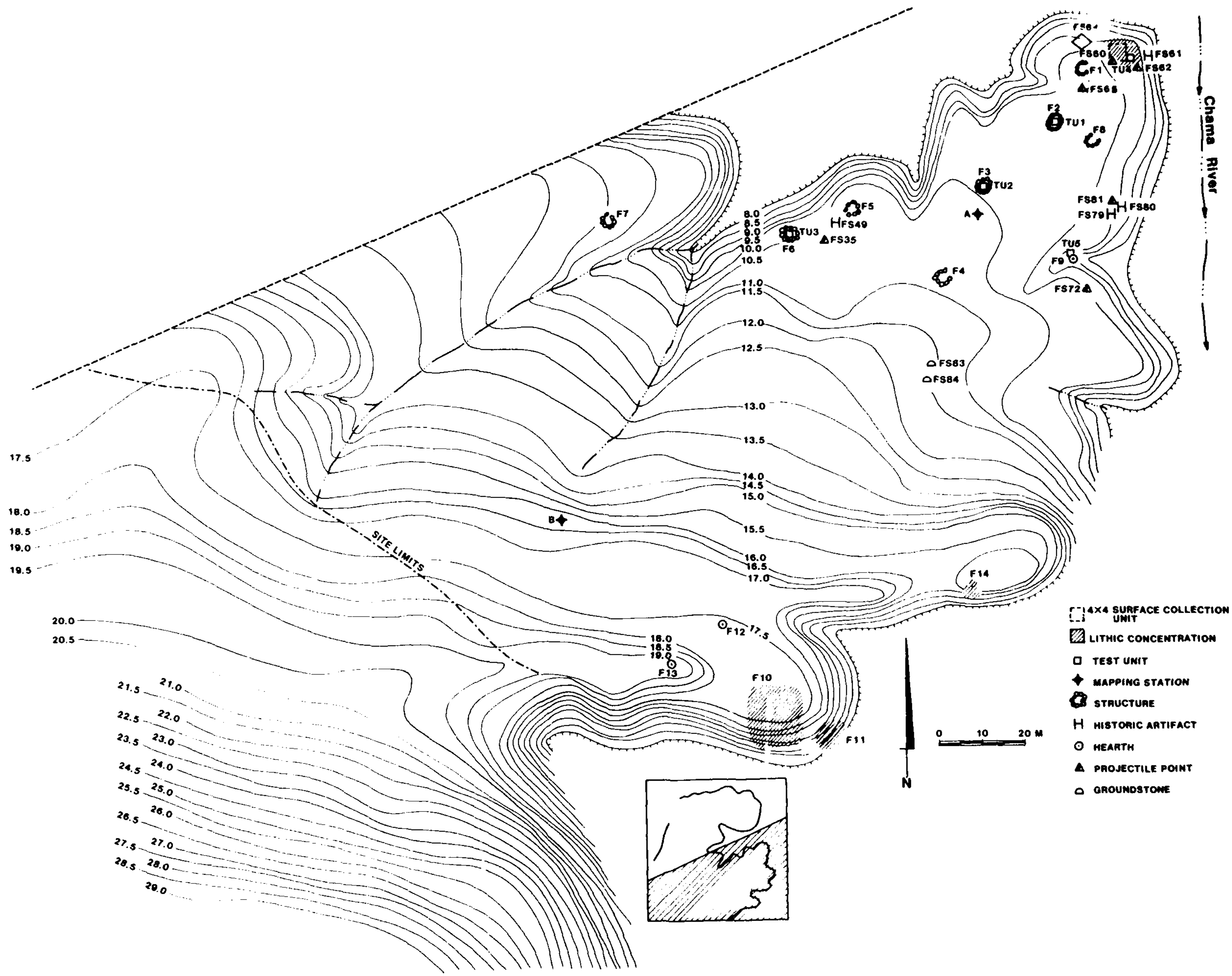


Figure 7.15 LA 25419, Feature 2, TU1 after Excavation, Uprights and Prone Log of Feature 8 in Background, Facing East (arrows mark ring cobbles), Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

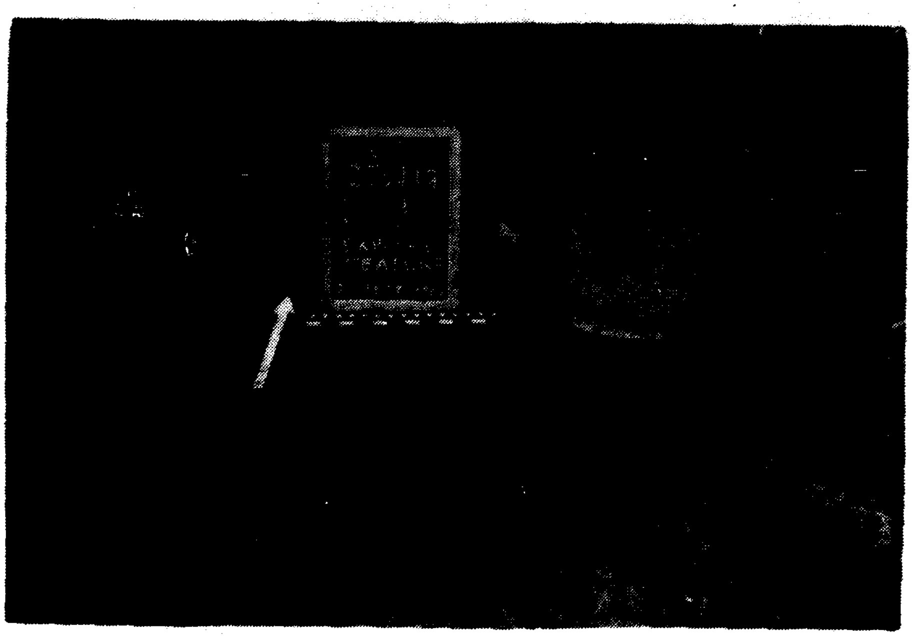
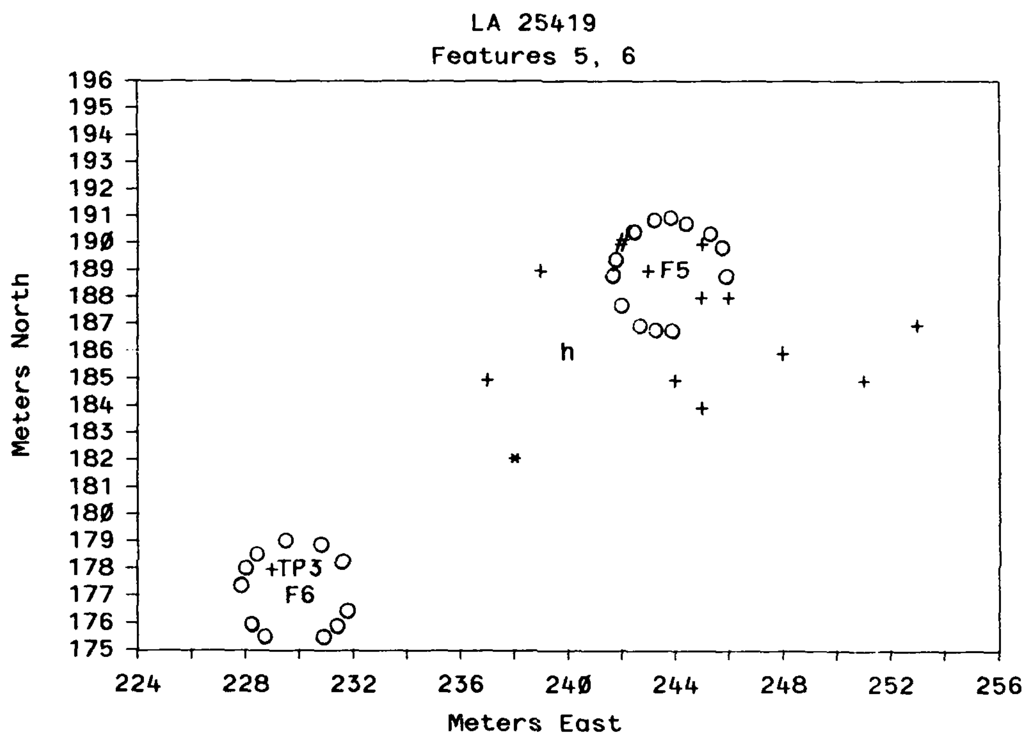


Figure 7.16 LA 25419, Feature 9, TU5 Profile, Mano and Metate above Hearth, Facing North, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Figure 7.17 LA 25419, Cobble Ring Features 5 and 6, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.



KEY:

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h Historic/Recent
^ Ground Stone
= Ceramic
o Cobble
● Fire-cracked Rock

Table 7.3 (continued)

Site	Fea. Num.	Location Meters East	Location Meters North	Test (1)	Diameter (cm) Interior N/S	Diameter (cm) Interior E/W	Diameter (cm) Exterior N/S	Diameter (cm) Exterior E/W	Area (m2)	Shape Index	Circumference	Number Stones	Stones Per M Circum	Disturbance	Out-Line Type (2)	Stone Spacing (cm) Min.	Stone Spacing (cm) Max.	Fire-Cracked Rock	Interior Stones	Artifacts W/I 10m (3)
LA 25419	30	288.0	268.5	N	210	160	250	250	2.7	1.32	5.81	5	0.9	No	S	10	165	No	No	--
LA 25419	31	304.7	278.7	N	275	225	300	300	4.9	1.22	7.85	16	2.0	Yes	S	15	100	No	No	--
LA 25419	32	302.5	304.0	N	365	310	400	400	9.0	1.18	10.60	15	1.4	Yes	S	20	125	No	Yes	--
LA 25419	36	21.7	235.2	N	410	415	460	460	13.4	1.01	12.96	12	0.9	No	S	40	200	No	Yes	--
LA 25419	37	20.9	223.3	N	440	440	500	500	15.2	1.00	13.82	13	0.9	No	S	40	200	No	No	--
LA 25419	41	-41.8	172.3	N	400	325	440	440	10.3	1.23	11.39	8	0.7	No	S	60	290	Yes	Yes	--
LA 25419	44	190.1	296.7	N	425	425	465	465	14.2	1.00	13.35	8	0.8	Yes	S	25	200	No	No	--
LA 25421	1	153.7	36.9	E	337	245	370	370	6.7	1.38	9.14	9	1.0	No	S	30	225	Yes	No	11
LA 25421	3	148.8	89.7	E	310	270	375	300	6.6	1.15	9.11	11	1.2	No	P	85	175	No	No	5

(1) E = Excavated, A = Auger Tested, N = Not Tested

(2) S = Single line of rocks, P = Paired line of rocks, C = continuous rocks

(3) -- = Missing data

(4) Adjacent rings

Table 7.3 Cobble Ring Morphological Attribures, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Site	Fea. Num.	Location Meters East	Location Meters North	Test (1)	Diameter (cm) Interior N/S	Diameter (cm) Interior E/W	Diameter (cm) Exterior N/S	Diameter (cm) Exterior E/W	Area (m2)	Shape Index	Circumference	Number Stones	Stones Per M Circum	Disturbance	Out-Line Type (2)	Stone Spacing (cm) Min.	Stone Spacing (cm) Max.	Fire-Cracked Rock	Interior Stones	Artifacts W/I 10m (3)
LA 25417	1	113.2	249.8	E	385	385	415	445	11.6	1.00	12.10	18	1.5	No	P	45	175	Yes	Yes	--
LA 25417	2	61.3	179.8	E	500	480	550	600	18.9	1.04	15.39	35	2.3	No	C	7	100	No	Yes	--
LA 25417	3	157.1	314.8	E	400	320	435	365	10.2	1.25	11.31	9	0.8	No	P	50	250	No	No	28
LA 25417	6	71.9	278.2	A	410	360	430	410	11.6	1.39	12.10	9	0.7	No	S	35	300	No	Yes	7 (4)
LA 25417	7	70.8	274.0	A	350	290	380	320	8.0	1.21	10.05	12	1.2	No	S	40	185	Yes	No	7 (4)
LA 25417	8	108.4	123.5	A	540	475	600	500	20.2	1.14	15.94	14	0.9	No	S	30	175	No	Yes	30
LA 25417	12	86.4	40.0	A	500	440	600	550	17.4	1.14	14.77	30	2.0	Yes	P	--	--	No	No	--
LA 25417	13	68.7	160.8	N	265	200	285	240	4.3	1.33	7.30	7	1.0	No	S	25	135	No	Yes	--
LA 25419	1	299.0	214.7	N	510	525	540	600	21.0	1.03	16.26	15	0.9	Yes	S	15	170	No	Yes	56
LA 25419	2	292.5	203.2	E	400	450	435	510	14.2	1.13	13.35	18	1.4	Yes	S	20	150	No	Yes	11
LA 25419	3	275.1	188.1	E	425	450	475	510	15.0	1.06	13.74	11	0.9	No	S	75	240	No	Yes	36
LA 25419	4	265.3	167.5	N	450	450	475	475	15.9	1.00	14.14	14	1.0	Yes	S	75	225	No	Yes	40
LA 25419	5	244.4	183.9	N	400	400	475	450	12.6	1.00	12.57	20	1.6	No	C	20	200	No	Yes	14 (4)
LA 25419	6	229.4	177.8	E	400	425	460	475	13.4	1.06	12.96	19	1.5	No	S	10	125	No	Yes	3 (4)
LA 25419	7	187.8	181.5	N	300	325	--	345	7.7	1.08	9.82	5	0.5	Yes	S	75	310	No	No	18
LA 25419	15	75.7	305.8	N	425	435	475	460	14.5	1.02	13.51	17	1.3	No	S	50	175	No	No	149
LA 25419	16	86.6	317.7	N	410	400	455	465	12.9	1.03	12.72	18	1.4	No	S	0	150	Yes	Yes	19
LA 25419	17	100.0	345.3	N	475	400	520	475	15.0	1.19	13.74	15	1.1	No	S	10	130	No	Yes	21
LA 25419	18	114.8	356.1	E	425	350	525	415	11.8	1.21	12.17	13	1.1	No	S	25	150	No	Yes	116
LA 25419	28	202.9	358.1	N	225	250	--	300	4.4	1.11	7.46	9	1.2	Yes	S	15	200	No	Yes	--
LA 25419	29	229.7	284.4	N	325	325	365	365	8.3	1.00	10.21	6	0.6	Yes	S	180	220	No	Yes	--

more nearly circular shape index, a generally larger number of stones, and the presence of both unmodified cobbles and tools in the center of the rings (fire-cracked rock is not present). Circle outline is disparate for the south rings, with continuous, isolated, and paired outlines all present. The central site rings, on the other hand, are more variable in shape and show a tendency to contain both fire-cracked rock and unmodified stones in the center of the rings, but no ground stone. These subarea features appear to represent different occupations or differential postdepositional processes. The larger size, absence of fire-cracked rock, and presence of ground stone on the south rings may be more indicative of a warm weather, family-based occupation than the smaller rings with central hearths, which could represent cold weather occupations by logistical hunting groups. Dates for the south rings are Developmental Period, Classic, and Historic for Feature 2 and San Jose through En Medio Phase and Coalition Period for Feature 8. The dates for Feature 1 on the central portion are San Jose Phase, Classic (probably an old wood date), and Historic Period. Given the obvious multicomponency of the few dated rings, the most that can be said is that the features on the southern portion appear to be different from those on the central portion, and that the ring from the northern portion is most like those on the central portion.

On LA 25419, the seven cobble rings from the southern half are contrasted with the 13 rings from the northern half that were measurable. Rings on the south average 14.25 m^2 and on the north average 10.51 m^2. The shape is consistently more nearly circular on the south than on the north. Fifty-seven percent of rings on the south were disturbed, compared to 46% on the north; the south disturbance probably relates to recent and earlier historic camping and herding activities suggested by recent campfires and historic structures. Presence of central unmodified cobbles was 86% on the south and 62% on the north. Ring outline varied little, with most rings having isolated stones. The only evidence of fire-cracked rock or central hearths was for two cases in the north sample. Distance between nearest rings on the south was 17 m, as opposed to the approximately 50 m figure for the two sites to the north. The north rings ranged from fairly well-defined, such as Feature 15 (Figure 7.18), to disturbed by modern activity, such as Feature 36 (Figure 7.19).

Ring area on the north sample resembled that from the northern and central portions of LA 25417; south ring area was smaller than and halfway between the 10-m^2 figure and the 19-m^2 figure from the southern portion of LA 25417. The tendency toward central hearths, the absence of ground stone in ring centers, and less circular outlines on the north sample (only a tendency since no ring centers were excavated in the north) also supports similarity with the central portion of LA 25417. If the north rings were occupied by hunting groups in cold weather, then this occupation may have occurred from the Bajada through En Medio Phases and possibly into the Developmental Period, based on ring Features 18, 30, and 44, based on cross-dated point types. The San Jose Phase (3000-1800 B.C.) is represented on each of these rings based on cross-dated points and is represented on Feature 1 of LA 25417 (central portion) by a C-14 date (2390-1775 B.C.) which may predate ring use. The obsidian En Medio dates are probably the best dates for the three LA 25419 rings; the Historic date (A.D. 1840-1880) may be the best for cobble ring use on Feature 1. If these dates and cobble ring patterns identified above are reliable, then the pattern of cold weather occupation by hunting groups and

Figure 7.18 LA 25419, Feature 15, Artifacts Flagged within 10 m of Ring Center, Facing East (arrows mark ring cobbles), Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Figure 7.19 LA 25419, Feature 36, Showing Southwest, Higher Portion of North Terrace, Facing South (arrows mark ring cobbles), Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

warm weather occupation by family groups may have been a long-lived adaptation strategy.

7.2.3 Cluster Analysis

A K-means cluster analysis was performed on cobble ring attributes from LA 25417 and LA 25419. Variables were selected based on a preliminary cluster analysis of all attributes. The correlation analysis (r^2) results were examined and variables without significant contribution to the r^2 were dropped. Variables selected were interior area in m^2, shape index, density of stones per linear meter of circumference, and presence or absence of fire-cracked rock. Selection of the best cluster of a series of two to five clusters is discussed for each site, followed by the characteristics of the individual clusters. The results support the descriptive morphological discussion above.

On LA 25417, the three-cluster run is judged to be the most informative (see Table 7.4 for a summary of the clusters). This run has a fairly low within-group sum of squares, except for the size variable, and has few clusters with only one member. The single member cluster in this case is Feature 13, the very disturbed ring in the southern portion of the site; the within-group sum of squares for size was reduced from 41.879 to 12.597 when this feature was isolated into a single cluster. Improvement for the size sum of squares only changed by a magnitude of 0.1 when four clusters were formed. The sum of squares for other variables was less than 1.5.

Within the first cluster, Features 2, 8, and 12 (Table 7.4), mean size is 18.83 standard deviation (s.d.) = 1.14, but the s.d. is less than 0.61 for all other variables), mean shape index i.e. 1.11, mean number of stones per meter of circumference is 1.73, and fire-cracked rock is absent. Within the second cluster, composed of Features 1, 3, 6, and 7, mean size is 10.35 m^2 (s.d.=1.47), mean shape index is 1.21, mean number of stones/m is 1.05, and fire-cracked rock occurs in two of four cases. Cluster 3 is composed of disturbed Feature 13.

On LA 25419, the cluster analysis consistently isolated Feature 1 into a separate cluster; this is because of its large size, 21.03 m^2. The best fit for this site occurs at the level of four clusters, where the size sum of squares (the only sum of squares above 3.0) showed no change in magnitude of decline between four and five clusters. This run includes in the first cluster rings 2-6 on the south terrace, rings 15-17 along the northwest terrace edge on the northern half, rings 36-37 on the southwest slope of the northern half, and ring 44 south of the north terrace axial ridge. Mean size is 14.21 m^2 (s.d.=0.99), mean shape index is 1.05, mean number of stones/m is 1.16, and fire-cracked rock occurs in two of 11 cases. Cluster 2 is composed of a solitary member, Feature 1. Cluster 3 is comprised of Features 28, 30, and 31, the first on the north edge and the latter two on the south edge of the north terrace. Mean size is a very small 4.0 m^2 (s.d.=0.94), mean shape index is 1.22, mean number of stones/m is 1.37, and fire-cracked rock is absent. Finally, Cluster 4 consists of five members, Features 7, 18, 29, 32, and 41. Feature 7 is west of other south terrace rings across a small drainage, Feature 18 is along the north edge of the north terrace east of

Feature 17, and Features 29 and 32 occur along the south edge of the north terrace. Feature 41 is located at the extreme southwest of the north terrace. Mean size is 9.42 m^2 (s.d.=1.47), mean shape is 1.14, mean number of stones/m is 0.86, and fire-cracked rock is present in one of five features.

Table 7.4 Summary of K-Means Cluster Analysis of Cobble Ring Size, Shape, Cobble Density/m of Circumference, and Presence of Central Fire-Cracked Rock, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Nunber of Clusters	LA 25417 Feature Numbres	LA 25419 Feature Numbers
2	2, 8, 12	2, 3, 4, 5, 6, 7, 15, 16, 17, 18, 28, 29, 30, 31, 32, 36, 37, 41, 44
	1, 3, 6, 7, 13	1
3	2, 8, 12	2, 3, 4, 5, 6, 15, 16, 17, 18, 36, 37, 41, 44
	1, 3, 6, 7	1
	13	7, 28, 29, 30, 31, 32
4	2, 8, 12	2, 3, 4, 5, 6, 15, 16, 17, 36, 37, 44
	1, 3, 6	1
	13	28, 30, 31
	7	7, 18, 29, 32, 41
5	2, 12	2, 3, 4, 15, 17, 37, 44
	1, 3, 6	1
	13	28, 20, 31
	7	7, 29, 32, 41
	8	5, 6, 16, 18, 36

The Abiquiu cluster analysis results are compared briefly with a Wyoming study (W. Davis 1983). A hierarchical cluster analysis was performed on data from Copper Mountain, Wyoming, on 113 rings on five sites. A hierarchical cluster analysis creates new clusters by breaking apart one of the previous clusters. A K-means cluster is nonhierarchical and may rearrange all items from previous clusters to create a new cluster. Four clusters had single course circles with a wide range of exterior and interior diameters and no central rock concentrations. Stone spacing remained relatively constant, however. The last two clusters had central rock concentrations, larger exterior and interior diameters, and double course alignments (W. Davis 1983). The results of the Abiquiu study are different in that hearths tended to occur in smaller rings on the more intensively tested LA 25417 than in the cluster with larger rings. The data could indicate fewer inhabitants or different band composition during bad weather/indoor cooking occupations at the Abiquiu and Wyoming camps. Also unlike the Wyoming study, double ring outlines (thought to reflect use of a tipi ring liner) were not identified at Abiquiu.

This chapter has presented attribute data for thermal and cobble ring features at the three Abiquiu sites. For thermal features, low densities of fire-cracked rock were identified as indicators of lowered potential integrity and action of postdepositional processes, primarily deflation and colluvial movement. Possible associations with cobble rings as outdoor hearths or activity areas were noted.

For cobble ring features, attribute data comparable with previous cobble ring studies were presented. Discussion covered artifact distributions around these features and feature analysis. Finally, a K-means cluster analysis on selected ring attributes produced three clusters of similar rings on LA 25417 and four clusters on LA 25419. Results showed a tendency on LA 25417 for hearths to occur in the smaller rings. Chapter 8.0 places these results into the research design context.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Amy C. Earls

This chapter summarizes results and recommendations of limited testing at three Abiquiu cobble ring sites. First, results are discussed in the context of the research design presented in Chapter 3.0. Second, the ethnicity of cobble ring inhabitants, although not a primary focus of this study, is addressed. Finally, recommendations for future cobble ring studies are given.

8.1 RESULTS

8.1.1 Comparisons with Other Tipi Ring Studies

Results relevant to the research issues of chronology, ethnographic analogy, site structure and function, and subsistence and settlement are summarized. Then, expectations for use of stone circles as tipi rings and for subsistence and settlement are compared with the Abiquiu results. As most of the research-oriented work on cobble ring sites has been carried out in states and Canadian provinces north of New Mexico where these sites occur in the greatest numbers, much of the comparative evidence is necessarily from studies on the northern plains.

8.1.1.1 Chronology

The clusters defined in Chapter 7.0 will allow for comparisons between Abiquiu cobble ring data and data from cobble ring sites on the northern plains. In terms of the chronology issue, addressed in the research design (Chapter 3.0), the LA 25417 clusters show no homogeneity of associated dates, with the south terrace cluster showing San Jose Phase through Historic Period occupation and the two dated features on the central and northern portions indicating San Jose Phase through Historic Period dates. There is some evidence of a Developmental Period occupation on Features 2 and 6 in Cluster 1 on LA 25419, but Coalition and Classic Period obsidian dates are also present. The only other dated feature in this cluster is a point near Feature 44 dated by obsidian hydration to the En Medio Phase. Cluster 2 consists of Feature 1, a large ring with a gunflint and Case knife (and Developmental through Historic Period point) within 20 m. The anomalously large area of this circle <u>could</u> indicate a late Historic Period occupation. The only date for Cluster 3 is a point cross-dated to the Bajada through San Jose Phase and obsidian dated to the En Medio Phase. The only dated circle for Cluster 4 is a point cross dated to the Bajada through En Medio Phases. As with LA 25417, there seems to be no chronological homegeneity characterizing these clusters.

Based on the studies cited in Chapter 3.0, the following variables are used in assessing the Abiquiu cobble rings. <u>Size</u> will be indicated by the longest interior diameter. Also used will be the <u>shape</u> index (circularity vs. ellipticity) and the standard deviation of the <u>mean number of stones/m</u> as an indication of relative constancy of number of stones per ring size. These variables are examined for the identified clusters on LA 25417 and LA 25419.

Cluster 1 on LA 25417 has longest interior diameters ranging from 5.0 to 5.4 m. This figure would fit within all actual tipi rings described in Chapter 3.0. The number of stones ranged from 14 to 35, somewhat lower than the 20-60 cited by W. Davis (1983). No double course outlines were present on this or any other site investigated. The mean number of stones per linear meter was quite variable. Shape index is 1.11. Thus, size is consistent with a tipi ring, but other characteristics typical on the northern plains were not identified in Cluster 1. For Cluster 2, longest interior diameter ranged from 3.9 to 4.1. This obviously fits the two broad ranges but is small when compared with the 4.5-6.4 m range (T-W-Diamond site range; Morris et al. 1983). The standard deviation of mean number of stones/m was higher than for Cluster 1. The shape index was higher (less circular) than for Cluster 1, falling into W. Davis's (1983) more elliptical category. Thus, Cluster 2 appears to be a less good fit to ethnographic analogies in terms of size and regularity of spacing than does Cluster 1. However, the more circular outline of Cluster 1 rings is unlike historically documented tipi rings. Cluster 3 consists of a disturbed feature and is not discussed further. Thus, Cluster 1, identified as a possible warm weather encampment by family groups, is more likely to contain tipi rings than Cluster 2, a possible cold or bad weather hunting group encampment.

On LA 25419, Cluster 1 has interior diameters ranging from 4.0 to 4.75; these would fall just below the T-W-Diamond site ring size ranges (Morris et al. 1983). The mean number of stones is 1.16 with a standard deviation of 0.27. Shape index is closer to circular than to elliptical. Cluster 2 had one member and is not discussed here. For Cluster 3 interior diameters ranged from 1.6 to 2.8 m. The mean number of stones/m is 1.37 with a standard deviation of 0.46. Shape index is 1.22, more elliptical than circular. Finally, Cluster 4 has interior diameters of 3.0-4.3 m. The mean number of stones/m is 0.86, with a standard deviation of 0.34. Shape index is 1.14, similar to Cluster 1. Again, the results are mixed: Cluster 1 scores well on mean number of stones (low standard deviation) and better than the other two on size. Cluster 3 is at the low end of the size scale but has a more elliptical shape; variation in number of stones is the highest for the three clusters. Finally, Cluster 4 is somewhat smaller in size than Cluster 1 but similar to it in a more circular shape; the mean number of stones standard deviation for the former cluster is moderately high. Cluster 1 scores highest, with the relatively best figures on two of the three variables.

Other cobble rings reported at Abiquiu Reservoir appear similar to those investigated in the present study. Schaafsma's (1978) work at a cobble ring and ramada work area at site AR-9 involved excavation of a ring 5.5 m in diameter with a central hearth. As with separate Feature 1s on both LA 25417 and LA 25419, historic artifacts and an archaeomagnetic date on the central hearth indicated a nineteenth century occupation. Work by NAI (Reed et al. 1982) failed to relocate four of the reported stone circles, and the cultural origin of three rings was questioned (Reed et al. 1982:73). One of the confirmed rings, on LA 25481, was located on the west edge of a broad, flat, grassy ridge overlooking an unnamed intermittent drainage to the west, a location found typical on the present site sample. On LA 27033 (Reed et al. 1982:53), two rings 4 m in diameter and 5 m apart were found on a moderately steep gravel slope. These diameters are consistent with our sample, although location on a moderate slope is unusual in our sample.

In terms of sites as a whole, the Morris et al. (1983) study of 32 ring sites in Colorado and Nebraska found that 20 sites had 1-6 rings each, nine sites had 9-16 rings each, and three sites had 47-76 rings each. Two of the Abiquiu sites fall into the middle category of 9-16 rings per site with eight on LA 25417 and 13 on LA 25419. Overlapping rings are very rare in the Colorado and Nebraska sample studied. The Abiquiu study located no overlapping rings and only two sets of adjacent rings (Features 6 and 7 on LA 25417 and Features 5 and 6 on LA 25419). Most ring sites in the Colorado and Nebraska study have small surface collections that typically lack points, sherds, and other artifacts providing cross dates. This situation was generally true at the Abiquiu sites in terms of artifacts within rings, although collections included a number of cross-dated items from areas outside the rings.

8.1.1.2 Site Structure and Function

Survey and excavation of the habitation area at the Johnson Bison Kill Site in Montana recovered evidence of more than three occupations (Deaver 1983). Brumley (1983) found that, in southeastern Alberta, stone circles containing hearths tended to have more items associated, both interior and exterior, indicating a longer-term occupation. The Abiquiu data (Table 7.3) show that the six cases with known central hearths (many of the rings would not report this variable reliably without excavation) have fewer than 20 artifacts within a 10-m radius. The two rings with the largest artifact associations within a 10-m radius, Features 1 and 15 on LA 25419, were not excavated (the former was not excavated because of its disturbed shape; the latter was not excavated because its depositional potential was low since it was situated on a gravel outcrop). The best Abiquiu case for cobble ring reoccupation is Feature 1 on LA 25417, with San Jose Phase and Classic Period C-14 dates and a Historic Period archaeomagnetic date.

Brumley (1983) found that, in southeastern Alberta, stone circles occur in locales where stone is readily available and soil conditions are naturally hard. More stones were found in ridgetop stone circles than in sheltered lowlands because wooden pegs are hard to drive into hardpan soils. Soil development on the Abiquiu sites is slight on the terraces and a hardpan caliche layer occurs within 50-90 cm of surface, so that wooden pegs may not have been used easily on these sites. A cobble terrace also occurs near the surface, and the availability of cobbles in conjunction with soils too hard for driving in wooden pegs would have encouraged use of cobbles as structural supports.

Work by Wilson (1983) at stone circle sites in Wyoming and Alberta observed variability in size, which Roll (1981) attributes to factors such as presence of horses, access to lodge poles, season, occupant status, and age. The variability in size is noticeable in the Abiquiu data, where relatively undisturbed ring clusters range from 10.35-18.83 m^2 on LA 25417 to 4.0, 9.42, and 14.21 m^2 on LA 25419. This size may well have meaning in terms of ring function. As was discussed above, rings with diameters from approximately 4.5

to 6.5 m are perhaps the best fit to ethnographic data, but smaller and larger rings have been documented as tipis. Documentation on groups using the tipis that are the basis for ethnographic analogy is needed in order to relate historically known groups involved in commercial hunting and using horses to archaeological sites from pre-horse periods. The Abiquiu clusters that do not fit the available ethnographic data on tipi rings very well could indicate other kinds of structures, such as windbreaks and drying racks (Kehoe 1983).

The situation of large Montana cobble ring sites near travel routes and representing many short term occupations (Loendorf and Weston 1983) is similar to that at Abiquiu. The Abiquiu site dates indicate great variability in temporal associations within ring clusters with similar morphological characteristics. The Abiquiu area has been documented as an important travel route during the Historic period (Bertram et al. 1987) for Utes using the area for winter hunting and for trade and movement among the Apaches, Navajos, Pueblos and Hispanics of the upper Rio Grande Valley. There is good reason to believe, in terms of topography and known population distributions through time, that such movement along the Chama Valley, situated between the Rio Grande Valley and the San Juan Basin, was also important during prehistoric times.

8.1.1.3 Subsistence-Settlement

Considered under subsistence and settlement are seasonality and the possible function of the sites in a larger settlement pattern. Indirect indications of winter occupation in the southern Black Hills are a sheltered location and a large central hearth with much charcoal. On tipi ring sites containing hearths and "probably" reflecting winter occupation, all activities did not take place inside the structure. "We still need to look for exterior features at winter habitations and cannot conclude that sites with only a few activities represented inside the rings were warm-season occupations" (Tratebas 1983:43). A Blackfoot informant told Kehoe (1960:432) that his father's family cooked inside only during bad weather, using the outside fireplace most of the year. The macrobotanical analysis of the Abiquiu sites (Appendix E) recovered goosefoot, beeweed, and purslane seeds, indicating late summer occupation at all three sites. Pollen samples from LA 25419 (Appendix F) support a spring occupation at this site.

Features such as the quartzite knapping station Feature 10 on LA 25419 have not been related to the cobble rings; the materials occur along a south facing slope (Figure 8.1) and could easily have been produced during the winter, for example, while watching the arroyo below for animal movements. A study of historically documented Cree tipi rings at York Factory, Manitoba, reports that summer occupations contained hearths, indicating that hearths are not to be found only in winter sites. Adams (1983) suggests that small interior fires were used for warmth, light, and insect repellence. When more tipi ring interiors are excavated at Abiquiu Reservoir, then study of variation in interior heating features may allow distinctions between cold weather and warm weather hearths; Chapter 7.0 provides some suggestions along these lines.

Figure 8.1 LA 25419, Feature 10, Dimensions Flagged, Facing Southeast, Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Site structure is a consideration in subsistence-settlement patterns. In Wyoming, Reher (1983) found that stone circle sites are commonly located along bluff edges, perhaps to catch upslope breezes during the summer. These locations, very similar to the pattern on Abiquiu sites of rings overlooking the Chama River (for example, Feature 31 on LA 25419; Figure 8.2) or tributary arroyos, could result in crowding near the edge that would "compress" the site pattern. This compression does not occur on LA 25417 but may be a factor at LA 25419, especially along the south and north edges of the central arroyo (Features 30-32 and Features 1-6) and perhaps at the northwest portion of the site (Features 15-18). With the exception of Feature 3, which may be associated with hearth Feature 4 at the northern portion of LA 25417, particular rings were not clearly associated with any hearths. At the Wagensen site in Wyoming, activity areas occurred alongside a creek at some distance from the site and were located using heavy equipment; the hearths contained butchered bone debris and activity floors associated with processing. Hearth-based features were 25 m from rings at the Buckskin site and historically documented Blackfoot cooking areas 6-7 m outside of the tipi (Reher 1983:198-215). These patterns suggest that some of the hearths on Abiquiu tipi ring sites may well be associated with the rings; excavation will be necessary to demonstrate such patterning. Given the relative lack of soil development on most of these Abiquiu sites, it is likely that heavy equipment will not be necessary to find such hearths and that many of them have already been located during the 1987 work.

Finally, in terms of Reher's (1983) model of stone circle site structure discussed in Chapter 3.0, the Abiquiu data do not appear to match the specialized aggregated big game hunter pattern of large sites with many rings. Certainly, the paucity of bison in the Chama River Valley may have had something to do with the lack of fit. While there are regularities in spacing, the Abiquiu data show little evidence of medium-sized planned villages typical for dispersed groups of specialized big game hunters. There is certainly evidence for reoccupation but not for distinct subclusters or the overall ring numbers indicated for the dispersed specialized big game hunter pattern; again, the lack of bison in the area prehistorically is another reason for rejecting this expectation based on work in the northern plains. The patterns that best fit the Abiquiu data are the aggregated and dispersed generalized hunter-gatherers. In distinguishing between the two patterns, important variables are site size and ring counts, as well as village plans relative to topography. Both sites with more than two rings cover a large area (although LA 25417 has very dispersed spacing of rings), but neither has a very large number of rings (both fall into the medium-sized category; see above). This is consistent with generalized hunter-gatherer use, where ring counts increase only with reoccupation. Reoccupation is very evident in both of these sites.

In terms of the village plan variable, LA 25417 has regular spacing of rings (approximately 50 m) that could indicate contemporaneity, but the associated dates are so different that a dispersed hunting and gathering strategy is the more likely interpretation. On the other hand, the rings on the south terrace and the south rim of the north terrace of LA 25419 are clustered in space and may indicate some kind of contemporaneity. The best evidence is for ring Features 2 and 6 and an associated hearth dating to the

Figure 8.2 LA 25419, Feature 31, Overlooking Chama River, Facing East (arrows mark ring cobbles), Abiquiu Reservoir Cobble Ring Study, ACOE, 1989.

Developmental Period. Too few dates are present on the north terrace rings to suggest a contemporaneous camp. Thus, there is evidence for some relatively small aggregation of hunter-gatherers. At least two kinds of camps are identified: on LA 25417 and on the north terrace of LA 25419, rings probably relate to dispersed hunting and gathering over a long period of time. On the LA 25419 south terrace, ring occupants may have camped together while engaged in hunting and gathering pursuits. The remainder of the rings probably relate to dispersed hunters and gatherers using the area at different times. The placement of rings near terrace edges suggests some commonality in use of the site topography. The terrace edges provide overlook potential for watching for game animals moving along the valleys; provide access to wood, water, and cobbles; and would catch upslope breezes from the valley in summer, although ridges would also provide good ventilation. Abiquiu rings are placed on fairly level ground and were not found in the more broken terrain upslope from LA 25417 and LA 25419, while rings in many parts of the northern plains are hidden in rolling terrain so that the topography can be used in a variety of hunting techniques. Either the target animals or the hunting techniques at Abiquiu are different from those on the northern plains. Analysis of the tipi ring point assemblages showed that the pattern of contemporaneity of corner-notched arrow points, medium dart points, and very large points at other Abiquiu sites (Bertram 1987) may apply at these sites; there are too few complete points and too few chronometric dates on these points to indicate more than a potential for this pattern to hold at the tipi ring sites.

8.1.2 Summary

To summarize, there are strong indications that the Abiquiu rings date to the prehistoric period. There are subsurface dates for Developmental or Classic Period obsidian at Feature 3 on LA 25421 and at Features 3 and 2 on LA 25417. On LA 25419, there is subsurface C-14 and obsidian evidence for Developmental Period occupation at Features 2 and 6. When surface cross-dated artifacts near cobble rings are considered, dates range from San Jose through En Medio Phase and Coalition Period at Feature 8 to Historic Period at Feature 2 on LA 25417. On LA 25419, surface cross-dated artifacts date from Bajada to San Jose Phase at Feature 30 and from San Jose Phase through Developmental Period at Feature 44 on the north terrace to En Medio Phase through Classic Period at Feature 6, San Jose Phase through Developmental Period at Feature 2, and Developmental through Historic Period at Feature 1. When only chronometric surface point (obsidian) dates are considered, the picture is quite different: dates range from En Medio Phase at Features 30 and 44 on the north terrace and Classic to Coalition Period at Feature 6, Developmental Period at Feature 2, and Developmental Period at Feature 1 on the south terrace of LA 25419. The likelihood is that the cross dates are wrong; solar insolation would act to increase surface rinds and produce older than expected dates, although erosion or trampling could be a factor in producing "too young" dates. There was evidence of grazing on LA 25419, but in most areas evidence was not fresh or intensive (Feature 15 was an exception).

Application of ethnographic analogy to the Abiquiu sites did not produce any clear tipi ring clusters, but the best candidates are Cluster 1 from LA 25417 and Cluster 1 from LA 25419. In terms of duration of occupation, the rings with the most artifacts within a 10-m radius did not have central hearths, but the evidence is not definitive without excavation. There was certainly considerable evidence for many reoccupations. As discussed above, the cobble rings did not fit especially well with the ethnographic evidence for tipi rings; however, since these accounts are based on northern plains bison hunters with horses, the lack of fit does not mean these were not tipi rings. The cluster analysis on morphological attributes has identified certain groups that may have functional integrity; when more intensive excavation produces additional information on these rings, their goodness of fit to ethnographic tipi rings can be assessed again. Possible functions other than tipi rings are windbreaks and drying racks.

Finally, the settlement-subsistence evidence on seasonality is inconclusive. Interior hearth variability may not be an indicator of season of occupation; presence of a hearth does not necessarily rule out summer occupation, since a hearth may be necessary for cooking, light, or insect repellence. However, a large, reused hearth in a cobble ring is probably an indicator of winter occupation. Ring sites are excellent for examining site structure, since survey and mapping information can indicate whether or not a village plan is present and rings were occupied contemporaneously, although dates are necessary for confirmation. Abiquiu data on spacing indicated that rings on LA 25417 may have been contemporaneously occupied, but current chronometric data do not support such a conclusion. The regular 50-m spacing suggests that occupants of this site were pursuing a different strategy than those on LA 25419. This may have been a dispersed hunting and gathering strategy, similar to that of the random rings on the north terrace of LA 25419. The possible Developmental Period camp on the south terrace of LA 25419 indicates a second, more aggregated, hunting and gathering strategy. As Brumley (1983) notes for southeastern Alberta, stone circle density increases with greater topographic relief, and near river valleys; the valley settlements may reflect year-round availability of water for animals and man, wood for fuel, and favorable topographic relief for a variety of hunting techniques. These variables probably apply to the situation of Abiquiu tipi rings as well.

8.1.3 What Historically Known Ethnic Group Used the Abiquiu Cobble Rings?

Previous work at the sites suggested that the tipi rings may date to the Historic Period, possibly indicating Capote Ute use of the Abiquiu Reservoir area as a winter hunting ground. This assignment was made with some reservation, however, since Archaic and Basketmaker points were found in association (Schaafsma 1976:107). Charles Carrillo (1988 personal communication) has stated that the ring structures could relate to Ute, Navajo, Apache, Genizaro, or Hispanic occupation. Because of the limited dates for Historic Period occupation, the question has become somewhat moot, but is briefly summarized here.

The best evidence for historic or protohistoric occupation at the sites occurs at the central and southern portions of LA 25417 and the southern terrace point of LA 25419. On LA 25417, the evidence consists of an archaeomagnetic date on Feature 1B dating probably in the 1800s and definitely before 1870. Across a tributary arroyo on the southern portion of the site, the evidence is three beads dating to the 1740-1880 period and several sherds from one jar identified as Chacon Micaceous and dating to the 1830-1870 period. On LA 25419, the evidence consists of a gunflint dated 1650-1880 and a very rusty Case knife blade dated 1840-present. These data taken together suggest a probable short-term occupation in the 1800s. The ceramic type, based on documentary evidence, is attributed to Chacon's Olleros band of Jicarilla Apaches (Carrillo 1987a).

Also known to have visited the valley were the Guaguatu or Capote Utes mentioned by the Jemez Pueblos in a Spanish account dating to 1626 (Schroeder 1965). The Utes used the reservoir area longer than any other aboriginal group, from the early seventeenth to late nineteenth centuries (Wozniak 1987). The Utes visited Jemez before Spanish colonization and, on departing, "they traveled northwest by way of the Chama River in order to return to their homes beyond the Navajo Indians" (Schroeder 1965:54). These Utes were said to live in thatch-covered huts. The Capote Utes were reportedly raiding in the Abiquiu area by 1747, leading to abandonment of Abiquiu in 1748 and Ute movement into the area of abandoned settlements on the lower Chama River. By 1754, peace with the Utes to the northwest was achieved, and Abiquiu was resettled (Schroeder 1965:59). The beads, gunflint, and archaeomagnetic dates indicate the possibility of use of the three site areas during the 1700s.

Archival evidence suggests that, besides the Utes and Apaches, Navajos and Tewas visited the reservoir area for trading and raiding purposes from the seventeenth to late nineteenth centuries. The Jicarilla Apaches are recorded west of the Rio Grande at only two times, 1694 and 1818, before the American period, settling in the area after 1846. The Comanches were infrequent but memorable raiders of the Chama Valley for a few years in the mid-eighteenth century. From 1598 to 1760, documents (Wozniak 1987) show that the Navajos are mentioned in the Piedra Lumbre Valley only in association with raids on Spanish and Pueblo settlements, particularly during the 1704-1713 period. Tewa occupation of the Chama Valley lasted until the early seventeenth century, with continued use of the reservoir area in the 1620s to obtain piedra lumbre (alum) for dying cloth and Pedernal chert for stone tools. Tewa traders moved through the valley to reach Ute territory (Wozniak 1987).

Schaafsma (1975) proposed that the Piedra Lumbre Phase (A.D. 1650-1750) represented a seventeenth and early eighteenth century Navajo sheepherding occupation in the Chama Valley (see Chapter 3.0). The Piedra Lumbre materials differ from post-Revolt Navajo components, however, in having no evidence of forked stick hogans, subfoundation excavation, or sweat lodges. Hearths in Piedra Lumbre structures are not centrally located, unlike post-Revolt Navajo structures in the Largo-Gobernador area. Another difference is that no indisputably Navajo ceramics are present on the Abiquiu sites. Finally, agricultural evidence is lacking on Piedra Lumbre Phase sites but seems to have been important on Navajo sites from the A.D. 1630-1750 period (Brugge 1979).

Wozniak (1987) indicates that during the period A.D. 1598-1760 the Spaniards consistently reported Navajo settlements in the Largo-Gobernador region, and Navajo presence east of the Continental Divide was associated with raids on the Spanish and Pueblo settlements in the Piedra Lumbre or upper Rio

Grande valleys. Furthermore, sheepherding appears not to have been adapted by the Navajo until after the Spanish reconquest of 1692-1696. Wozniak (1987) supports a Tewa origin for the Piedra Lumbre Phase structures based on the archival and archaeological evidence, but no consensus has yet been reached on the matter.

Hispanic expansion into the area occurred during the first half of the eighteenth century. Sheep camps in the reservoir area during the nineteenth century are described as canvas tents apparently held down by stones and pegs forming a circular structure; most cooking was done outside (Carrillo 1987b).

At least seven ethnic groups are documented in the Chama Valley at least sporadically from the time of Spanish contact to the late nineteenth century. Of these, the Comanches are not likely to have left structural evidence, and the Tewas are not believed to have used tents or tipis (although they may have built brush structures with stone supports at the base). The Navajos are reported to have raided in the valley (Schaafsma 1975). The most likely candidates for production of some of the cobble ring remains at Abiquiu are the Apaches (supported by the Chacon Micaceous sherds and comparative information for an 1800s date), the Utes (supported by archival evidence that they used the Chama Valley extensively from the early 1600s to the late 1800s), or Hispanics/Genizaros (extensive use of the valley beginning in the mid-1700s).

Although there is a large body of data on Ute, Crow, Cheyenne, Sioux, and other Plains groups' tipi morphology and size (e.g., Campbell 1915, 1927; Laubin and Laubin 1977; Smith 1974) and even some details on stone boiling (e.g., Wissler 1910), there are too few consistently recorded attributes that can allow distinction of ethnicity. The paucity of measurements, the lack of documentation on the subsistence-settlement system of the group in question, and the difficulty involved in converting ethnographic/historic measurements to measurements on archaeological remains are problems in using ethnographic analogy. Even archaeologically based studies are inadequate in this respect. For example, Buckles (1971) presents an entire study of Uncompahgre Plateau remains thought to be Ute, but archaeological remains dating back to the Archaic Period cannot be demonstrated to represent one genetically/ethnically related group such as the Utes. The ethnographic data for even the recent historical remains are too inexact for ethnic attribution, even when they are from areas known to have been used by southern Colorado Utes in the nineteenth century. While there are enough general data on tipi rings that can be used as a comparative data base, there are insufficient data to distinguish ethnicity of rings, and there are insufficient data to differentiate tipi rings from remains of brush structures or wickiups. Alan D. Reed of Alpine Archaeological Consultants, Inc., in Montrose, Colorado (Reed, 1988 personal communication), states that no tipi rings as such exist within the traditional Ute range of west central Colorado. Huscher and Huscher's (1943) survey of many drainages in this area did report a number of cobble ring structures, however, and attributes all stone "hogans" and less substantial stone structures to southern Athabaskans because of congruence of these remains with known migration routes (Huscher and Huscher 1943:72-83). Buckles (1971) reports standing wickiup features leaving rock rings that could be recorded as tipi rings.

Excavated structures in New Mexico attributed to Apaches, on the other hand, include small pueblos (the Glasscock site near Cimarron), stone foundation pit structures (the Sammis site near Cimarron), and tipi rings (Gunnerson 1987:108-109). The 200-ring Ojo Perdido near Las Vegas contains thin micaceous Perdido Plain pottery in low density association with many rings. The site has been dated to the mid-1600s by Pecos and Picuris glazewares. Other ceramic types associated with these "Apache" sites are Ocate Micaceous, a thin striated micaceous ware, and Pueblo glaze and culinary wares (Gunnerson 1987:108-109).

The best data bearing on the ethnicity question may be a combination of feature dates (chronometric and cross dates on artifacts) and reference to the archival information. Based on both archival evidence and chronometric and cross dates suggesting an 1800s occupation (although not ruling out a 1700s occupation) at the two Historic Period features, Feature 1 on LA 25417 and Feature 1 on LA 25419, the Jicarilla Apaches appear to be the most likely candidates for site occupants. The ceramic type, attributed to these Apaches, is a strong component of this judgment. These Historic Period occupations form only a small part of the prehistoric remains at these sites, however. Mariah's work suggests that the most intensive use of these sites and probably the cobble ring features occurred during prehistoric times.

Association of cobble rings with prehistoric cultures is even more difficult than for historically documented groups. While Apaches or other Athabaskans may have been responsible for making the prehistoric cobble rings, it is equally possible that Anasazi or Late Archaic peoples built and used these structures during trips to the Piedra Lumbre Valley for hunting purposes or during traveling. There is simply insufficient associational evidence to determine ethnicity on the prehistoric structures.

8.2 RECOMMENDATIONS

The Abiquiu results are not atypical of tipi ring studies in terms of low artifact density near rings and the types of information derived from interior excavation of rings. Schneider's (1983) work at the Sprenger Tipi Ring Site in North Dakota, for example, found that artifact density/m^2 is slightly higher inside than outside of stone circles and that ring interiors provided information on site culture and age, as well as a good representation of the site's artifact assemblage. Interior excavations indicated quantity and density of artifacts and debitage at each site. Average densities outside of rings on the T-W-Diamond site in Colorado were less than 1 flake/m^2, and outside activity areas were not located. Six other stone ring sites near the T-W-Diamond site produced more artifacts as a result of re-collection of the sites during successive seasons by larger survey crews. Future plans were re-collection of known sites to increase the size of surface collections and dating and detailed mapping of surface features (Morris et al. 1983).

A significant advantage of dealing with low artifact density tipi ring sites versus high density lithic scatters without cobble rings is the ability to discuss site structure in relation to topography from surficial evidence alone. Questions about settlement pattern and site plan, contemporaneity of rings, activity areas, or hearths associated with rings can be posed on the basis of survey and mapping data. Of course, surface collections (especially of obsidian) and excavation data are needed to confirm contemporaneity and address questions about complex site structure. Reher (1983), for example, notes that basic site structure on tipi ring sites is visible without block excavation, but that lack of clear stratigraphic separation makes interpretation difficult. He recommends a settlement analysis using intensive excavation, mapping, artifact analysis, and C-14 dating. Levine (1984) also recommends extensive block excavations on tipi ring sites.

8.2.1 Specific Abiquiu Recommendations

Further work is recommended at Abiquiu on cobble ring sites. Much has been learned from this sample of Abiquiu ring sites and the potential of this kind of site to yield significant information. The major drawback of the three sites sampled for this project is their multicomponency, a problem which also has been recognized on the northern plains (Kehoe 1983). It is recommended that future work focus on single component sites, if possible. However, given the intensity of occupation at the reservoir, this situation is not likely to occur. Recognizing that the Abiquiu sites will likely be multicomponent, researchers will have to approach the sites cautiously and focus their studies on chronometric analysis.

Specific recommendations for further work at LA 25417, LA 25419, and LA 25421 are discussed below. The results of analysis of the tipi ring sites show that the sites <u>do</u> in fact retain considerable research and dating potential. Interesting patterning in structure, feature, and artifact distributions was discernible despite the relatively low level of testing effort at these very large sites. On LA 25421, 4 m^2 of a total site area of 8,024 m^2 was excavated; on LA 25417, 6.25 m^2 of the total site area of 32,523 m^2 was excavated; on LA 25419, 7 m^2 of the total of 64,905 m^2 was excavated. Mapping data, particularly plan maps of cobble rings and thermal features, were necessary for the morphological analysis and for deciding goodness of fit with ethnographic analogies. Analysis produced a multitude of dates, an assessment of structural similarity to known tipi rings, an assessment of duration of occupation, and suggestions, based on site structure and ring locations, on subsistence-settlement systems involved in producing these site remains.

8.2.1.1 Mapping

Mariah's work at three cobble ring sites focused on plan view site and feature mapping. This task has been completed for the sites with the possible exception of the north terrace of LA 25419, which was hastily mapped. More intensive work in this area may discover additional hearth features. In terms of stratigraphic mapping, many previous studies have shown that occupation floors/living surfaces in tipi rings are often difficult to define, primarily because of a relative lack of prepared surfaces. In the Abiquiu area, there is also a relative lack of soil development. The lack of soil development and the action of wind and water erosion have resulted in at most two basic strata at these sites, an upper aeolian/colluvial sandy loam and a lower C-horizon with caliche and gravels. Cultural materials are found in the upper stratum or the contact with the lower sterile stratum. Because of ongoing deflation, there is thought to have been considerable mixing of different occupations in the upper stratum. As there is only one cultural stratum and artifacts occur in extremely low densities within it, stratigraphic correlations of artifacts over an entire site are virtually meaningless. One method that might prove useful for defining floor surfaces is particle size analysis on sediments in the rings in order to define microstratigraphic changes; this approach would, unfortunately, be quite expensive.

8.2.1.2 Dates

Most researchers emphasize the importance of dating cobble ring sites, given the often sparse artifact density, the ephemeral nature of the occupations, and, for the Abiquiu area, the diversity of ethnic groups known to have used the area during historical times. Much of the utility of the present study derives from the large number of dates that were obtained, relative to the small amount of excavation. Ring interiors often suggest culture and age and provide information on assemblage type, quantity, and density. The artifact density is often slightly higher inside than outside rings. These factors may have allowed the 1-m^2 test pits placed in ring centers to uncover as much information as they did. Test pit placements were biased for ring centers because of a number of factors including potential for dates from a central hearth, expected higher artifact densities, and possibility for determining whether some of the disturbed rings were in fact tipi ring-type features. Further excavation can now be better directed.

8.2.1.3 Excavation

Many authors have recommended block excavations on tipi ring sites. For example, Deaver (1983), working at the Johnson Bison Kill Site in Montana, finds that when average artifact density is less than 20/m^2, deriving significant information requires a large time and labor investment. Of the 30 points recovered from the Johnson site, two-thirds were from outside of features although only 40% of the excavated area was outside of features Deaver (1983:70) observes that:

> A couple of 1 x 1 m test pits would not have provided much information about 24PH8. Test pits smaller than 4 x 4 m are probably not cost-effective, and small test pits in rings are likely to yield minimal debris, inferences from which may be misleading. Excavation of one-quarter to one-half of rings is recommended. More material was found and more activities documented between rings than within them at 24PH8.

Deaver's point is probably valid. Block excavations would be very informative on cobble ring sites for several reasons. First, they may allow documentation of living floors inside cobble rings where hearth disturbances might have prevented such recognition. Second, excavation inside rings provides the best data on associated artifacts, even though Feature 1A in the center of ring Feature 1 on LA 25417 produced a San Jose Phase radiocarbon date. At the Abiquiu sites, there is abundant subsurface obsidian which produces reliable dates. Third, extramural excavation may allow documentation of outside activity areas, orientation of doorways, etc. Such was not the focus of the present study.

Given that most of the Abiquiu sites are multicomponent, block excavations should be very structured. Useful variables for structuring such work would include chronometric dates and morphological clusters. Differences in tipi ring spacing on LA 25417 and the south terrace of LA 25419 were identified and are possibly related to different adaptive strategies. Work should focus on these two sites (particularly since LA 25421 possessed only two rings). The cluster analysis suggested that Features 2, 8, and 12 on LA 25417 were similar morphologically, although dates suggest they are not contemporaneous. Work should focus on at least the Features 2 and 8, since they have already produced surface and subsurface datable materials. A sample of interior and exterior space should be excavated, as well as at least one of the possibly associated hearths (Feature 9, 10, or 11).

On LA 25419, on the other hand, the morphological analysis suggested that ring Features 2-6 possessed similar characteristics, and the dates suggested that some of these rings were occupied during the Developmental Period and may be related to the Developmental (and Bajada Phase) hearth Feature 9. These rings may represent an encampment and should be examined further. While both Feature 1 and, to a lesser extent, Feature 4 were disturbed, the former may warrant testing simply because of its proximity to dated artifacts such as the gunflint and the Case knife, as well as three points. As with LA 25417, excavation should encompass both interior and immediate exterior areas to provide a comparative data base. Cobble ring features on the north terrace should be tested, since only one was tested during this study. Feature 15, although disturbed by cattle, had unusually high artifact densities within 10 m and would be an excellent candidate for testing. Hearths along the central ridge should be tested to compare with tipi ring dates and the many dated points occurring on this stable land surface. Also, at least one hearth and one ring in the upper southwest portion of the north terrace should be tested, as tnese rings are at a slightly higher elevation and in more rolling terrain than all other rings studied.

In summary, while this study involved only limited testing at these three tipi ring sites, the sites produced a large number of dates and a good deal of surface information on these features. The next step is to obtain the subsurface information that will inform on goodness of fit with ethnographic data on tipi ring characteristics. Needed are data on chronology, duration of occupation, site function, and settlement-subsistence. These sites have promising potential to provide those data.

8.2.2 Field Method Recommendations

Mariah's work at the three Abiquiu sites identified significant features and artifact concentrations missed by survey crews. The greater time spent on sites during testing as opposed to survey resulted in more cobble rings reported at LA 25417 (seven vs. three) and LA 25419 (22 vs. 20) and numerous thermal features. For multicomponent sites of these sizes and artifact densities, survey budgets should be adequate for reconnaissance of the site surface and identification of structure, feature, and artifact concentration locations.

It is difficult to suggest a cookbook approach to field methodology when tipi ring sites vary so much in size of artifact assemblage, postdepositional activities, topographic situation, feature number and morphology, and site plans. Quigg and Brumley (1984) make useful suggestions for standardizing data collection on ring sites. In the northeastern Colorado study Morris et al. (1983) recommended certain field strategies for future studies. These included surface collection, detailed mapping of surface features, and excavation of selected stone ring sites. Similarly, Reher (1983) recommends intensive excavation, mapping, artifact analysis, and C-14 dating. These recommendations are aimed at providing comparative data which is useful for analyzing tipi rings and tipi ring sites as a class, and particularly for collecting data which demonstrate the range of variability in these features and which can be used in future pattern recognition studies. Level of effort and selection of excavation units on Montana tipi ring sites was guided by the presence of datable materials such as obsidian, bone, and charcoal (L. Davis 1983).

Quigg and Brumley (1984) provide excellent recommendations for standardizing data collection on stone circle sites. Cobble ring discovery techniques such as transect intervals in a variety of ground cover and depositional situations have not been evaluated systematically (Quigg and Brumley 1984:50). During the site evaluation phase, techniques include site mapping, feature recording, and *subsurface testing*. Mapping data should allow analysis of cultural features relative to one another, should show site and feature locations relative to local geographic features, and should form a framework for individual features data. For individual features, plan maps, stone circle interior diameters, individual stone weights, stone distribution, and depth of stone bases below surface should be recorded (Quigg and Brumley 1984:81-82). Stones thought to be part of a cultural feature should be distinguished from naturally occurring stones. Sampled areas should include extramural and interior units and units in possibly associated activity areas. Distance from the center of the circle may be a useful means of stratifying the surface area to be sampled. Windward and leeward units form another possible sampling stratum.

8.2.3 General Recommendations for Abiquiu Cobble Ring Sites

Tipi ring, or stone circle, sites in intensively occupied regions such as north central New Mexico can be extremely difficult problems for archaeological and ethnohistorical research. General recommendations are phrased in the context of management objectives.

Four management objectives relating to cobble ring sites are presented below. The objectives include both contrastive and complementary goals.

1. One objective could be to further investigate the sites to learn about the processes that lead to site formations.

2. A second objective could be to attempt to isolate and investigate the cobble ring associated occupations.

3. Ethnoarchaeological, ethnohistorical, cultural-ecological, and other research could be done to build predictive models to assess features of these three sites and other related sites.

4. A fourth objective could be to develop a regional model which encompasses cobble ring sites within a broader cultural framework.

In light of the long history of site reuse, it appears that the Abiquiu locations were strategic to a number of activities, some of which revolved around cobble ring architecture. One question to be explored could be why cobble rings occur on the sites to the exclusion of other types of structures (e.g., pithouses and surface pueblos) which are found throughout the reservoir. Questions relating to site formation processes, which are relevant to discovering the roles of cobble ring architecture through time and which could considerably expand our knowledge of prehistoric culture processes in the Southwest, could be formulated.

A second objective would be to attempt to isolate and investigate the cobble ring occupations. This would involve very detailed surface mapping and artifact collection strategies to isolate the individual site components. On multicomponent sites such as those found in Abiquiu, this would be very tedious. By necessity, numerous dates (e.g., obsidian, archaeomagnetic, radiocarbon) would have to be obtained.

Objectives 1 and 2 require detailed information about the stratigraphy of the sites and resolution of the questions concerning reoccupation of the structures and/or site areas. Where sites have been eroded significantly, such stratigraphic work may be impossible.

The third objective would be to extract ethnoarchaeological, ethnohistorical, and cultural ecological supplemental data which can be used to address issues such as ethnicity, feature function, and subsistence. There is good historical documentation of Ute, Navajo, and Apache architecture dating from the Spanish to the mid-1800s during Anglo-American occupation of New Mexico.

The fourth objective complements the other three objectives. It involves developing a comprehensive regional model encompassing all known cultural systems operant within the project area sphere of influence. Rather than focusing on individual sites, or features within sites, the model would address larger issues such as settlement patterning, ethnicity, trade networks, social structure, and other variables related to site formation. The research would assist the ACOE in meeting its future cultural resource management goals. Future research projects on Abiquiu cobble rings could focus productively on objective 4, which could then structure research on the more detailed objectives.

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AD-A209 239 ANALYSIS OF THREE COBBLE RING SITES AT ABIQUIU RESERVOIR RIO ARRIBA COUNTY NEW MEXICO(U) MARIAH ASSOCIATES INC ALBUQUERQUE NM A C EARLS ET AL. JAN 89 4/4

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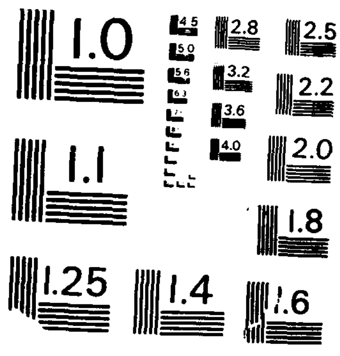

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APPENDIX A:

Obsidian Hydration Data

Christopher M. Stevenson
and
Richard E. Hughes

The Hydration Dating of Obsidian Artifacts from the Abiquiu Dam Reservoir and Other Parts of Northern New Mexico

by

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Submitted to:

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Albuquerque, New Mexico 87107

Twenty obsidian artifacts from archaeological sites in northern New Mexico were submitted to Archaeological and Historical Consultants, Inc. for age determinations using the obsidian hydration dating method. The samples were selected from surface or subsurface contexts at six prehistoric archaeological sites. Three of the sites (LA 25417, LA 25419, LA 25421) are located at the Abiquiu Reservoir project area within the Jemez Mountain region of northern New Mexico. The remaining three sites (LA 60561, LA 60571, LA 60580) are found in the Conchas Reservior project area in northeastern New Mexico.

In order to calculate an absolute date for an obsidian artifact four analytical procedures need to be completed. First, the amount of surface hydration, or the thickness of the hydration rim, must be measured. Secondly, the geological origin of the artifact needs to be ascertained so that the appropriate set of hydration rate constants particular to each glass type may be applied. Third, the hydration rate constants for each of the compositionally distinct natural glasses are determined at elevated temperature within the laboratory. Lastly, the soil temperature at the archaeological site is estimated in order that the rate of hydration developed at high temperature may be adjusted to reflect the hydration temperature at the prehistoric site. Each of the analytical steps is discussed below.

Hydration Rim Measurement

A thin section was prepared for each sample under the guidelines presented by Michels and Bebrich (1971). Hydration rim width measurements were made at 2000X with a Watson image-splitting measurement instrument. Seven independent measurements were made and a mean value and standard deviation calculated (Table 1). The standard deviations represent precision errors associated with the measurement process and have been used to determine the uncertainty factor associated with each age determination.

Table 1

Obsidian Hydration Dates for Various Sites in Northern New Mexico

AHC Lab No.	Provenience	Cut	Chemical Group	Rim Width	S.D.	Date	S.D.
87-314	LA 25417, FS89	A	MED	3.28	0.06	------	
87-315	LA 25417, FS18	A	POL	6.18	0.06	2348BC	85
87-316	LA 25417, FS115	A	MED	6.01	0.09	------	
87-351	LA 25417, FS115	B	MED	5.66	0.04	------	
87-317	LA 25417, FS2	A	POL	3.19	0.04	832AD	29
87-318	LA 25417, FS1	A	MED	2.87	0.04	------	
87-319	LA 25417, FS114	A	POL	6.15	0.08	2306BC	112
87-359	LA 25417, FS114	B	POL	6.24	0.06	2432BC	86
87-320	LA 25419, FS175	A	POL	4.21	0.04	24BC	39
87-360	LA 25419, FS175	B	POL	4.13	0.06	51AD	56
87-361	LA 25419, FS175	C	POL	4.28	0.05	92BC	49
87-321	LA 25419, FS1	A	POL	2.92	0.08	1019AD	53
87-353	LA 25419, FS1	B	POL	2.85	0.06	1065AD	39
87-322	LA 25419, FS35	A	POL	2.14	0.05	1467AD	24
87-357	LA 25419, FS35	B	POL	2.50	0.05	1278AD	29
				3.07	0.03	917AD	21
87-323	LA 25419, FS186	A	POL	4.56	0.08	373BC	84
87-358	LA 25419, FS186	B	POL	3.86	0.04	296AD	35
87-324	LA 25419, FS191	A	MED	3.93	0.04	------	
87-356	LA 25419, FS191	B	MED	3.67	0.09	------	
87-325	LA 25419, FS1	A	POL	3.34	0.03	721AD	23
				2.74	0.08	1135AD	50
87-326	LA 25419, FS7	A	POL	3.52	0.05	581AD	41
87-327	LA 25421, FS91	A	MED	5.34	0.06	------	
87-362	LA 25421, FS91	B	MED	4.59	0.03	------	
87-328	LA 25421, FS1	A	POL	2.42	0.03	1322AD	16
				3.40	0.05	675AD	39
87-329	LA 25421, FS101	A	POL	3.73	0.04	408AD	34
87-352	LA 25421, FS101	B	POL	3.79	0.04	357AD	35

Additional thin sections were prepared for ten of the twenty samples to determine if the artifact had undergone periods of use separated by long time intervals. The locations for these additional thin sections were provided by Mariah Associates.

Compositional Analysis

In order to determine the geological parent material of the obsidian artifacts, each sample was analyzed for its parts per million concentration of seven trace elements (Zn, Ga, Rb, Sr, Y, Zr, Nb) using a non-destructive, solid sample, X-ray flourescence analysis (See Attachment). A comparison of the trace element concentrations for the artifacts with those determined for obsidian source locations in the Jemez Mountains indicated that two types of obsidian are represented. Fifteen of the samples have been derived from the Polvadera Peak obsidian source and five from the Cerro del Medio obsidian outcropping (Table 1).

Hydration Rate Development

A hydration rate for Polvadera Peak has been developed in the laboratory under conditions of high temperature and pressure. Seven freshly fractured flakes were hydrated in 500ml of distilled deionized water containing 500gm of amorphous silica at temperatures ranging between 150oC and 180oC for durations of up to 10 days (Table 2). At the end of the reaction period each sample was thin sectioned and the hydration rim measured. The induced hydration rims (Table 2) were then used to calculate the Activation Energy (E=81324 J/mol Figure 1, Table 3) and the Preexponential at 180oC (A=6.17, Figure 2, Table 4). The mathematical calculations used in the rate development procedure are presented by Michels et al (1983). With these variables now known, chronometric dates for the Polvadera Peak obsidian artifacts may be calculated once the effective hydration temperature of the archaeological archaeological samples has been estimated.

Soil Temperature Estimation

Soil temperature data is not available for the Jemez Mountain region. Therefore, in order to estimate the effective hydration temperature of the soil for the Abiquiu Reservoir project area, Lee's (1969) temperature integration equation will be applied to local air temperature readings. This formula provides an integrated temperature that can be applied to exponential processes such as obsidian hydration. Air temperature data from Abiquiu Dam (Elevation: 6380 feet) presented in an earlier report compiled by Chambers Consultants and Planners (K. Lord, Chapter 9, Page 7), results in an effective hydration temperature of:

$$Te = \frac{(Ta + 1.2316) + (0.1607 * Rt)}{1.0645}$$

Table 2

Induced Hydration Rim Measurements for Polvadera Peak Obsidian

Sample No.	Temperature(oC)	Duration	Rim Width(um)	S.D.
1	180	4 Day	5.04	0.06
2	180	6 Day	6.16	0.04
3	180	8 Day	7.02	0.09
4	180	10 Day	7.84	0.09
5	150	8 Day	3.31	0.07
6	160	8 Day	4.20	0.06
7	170	8 Day	5.61	0.08

Figure 1: Activation Energy Plot for Polvadera Peak Obsidian

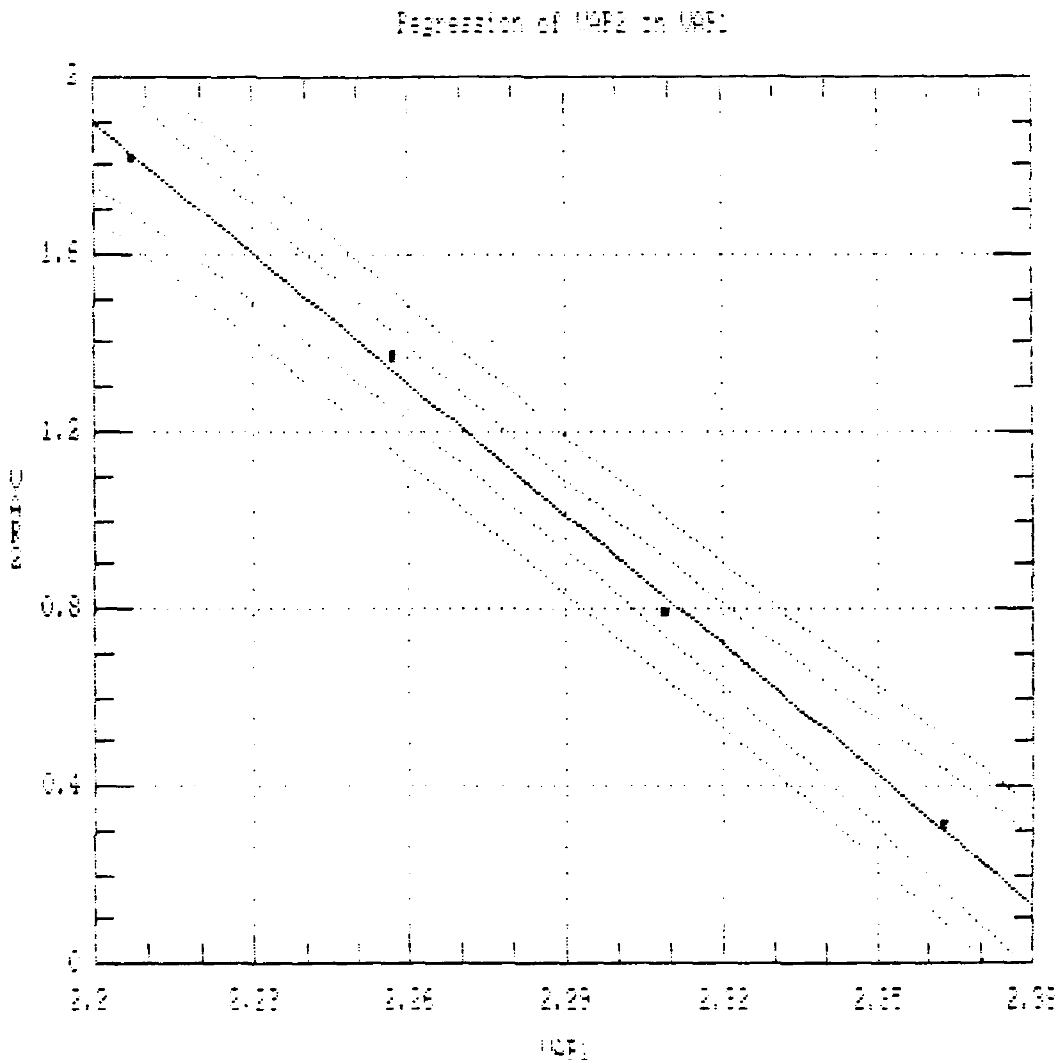

Table 3: Regression Statistics for the Polvadera Peak Activation Energy Plot

Regression Analysis - Linear model: Y = a+bX

Dependent variable: [illegible] | Independent variable: [illegible]

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	23.4335	0.727216	32.2225	9.61733E-4
Slope	-9.76963	0.318294	-30.7555	1.05544E-3

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.29610	1	1.29610	945.96671	.00106
Error	.0027403	2	.0013701		
Total (Corr.)	1.2988333	3			

Correlation Coefficient = -0.998945 R-squared = 99.79 percent

Stnd. Error of Est. = 0.0370152

Figure 2: Preexponential Plot for Polvadera Peak Obsidian

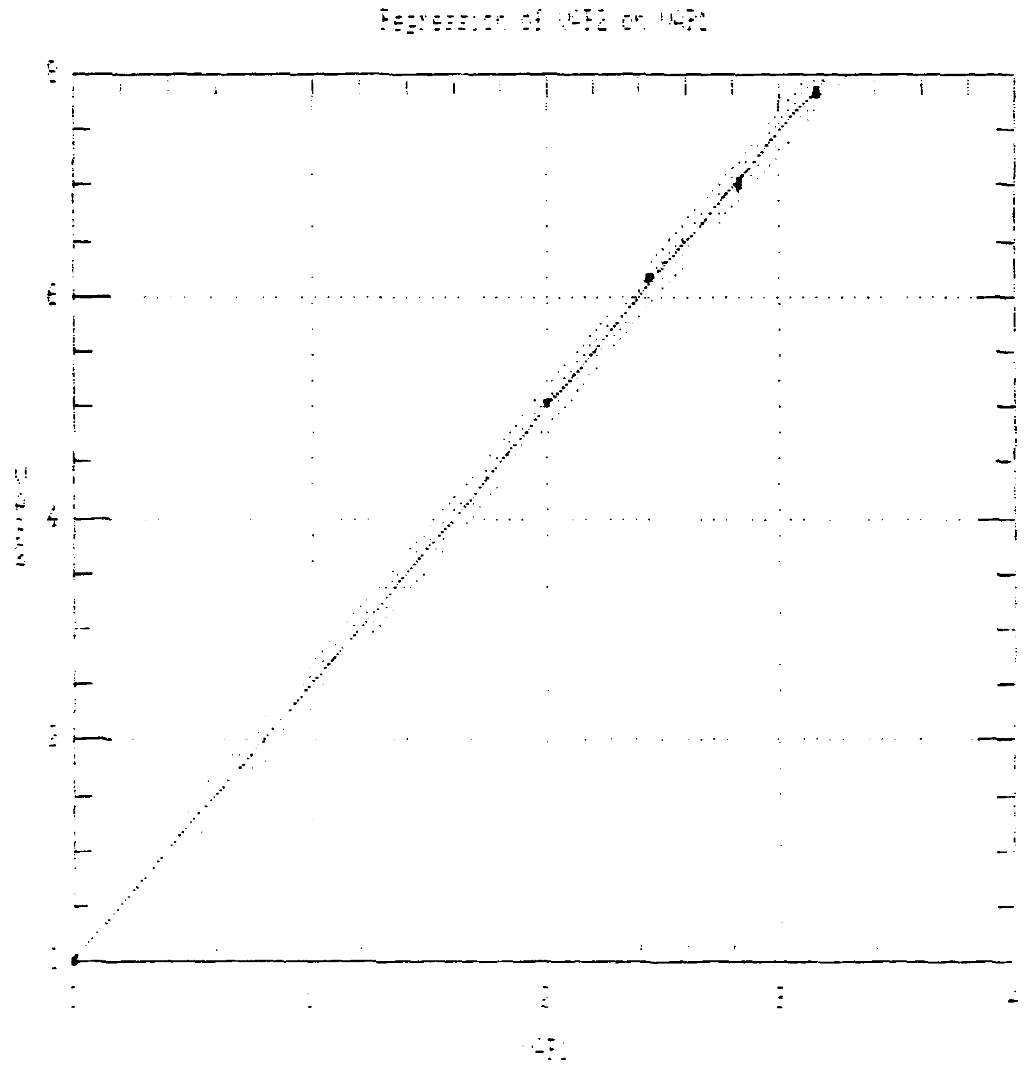

Table 4: Regression Statistics for the Polvadera Peak Preexponential Plot

Regression Analysis - Linear model: Y = a+bX

Dependent variable: VAR2 Independent variable: VAR1

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	0.0243386	0.0478764	0.507177	0.648352
Slope	2.48452	0.0202748	122.542	1.1[illegible]E-6

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	38.261	1	38.261	15016.507	.00000
Error	.0076438	3	.0025479		
Total (Corr.)	38.268480	4			

Correlation Coefficient = 0.9999 R-squared = 99.98 percent

Stnd. Error of Est. = 0.0504769

$$= \frac{(9.80 + 1.2316) + (0.1607 * 25.28)}{1.0645}$$

$$= 14.18oC$$

where: Te= effective hydration temperature
Ta= mean annual air temperature (oC)
Rt= the range in mean annual air temperature (oC)

Suitable air temperature data was not available for the Conchas Reservior area. Therefore, an estimate of the soil temperature could not be made.

Discussion

Using the effective hydration temperature estimate, a hydration rate for Polvadera Peak obsidian at the Abiquiu Reservoir project area may now be made. The hydration rate developed at 180oC is extrapolated to the hydration rate at 14.18oC by use of the Arrhenius equation:

$$K= K'EXP\ E/RT$$

$$= K'\ EXP\ E/R\ (1/T' - 1/T)$$

$$= 6.17\ EXP\ (81324/8.317)\ (1/453.16 - 1/287.34)$$

$$= 8.81\ um2/1000\ years$$

where: K= archaeological hydration rate
K'= preexponential at 180oC (um2/day)
E= activation energy (J/mol)
R= universal gas constant
T'= experimental temperature (180oC)
T= effective hydration temperature (14.18oC)

The hydration rate of 8.81 um2/1000 years was used to calculate the absolute dates on Table 1. It should be noted, that the rate estimation procedures used in this study are experimental and subject to revision since the induced hydration rate procedure is a relatively new approach that has yet to be thoroughly evaluated.

References

Lee, R.
1969 Chemical temperature integration. Journal of Applied Meteorology. 8:423-430

Michels, J. and Bebrich, C.
1971 Obsidian hydration dating. In Dating Techniques for the Archaeologist. H.N. Michael and E.K. Ralph, Eds., MIT Press, Cambridge.

Michels, J., Tsong, I.S.T., and Nelson, C.
1983 Obsidian dating and East African archaeology. Science 219:361-366

SONOMA STATE UNIVERSITY ACADEMIC FOUNDATION, INC.

ANTHROPOLOGICAL STUDIES CENTER
CULTURAL RESOURCES FACILITY
707 664-2381

December 1, 1987

Dr. Christopher M. Stevenson
Archaeological and Historical Consultants, Inc.
P.O. Box 482
Centre Hall, PA 16828

Dear Chris:

Enclosed with this letter you will find copies of two tables presenting x-ray fluorescence (xrf) data generated from the analysis of 20 obsidian artifacts from Moriah Associates work in the Abiquiu Dam area, northern New Mexico. This research was conducted pursuant to your letter request of November 23, 1987 under Sonoma State University Academic Foundation, Inc. Account 6081, Job X87-81.

Laboratory investigations were performed on a Spectrace™ 5000 (Tracor X-ray) energy dispersive x-ray fluorescence spectrometer equipped with a Rh x-ray tube, a 50 kV x-ray generator, with microprocessor controlled pulse processor (amplifier) and bias/protection module, a 100 mHz analog to digital converter (ADC) with automated energy calibration, and a Si(Li) solid state detector with 150 eV resolution (FWHM) at 5.9 keV in a 30 mm^2 area. The x-ray tube was operated at 30.0 kV, .30 mA, using a .127 mm Rh primary beam filter in an air path at 200 seconds livetime to generate quantitative data for elements Zn - Nb. Data processing for all analytical subroutines is executed by a Hewlett Packard Vectra™ microcomputer, with operating software and analytical results stored on a Hewlett Packard 20 megabyte fixed disk. Trace element concentrations were computed from a least-squares calibration line established for each element from analysis of up to 25 international rock standards certified by the U.S. Geological Survey, the U.S. National Bureau of Standards, the Geological Survey of Japan, and the Centre de Recherches Petrographiques et Geochimiques (France). Further details pertaining to operating conditions and calibration appear in Hughes (1987).

Trace element measurements on the xrf data table are expressed in quantitative units (i.e. parts per million [ppm] by weight), and matches between unknowns (artifacts) and known obsidian chemical groups were made on the basis of correspondences in diagnostic trace element concentration values (in this case, ppm values for Rb, Sr, Y, and Zr) that appear in Baugh and Nelson (n.d.), Hughes (n.d.), Nelson (1984), and Newman and Nielsen (1985). I use the term "diagnostic" to specify those trace elements that are well-measured by x-ray fluorescence, and whose concentrations show low intra-source variability and marked variability across sources. In short, diagnostic elements are those whose concentration values allow one to draw the clearest geochemical distinctions between sources. Although Zn, Ga ppm concentrations also

1801 East Cotati Avenue Rohnert Park, California 94928

December 1, 1987
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were measured and reported for each specimen, they are not considered "diagnostic" because they don't usually vary significantly across obsidian sources (see Hughes 1982, 1984). This is particularly true of Ga, which occurs in concentrations between 10-30 ppm in nearly all parent obsidians in the study area. Zn ppm values are infrequently diagnostic; they are always high in Zr-rich, Sr-poor peralkaline volcanic glasses, but they do not vary significantly between non-peralkaline sources in the study area.

The data tables present obsidian source type attributions for each specimen, so there is no need to repeat individual assignments. Only two geochemical varieties of obsidian were identified in this sample--Polvadera Peak and Cerro del Medio. Polvadera Peak accounted for 75% of the sample (15 of 20 specimens) and Cerro del Medio glass made up the remaining 25% (5 of 20). These findings are consistent with my earlier analyses of artifacts from other sites in the Abiquiu Dam area (Hughes 1986).

I hope this information will help in your analysis of these site materials. Please contact me if I can be of further assistance.

Sincerely,

Richard Hughes

Richard E. Hughes, Ph.D.
Senior Research Archaeologist

December 1, 1987

References

Baugh, Tomothy G., and Fred W. Nelson

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1986 X-ray Fluorescence Analysis of Artifacts from the Abiquiu Dam Area, New Mexico. Letter report submitted to Christopher M. Stevenson, September 5, 1986.

1987 The Coso Volcanic Field Re-examined. Manuscript in possession of the author.

n.d. Archaeological Significance of Geochemical Contrasts Between Obsidians from Southwestern New Mexico. Manuscript in posession of the author.

Nelson, Fred W.

1984 X-ray Fluorescence Analysis of Some Western North American Obsidians. **In** Richard E. Hughes (ed.), Obsidian Studies in the Great Basin. **Contributions of the University of California Archaeological Research Facility**, No. 45, pp. 27-62.

Newman, Jay R., and Roger L. Nielsen

1985 Initial Notes on X-ray Fluorescence Sourcing of Northern New Mexico Obsidians. **Journal of Field Archaeology**, Vol. 12: 377-383.

Specimen Number	Trace Element Concentrations Zn*	Ga*	Rb*	Sr*	Y*	Zr*	Nb*	Obsidian Source (Chemical Type)
87-314	77.5 ±8.0	17.7 ±4.9	159.1 ±5.4	7.2 ±3.1	42.6 ±2.4	164.6 ±4.6	47.9 ±3.6	CERRO DEL MEDIO
87-315	37.9 ±14.7	18.2 ±5.5	163.8 ±5.8	11.1 ±3.0	25.0 ±2.7	68.2 ±4.4	46.4 ±3.8	POLVADERA PEAK
87-316	79.2 ±9.0	19.2 ±5.0	155.6 ±5.6	7.0 ±3.3	42.5 ±2.5	160.5 ±4.8	46.4 ±3.7	CERRO DEL MEDIO
87-317	50.9 ±12.6	18.7 ±5.6	148.1 ±5.9	8.8 ±3.3	26.6 ±2.9	70.4 ±4.6	38.7 ±4.0	POLVADERA PEAK
87-318	67.8 ±8.8	15.8 ±5.6	162.0 ±5.6	9.5 ±3.0	40.7 ±2.5	173.9 ±4.7	48.4 ±3.6	CERRO DEL MEDIO
87-319	52.7 ±8.1	17.7 ±4.4	147.9 ±5.3	10.1 ±2.9	26.2 ±2.4	72.8 ±4.2	46.8 ±3.5	POLVADERA PEAK
87-320	41.2 ±10.	13.2 7±6.6	156.1 ±5.4	7.2 ±3.2	25.7 ±2.4	72.8 ±4.2	46.1 ±3.5	POLVADERA PEAK
87-321	49.3 ±9.3	18.7 ±4.5	145.0 ±5.5	10.5 ±2.9	23.5 ±2.5	68.0 ±4.3	46.2 ±3.6	POLVADERA PEAK
87-322	47.8 ±9.3	21.6 ±4.0	149.3 ±5.5	7.4 ±3.1	25.7 ±2.5	67.9 ±4.3	44.2 ±3.6	POLVADERA PEAK
87-323	35.9 ±10.6	18.0 ±4.2	150.0 ±5.3	9.3 ±2.9	23.3 ±2.4	67.8 ±4.2	46.4 ±3.4	POLVADERA PEAK
87-324	65.3 ±8.1	19.1 ±4.4	154.9 ±5.4	6.2 ±3.4	40.7 ±2.4	155.8 ±4.5	50.4 ±3.5	CERRO DEL MEDIO
87-325	62.7 ±9.5	14.2 ±7.4	158.9 ±5.8	12.4 ±3.1	24.2 ±2.8	77.0 ±4.5	49.5 ±3.9	POLVADERA PEAK
87-326	66.6 ±12.8	15.3 ±9.2	170.9 ±6.8	10.2 ±3.6	22.7 ±3.6	73.3 ±5.0	48.0 ±4.6	POLVADERA PEAK
87-327	68.8 ±7.8	20.5 ±4.1	148.0 ±5.4	8.3 ±3.0	38.2 ±2.4	157.0 ±4.5	46.4 ±3.5	CERRO DEL MEDIO
87-328	48.4 ±8.8	20.3 ±4.2	149.2 ±5.5	5.7 ±3.7	24.3 ±2.5	63.5 ±4.3	39.7 ±3.6	POLVADERA PEAK
87-329	50.1 ±7.9	21.0 ±3.9	145.2 ±5.3	9.2 ±2.9	22.4 ±2.4	70.2 ±4.2	47.1 ±3.5	POLVADERA PEAK

* = trace element values in parts per million (ppm); ± = counting and fitting error uncertainty at 200 seconds livetime.

APPENDIX B:

C-14 Data

University of Texas-Austin
Radiocarbon Laboratory

Univ. of Texas-Austin Radiocarbon Laboratory SPECIMEN DATA SHEET

---For lab use only---

Average				X-no.	5848
Age	550 ± 50	Age		Tx-no.	5848
$\delta^{14}C$	-68.90 ± 4.89‰	$\delta^{14}C$		Published	
$\delta^{13}C$	-21.7	$\delta^{13}C$			
Run #	77C	Run #			

Remarks

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: Charcoal
2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):
   Mariah Abiquiu Sample 1
3. Name and number of site: LA 25417, F1B, TU 8
4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):
   ~16 mi NW of Abiquiu, NM, on the west bank of the Rio Chama.
5. Latitude & Longitude, at least to the minute: 36° 18', 106° 31'
6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:
   Sample is in northern half of Feature 1, a well defined tipi ring. Charcoal from E 1/2 of hearth contents, 0-10 cm BS.
7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):
   Dr. Christopher Lintz Sept. 24 1987

(over)

Context: For archeological samples--significant artifact association; ultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.
The tipi ring contained flakes & bone to a depth of less than 30 cm below surface. Numerous points are not clearly associated. Tipi ring thought to be Ute based on documents.

9. Previous radiocarbon dates, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:
None known for Abiquiu Reservoir tipi rings.

10. Variables affecting validity of date: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:
Charcoal is from a basin shaped pit containing some coal. Charcoal was floated to remove coal fragments.

11. Significance of sample: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?
We would like to know if the "tipi rings" on these sites are historical in date or if they pertain to earlier occupations.

12. Estimated sample age: Your advance guess as to the age of the sample-- may be stated as a range:
AD 1600-1850

13. Signature of submitter: Amy C. Earls

Type or print name: Amy C. Earls

Address, institutional affiliation: Mariah Associates, Inc.
2825-C Broadbent Pkwy NE Albuquerque, NM 87107

Date: Oct. 2, 1987

Univ. of Texas-Austin   Radiocarbon Laboratory   SPECIMEN DATA SHEET

----For lab use only----

Average				X-no.	5856
Age	3700 ± 90	Age		Tx-no.	5856
$\delta^{14}C$	−36[illegible] ± [illegible]	$\delta^{14}C$		Published	
$\delta^{13}C$		$\delta^{13}C$			
Run #	95C	Run #			

Remarks

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: Burned/stained soil

2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):

Mariah Abiquiu Sample 2

3. Name and number of site: LA 25421, F2, TU2, Bag 2/2

4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):

~16 mi NW of Abiquiu, NM, on the west bank of the Rio Chama.

5. Latitude & Longitude, at least to the minute: 36° 18', 106° 34'

6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:

Sample is from Feature 2 on the western part of the site, in a well defined cobble & slab-lined roasting pit. Sample from N 1/2 below feature, 20-23 cm

7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):

Amy C. Earls Sept. 10, 1987

(over)

8. __Context__: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.
No artifacts were associated with the feature.
Surface points are not definitely associated.

9. __Previous radiocarbon dates__, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:
None known.

10. __Variables affecting validity of date__: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:
Numerous rootlets throughout upper feature matrix, no other contaminants known.

11. __Significance of sample__: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?
To provide a date for subsurface materials at the site. The two tipi rings on the east half of site were poorly defined; site may not be Ute.

12. __Estimated sample age__: Your advance guess as to the age of the sample--may be stated as a range:
2000 BC - AD 1850

13. Signature of submitter: Amy C. Earls

Type or print name: Amy C. Earls
Address, institutional affiliation: Mariah Associates, Inc.
2825-C Broadbent Pkwy. NE Albuq., NM 87107
Date: Oct. 2, 1987

Univ. of Texas-Austin **Radiocarbon Laboratory** **SPECIMEN DATA SHEET**

---For lab use only---

Average				X-no.	5857
Age	3670 ± 80	Age		Tx-no.	5857
$\delta^{14}C$	-366.5 ± 4.5	$\delta^{14}C$		Published	
$\delta^{13}C$		$\delta^{13}C$			
Run #	93C	Run #			

Remarks

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: Burned/stained soil
2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6): Mariah Abiquiu Sample 3
3. Name and number of site: LA 25417, F1A, TU3, Level 3
4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream): ~16 mi NW of Abiquiu, NM, on the west bank of the Rio Chama.
5. Latitude & Longitude, at least to the minute: 36° 18', 106° 24'
6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data: Sample is in the center of Feature 1 tipi ring. Soil was beneath a concentration of fire-cracked cobbles. Depth 30-40 cm BS.
7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student): Amy C. Earls Sept. 17, 1987

(over)

8. **Context**: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

The tipi ring contained surface + subsurface lithics & bone to a depth of 30 cm BS. Surface points not clearly associated. Tipi ring thought to be Ute on the basis of documents.

9. **Previous radiocarbon dates**, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None known.

10. **Variables affecting validity of date**: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

None known.

11. **Significance of sample**: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

We would like to date this tipi ring, from which we also obtained an archaeomag sample. We would like to date both features.

12. **Estimated sample age**: Your advance guess as to the age of the sample--may be stated as a range:

AD 1600-1850

13. **Signature of submitter**: Amy C. Earls

Type or print name: Amy C. Earls

Address, institutional affiliation: Mariah Associates, Inc. 2825-C Broadbent Pkwy. NE Albuq., NM 87107

Date: Oct. 2, 1987

Univ. of Texas-Austin **Radiocarbon Laboratory** **SPECIMEN DATA SHEET**

---For lab use only---

Average ______ X-no. 5858

Age 4840 ± 80 Age ______ Tx-no. 5858

$\delta^{14}C$ -452 [illegible] $\delta^{14}C$ ______ Published ______

$\delta^{13}C$ ______ $\delta^{13}C$ ______

Run # 96C Run # ______

Remarks ______

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: Burned/stained soil

2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):

Mariah Abiquiu Sample 4

3. Name and number of site: LA 25419, F9, TUS, Level 2

4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):

~16 mi NW of Abiquiu, NM, on the west bank of the Rio Chama.

5. Latitude & Longitude, at least to the minute: 36° 17', 106° 34'

6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:

Sample is from a cobble lined roasting pit (Feature 9), S 1/2, at 10-20 cm BS.

7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):

Amy C. Earls Sept. 23, 1987

(over)

8. <u>Context</u>: For archeological samples--significant artifact association; cultural identification (phase, focus, period, or other), and other context (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

Flakes & a cached mano & metate were associated. A knife blade & point tip occurred 40-50 m E of feature. Tipi rings on site thought to be Ute, but age of feature itself unknown.

9. <u>Previous radiocarbon dates</u>, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None known.

10. <u>Variables affecting validity of date</u>: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

Minor root disturbance. No other contaminants known.

11. <u>Significance of sample</u>: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

Provide date for a feature not directly associated with tipi rings.

12. <u>Estimated sample age</u>: Your advance guess as to the age of the sample-- may be stated as a range:

2000 BC - AD 1850

13. Signature of submitter: Amy C. Earls

Type or print name: Amy C. Earls

Address, institutional affiliation: Mariah Associates, Inc. 2825-C Broadbent Pkwy. NE Albuq., NM 87107

Date: Oct. 2, 1987

Univ. of Texas-Austin **Radiocarbon Laboratory** **SPECIMEN DATA SHEET**

---For lab use only---

Average				X-no.	5859
Age	1160 ± 60	Age		Tx-no.	5859
$\delta^{14}C$	[illegible]	$\delta^{14}C$		Published	
$\delta^{13}C$		$\delta^{13}C$			
Run #	97C	Run #			

Remarks ______________________________

Submitter fill out the information below and on reverse side of sheet, in as much detail as possible. (Use a separate sheet for each sample.) TYPE OR PRINT.

1. Nature of sample: Burned/stained soil

2. Submitter's catalog number, with identification of catalog (for instance, Univ. of Texas Dept. Anthro. no. 41AD72/219; C. H. Webb No. 16CD12/Log #6):

Mariah Abiquiu Sample 5

3. Name and number of site: LA 25419 F6, TU 3 0-6 cm BS

4. Descriptive location of site (e.g., so many miles NE of a town, at such and such a place on a given stream):

~16 mi NW of Abiquiu, NM, on the west bank of the Rio Chama.

5. Latitude & Longitude, at least to the minute: 36° 17′ 106° 34′

6. Location of sample within site, as precisely as possible: coordinates, elevation, zone, other specific provenience data:

Sample is from center of tipi ring (Feature 6), 0-6 cm below surface, a surface soil stain.

7. Date of collection, name of collector (person or persons responsible for collection, rather than laborer or student):

Amy C. Earls Sept. 22, 1987

(over)

.Context: For archeological samples--significant artifact association; ..ltural identification (phase, focus, period, or other), and other con-..ext (e.g., geologic) where pertinent. For geologic samples, stratigraphic assignment, etc. Similar data for other types of samples.

No artifacts were recovered from the 1 m^2 test pit. A complete point was located on the surface midway between Feature 5 & 6.

9. Previous radiocarbon dates, if any, bearing on the problem for which this sample is being dated. Give sample numbers assigned by dating laboratories, name of laboratory, and bibliographic references if any:

None known.

10. Variables affecting validity of date: If the date turns out differently from what you expected, are there factors in the field or elsewhere which might help explain the discrepancy? (e.g., disturbance, intrusion, uncertainty of stratigraphic assignment, rootlet contamination, method of handling, use of preservative). If none are known, so state:

Some root ~~disturbance,~~ deflation moderate.

11. Significance of sample: What is the problem you are trying to solve? What part do you hope this date will play in its solution? In other words, why do you feel the sample is worth dating?

Date will be relevant to tipi ring occupation.

12. Estimated sample age: Your advance guess as to the age of the sample-- may be stated as a range:

AD 1600 - 1850

13. Signature of submitter: Amy C. Earls

Type or print name: Amy C. Earls

Address, institutional affiliation: Mariah Associates, Inc. 2825-C Broadbent Pkwy. NE Albuq., NM 87107

Date: Oct. 2, 1987

APPENDIX C:

Archaeomagnetic Data

Jeffrey L. Eighmy

Colorado State University

Department of Anthropology
Archaeometric Laboratory
Fort Collins, Colorado 80523

1/22/88

Dr. Christopher Lintz
Project Manager
Mariah Associates, Inc.
2825-C Broadbent Pky. N.E.
Albuquerque, New Mexico 87107

Dear Chris:

We got the collecting kit back, and just finished the sample from Abiquiu Reservoir.

As you can see the sample had a fairly large alpha 95 - between 3.5 and 4 degrees through the demag steps. We took it to 200 Oe through five steps because the sample direction was drifting slightly. It seems to have settled down between 150 and 200. We are reporting results at 150 because it had a smaller alpha at that step.

Because the alpha was so large, the plot covers a large area and is not very precise. However, I believe you told me that a radiocarbon sample coming from the feature gave you a date of around AD 1400. The archaeomagnetic date, as imprecise as it is, does not support a date as early as AD 1400. You can see from the plot that your sample falls far away from the AD 1400 area. If archaeological evidence rules out historic, I would say the sample is very late prehistoric.

If you have any questions, call. Otherwise, I'll see you at the SAA meetings in Phoenix.

Sincerely

Jeffrey L. Eighmy, Ph.D.
Director

ARCHAEOMAGNETIC LABORATORY REPORT

Archaeometric Laboratory
Department of Anthropology
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7408 or 491-5784

Sample I.D. LA 25417-1 Feature I.D. 1B hearth

Site Latitude 36.30° N Site Longitude 253.43° E

Site Declination 11.2° E Archaeological Guess Date AD 1400-1800

Collector C. Lintz Date Collected 9/24/87

Laboratory Analysis

Demagnetization Steps (Oe)	NRM	50	100
Alpha 95 (degrees)	3.48	3.75	3.62
Precision Parameter - k	156.29	134.85	144.84
Inclination (degrees dip)	67.09	66.41	65.59
Declination (degrees E)	13.38	14.60	13.72
Mean Sample Intensity (E-07 Tesla)	1.573	1.217	.8894
No. Specimens Collected/ No. Specimens Used	12/12	12/12	12/12
Specimen No. of Outlier(s)	none	none	none

Demagnetization Steps (Oe)	150	200
Alpha 95 (degrees)	3.96	4.29
Precision Parameter - k	120.98	103.48
Inclination (degrees dip)	64.69	64.69
Declination (degrees E)	12.93	13.81
Mean Sample Intensity (E-07 Tesla)	.6723	.5231
No. Specimens Collected/ No. Specimens Used	12/12	12/12
Specimen No. of Outlier(s)	none	none

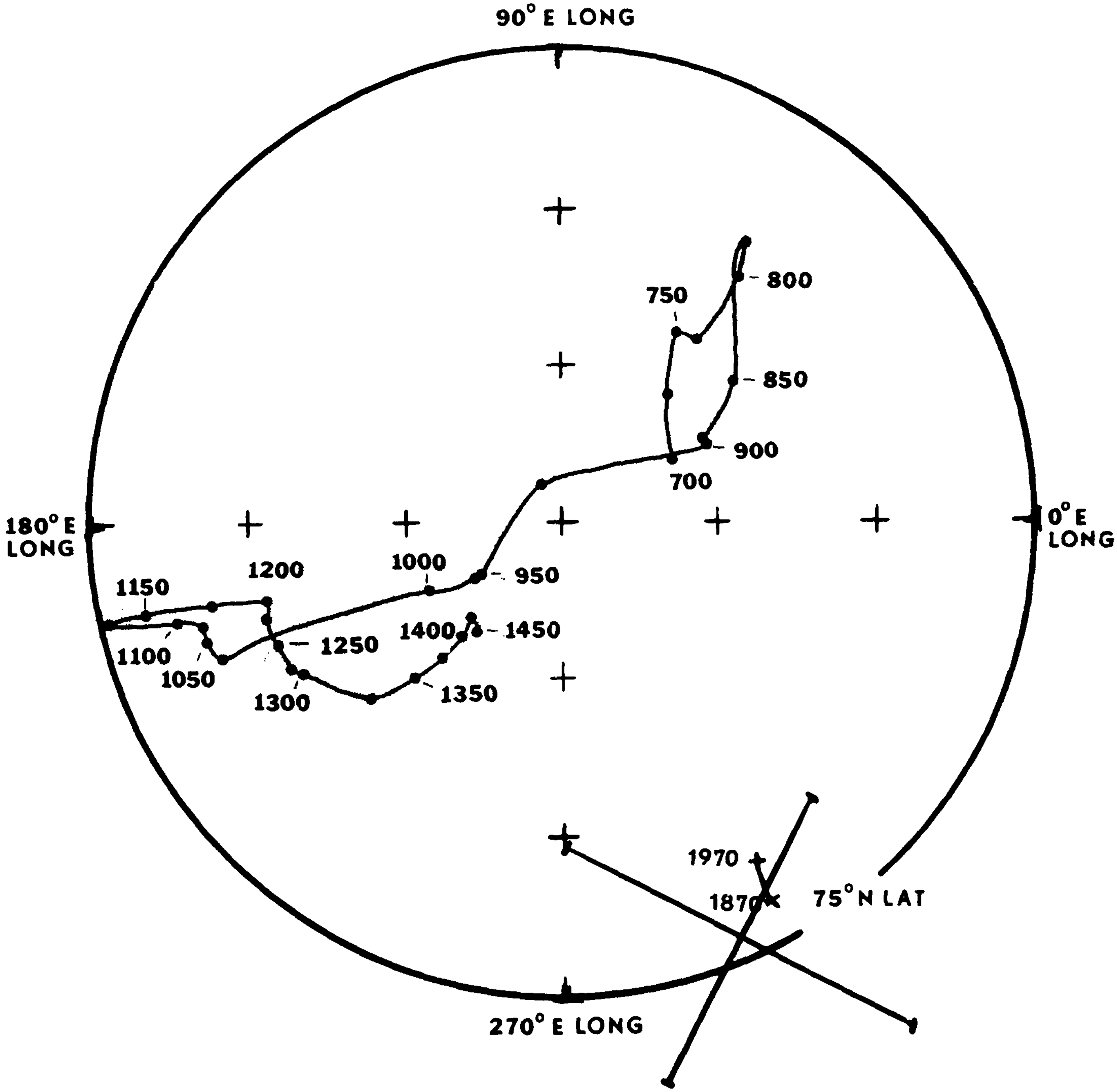
Sample LA 25417-1 (continued)

Final Processing Results

Demagnetization Level Used	150
Paleolatitude (degrees N)	75.89
Paleolongitude (degrees E)	292.55
Error Along the Great Circle - EP (degrees)	5.12
Error Perpendicular to the Great Circle - EM (degrees)	6.37

Signed [signature] Date 1/22/88

Plot of sample LA25417-1 VGP with the current master Southwest VGP curve



Pre AD 1870-1970

curve used: SWCV187

APPENDIX D:

Petrographic Data

Elizabeth M. Garrett

PETROGRAPHIC ANALYSIS OF THREE SHERDS FROM ABIQUIU RESERVOIR, NEW MEXICO

D.1 INTRODUCTION

Three sherds, collected during investigation of sites in the Abiquiu Reservoir area, were submitted by Amy Earls, Project Director, for petrographic analysis. The sample included a Chacon Micaceous plain brownware sherd and a smeared indented corrugated brownware sherd, both from LA 25417. The third item is a Tewa plain utility ware retrieved from a site west of LA 25421.

The research questions to be addressed by petrographic examination of these three sherds are as follows:

1. Is the tempering material locally available, or is it nonlocal?
2. If nonlocal, how far and in which direction is the nearest source?

D.2 METHODOLOGY

The three sherds were thin-sectioned at the Geology Department, University of New Mexico, where the sherds were cut to size, ground flat, then glued to a glass slide. The ceramics were ground down to 30 microns, the thickness of material best suited for analysis using the petrographic microscope. A thin cover slip was cemented over the ceramic material.

The three thin sections thus produced were examined with a petrographic microscope. Polarized light and various optical devices on the instrument allow the identification and measurement of certain physical attributes of the rock fragments and disaggregated minerals produced by the prehistoric potter during the manufacture of the ceramic item.

Tempering material was added to aerate the clay so that steam could escape quickly during firing thus preventing the ceramic item from developing cracks or shattering. Usually the tempering material is of geologic origin, that is, rock fragments, minerals, or sand grains. Occasionally, the tempering material is of cultural origin, that is, crushed fragments of previously fired ceramics.

Tempering material of geologic origin can be compared to the geologic outcrops present in the vicinity of the site. Inferences can be made as to whether or not the ceramic item under investigation contains locally available or non-locally available material. If the tempering grains do not match what is present in the area of the site, then the nearest source can be postulated and questions of migration or trade can be addressed.

Only tempering grains that are sand-sized and coarse silt-sized (2.00 to 0.031 mm) are large enough for petrographic identification and measurement. Clay minerals, that is, grains less than 0.0039 mm in size, are too small for identification. More sophisticated techniques, such as neutron activation or X-ray diffraction, are necessary in order to identify the different kinds of clay minerals.

However some visual observations regarding the clay matrix can be made: the color of the clay matrix as observed in unpolarized light; whether the clay matrix is compact or exhibits microcracks and microvoids; the siltiness of the clay; whether or not organic debris is present; and the apparent texture of the clay matrix. This latter attribute exhibits either a thick-and-thin, that is, mottled texture, or is an even looking, homogeneous texture.

The siltiness of the clay matrix gives clues as to whether the clay source utilized by the potters was collected from a primary or a secondary source. If the silt-sized content is greater than 20% by volume, then it may be assumed that a secondarily deposited clay body provided the raw material for ceramic manufacture.

The following data were recorded on individual sheets for each of the three thin sections:

1. The type and estimated percentage of rock fragments and mineral grains present, their maximal size and angularity.

2. The estimated percentage of total tempering material present.

3. The color of the clay matrix in unpolarized light.

4. The estimated percentage of silt-sized materials present in the clay matrix.

5. The texture of the clay matrix as seen in unpolarized light.

6. Whether or not organic material is present.

When the recording of the above information was completed for the three thin sections, the ceramic identification and provenience for each sherd was entered on the appropriate recording sheet. A table summarizing the data was constructed (see Table D.1).

D.3 SURFACE GEOLOGY OF THE PROJECT AREA

The project sites are located in an area of the Piedra Lumbre Grant where the Permian age Cutler Formation is present. This formation consists of resistant sandstones and less resistant mudstones. Surrounding the project area is an extensive sheet of Triassic age Chinle formation that has a shale upper member and a sandstone lower member. Approximately 15 km to the north of the project area is the Mesa de los Viejos, a highland area that has a narrow band of San Rafael group sandstones and limestones at the base, a steep escarpment of Morrison Formation sandstones, and a flat area of Cretaceous age Dakota Formation sandstones.

Table D.1 Petrographic Data for Three Abiquiu Reservoir Sherds, Abiquiu Reservoir Cobble Ring Study, ACOE, 1988.

		Temper			Clay				
Thin Section Number	Ceramic Identification	Type	Max. Size mm	Est. %	Color in Unpolarized Light	Est. % of Silt	Texture	Organic Material	Provenience
AB-1	Micaceous Plain Brownware	Quartz Mica Schist	2.00	40	Black	>20	Mottled	None	LA 25417 Feature 2, Level 2
AB-2	Smeared Indented Corrugated Brownware	Basaltic Rock Fragments + Quartz Grains	1.6	25	Light Brown	<20	Homogeneous	None	LA 25417 Feature 8, Surface
AB-3	Plain Brownware	Quartz Mica Schist	2.1	40	Black	>20	Mottled	None	Site west of LA 25421 at USFS Fence

A similar highland area, composed of the same San Rafael group, Morrison Formation, and Dakota Formation rocks, is present approximately 15 km southeast of the project area. Further away, 25 to 30 km south and southeast of the sites, are exposures of basaltic and andesitic composition, and areas where the Santa Fe group rocks are present. Both of these bodies are of Tertiary age.

D.4 DISCUSSION OF FINDINGS

As can be seen from Table D.1, two of the thin sections contain crushed fragments of quartz mica schist, whereas the remaining thin section is tempered with quartz grains and crushed fragments from rapidly cooled basaltic rock. Each thin section will be discussed separately.

AB-1, identified as a Chacon Micaceous plain brownware from LA 25417, is heavily tempered with coarse-grained fragments of quartz mica schist; the mica present is biotite. The maximal size of the angular grains is 2.0 mm. The silt-sized content is greater than 20% by volume indicating a secondarily redeposited clay source. There was no organic matter in the clay suggesting a "clean" clay that was deposited from water that flowed over vegetation-free terrain.

In the area of the sites and the surrounding area there is only sedimentary rock; no metamorphic rock bodies are present. It is safe to assume that this ceramic item is not of local manufacture. Metamorphic rocks of Precambrian age occur in the Sangre de Cristo Mountains 40 to 45 km to the northeast.

AB-2 is identified as a smeared indented corrugated brownware from LA 25417. This ceramic item is basically tempered with coarse-grained igneous rock fragments of rapidly cooled basaltic composition. The glassy ground mass of the rock fragments contains feldspar laths all oriented in the same direction suggesting that the basalt originated as a volcanic flow. This basaltic rock appears to match the description of the basalt/glassy vitrophyre found in lithic items from the project area sites, the source area being Cerro Pavo. This volcanic outcrop is approximately 26 km south of LA 25417.

A puzzling feature about the temper in this thin section is that 15% of the tempering material is very large coarse-grained quartz. The size of these grains, 1.8 mm, is far too large for the quartz to occur naturally in the raw clay. One plausible explanation is that the grinding tool used for raw material preparation was a rather friable metamorphic rock that shed easily loosened grains of quartz into the raw clay. However, the quartz grains make up about 15% of the tempering component, a percentage that seems too large for accidental incorporation into raw clay. Perhaps the thin sectioning of several similarly tempered sherds would shed some light on this curious mixture of tempering grains.

AB-3 is identified as a Tewa plain utility ware and was recovered from a site located at the U.S. Forest Service fence west of LA 25421. This ceramic item is also tempered with fragments from a coarse-grained quartz mica schist. The mica present is biotite with a small component of muscovite. The maximal size of the tempering grains is 2.1 mm. The estimated percentage of tempering material is 40%.

As has been discussed in the findings for AB-1, quartz mica schist, a metamorphic rock, was not available either in the project area or the surrounding area where sedimentary rocks predominate. This ceramic item probably was produced in an area 40 to 45 km to the northeast where the massive metamorphic rocks of the Sangre de Cristo Mountains are available.

Although AB-1 and AB-3 are both tempered with fragments of crushed quartz mica schist the rock fragments are not completely identical in mineral composition. The biotite in the rock fragments in AB-1 is in greater abundance, the biotite grains are much longer (up to 0.8 mm), and the biotite is present in larger masses than in sample AB-3. In the latter sherd the biotite is quite sparse in amount, has a maximal length of only 0.2 mm, and is present in isolated needle-like grains. The variability in biotite content of quartz mica schist from different areas probably reflects inherent differences present in the chemical composition of the original rock material prior to the episodes of metamorphism.

The differences in the biotite content in AB-1 and AB-3 appear to suggest that the tempering material was collected from two different locations, both of which are in the immediate vicinity of the Sangre de Cristo Mountains to the northeast of the Abiquiu Reservoir area.

D.5 CONCLUSIONS

The quartz mica schist found in AB-1 and AB-3 was not available in the project area. It occurs approximately 40 to 45 km to the northeast where the Sangre de Cristo Mountains contain granites, schists, and gneisses. The basaltic rock present in AB-2 is probably from Cerro Pavo, a distance of 26 km from the project area sites. It is possible that potters desiring this tempering material journeyed the 26 km to Cerro Pavo. However, ethnographic studies (see Carrillo 1987a) suggest that almost all raw material for ceramic manufacture is collected within a radius of 10 km of habitation sites. If this also applied to prehistoric potters, then all three ceramic items were produced elsewhere than in the project area sites.

APPENDIX E:

Flotation Data

Craig Smith and Thomas Reust

E.0 PLANT MACROFOSSIL ANALYSIS

Eight samples (Samples A-H) of feature fill collected during the Abiquiu project were floated and examined for plant macrofossils. Five samples were from LA 25417, two were from LA 25419, and one was from LA 25421. Samples D and E were both from Feature 2, Test Unit 6 at LA 25417. The size of the samples ranged from 1.0 to 2.5 liters. Charred seeds identified as goosefoot, purslane, and beeweed, as well as charcoal from pinyon pine were recovered during the analysis. The samples were examined to obtain information on subsistence patterns, composition of the prehistoric diet, and season of site use.

E.1 METHODS

The plant macrofossil analysis was conducted by Craig Smith and Thomas Reust of Mariah Associates, Inc., Laramie, Wyoming. The bulk samples were processed using water flotation techniques as outlined by Bohrer and Adams (1977). This procedure consisted of pouring the bulk samples into a bucket of water, stirring to allow the organic material to float to the surface, and then skimming off the floating debris with a fine cotton cloth. This process was repeated several times for each sample to ensure complete recovery of macrofossils.

The residue from each sample was then air dried and examined under a binocular dissecting microscope at 10x magnification. The charred plant macrofossils were removed and identified using seed manuals (Albee 1980; Martin and Barkley 1961) and the seed reference collection at Mariah.

To avoid spurious interpretations due to contamination from the modern seed rain, only charred plant remains were analyzed. Seeds are produced in enormous quantities and are naturally deposited by such means as root holes, drying cracks, downwashing, and burrowing organisms (Keepax 1977). Generally, under normal environmental conditions, these uncharred seeds will decompose in less than a century after deposition (Minnis 1981). Some seeds, especially goosefoot, are brittle and dark, making it difficult to determine of whether a specimen is charred.

E.2 RESULTS

Each of the eight samples examined for plant macrofossils yielded charred seeds or identifiable charcoal (Table E.1). The major taxon represented by the seeds was goosefoot (*Chenopodium* sp.), which was found in six samples. Also identified from one sample each was beeweed (*Cleome* sp.) and purslane (*Portulaca* sp.). The charcoal appears to be from pinyon pine (*Pinus edulis*).

The five samples for LA 25417 were from Feature 1B (hearth inside tipi ring), Feature 5 (Test Unit 5), Feature 1A (Test Unit 2), and Feature 2 (Test Unit 6). Feature 1B contained only charcoal fragments identified as pinyon. Feature 5 produced one goosefoot seed and Feature 1A yielded five purslane seeds. Of the two samples from Feature 2, one (Sample D) contained 68 goosefoot seeds and the other (Sample E) had a beeweed and goosefoot seed.

Two samples were examined from LA 25419. Sample C from Feature 3 (Test Unit 2) produced a goosefoot seed and small charcoal fragments identified as pinyon. Sample H from Feature 9 (Test Unit 5) yielded 95 goosefoot seeds.

Only one sample was analyzed from Site LA25421. The sample was from Feature 2 (Test Unit 2) and contained six goosefoot seeds and an unidentifiable seed fragment. Unidentified fragments of charcoal also were recovered from the sample.

E.3 DESCRIPTION OF TAXA AND ETHNOGRAPHIC USES

Goosefoot is a weedy annual which invades culitivated places and waste areas and can produce up to 72,000 seeds per plant. The use of goosefoot seeds by historic Indian groups throughout the Western United States is noted in numerous ethnobotanic and ethnographic reports (Yanovsky 1936). Palmer (1871) mentions that many tribes in New Mexico, Arizona, California, and Utah gathered the seeds in large numbers. According to Castetter (1935), various species of goosefoot were formerly gathered by various Pueblo Indians of the Rio Grande Valley, ground or parched and then used in making cakes or a mush. The Zuni would eat goosefoot seeds alone or in combination with corn meal (Stevenson 1915). Zuni myths refer to goosefoot as one of the most important food plants utilized when the Zunis first reached this world. In addition to goosefoot seeds, young plants and leaves were boiled as "greens" alone or with other food (Palmer 1871, Standley 1912).

Beeweed is an annual plant with stems up to a meter tall. It flowers in July and August and grows in waste places or open, sandy areas. Throughout the Southwest the young shoots, leaves, and flowers of beeweed were commonly used as a potherb (Castetter 1935, Robbins et al. 1916, Standley 1912). The Tewa would collect large quantities of the young plant in July, boil them in water until they became a thick black fluid, and then dry the material in the sun. The resulting harden cakes where soaked in water and fried in grease (Robbins et al. 1916). Beeweed seeds also were gathered and eaten (Castetter 1935; Elmore 1944). It is also one of the wild plants listed by Whiting (1939) that the Hopi encouraged and allowed to grow and seed in their corn fields. Its distribution is probably the result of human manipulation.

Purslane also is a weedy annual that thrives in waste places and disturbed areas. A single purslane plant can produce up to 52,000 seeds. Seeds from both goosefoot and purslane are available for collection in the late summer or early fall. As with the other two identified taxa, purslane was collected for both its seeds and greens by Indian groups throughout the Southwest (Castetter 1935; Robbins et al. 1916; Standley 1912). It was treated and prepared in a manner similar to goosefoot and beeweed.

E.4 DISCUSSION

The three identified taxa from the plant macrofossil collection are weedy species or "camp followers" that invade recently disturbed environments and may have been quite common at the sites in the past. The seeds and greens from these taxa were important foods used by Indian groups throughout the Southwest and each probably was collected and processed in a similar manner.

The seeds for goosefoot, beeweed, and purslane are available for gathering during the late summer or early fall.

If the recovered seeds represent collecting and processing by the prehistoric inhabitants, then the sites were probably occupied at least in the late summer or early fall. The 68 goosefoot seeds from Feature 2 at LA 25417 and the 95 goosefoot seeds from Feature 9 at LA 25419 may actually have been introduced into the archaeological record as a result of processing activities near the hearths. The few seeds from the other features may have become incorporated into the samples due to the natural prehistoric seed rain or by the indirect use of the plant containing the seed (Minnis 1981). Plants growing on the site at the time of occupation could have produced seeds that were accidentally charred and preserved in the features. Additionally, the prehistoric inhabitants could have encouraged and used the weedy plants that had invaded their living area.

Table E.1 Results of Plant Macrofossil Analysis, Abiquiu Reservoir Tipi Ring Study, ACOE, 1988.

SAMPLE	SITE NUMBER	PROVENIENCE	SAMPLE SIZE (L)	RESULTS
A	LA 25421	Feat. 2, TU 2	2.5	6 *Chenopodium* 1 Unident. Frag. Charcoal
B	LA 25417	Hearth Inside Tipi Ring Feature 1, Hearth F1B	2.0	Charcoal (Pinyon?)
C	LA 25419	Feat. 3, TU 2	1.0	1 *Chenopodium* (Uncharred) Small fragments charcoal (Pinyon?)
D	LA 25417	Feat. 2, TU 6	2.5	68 *Chenopodium*
E	LA 25417	Feat. 2, TU 6	2.5	1 *Cleome* 1 *Chenopodium* (uncharred) Charcoal (unident. fragments)
		Level 1, Sample 1		Glass Bead
F	LA 25417	Feat. 5, TU 5	1.5	1 *Chenopodium*
G	LA 25417	Feat. 1A, TU 2	2.5	5 *Portulaca*
H	LA 25419	Feat. 9, TU 5	2.5	95 *Chenopodium*

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APPENDIX F:

Pollen Data

Peter Wigand

REPORT ON POLLEN ANALYSIS OF SAMPLES FROM LA 25419

INTRODUCTION

Three samples from a tipi ring site (LA 25419) on a terrace overlooking Abiquiu Reservoir in north-central New Mexico were analyzed for significant differences in their pollen content. The three samples are from the vicinity of Feature 9, a cobble filled hearth in TU-5. Sample #25 (Field Sample #1) consists of a "pinch" sample collected from the site surface beneath a sagebrush growing near Feature 9. Sample #26 was obtained from the soil packaged (Field Sample #2) with the exfoliated metate fragments and an initial wash of the metate surface. Sample #27 was obtained from a scrub of the use-surfaces of the exfoliated metate fragments.

Table 1. Samples extracted for pollen from site LA 25419.

Extraction #	Description	For
25	Pollen Sample #1. Modern pollen. Site MA 265E (LA 25419). Feature 9, TU 5. Collected 9.24.87 by Geister.	Modern pollen rain.
26	Pollen Sample #2. Metate and metate matrix. Site MA 265E (LA 25419). Feature 9, TU 5. 12 cm B.D. 85 cm N, 63 cm E. Collected 9.24.87 by Geister.	Past pollen rain.
27	Pollen Sample #2. Metate and metate matrix. Site MA 265E (LA 25419). Feature 9, TU 5. 12 cm B.D. 85 cm N, 63 cm E. Collected 9.24.87 by Geister.	Economic pollen.

METHODS

Three tablespoons were taken of the modern surface sample (Field Sample #1) to represent the modern pollen rain (Sample #25). One tablespoon of the sediment packaged with the metate fragments and a wash of the metate fragments (Field Sample #2) was taken to represent the pollen rain at the time of burial and use of the metate (Sample #26). To detect possible economic pollen the material washed off of the use surface of the metate after a vigorous scrubbing was collected for Sample #27.

For statistical purposes three *Lycopodium* tracer spore tablets (33,987$\pm$ 604 *Lycopodium* spores per sample) were added to each sample. Samples were screened through a 100 mesh screen, transferred to 40 ml test tubes and treated with concentrated HCl. After 2 hot distilled water washes the samples were treated with concentrated HF and left to stand overnight. The samples were in a 30 minute boiling water bath after the HF was freshened. Following two hot distilled water washes the samples were again treated with HCl followed by two further hot water washes. After a ten minute stand in 20% HNO_3 and two hot water washes the samples were treated with concentrated HCl and placed in a two minute boiling water bath. Following two hot distilled water washes the samples were treated with Glacial Acetic acid followed by the acetolysis procedure (treatment with a solution of 9 parts acetic anhydride and 1 part H_2SO_4). After another Glacial Acetic treatment and two further hot distilled water washes the samples were treated with hot 5% KOH and given hot distilled water washes until neutral. Staining with safrinin after an initial drying alcohol treatment was followed by a second alcohol treatment. Additional drying with tert-butyl alcohol was followed by the addition of 2000 cs silicone oil. The samples were then placed on a hot plate and the alcohol was allowed to evaporate.

The samples were mounted on glass slides and at least 200 terrestrial pollen grains were counted. Percentages were calculated from the raw counts divided by the "Pollen Sum" (total terrestrial pollen) (Table 2).

RESULTS

Because upon initial inspection the surface sample and the matrix sample appeared more similar to each other than to the metate scrub sample they were combined. A mean and standard deviation was calculated for the combined population and the metate pollen sample was compared with it using a Student's t test (Table 2). Rejecting significance at the .01 level the pollen types from the metate surface sample that initially appear to vary significantly from the matrix and surface samples are *Pinus* (pine), *Juniperus* (juniper), *Sarcobatus* (greasewood) and Other Cheno-Ams (other goosefoot family members).

However, there are two problems with this conclusion. First is that the greater amount of pine pollen in the metate sample affects the percentages of the other pollen types in that sample through constraint. The second point is that counts of the rarer pollen types are so small that an accurate estimate of the true proportion of these types has not yet been achieved. In order to do so raw counts of each of the rarer types would have to be about 50 or so grains. Such counts would make the cost of pollen analysis well in excess of $200.00 per sample because of the extra time required to build up the pollen counts. One can check the effect of constraint by either making the proportion of pine in Sample #27 similar to that in the other two samples (Table 3) or by eliminating pine from the counts of all the samples (Table 4). When this is done only *Sarcobatus* and Other Cheno-ams remain significant. The *Sarcobatus* can be rejected because the actual percentage difference between the mean of the matrix and surface samples compared with the metate sample is slight. The t-test appears significant only because the standard deviation of the combined population is so small (by chance the counts of *Sarcobatus* in samples 25 and 26 were so close proportionally that the standard deviation was negligible). So in summary, it appears that increased pine and goosefoot family pollen on the metate surface is significant.

DISCUSSION

Significant amounts of Cheno-am pollen could have been ground into the surface of the metate during grinding of the *Chenopodium* seeds some of which were recovered during flotation of samples from Feature 9. Members of the goosefoot family have indeterminate inflorescences (flowers in seed at the base of the inflorescence and still in bloom at the distal end of the plant). During collection the beating of the plant to knock off seeds

Table 2. Abiquiu Reservoir (LA 25419), New Mexico: Analysis of Pollen from a metate and matrix samples. (Percentages expressed as % of Pollen Sum)

Extraction Number Description	Sample 25 Surface Sample	Sample 26 Metate Wash	Sample 27 Metate Scrub	Mean % of Matrix Samples	Standard Deviation of Matrix Samples	t-test
Total Pollen	258	344	235			
Pollen Sum	257	342	235			
Total Pollen / Sample	1096081.	299782.8	27926.38			
Lycopodium Introduced	33987	33987	33987			
Lycopodium Recovered	8	39	286			
Pinus	112	155	145			
% Pinus	43.57977	45.32164	61.70213	44.45070	1.231689	19.80793
Juniperus	37	51	21			
% Juniperus	14.39689	14.91228	8.936170	14.65458	.3644383	22.19047
Picea	5	1	1			
% Picea	1.945525	.2923977	.4255319	1.118961	1.168938	.8389305
Quercus	0	2	0			
% Quercus	0	.5847953	0	.2923977	.4135127	1
Ephedra	1	0	1			
% Ephedra	.3891051	0	.4255319	.1945525	.2751388	1.187234
Artemisia	25	29	12			
% Artemisia	9.727626	8.479532	5.106383	9.103579	.8825359	6.405279
Ambrosia-type	21	12	2			
% Ambrosia-type	8.171206	3.508772	.8510638	5.839989	3.296839	2.140052
Tubuliflorae	3	11	12			
% Tubuliflorae	1.167315	3.216374	5.106383	2.191845	1.448904	2.844758
Sarcobatus	15	20	9			
% Sarcobatus	5.836576	5.847953	3.829787	5.842265	.0080450	353.7694
Other Cheno-ams	17	23	14			
% Other Cheno-ams	6.614786	6.725146	5.957447	6.669966	.0780365	12.91261
Gramineae	19	37	17			
% Gramineae	7.392996	10.81871	7.234043	9.105855	2.422348	1.092800
Eriogonum	1	1	1			
% Eriogonum	.3891051	.2923977	.4255319	.3407514	.0683825	1.753342
Undetermined	1	0	0			
% Undetermined	.3891051	0	0	.1945525	.2751388	1
Bryophyta	1	2	0			
% Bryophyta	.3891051	.5847953	0	.4869502	.1383739	4.976744

Table 3. Abiquiu Reservoir (LA 25419), New Mexico: Analysis of Pollen from a metate and matrix samples.
(Percentages expressed as % of Pollen Sum)

Extraction Number Description	Sample 25 Surface Sample	Sample 26 Metate Wash	Sample 27 Metate Scrub	Mean % of Matrix Samples	Standard Deviation of Matrix Samples	t-test
Total Pollen	258	344	162			
Pollen Sum	257	342	162			
Total Pollen / Sample	1096081.	299782.8	19251.38			
Lycopodium Introduced	33987	33987	33987			
Lycopodium Recovered	8	39	286			
Pinus	112	155	72			
% Pinus	43.57977	45.32164	44.44444	44.45070	1.231689	.0071848
Juniperus	37	51	21			
% Juniperus	14.39689	14.91228	12.96296	14.65458	.3644383	6.564386
Picea	5	1	1			
% Picea	1.945525	.2923977	.6172840	1.118961	1.168938	.6069435
Quercus	0	2	0			
% Quercus	0	.5847953	0	.2923977	.4135127	1
Ephedra	1	0	1			
% Ephedra	.3891051	0	.6172840	.1945525	.2751388	2.172840
Artemisia	25	29	12			
% Artemisia	9.727626	8.479532	7.407407	9.103579	.8825359	2.718019
Ambrosia-type	21	12	2			
% Ambrosia-type	8.171206	3.508772	1.234568	5.839989	3.296839	1.975544
Tubuliflorae	3	11	12			
% Tubuliflorae	1.167315	3.216374	7.407407	2.191845	1.448904	5.090690
Sarcobatus	15	20	9			
% Sarcobatus	5.836576	5.847953	5.555556	5.842265	.0080450	50.4
Other Cheno-ams	17	23	14			
% Other Cheno-ams	6.614786	6.725146	8.641975	6.669966	.0780365	35.73769
Gramineae	19	37	17			
% Gramineae	7.392996	10.81871	10.49383	9.105855	2.422348	.8103251
Eriogonum	1	1	1			
% Eriogonum	.3891051	.2923977	.6172840	.3407514	.0683825	5.718954
Undetermined	1	0	0			
% Undetermined	.3891051	0	0	.1945525	.2751388	1
Bryophyta	1	2	0			
% Bryophyta	.3891051	.5847953	0	.4869502	.1383739	4.976744

Table 4. Abiquiu Reservoir (LA 25419), New Mexico: Analysis of Pollen from a metate and matrix samples.
(Percentages expressed as % of Pollen Sum)

Extraction Number Description	Sample 25 Surface Sample	Sample 26 Metate Wash	Sample 27 Metate Scrub	Mean % of Matrix Samples	Standard Deviation of Matrix Samples	t-test
Total Pollen	146	189	90			
Pollen Sum	145	187	90			
Total Pollen / Sample	620262.8	164706.2	10695.21			
Lycopodium Introduced	33987	33987	33987			
Lycopodium Recovered	8	39	286			
Juniperus	37	51	21			
% Juniperus	25.51724	27.27273	23.33333	26.39498	1.241316	3.488095
Picea	5	1	1			
% Picea	3.448276	.5347594	1.111111	1.991518	2.060167	.6043601
Quercus	0	2	0			
% Quercus	0	1.069519	0	.5347594	.7562639	1
Ephedra	1	0	1			
% Ephedra	.6896552	0	1.111111	.3448276	.4876598	2.222222
Artemisia	25	29	12			
% Artemisia	17.24138	15.50802	13.33333	16.37470	1.225669	3.509220
Ambrosia-type	21	12	2			
% Ambrosia-type	14.48276	6.417112	2.222222	10.44994	5.703273	2.040187
Tubuliflorae	3	11	12			
% Tubuliflorae	2.068966	5.882353	13.33333	3.975659	2.696472	4.907801
Sarcobatus	15	20	9			
% Sarcobatus	10.34483	10.69519	10	10.52001	.2477416	2.968421
Other Cheno-ams	17	23	14			
% Other Cheno-ams	11.72414	12.29947	15.55556	12.01180	.4068178	12.31909
Gramineae	19	37	17			
% Gramineae	13.10345	19.78610	18.88889	16.44477	4.725346	.7314815
Eriogonum	1	1	1			
% Eriogonum	.6896552	.5347594	1.111111	.6122073	.1095279	6.441799
Undetermined	1	0	0			
% Undetermined	.6896552	0	0	.3448276	.4876598	1
Bryophyta	1	2	0			
% Bryophyta	.6896552	1.069519	0	.8795869	.2686041	4.631068

will result in both seeds and pollen falling into the basket. Both will then be processed together.

Presence of pine pollen is more difficult to explain. The increased pine pollen found in the metate surface sample consists to a large extent of small hapoloxylon pine grains (probably *Pinus edulis*). If we had found tetrads of this pine we could have assumed that male pine cones had been processed. However, this was not the case. Another scenario would be that something was collected and processed on the metate that had been well dusted by pine pollen during the period when pine was dispersing its pollen. This could not be the goosefoot, because it matures after pine pollinates. There is no other clue as to what this other plant may have been.

Another possible explanation for the presence of pine pollen on the metate surface could be that the stone had been left with its grinding surface up during the season that it was used. Pine pollen falling from nearby trees would accumulate on the surface and be ground into it when other plants were being processed. This would be a clue as to the season of use of the metate (i.e., more abundant pine pollen = spring; processing of cheno-am seeds with pollen still being produced on the inflorescences = late spring/early summer).

CONCLUSION

Analysis of pollen from three samples from near Feature 9, site LA 25419 suggests that seeds of the goosefoot family may have been processed on the metate recovered from near this feature during late spring or early summer. Higher values of pine may provide an additional clue as to the season of use of the metate (i.e., Spring) or may reflect the processing of some plant that acted as a trap for pine pollen during the spring. The similarity of the modern surface pollen sample and the matrix surrounding the metate indicates that the vegetation at the time the metate was buried was much as it is today.

APPENDIX G:

Recorded Artifact Attributes

W. Nicholas Trierweiler

APPENDIX G

This appendix contains a copy of the artifact analysis form used in the study (Table G.1). Each attribute monitored on the form is described briefly. Two analytical variables average remaining cortex and reduction ratios, were calculated for each site and site provenience. Measurements were made only on points (Chapter 6.0).

G.1 Provenience

Horizontal - Artifact location was recorded in the field either as a point provenience, or within collection units. Point proveniences were recorded as distance and bearing from a feature, datum or mapping station, each of which was tied to a master site datum. Later, in the lab, the location of each individual artifact was converted into a unified grid system for each site using an arbitrary origin point. For purposes of spatial analysis, artifact location was recorded in two dimensions to the nearest meter.

Depth - Vertical provenience was recorded as depth in centimeters below the present ground surface. For surface collected artifacts, this value was zero, while excavated artifacts were recorded generally to the nearest 10 cm.

G.2 Artifact Type

Artifact type was recorded within a nested typology. Within five primary artifact classifications, artifacts were then recorded using 31 secondary classifications. The primary types were: core, debitage, tool, groundstone, and nonlithic.

Cores - Four types of cores were recorded:

- Tested Cobbles - have cortex remaining over most of the surface with a minimum of flake scars. The flake scars are large and are generally restricted to one area of the cobble.

- Retouched Cobbles - are small, thin cobbles, generally less than 10cm in length having a retouched margin but with unmodified faces.

- Single Platform Cores - have a single striking surface serving as the platform for flake removal. Flakes scars are generally parallel and similar in length, resulting in a conical shaped core.

- Multiple Platform Cores - have more than one striking surface from which flakes have been removed. Flake scars are randomly oriented and of varying sizes, resulting in an irregular shaped, angular core.

Table G.1 Artifact Analysis Form Used in the Abiquiu Reservoir Study, Abiquiu Reservoir Cobble Ring Study, ACOE, 1988.

ABIQUIU LITHIC CODES

SITE	17	LA25417
	19	LA25419
	21	LA25421

PROVENIENCE

[prefix] provenience type

A-E	datum point prov.
F	surface feature
G-I	datum point prov.
L	surface grid
T	test unit
X	permanent site datum

[suffix] test pits

1 - 8 (test pits 1 - 8)

collection grids

1/A1 - 3/D4 unit/square

point provenience

1/000 - 9999/359 (cms, degrees)

features

1/001/000 - 43/999/359 (no.,cms.deg.)

DEPTH	00	surface
	01 - 99 (cm below datum)	

ARTIFACT TYPE	01	tested cobble
	02	retouched cobble
	03	single platform core
	04	multiple platform core
	05	thick biface, 1
	06	thick biface, 2
	07	thin biface, 1
	08	thin biface.2
	09	angular debris/shatter
	10	core flake
	11	biface flake
	12	unknown flake
	13	chopper/handaxe
	20	projectile point
	21	drill
	22	scraper, end
	23	scraper, side
	24	scraper, notched
	25	uniface
	26	denticulate/saw
	27	graver
	30	hammerstone
	31	anvil
	32	maul
	40	metate
	41	oval (1-hand) mano
	42	rectangular (2-hand) mano

MATERIAL igneous

01	obsidian, black
02	obsidian, grey/smoky
03	basalt, black, fine grn.
04	basalt, black, vesicular
04	andesite, grey
05	rhyolite

crypto-crystalline

11	chalced., white/pink/orange, translucent
12	chalced., white, opaque
13	chalced., orange/red/brown, translucent
14	chalced., black, translucent
15	chert, red, opaque
16	chert, yellow/red, mossy/veins, opaque
17	chert, yellow/tan, opaque
18	silicified wood,
19	chert, green/white, opaque
20	jasper, orange/yellow
21	chert, "welded"
22	chert, other

sedimentary

31	siltstone
32	sandstone, fine grained
33	sandstone, coarse grained
34	limestone
35	conglomerate

quartzite

41	ortho. pink/tan/lt.gry. fine grn.
42	ortho. dark orange, med grn.
43	meta. pink/orange. coarse grn.
44	meta. white/grey. fine grn.
45	meta. black, coarse grn.
46	meta. black, fine grn.
47	meta. white, coarse grn.

Table G.1 (Continued)

PORTION	0	not applicable
	1	complete
	2	proximal
	3	medial
	4	distal
	5	lateral
	6	unknown
CORTEX	0	not applicable
	1	none
	2	1 - 33%
	3	34 - 66%
	4	67 - 99%
	5	100%
PLATFORM	0	not applicable
	1	single facet
	2	multiple/retouched
	3	cortical
	4	collapsed
	5	absent
	6	abraded
	7	unknown
	9	other
RETOUCH	<u>none</u>	
	00	none
	<u>unidirectional dorsal</u>	
	11	proximal
	12	lateral
	13	distal
	14	multiple
	15	unknown
	<u>unidirectional ventral</u>	
	21	proximal
	22	lateral
	23	distal
	24	multiple
	25	unknown
	<u>bidirectional</u>	
	31	proximal
	32	lateral
	33	distal
	34	multiple
	35	unknown
WEAR	<u>none</u>	
	00	none
	<u>edge wear</u>	
	11	ground
	12	battered
	13	flaked
	14	ground & battered
	15	ground & flaked
	16	battered & flaked
	17	ground & battered & flaked
	<u>surface wear</u>	
	21	unifacial
	22	bifacial
	23	multiple faces
	24	unknown
RECYCLE	0	none
	1	pecked
	2	battered
	3	ground
	4	burned
	9	other

Debitage - Eight types of debitage were recorded, including debris, three types of flakes and four types of bifacially reduced discards:

- Angular Debris - has no definable ventral surface or striking platform, and is viewed as unintentional shatter resulting from hard-hammer reduction.

- Core Flakes - are defined on the basis of single facet or cortical platforms, and relatively shallow dorsal angles. In general, core flakes are thicker than biface flakes, and have asymmetrical outlines.

- Biface Flakes - are defined as being less than 5 mm in thickness, are convex in cross section, have relatively acute dorsal angles, retouched or multiple facet platforms, regular dorsal surface morphology, even edge outline, and possibly have parallel and opposing dorsal flake scar orientation.

- Unknown Flakes - are those which lack enough attributes to classify as either core flake or biface flake. Often, flakes represented by the distal portion only are classified as unknown flakes because the platform and edge angle are missing.

Also included in the debitage primary classification were four varieties of bifacially reduced artifacts. Although these exhibit bifacial reduction of varying degree, they are here treated as debitage because they are discards of the manufacturing process and are not utilized:

- Thick Bifaces, Type 1 - are cobbles which have been subjected to initial bifacial reduction. These artifacts have thick, irregular cross sections, more than 50% cortex on one or more faces, large flake scars and sinuous edges.

- Thick Bifaces, Type 2 - are also thick, but have somewhat less sinuous edges, less than 50% cortex, and are more extensively retouched than the previous type.

- Thin Bifaces, Type 1 - have very little remaining cortex and have small flake scars and slightly sinuous edges.

- Thin Bifaces, Type 2 - represent the final stages in the bifacial reduction process. These are bifacially thinned, have straight edges, and have small and regular flake scars.

Tools - Ten types of tools were recorded:

- Choppers - are utilized cores or thick bifaces which have battered or crushed edges.

- Projectile Points - are bilaterally symmetrical tools with extensive bifacially retouching, and have thin uniform cross sections, and a prepared hafting element but have no cortex.

- Drills - have a bifacially retouched shaft-like projection that is several times longer than it is wide, which may have edge abrasion perpendicular to the shank axis.

- End Scrapers - are modified flakes with unifacial distal retouch.

- Side Scrapers - are modified flakes with unifacial lateral retouch.

- Notched Scrapers - are modified flakes with unifacial or bifacial retouch creating one or more notches in the flake edge.

- Gravers - are modified flakes with bifacial or unifacial retouch creating a projection from the flake edge that is about as wide as it is long.

- Hammerstones - are cobbles, cores or other massive artifacts with extensive battering along one or more edges.

- Anvils - are massive, tabular shaped artifacts with extensive pecking wear, ring fractures, and little or no evidence of grinding.

- Mauls - are hammerstones with bifacially or unifacially prepared hafting elements, and with extensive battering on the edges.

Ground Stone - Four varieties of ground stone artifacts were recorded:

- Metates - have concave grinding surfaces, are often tabular in shape and are generally several times broader than they are thick.

- One-hand Manos - have convex grinding surfaces, are oval shaped and are nearly as thick as they are broad, and often retain much of the shape of the original cobble.

- Two-hand Manos - also have convex grinding surfaces, but are rectangular in shape and have been extensively shaped.

- Unknown Groundstone - are artifacts with extensive surficial grinding, but which are fragmentary and cannot be further classified.

Nonlithic - Because of the potential extreme diversity within this residual category, nonlithic categories were created as these artifacts were encountered in the assemblage. Categories included: ceramics, beads, tin cans, and metal tools.

G.3 Material

As with artifact types, artifact material was similarly recorded within a nested typology. The primary lithic categories were: igneous, cryptocrystalline silicate, sedimentary, quartzite. Nonlithic categories were metal, glass, and ceramic.

Igneous - Five different kinds of igneous lithic materials were recorded. These were opaque black obsidian, smoky grey obsidian, fine grained black basalt, grey andesite, and rhyolite. The two varieties of obsidian correspond to visually differentiated Jemez and Polvadera sources, respectively. While visual determination of Polvadera obsidian is reliable, a small but significant percentage of the visually classified Jemez obsidian may be expected to actually be from the Polvadera source (Meighan and Russell 1979).

Silicates - Twelve different varieties of cryptocrystalline silicates were recorded. These included four types of chalcedony, six of chert, a silicified wood and a jasper. The chalcedonies were defined as: translucent white/pink/orange, opaque white, translucent orange/red/brown, and translucent black/dark brown. However, these varieties exist along a continuum of color, and more than one classification was frequently possible for a single specimen. All four are probably from the Pedernal source. The varieties of chert were somewhat more distinct and were defined as: opaque red, opaque yellow/red with veins or mossy inclusions, opaque yellow/tan, opaque green/white, opaque "welded" and "other" chert. The jasper was orange/yellow and the silicified wood was brown/sienna with distinctive internal organic structuring.

Sedimentary - Five varieties of sedimentary rock were classified, including: siltstone, fine grained sandstone, coarse grained sandstone, limestone, and conglomerate.

Quartzite - Seven varieties of quartzite were classified. Two of these were orthoquartzites and five were metaquartzites. The orthoquartzites were defined as: fine grained tan/light grey, and medium grained dark orange. The metaquartzites were defined as: coarse grained pink/orange, coarse grained black, fine grained black, coarse grained white, and fine grained white/grey.

G.4 Heat Treatment

Heat treatment was recorded for all cryptocrystalline silicate artifacts, regardless of artifact type. Heating was recorded as either present or absent and was defined as a waxy luster on noncortical surfaces, and/or reticular cracking or crazing of the lithic matrix.

G.5 Portion

Because the artifact typology for flakes was based largely on imbedded attributes, it was realized that broken or fragmented artifacts may not possess the physical portion of the artifact necessary to evaluate the imbedded attributes. For example, a flake with a missing proximal portion will probably lack the platform, percussion bulb, and dorsal angle necessary to classify the flake. As a result, the artifact typology, especially for debitage, is largely dependent on the portion of the artifact present. Consequently, artifact portion was separately recorded. Six nominal states were recorded: complete, proximal portion, medial portion, distal portion, lateral portion, and unknown portion.

G.6 Cortex

The amount of cortex remaining on the artifact was recorded using a five class interval scale: no remaining cortex, 1-33% cortex, 34-66% cortex, 67-99% cortex, and 100% cortex. For flakes, cortex was estimated for the dorsal surface only, while for cores, bifaces, angular debris, and tools, cortex was estimated for the entire artifact. Cortex was not recorded for groundstone.

G.7 Platform

The type of platform was recorded for flakes and cores using an eight class nominal scale. Platform states were: single faceted, multiple faceted or retouched, cortical, collapsed, absent, abraded, unknown, or other. Platform was not recorded for groundstone, tools, angular debris, and bifaces.

G.8 Retouch

For all artifacts, retouch was recorded within a nested typology. The primary states were: no retouch, unidirectional dorsal, unidirectional ventral, and bidirectional. Within each of the latter three categories,, the location of retouch was coded as to: proximal, lateral, distal, multiple, or unknown.

G.9 Wear

For all artifacts, wear was also recorded using a nested classification. The three primary attribute states were: no wear, edge wear, and surface wear. Edge wear was further classified as: ground, battered, flaked, ground and battered, ground and flaked, battered and flaked, and ground and battered and flaked. Surface wear was further classified as: unifacial, bifacial, on multiple faces, or on unknown faces.

G.10 Recycling

Recycling was defined as evidence of use or other modification that occurred subsequent to, or subsidiarily to, the primary functional design of the artifact. Recycling was recorded for all artifacts using a six class typology: none, pecking, battering, grinding, burning, and other.

G.11 Analytical Variables

In addition to the above ten observed variables, two additional variables are defined for each site and site provenience. These second order variables were not directly observed, but were generated by means of preliminary statistical reduction of the raw data.

Average Remaining Cortex - Within each of the major lithic artifact type classes (debitage, tools, cores), the average percent of remaining cortex per specimen was calculated. This index value is obtained by multiplying the median of each ordinal cortex category (0%, 16.5%, 50%, 83.5%, 100%) by the observed frequency of specimens in that category, summing these values, and then dividing the sum by the total number of specimens in all categories.

This value is used as a relative index of the intensity of lithic reduction. It should be noted however, that varying proportions of artifact types within each of the major classes can skew the index value because of differing definitions of remaining cortex (see Section 4.1.4.6 above). For example, within the debitage class, cortex on angular debris is a function of the entire artifact, while cortex on flakes reflects the dorsal flake surface only.

Reduction Ratios - For each site, the ratio of core flakes to biface flakes was calculated by dividing the former by the latter to obtain the ratio X, and then by expressing the ratio as X:1. Tools were not included as a third reduction class because (1) tools (especially projectile points) were preferentially collected for chronometric analyses and are thus overrepresented in the collection, and (2) tools are generally preferentially removed from sites, prehistorically for reworking and historically by amateurs.

APPENDIX H:

Lithic Artifact Data

Table H.1 LA 25421 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
21	N	A	26	126	0	tool	20	obsidian	2	3	1	0	34	0	0	0
21	N	A	65	204	0	tool	20	obsidian	2	3	1	0	34	0	0	0
21	N	B	89	139	0	debitage	12	crypto-c	11	3	1	5	0	0	0	0
21	N	B	71	134	0	debitage	11	crypto-c	11	1	1	1	0	0	0	0
21	N	B	69	126	0	debitage	11	crypto-c	11	1	2	1	0	0	0	1
21	N	B	63	144	0	debitage	9	crypto-c	12	0	1	0	0	0	0	0
21	N	B	65	127	0	debitage	11	crypto-c	12	2	1	4	0	0	0	0
21	N	B	74	117	0	debitage	11	crypto-c	11	1	1	1	0	0	0	1
21	N	B	73	116	0	debitage	10	crypto-c	11	2	1	1	0	0	0	1
21	N	B	96	133	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
21	N	B	67	133	0	debitage	10	obsidian	2	2	5	1	0	0	0	0
21	N	B	98	134	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
21	N	B	73	117	0	debitage	11	crypto-c	11	1	1	1	0	0	0	1
21	N	B	84	141	0	tool	20	obsidian	2	4	2	0	34	0	0	0
21	N	B	67	118	0	debitage	11	crypto-c	12	2	1	1	0	0	0	1
21	N	B	90	114	0	debitage	7	qrtzite	41	1	1	2	34	17	0	0
21	N	B	74	117	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
21	N	B	73	114	0	debitage	12	crypto-c	12	3	1	5	0	0	0	0
21	N	B	92	118	0	debitage	10	crypto-c	12	3	3	5	0	0	0	0
21	N	B	71	140	0	debitage	10	crypto-c	11	2	1	1	0	0	0	1
21	N	B	73	115	0	debitage	10	crypto-c	11	3	2	5	0	0	0	1
21	N	B	98	122	0	debitage	11	crypto-c	11	2	1	5	0	0	0	1
21	N	B	80	134	0	debitage	10	crypto-c	11	0	1	0	0	0	0	0
21	N	B	83	129	0	tool	20	obsidian	1	2	1	0	34	0	0	0
21	N	B	80	122	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
21	N	B	91	125	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
21	N	B	95	134	0	debitage	11	crypto-c	11	1	0	1	0	0	0	0
21	N	B	95	132	0	debitage	10	obsidian	2	1	2	4	0	0	0	0
21	N	B	72	130	0	debitage	11	crypto-c	11	1	1	1	0	0	0	0
21	N	B	71	124	0	debitage	10	obsidian	2	2	1	4	0	0	0	0
21	N	B	98	129	0	debitage	10	crypto-c	14	1	1	5	0	0	0	1
21	N	B	77	131	0	debitage	10	crypto-c	11	1	1	2	0	0	0	1
21	N	B	69	122	0	debitage	11	crypto-c	11	2	1	4	0	0	0	1
21	N	B	87	138	0	debitage	10	obsidian	2	1	4	1	0	0	0	0
21	N	B	95	134	0	debitage	10	qrtzite	43	1	2	4	0	0	0	0
21	N	B	87	144	0	debitage	10	crypto-c	12	1	1	1	0	0	0	0
21	N	B	68	126	0	debitage	11	crypto-c	11	1	1	1	0	0	0	1
21	N	B	86	136	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
21	N	B	75	129	0	debitage	8	crypto-c	11	6	1	0	34	13	0	0
21	N	B	63	144	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
21	N	B	96	134	0	debitage	10	crypto-c	17	2	5	4	0	0	0	0
21	N	B	85	145	0	debitage	10	obsidian	2	1	2	1	0	0	0	0
21	N	B	75	115	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
21	N	B	91	136	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
21	N	B	75	124	0	debitage	12	crypto-c	11	3	1	5	0	0	0	0
21	N	B	102	137	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
21	N	C	116	112	0	debitage	10	crypto-c	11	2	1	1	0	0	0	0
21	N	C	115	110	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
21	N	C	104	122	0	debitage	12	crypto-c	11	4	0	5	0	0	0	1
21	N	C	107	112	0	debitage	10	crypto-c	14	1	2	4	0	0	0	1
21	N	C	107	129	0	debitage	10	crypto-c	11	2	2	2	12	0	0	1
21	N	C	110	117	0	debitage	10	crypto-c	11	1	1	4	12	0	0	1
21	N	C	112	123	0	debitage	12	obsidian	2	3	1	5	0	13	0	0
21	N	C	97	112	0	debitage	11	crypto-c	11	2	1	6	0	0	0	1

Table H.1 LA 25421 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
21	N	C	104	122	0	debitage	12	obsidian	[illegible]	4	[illegible]	5	[illegible]	[illegible]	[illegible]	0
21	N	C	106	125	0	debitage	10	crypto-c	11	2	1	1	0	0	[illegible]	[illegible]
21	N	C	101	129	0	debitage	9	crypto-c	11	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	N	C	104	13[illegible]	0	debitage	11	crypto-c	11	1	1	1	[illegible]	[illegible]	0	[illegible]
21	N	C	106	128	0	debitage	10	crypto-c	11	[illegible]	1	[illegible]	[illegible]	0	0	[illegible]
21	N	C	105	133	0	debitage	9	crypto-c	12	[illegible]	2	[illegible]	[illegible]	0	[illegible]	[illegible]
21	N	C	110	133	0	debitage	10	crypto-c	11	1	1	1	[illegible]	[illegible]	[illegible]	[illegible]
21	N	C	103	141	0	debitage	10	crypto-c	11	2	0	1	0	0	0	1
21	N	C	112	124	0	debitage	10	qrtzite	43	4	5	5	0	0	0	0
21	N	C	109	124	0	debitage	10	crypto-c	19	1	4	1	[illegible]	0	[illegible]	0
21	N	C	106	127	0	debitage	10	crypto-c	11	1	1	1	0	0	[illegible]	[illegible]
21	N	C	107	118	0	debitage	10	sedmntry	35	1	1	1	0	0	0	[illegible]
21	N	C	100	117	0	debitage	12	crypto-c	11	4	4	5	0	0	0	0
21	N	C	105	124	0	debitage	9	qrtzite	44	0	5	0	0	0	0	0
21	N	C	114	129	0	debitage	12	crypto-c	11	3	1	3	0	0	0	0
21	N	C	109	124	0	debitage	10	crypto-c	11	2	1	1	0	0	0	0
21	N	E	96	122	0	debitage	9	crypto-c	12	0	1	0	0	0	0	1
21	N	E	99	122	0	debitage	10	crypto-c	11	2	1	1	0	0	0	[illegible]
21	N	E	102	115	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
21	N	E	106	117	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
21	N	E	107	123	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
21	N	E	96	124	0	debitage	11	qrtzite	41	1	1	1	12	0	0	0
21	N	E	95	124	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
21	N	E	85	126	0	tool	20	crypto-c	11	3	1	0	34	0	0	0
21	N	E	96	123	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
21	N	T2	71	132	30	debitage	12	qrtzite	42	1	1	1	0	0	0	0
21	N	T4	58	155	10	debitage	12	crypto-c	13	3	2	5	0	0	0	1
21	S	G	138	66	0	debitage	10	crypto-c	14	1	2	1	0	0	0	1
21	S	G	152	88	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
21	S	G	148	80	0	debitage	10	obsidian	1	1	2	1	0	0	0	0
21	S	G	150	71	0	debitage	10	qrtzite	44	1	5	1	0	0	0	0
21	S	G	148	90	0	debitage	12	obsidian	1	4	2	5	23	17	0	0
21	S	G	135	84	0	debitage	10	obsidian	1	1	1	4	0	0	0	0
21	S	G	147	80	0	debitage	11	crypto-c	11	2	1	4	0	0	0	1
21	S	G	142	78	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
21	S	G	148	90	0	debitage	10	crypto-c	11	1	1	1	32	15	0	0
21	S	G	152	89	0	debitage	10	crypto-c	11	1	1	2	0	0	0	0
21	S	H	152	43	0	debitage	11	crypto-c	11	1	1	1	0	0	0	1
21	S	H	161	47	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
21	S	H	159	43	0	debitage	12	crypto-c	11	3	1	5	0	0	0	0
21	S	H	157	41	0	debitage	10	crypto-c	[illegible]	2	1	1	0	0	0	1
21	S	H	135	52	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
21	S	H	159	39	0	debitage	10	crypto-c	13	1	1	4	0	13	0	1
21	S	H	160	43	0	debitage	12	crypto-c	12	3	1	5	0	0	0	0
21	S	H	153	41	0	debitage	11	crypto-c	11	1	1	1	0	0	0	0
21	S	H	149	56	0	debitage	11	crypto-c	11	2	1	1	0	0	0	0
21	S	H	137	51	0	debitage	12	crypto-c	11	3	1	5	0	0	0	0
21	S	H	153	41	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
21	S	H	150	41	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
21	S	H	150	41	0	debitage	12	crypto-c	11	4	1	5	[illegible]	0	0	0
21	S	H	149	58	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
21	S	H	152	44	0	debitage	11	crypto-c	11	2	1	2	0	0	0	0
21	S	H	138	48	0	debitage	10	crypto-c	11	2	1	1	0	0	0	1
21	S	T1	154	57	10	debitage	9	crypto-c	11	1	1	0	[illegible]	0	0	1

Table H.1 LA 25421 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
21	5	73	149	90	30	debitage	12	obsidian	2	3	1	5	12	0	0	0

Table H.2 LA 25417 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	M	A	159	239	0	tool	22	rhyolite	5	2	4	0	32	0	0	0
17	M	A	141	204	0	debitage	7	obsidian	2	6	2	0	35	0	0	0
17	M	A	133	224	0	debitage	10	obsidian	2	1	2	1	0	17	0	0
17	M	A	138	199	0	debitage	7	obsidian	2	1	1	0	34	0	0	0
17	M	A	135	197	0	core	4	crypto-c	11	[illegible]	4	1	0	0	0	0
17	M	A	144	223	0	tool	22	crypto-c	20	4	2	0	14	13	0	0
17	M	A	146	205	0	core	4	obsidian	2	0	1	2	0	17	0	0
17	M	F1	109	250	0	debitage	10	sedmntry	34	4	3	5	0	11	0	0
17	M	F1	115	246	0	debitage	12	crypto-c	20	3	1	5	0	0	0	0
17	M	F1	110	252	0	debitage	11	crypto-c	12	1	1	1	0	0	0	0
17	M	F1	114	247	0	debitage	12	crypto-c	20	4	3	5	0	0	0	0
17	M	F1	114	251	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
17	M	F1	114	247	0	debitage	12	crypto-c	20	3	1	5	0	0	0	0
17	M	F1	108	255	0	debitage	11	crypto-c	12	1	1	2	0	0	0	0
17	M	F6	65	279	0	debitage	10	crypto-c	11	1	2	1	22	0	0	0
17	M	F6	76	266	0	debitage	10	obsidian	2	2	1	4	0	0	0	0
17	M	F6	84	282	0	debitage	10	crypto-c	11	1	2	1	0	0	0	0
17	M	F6	79	280	0	debitage	10	crypto-c	11	5	2	4	14	0	0	1
17	M	F6	71	275	0	debitage	10	qrtzite	43	1	1	1	0	0	0	0
17	M	F6	76	268	0	debitage	9	obsidian	2	0	1	0	0	0	0	0
17	M	F6	70	287	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
17	M	F6	76	275	0	debitage	11	crypto-c	11	1	1	1	0	0	0	0
17	M	F6	71	285	0	debitage	10	crypto-c	11	1	2	1	0	0	0	1
17	M	L1	116	226	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	117	226	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	L1	117	228	0	debitage	11	qrtzite	41	1	1	4	0	0	0	0
17	M	L1	116	228	0	debitage	11	obsidian	2	2	1	4	0	0	0	0
17	M	L1	115	228	0	debitage	10	crypto-c	17	1	2	1	0	0	0	0
17	M	L1	117	228	0	debitage	12	qrtzite	41	5	1	5	0	0	0	0
17	M	L1	115	228	0	debitage	9	crypto-c	17	0	2	0	0	0	0	0
17	M	L1	116	228	0	debitage	10	qrtzite	41	1	2	1	0	0	0	0
17	M	L1	117	228	0	debitage	11	crypto-c	17	2	1	2	0	0	0	0
17	M	L1	116	228	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	crypto-c	17	6	1	5	0	0	0	0
17	M	L1	116	228	0	debitage	9	qrtzite	41	0	3	0	0	0	0	0
17	M	L1	116	227	0	debitage	11	crypto-c	17	1	1	2	0	0	0	0
17	M	L1	115	228	0	debitage	11	qrtzite	41	2	1	2	0	0	0	0
17	M	L1	115	228	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	115	228	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	crypto-c	17	6	1	5	0	0	0	0
17	M	L1	117	228	0	debitage	12	qrtzite	41	3	1	4	0	0	0	0
17	M	L1	115	227	0	debitage	9	crypto-c	17	0	1	0	0	0	0	0
17	M	L1	117	228	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	115	226	0	debitage	11	crypto-c	17	1	1	1	0	0	0	0
17	M	L1	116	228	0	debitage	12	qrtzite	41	3	0	5	0	0	0	0
17	M	L1	115	226	0	debitage	9	crypto-c	17	0	2	0	0	0	0	0
17	M	L1	117	228	0	debitage	12	qrtzite	41	2	1	4	0	0	0	0
17	M	L1	115	226	0	core	3	crypto-c	17	0	2	2	0	0	0	0
17	M	L1	116	228	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	116	226	0	debitage	10	crypto-c	17	1	1	1	0	0	0	0
17	M	L1	118	227	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	228	0	debitage	11	crypto-c	16	2	1	4	0	0	0	0
17	M	L1	116	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	115	227	0	debitage	11	crypto-c	15	2	1	1	0	0	0	1

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	117	226	0	debitage	10	crypto-c	18	1	2	1	0	0	0	0
17	M	L1	115	227	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	116	226	0	debitage	11	crypto-c	18	2	1	2	0	0	0	0
17	M	L1	115	227	0	debitage	11	crypto-c	11	5	1	5	0	0	0	0
17	M	L1	116	226	0	debitage	10	crypto-c	18	2	1	4	0	0	0	0
17	M	L1	115	227	0	debitage	12	crypto-c	11	1	1	4	0	0	0	0
17	M	L1	133	225	0	debitage	7	crypto-c	19	4	1	0	34	0	0	1
17	M	L1	116	226	0	debitage	11	crypto-c	11	2	1	1	0	0	0	0
17	M	L1	117	225	0	debitage	11	crypto-c	20	1	2	1	0	0	0	0
17	M	L1	117	225	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
17	M	L1	115	227	0	debitage	11	crypto-c	20	2	1	1	12	0	0	0
17	M	L1	114	225	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
17	M	L1	116	226	0	debitage	11	obsidian	1	3	1	5	0	0	0	0
17	M	L1	116	225	0	debitage	9	crypto-c	11	0	2	0	0	0	0	0
17	M	L1	116	226	0	debitage	11	crypto-c	21	2	1	0	0	0	0	0
17	M	L1	117	228	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	117	225	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	116	228	0	debitage	10	qrtzite	41	2	1	4	0	0	0	0
17	M	L1	116	225	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	118	227	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	116	225	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	117	225	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	118	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	116	225	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	10	qrtzite	41	5	1	1	0	0	0	0
17	M	L1	116	225	0	debitage	12	qrtzite	41	6	1	5	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	116	226	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	116	226	0	debitage	11	qrtzite	41	2	1	2	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	117	226	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	117	228	0	debitage	12	qrtzite	41	5	1	5	0	0	0	0
17	M	L1	116	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	115	227	0	debitage	12	crypto-c	11	2	2	5	0	0	0	0
17	M	L1	115	227	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
17	M	L1	116	225	0	debitage	10	obsidian	2	1	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	115	228	0	debitage	9	crypto-c	17	0	1	0	0	0	0	0
17	M	L1	115	227	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	116	227	0	debitage	11	crypto-c	17	2	1	4	0	0	0	0
17	M	L1	116	227	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	116	227	0	debitage	7	crypto-c	17	6	1	0	35	0	0	0
17	M	L1	115	227	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	crypto-c	17	4	1	5	0	0	0	0
17	M	L1	116	227	0	debitage	11	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	116	226	0	debitage	10	crypto-c	17	1	1	1	0	0	0	1
17	M	L1	115	227	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	226	0	debitage	12	crypto-c	17	6	1	5	0	0	0	0
17	M	L1	116	227	0	debitage	11	qrtzite	41	3	1	4	0	0	0	0
17	M	L1	115	228	0	debitage	9	crypto-c	16	0	3	0	0	0	0	1

Table H.2 LA 25417 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	116	226	0	debitage	9	crypto-c	18	[illegible]	1	[illegible]	0	0	0	1
17	M	L1	115	227	0	debitage	11	qrtzite	41	2	1	4	0	0	0	[illegible]
17	M	L1	115	227	0	debitage	10	crypto-c	15	1	1	1	0	0	0	
17	M	L1	115	227	0	debitage	10	qrtzite	41		2	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	crypto-c	20	3	1	5	0	0	0	0
17	M	L1	115	227	0	debitage	11	qrtzite	41	2	1	2	0	0	0	0
17	M	L1	117	226	0	debitage	10	obsidian	1	2	2	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	117	225	0	debitage	10	qrtzite	41	2	2	1	0	0	0	0
17	M	L1	115	227	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	117	225	0	debitage	12	qrtzite	41	6	1	5	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	116	225	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	11	qrtzite	41	2	1	2	0	0	0	0
17	M	L1	117	226	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	139	226	0	debitage	8	qrtzite	41	5	1	0	34	0	0	0
17	M	L1	118	227	0	debitage	11	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	116	223	0	debitage	11	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	115	227	0	debitage	10	qrtzite	41	2	2	1	0	0	0	0
17	M	L1	117	228	0	debitage	12	crypto-c	17	4	1	5	0	0	0	0
17	M	L1	115	227	0	debitage	10	qrtzite	41	1	3	1	0	0	0	0
17	M	L1	115	227	0	debitage	9	crypto-c	17	0	1	0	0	0	0	0
17	M	L1	116	227	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	115	226	0	debitage	10	crypto-c	17	1	1	1	0	0	0	0
17	M	L1	116	226	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	115	208	0	debitage	10	crypto-c	17	1	3	4	0	0	0	0
17	M	L1	116	226	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	117	225	0	debitage	11	crypto-c	12	1	1	1	0	0	0	0
17	M	L1	116	226	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	117	225	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	117	228	0	debitage	12	crypto-c	17	6	1	5	0	0	0	0
17	M	L1	117	225	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
17	M	L1	115	226	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	115	226	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	116	226	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
17	M	L1	117	228	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
17	M	L1	116	226	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	117	226	0	debitage	10	crypto-c	17	1	2	1	0	0	0	1
17	M	L1	116	226	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	116	226	0	debitage	9	crypto-c	18	0	1	0	0	0	0	0
17	M	L1	116	226	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	116	225	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
17	M	L1	116	226	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	117	228	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	116	226	0	debitage	11	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	116	225	0	debitage	11	crypto-c	17	1	1	1	0	0	0	0
17	M	L1	116	226	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
17	M	L1	116	225	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
17	M	L1	117	225	0	debitage	11	crypto-c	20	1	2	2	0	0	0	0
17	M	L1	115	227	0	debitage	10	crypto-c	17	2	1	4	0	0	0	0
17	M	L1	116	226	0	debitage	11	qrtzite	41	2	1	2	0	0	0	0
17	M	L1	141	205	0	debitage	11	crypto-c	11	2	1	2	0	0	0	1

Table H.2 LA 25417 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	debitage	11	obsidian	2	4	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	L2	144	[illegible]	[illegible]	debitage	11	obsidian	2	1	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	debitage	11	obsidian	2	4	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	debitage	10	obsidian	2	4	1	4	[illegible]	0	[illegible]	[illegible]
17	M	L2	144	208	0	debitage	12	obsidian	2	6	1	5	0	0	0	0
17	M	L2	142	206	0	debitage	11	crypto-c	11	1	1	1	0	0	0	1
17	M	L2	143	208	0	debitage	12	obsidian	2	2	1	5	0	0	0	0
17	M	L2	141	206	0	debitage	11	crypto-c	11	1	1	1	0	0	0	0
17	M	L2	144	207	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	L2	144	207	0	debitage	12	obsidian	2	6	1	5	0	0	0	0
17	M	L2	143	207	0	debitage	12	obsidian	2	2	2	4	0	0	0	0
17	M	L2	141	207	0	debitage	9	obsidian	2	0	1	0	0	0	0	0
17	M	L2	142	207	0	debitage	11	obsidian	2	1	2	4	0	0	0	0
17	M	L2	142	205	0	debitage	10	obsidian	2	1	3	1	0	0	0	0
17	M	L2	141	207	0	debitage	12	obsidian	2	1	1	4	0	0	0	0
17	M	L2	142	205	0	debitage	9	obsidian	2	0	3	0	0	0	0	0
17	M	L2	141	207	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	L2	141	205	0	debitage	11	obsidian	2	1	1	4	0	0	0	0
17	M	L2	143	207	0	debitage	11	obsidian	2	1	1	4	0	0	0	0
17	M	L2	143	205	0	debitage	12	obsidian	2	2	1	9	22	0	0	0
17	M	L2	141	207	0	debitage	12	obsidian	2	6	1	4	0	0	0	0
17	M	L2	141	208	0	debitage	10	obsidian	2	5	1	4	0	0	0	0
17	M	L2	144	205	0	debitage	12	obsidian	2	6	1	5	0	0	0	0
17	M	L2	143	208	0	debitage	12	obsidian	2	6	1	5	0	0	0	0
17	M	L2	142	207	0	debitage	9	obsidian	2	0	1	0	0	0	0	0
17	M	L2	142	207	0	debitage	11	obsidian	2	1	1	1	0	0	0	0
17	M	L2	144	207	0	debitage	12	obsidian	2	2	1	4	0	0	0	0
17	M	L2	142	205	0	debitage	9	obsidian	2	0	1	0	0	0	0	0
17	M	[illegible]	141	205	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
17	M	L2	141	208	0	debitage	9	obsidian	2	0	1	0	0	0	0	0
17	M	L2	144	206	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
17	M	L2	143	208	0	debitage	10	obsidian	2	2	1	1	0	0	0	0
17	M	L2	143	207	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
17	M	L2	142	208	0	debitage	11	obsidian	2	1	1	2	0	0	0	0
17	M	L2	144	207	0	debitage	12	crypto-c	18	4	1	5	0	0	0	0
17	M	L2	143	208	0	debitage	11	obsidian	2	1	1	1	0	0	0	0
17	M	L2	141	206	0	debitage	12	crypto-c	18	3	1	5	0	13	0	0
17	M	L2	142	208	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	L2	142	206	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	L2	141	206	0	debitage	12	crypto-c	11	3	2	5	0	0	0	1
17	M	L2	142	206	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
17	M	L2	142	208	0	debitage	12	qrtzite	44	3	4	5	0	0	0	0
17	M	L2	144	206	0	debitage	10	obsidian	2	1	2	1	0	0	0	0
17	M	L2	142	205	0	debitage	10	obsidian	2	4	1	1	0	0	0	0
17	M	L2	142	206	0	debitage	10	obsidian	2	2	3	1	0	0	0	0
17	M	L2	143	206	0	debitage	12	obsidian	2	5	1	4	0	0	0	0
17	M	L2	144	206	0	debitage	10	obsidian	2	2	1	1	0	0	0	0
17	M	L2	144	205	0	debitage	11	crypto-c	11	2	1	1	0	0	0	0
17	M	L2	142	206	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
17	M	L2	144	208	0	debitage	12	obsidian	2	2	1	4	0	0	0	0
17	M	L2	141	206	0	debitage	12	obsidian	2	4	1	5	12	0	0	0
17	M	L2	144	208	0	debitage	11	obsidian	2	1	1	2	0	0	0	0
17	M	L2	141	206	0	debitage	10	obsidian	2	1	1	2	0	0	0	0
17	M	L2	141	205	0	debitage	11	obsidian	2	2	1	2	0	0	0	0

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	M	L2	144	206	0	debitage	12	obsidian	2	4	5	5	0	0	0	0
17	M	L2	143	206	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
17	M	L2	141	205	0	debitage	12	obsidian	2	2	1	5	12	0	0	0
17	M	L2	143	205	0	debitage	10	obsidian	2	2	2	1	0	0	0	0
17	M	L2	142	206	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	L2	144	207	0	debitage	9	obsidian	2	0	1	0	0	0	0	0
17	M	L2	144	206	0	debitage	10	obsidian	2	3	1	1	0	0	0	0
17	M	L2	144	208	0	debitage	12	obsidian	2	5	1	4	0	0	0	[illegible]
17	M	L2	143	206	0	debitage	12	obsidian	2	6	1	5	0	0	0	[illegible]
17	M	L2	144	208	0	debitage	12	crypto-c	11	1	1	4	0	0	0	1
17	M	L2	142	206	0	debitage	11	obsidian	2	2	1	1	0	0	0	0
17	M	L2	143	208	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	L2	144	207	0	debitage	10	obsidian	2	1	2	1	0	0	0	0
17	M	L2	142	206	0	debitage	12	obsidian	2	5	1	4	0	0	0	0
17	M	L2	144	206	0	debitage	12	obsidian	2	6	1	5	0	0	0	0
17	M	M1	124	218	0	debitage	7	obsidian	2	6	1	0	34	0	0	0
17	M	M1	121	231	0	debitage	12	qrtzite	41	0	1	5	21	0	0	0
17	M	T2	113	250	20	debitage	10	crypto-c	20	4	1	5	0	0	0	0
17	M	T2	113	250	20	debitage	12	qrtzite	43	1	1	5	0	11	0	0
17	M	T2	113	250	20	debitage	9	crypto-c	15	0	1	0	0	0	0	0
17	M	T2	113	250	0	debitage	9	sedmntry	31	0	3	0	0	0	0	1
17	M	T2	113	250	20	debitage	12	qrtzite	43	1	1	5	0	11	0	0
17	M	T2	113	249	0	metal	71	metal	70							
17	M	T2	113	250	20	debitage	10	crypto-c	20	2	1	1	0	0	0	0
17	M	T3	113	249	0	debitage	12	crypto-c	20	4	1	5	0	0	0	0
17	M	T3	113	249	30	debitage	9	crypto-c	11	0	3	0	0	0	0	0
17	M	T3	113	249	0	debitage	12	crypto-c	20	4	2	5	0	0	0	0
17	M	T3	113	249	30	debitage	11	crypto-c	20	2	1	2	0	0	0	0
17	M	T3	113	249	10	debitage	11	crypto-c	20	2	1	2	0	0	0	0
17	M	T3	113	249	10	debitage	11	crypto-c	20	4	1	5	0	0	0	0
17	M	T7	139	207	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	M	T7	139	207	0	debitage	9	obsidian	2	0	1	0	0	0	0	0
17	M	T7	139	207	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
17	M	T7	139	207	0	debitage	11	obsidian	2	2	1	1	0	0	0	0
17	M	T7	139	207	0	debitage	12	obsidian	2	4	1	5	0	11	0	0
17	M	T7	139	207	0	debitage	12	obsidian	1	3	1	5	0	0	0	0
17	M	T7	139	207	0	debitage	11	obsidian	2	3	1	5	0	0	0	0
17	M	T7	139	207	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
17	M	T7	139	207	0	debitage	12	crypto-c	11	3	1	5	0	0	0	0
17	M	T8	113	251	10	debitage	11	crypto-c	15	3	1	5	0	0	0	1
17	M	T8	113	251	10	debitage	12	crypto-c	11	2	1	4	0	0	0	0
17	M	T8	113	251	0	debitage	9	crypto-c	15	0	4	0	0	0	0	0
17	N	B	115	380	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
17	N	B	111	379	0	debitage	11	crypto-c	11	2	1	2	0	0	0	1
17	N	B	97	378	0	debitage	10	qrtzite	44	1	5	1	0	0	0	0
17	N	B	101	376	0	debitage	11	crypto-c	11	1	1	2	0	0	0	0
17	N	B	110	391	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
17	N	B	109	375	0	debitage	12	crypto-c	11	1	1	4	0	0	0	1
17	N	B	95	386	0	debitage	10	crypto-c	11	2	1	2	0	0	0	0
17	N	B	102	374	0	debitage	11	crypto-c	11	1	1	4	0	0	0	1
17	N	B	117	385	0	debitage	10	crypto-c	11	1	1	2	0	0	0	1
17	N	B	117	373	0	debitage	12	crypto-c	11	4	1	5	0	13	0	1
17	N	B	102	376	0	debitage	9	crypto-c	12	0	1	0	0	0	0	0
17	N	B	109	372	0	debitage	10	crypto-c	11	1	1	1	22	0	0	1

Table H.2 LA 25417 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	N	B	103	385	0	tool	27	crypto-c	11	1	2	1	33	16	0	0
17	N	B	118	372	0	debitage	10	crypto-c	11	1	1	4	0	0	0	1
17	N	B	105	384	0	debitage	12	crypto-c	11	1	1	4	0	0	0	1
17	N	B	107	371	0	debitage	12	crypto-c	11	2	1	4	0	0	0	1
17	N	B	116	384	0	debitage	7	crypto-c	11	5	1	0	32	0	0	1
17	N	B	101	370	0	debitage	12	crypto-c	11	1	1	4	0	0	0	1
17	N	B	108	383	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
17	N	B	102	369	0	debitage	11	crypto-c	11	1	1	4	0	0	0	0
17	N	B	111	381	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
17	N	B	88	353	0	tool	22	crypto-c	11	4	1	5	0	13	0	1
17	N	B	114	381	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
17	N	B	116	373	0	debitage	12	crypto-c	20	5	1	4	0	0	0	1
17	N	B	89	357	0	debitage	7	crypto-c	18	5	1	0	32	15	0	0
17	N	B	140	360	0	tool	20	obsidian	1	3	1	0	34	13	0	0
17	N	B	113	386	0	debitage	8	crypto-c	11	3	1	0	34	13	0	0
17	N	B	110	379	0	debitage	10	qrtzite	43	1	2	1	0	0	0	0
17	N	B	113	386	0	debitage	7	crypto-c	12	3	1	0	34	0	0	0
17	N	B	97	353	0	debitage	10	obsidian	2	2	2	1	0	13	0	0
17	N	B	117	379	0	debitage	10	crypto-c	13	2	1	4	0	0	0	1
17	N	B	139	354	0	debitage	10	obsidian	2	2	2	1	34	13	0	0
17	N	B	117	381	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
17	N	B	93	365	0	debitage	11	obsidian	2	1	1	4	0	0	0	0
17	N	B	110	379	0	debitage	11	crypto-c	11	2	1	2	0	0	0	1
17	N	B	109	374	0	debitage	10	obsidian	2	1	2	1	0	0	0	0
17	N	B	114	385	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
17	N	B	110	379	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
17	N	B	116	383	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
17	N	B	111	381	0	tool	20	obsidian	2	4	1	0	34	0	0	0
17	N	B	110	390	0	debitage	11	crypto-c	11	2	1	6	0	13	0	1
17	N	B	117	381	0	debitage	10	crypto-c	11	2	2	1	12	13	0	0
17	N	B	104	385	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
17	N	B	108	369	0	debitage	12	obsidian	2	4	2	5	0	13	0	0
17	N	C	148	331	0	debitage	12	crypto-c	11	4	1	5	0	13	0	0
17	N	C	158	313	0	debitage	12	crypto-c	11	3	1	5	0	13	0	1
17	N	C	158	313	0	debitage	10	crypto-c	11	2	1	2	0	13	0	1
17	N	C	122	344	0	debitage	10	crypto-c	13	1	1	1	0	13	0	1
17	N	C	155	318	0	debitage	12	crypto-c	11	4	1	5	0	13	0	0
17	N	C	138	330	0	debitage	10	crypto-c	12	1	1	2	0	13	0	0
17	N	C	159	318	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
17	N	C	158	315	0	debitage	9	crypto-c	12	0	2	0	0	0	0	0
17	N	C	156	317	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
17	N	C	159	314	0	debitage	11	crypto-c	12	1	1	1	0	0	0	0
17	N	C	160	317	0	debitage	10	crypto-c	11	1	5	4	0	0	0	1
17	N	C	156	324	0	debitage	12	obsidian	2	1	2	4	0	0	0	0
17	N	C	158	320	0	debitage	9	qrtzite	43	0	2	0	0	0	0	0
17	N	C	150	322	0	debitage	11	obsidian	2	1	1	2	0	0	0	0
17	N	C	159	317	0	debitage	9	crypto-c	11	0	2	0	0	0	0	0
17	N	C	157	316	0	debitage	11	obsidian	2	1	1	2	0	0	0	0
17	N	C	160	317	0	debitage	10	crypto-c	11	1	2	1	0	0	0	1
17	N	C	155	321	0	debitage	11	obsidian	2	2	1	2	0	0	0	0
17	N	C	155	314	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
17	N	C	156	314	0	debitage	10	crypto-c	11	1	1	2	0	0	0	0
17	N	C	138	353	0	debitage	10	crypto-c	13	1	2	2	0	13	0	1
17	N	C	159	314	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1

Table H.2 LA 25417 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	0	
17	N	C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	0	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	3	[illegible]	11	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	debitage	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	N	C	157	316	0	debitage	12	crypto-c	[illegible]	[illegible]	[illegible]	3	[illegible]		[illegible]	
17	N	C	155	316	0	debitage	[illegible]	crypto-c	11	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]
17	N	C	155	317	0	debitage	12	crypto-c	[illegible]			2		[illegible]	[illegible]	[illegible]
17	N	C	156	316	0	debitage	12	crypto-c	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
17	N	C	156	314	0	debitage	10	crypto-c	11		[illegible]				[illegible]	
17	N	C	158	316	0	debitage	12	crypto-c	11	4		[illegible]			[illegible]	[illegible]
17	N	C	153	320	0	debitage	10	crypto-c	11	[illegible]	[illegible]	[illegible]		[illegible]		
17	N	C	159	316	0	debitage	10	crypto-c	11	1		[illegible]			[illegible]	[illegible]
17	N	C	157	314	0	debitage	10	crypto-c	11	[illegible]	[illegible]	[illegible]			0	
17	N	C	155	316	0	debitage	9	crypto-c	11	[illegible]	[illegible]					[illegible]
17	N	C	145	325	0	debitage	10	crypto-c	11	[illegible]		4	[illegible]	0	0	1
17	N	C	149	323	0	debitage	11	obsidian	[illegible]	[illegible]	[illegible]	3	[illegible]	11	0	[illegible]
17	N	C	159	318	0	debitage	12	crypto-c	11	[illegible]	1	3	11	0	0	1
17	N	C	157	315	0	debitage	11	crypto-c	11	1	1	1	0	0	0	0
17	N	T1	157	315	20	debitage	11	obsidian	[illegible]	[illegible]	1	2	0	0	0	0
17	N	T1	157	315	10	debitage	11	obsidian	2	1	[illegible]	[illegible]	[illegible]	0	0	0
17	N	T1	157	315	20	debitage	12	obsidian	2	4	1	5	0	0	0	0
17	N	T1	157	315	20	debitage	9	crypto-c	11	0	4	[illegible]	[illegible]	0	0	0
17	N	T1	157	315	10	debitage	12	obsidian	2	4	0	5	[illegible]	0	0	[illegible]
17	N	T4	162	307	10	debitage	12	crypto-c	11	4	1	5	0	0	0	0
17	N	T4	162	307	10	debitage	10	crypto-c	12	[illegible]	1	2	0	0	0	1
17	N	T4	162	307	10	debitage	10	crypto-c	11	1	1	2	0	0	0	0
17	N	T4	162	307	10	debitage	10	obsidian	2	4	1	5	0	0	0	0
17	N	T4	162	307	0	debitage	10	crypto-c	11	1	1	2	0	0	0	0
17	N	T4	162	307	10	debitage	12	crypto-c	12	4	1	5	0	0	[illegible]	1
17	N	T4	162	307	10	debitage	12	crypto-c	11	4	1	5	0	[illegible]	0	1
17	N	T4	162	307	10	debitage	12	crypto-c	11	4	2	5	0	0	0	0
17	N	T4	162	307	0	debitage	11	obsidian	2	4	1	5	0	0	0	0
17	N	T4	162	307	10	debitage	12	obsidian	2	5	1	4	0	0	0	0
17	S	1	156	153	0	tool	10	crypto-c	12	1	4	[illegible]	12	12	0	1
17	S	C	154	31	0	debitage	10	crypto-c	11	1	1	2	0	13	0	1
17	S	D	57	182	0	debitage	11	obsidian	2	11	[illegible]	2	[illegible]	0	0	0
17	S	D	66	194	0	debitage	11	obsidian	2	2	1	2	0	0	0	0
17	S	D	65	180	0	ceramic	50	ceramic	50							
17	S	D	65	196	0	debitage	11	obsidian	2	2		[illegible]	0	0	0	0
17	S	D	72	192	0	debitage	9	obsidian	1	[illegible]			[illegible]	0	0	0
17	S	D	66	197	0	debitage	11	obsidian	2	1	2	[illegible]	[illegible]	[illegible]	0	
17	S	D	57	188	0	debitage	12	obsidian	1	2	1	4	[illegible]	0	0	
17	S	D	62	179	0	bead	60	glass	[illegible]							
17	S	D	68	186	0	debitage	10	crypto-c	11	[illegible]		1	[illegible]	[illegible]	[illegible]	
17	S	D	63	189	0	debitage	10	sedmntry	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
17	S	D	56	180	0	debitage	12	obsidian	[illegible]	[illegible]	[illegible]	5	[illegible]	[illegible]	0	[illegible]
17	S	D	57	181	0	debitage	10	qrtzite	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	S	D	71	194	0	debitage	11	crypto-c	11		1	1	[illegible]	[illegible]	[illegible]	1
17	S	D	55	180	0	debitage	[illegible]	crypto-c	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]
17	S	D	55	187	[illegible]	debitage	12	obsidian	[illegible]	4	[illegible]	5	0	[illegible]		[illegible]
17	S	D	56	[illegible]	[illegible]	debitage	[illegible]	crypto-c	11		[illegible]	5	0	0		[illegible]
[illegible]	S	[illegible]	[illegible]	[illegible]	[illegible]	debitage	11	obsidian	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]
17	S	[illegible]	[illegible]	[illegible]	0	debitage	9	crypto-c	12	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	S	[illegible]	[illegible]	[illegible]	[illegible]	ceramic	[illegible]	ceramic	50							

Table H.2 LA 25417 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	S	D	55	180	0	debitage	9	obsidian	1	0	2	0	0	0	0	0
17	S	D	59	182	0	debitage	10	obsidian	2	2	1	1	0	0	0	0
17	S	D	55	179	0	debitage	10	crypto-c	12	2	1	1	0	0	0	0
17	S	D	59	187	0	debitage	11	obsidian	2	4	1	5	0	15	0	0
17	S	D	59	185	0	debitage	9	crypto-c	12	0	1	0	0	0	0	0
17	S	D	56	177	0	debitage	11	obsidian	2	1	1	2	0	0	0	0
17	S	D	60	194	0	debitage	12	obsidian	2	3	2	5	0	12	0	0
17	S	D	54	178	0	debitage	11	obsidian	1	3	1	5	0	0	0	0
17	S	D	59	186	0	debitage	10	crypto-c	12	2	1	2	0	0	0	0
17	S	F2	61	180	10	ceramic	50	ceramic	50							
17	S	F2	61	180	5	bead	60	glass	60							
17	S	F2	61	180	10	ceramic	50	ceramic	50							
17	S	F2	61	180	10	ceramic	50	ceramic	50							
17	S	F8	117	131	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
17	S	F8	117	131	0	debitage	10	crypto-c	11	1	2	1	0	0	0	0
17	S	F8	117	131	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
17	S	F8	116	123	0	debitage	12	crypto-c	11	1	1	4	0	0	0	1
17	S	F8	117	131	0	debitage	12	crypto-c	11	4	1	1	0	0	0	0
17	S	F8	107	122	0	debitage	11	crypto-c	11	1	1	2	0	0	0	0
17	S	F8	116	131	0	debitage	11	crypto-c	11	1	1	4	0	0	0	1
17	S	F8	116	125	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
17	S	F8	117	131	0	debitage	10	crypto-c	11	1	1	1	12	0	0	1
17	S	F8	101	127	0	debitage	12	crypto-c	11	3	1	3	0	0	0	1
17	S	F8	117	128	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
17	S	F8	109	125	0	grnd stn	42	sedmntry	35	1	0	0	0	11	0	0
17	S	F8	115	128	0	debitage	10	crypto-c	11	1	1	2	0	0	0	0
17	S	F8	116	129	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
17	S	F8	115	131	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
17	S	F8	118	129	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
17	S	F8	117	131	0	debitage	10	crypto-c	12	1	1	1	0	0	0	0
17	S	F8	115	130	0	debitage	11	crypto-c	11	2	1	1	0	0	0	1
17	S	F8	106	121	0	debitage	10	obsidian	2	1	5	1	0	0	0	0
17	S	F8	117	130	0	debitage	11	crypto-c	11	1	1	1	0	0	0	1
17	S	F8	109	117	0	tool	20	obsidian	2	3	1	0	34	0	0	0
17	S	F8	115	130	0	debitage	11	crypto-c	11	1	1	4	0	0	0	0
17	S	F8	117	131	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
17	S	F8	117	131	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
17	S	F8	111	118	0	debitage	11	crypto-c	12	1	1	1	0	0	0	0
17	S	F8	115	124	0	debitage	12	crypto-c	11	1	1	4	0	0	0	0
17	S	F8	115	131	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
17	S	F8	107	124	0	debitage	11	crypto-c	11	4	1	5	0	0	0	1
17	S	F8	117	132	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
17	S	F8	118	129	0	debitage	10	crypto-c	11	1	1	2	0	0	0	1
17	S	F8	117	132	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
17	S	F8	116	129	0	debitage	12	crypto-c	11	1	1	4	0	0	0	0
17	S	F8	109	133	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
17	S	F8	116	130	0	debitage	12	crypto-c	11	4	1	5	0	13	0	0
17	S	F8	110	133	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
17	S	F8	117	131	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
17	S	F8	116	133	0	core	4	crypto-c	11	0	1	0	0	0	0	1
17	S	F8	117	125	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
17	S	F8	116	133	0	debitage	12	crypto-c	11	4	1	5	0	13	0	0
17	S	F8	117	130	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
17	S	F8	115	137	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0

Table H.2 LA 25417 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
17	S	F6	105	122	0	debitage	10	crypto-c	11	1	2	2	0	0	0	0
17	S	F6	115	130	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
17	S	F8	112	129	0	debitage	10	crypto-c	11	2	1	1	0	0	0	1
17	S	F8	106	124	0	ceramic	50	ceramic	51							
17	S	M4	20	149	0	tool	20	obsidian	2	4	1	0	34	0	0	0
17	S	M4	97	84	0	tool	20	obsidian	2	1	1	0	34	0	0	0
17	S	M4	14	132	0	tool	20	obsidian	2	5	1	0	34	0	0	0

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	N	C	[illegible]	356	0	debitage	12	crypto-c	13	2	2	4	[illegible]	[illegible]	[illegible]	1
19	N	C	192	[illegible]	0	tool	22	crypto-c	11	5	1	0	0	0	0	1
19	N	C	192	304	0	tool	20	obsidian	2	2	1	0	24	13	0	0
19	N	C	189	345	0	debitage	6	obsidian	2	2	1	0	0	0	0	1
19	N	F15	79	301	0	debitage	11	obsidian	2	1	3	1	0	0	0	0
19	N	F15	78	299	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F15	78	298	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F15	76	300	0	debitage	12	crypto-c	11	6	1	5	0	0	0	1
19	N	F15	78	300	0	debitage	10	qrtzite	42	1	5	1	0	0	0	0
19	N	F15	76	298	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F15	79	299	0	debitage	10	crypto-c	11	1	0	1	0	0	0	1
19	N	F15	76	299	0	debitage	12	crypto-c	11	6	1	5	0	0	0	0
19	N	F15	79	300	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
19	N	F15	76	299	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F15	79	298	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F15	77	301	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F15	79	301	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	N	F15	77	300	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	N	F15	79	301	0	debitage	11	crypto-c	11	2	1	4	0	0	0	1
19	N	F15	77	300	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
19	N	F15	79	299	0	debitage	11	crypto-c	11	2	0	2	0	0	0	1
19	N	F15	77	300	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F15	79	301	0	debitage	11	crypto-c	11	2	1	5	0	0	0	1
19	N	F15	77	300	0	debitage	12	obsidian	2	3	1	5	0	0	0	0
19	N	F15	79	298	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	N	F15	77	300	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F15	79	300	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F15	77	298	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F15	79	298	0	debitage	11	crypto-c	11	1	1	4	0	0	0	1
19	N	F15	77	300	0	debitage	11	crypto-c	11	3	1	5	0	0	0	1
19	N	F15	79	301	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F15	79	300	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F15	79	299	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
19	N	F15	78	299	0	debitage	12	crypto-c	13	3	1	5	0	0	0	1
19	N	F15	79	300	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F15	78	298	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
19	N	F15	79	301	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	N	F15	76	300	0	debitage	11	crypto-c	11	3	1	5	0	0	0	1
19	N	F15	79	299	0	debitage	11	crypto-c	11	1	0	2	0	0	0	1
19	N	F15	76	299	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
19	N	F15	79	300	0	debitage	11	crypto-c	11	2	2	4	0	0	0	0
19	N	F15	76	299	0	debitage	12	crypto-c	11	3	1	5	0	0	0	0
19	N	F15	79	301	0	debitage	11	crypto-c	11	2	1	2	0	0	0	0
19	N	F15	76	299	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F15	79	301	0	debitage	10	obsidian	2	5	1	4	0	0	0	0
19	N	F15	77	300	0	debitage	9	sedmntry	31	0	1	0	0	24	0	0
19	N	F15	79	299	0	debitage	10	obsidian	2	4	5	5	0	0	0	0
19	N	F15	77	301	0	debitage	12	crypto-c	11	6	1	5	0	0	0	1
19	N	F15	76	300	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
19	N	F15	76	298	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
19	N	F15	77	300	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F15	78	297	0	debitage	11	crypto-c	11	1	1	4	0	0	0	1
19	N	F15	77	299	0	debitage	11	crypto-c	12	3	1	5	0	0	0	0
19	N	F15	78	298	0	debitage	12	obsidian	2	2	1	4	0	0	0	0

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Fetouch	Wear	Recycle	Heat
19	N	F15	77	[illegible]	[illegible]	debitage	[illegible]	crypto-c	[illegible]	-	[illegible]	1				
19	N	F15	73	299	[illegible]	debitage	[illegible]	crypto-c		-	[illegible]	1	[illegible]			[illegible]
19	N	F15	[illegible]	[illegible]	[illegible]	debitage	[illegible]	[illegible]	41	[illegible]	[illegible]	1	[illegible]		[illegible]	[illegible]
19	N	F15	77	300	[illegible]	debitage	12	crypto-c	11		[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]
19	N	F15	76	298	0	debitage	9	crypto-c	11		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
19	N	F15	78	299	[illegible]	debitage	12	crypto-c	11	4	1	1	[illegible]		[illegible]	1
19	N	F15	78	300	0	debitage	9	crypto-c	11	[illegible]	[illegible]			[illegible]	[illegible]	1
19	N	F15	76	298	0	debitage	9	crypto-c	11		[illegible]		0	0	[illegible]	1
19	N	F15	76	300	0	debitage	11	crypto-c	11	1	1	1	[illegible]		[illegible]	0
19	N	F16	79	301	0	tool	22	crypto-c	12	4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
19	N	F16	111	335	0	debitage	11	crypto-c	11	1	[illegible]	1	0			[illegible]
19	N	F16	94	291	0	debitage	10	crypto-c	11	1	1	1	0	0	[illegible]	1
19	N	F16	121	343	0	debitage	12	crypto-c	11	1	[illegible]	4	0	[illegible]	[illegible]	[illegible]
19	N	F16	83	308	0	debitage	10	qrtzite	41	[illegible]	1	1	0	[illegible]	0	0
19	N	F16	91	308	0	debitage	7	crypto-c	11	1	1	0	0	0	0	[illegible]
19	N	F16	124	348	0	debitage	7	crypto-c	11	1	1	0	[illegible]	0	0	1
19	N	F16	115	332	0	debitage	7	crypto-c	11	3	1	0	0	0	0	1
19	N	F18	115	357	0	debitage	11	crypto-c	11	2	1	1	0	0	0	1
19	N	F18	117	357	0	debitage	9	crypto-c	12	0	2	0	0	0	0	1
19	N	F18	117	358	0	debitage	10	crypto-c	20	5	1	4	0	0	0	1
19	N	F18	117	359	0	debitage	11	crypto-c	11	1	1	1	0	0	0	1
19	N	F18	117	360	0	debitage	12	crypto-c	13	2	2	4	0	0	0	1
19	N	F18	118	358	0	debitage	9	crypto-c	11	1	1	0	0	0	0	1
19	N	F18	117	359	0	debitage	10	crypto-c	12	1	1	2	0	0	0	1
19	N	F18	118	357	0	debitage	9	crypto-c	11	[illegible]	1	0	[illegible]	[illegible]	0	0
19	N	F18	117	360	0	debitage	12	crypto-c	11	3	1	5	0	[illegible]	0	0
19	N	F18	118	359	0	debitage	10	crypto-c	12	2	1	1	0	0	0	1
19	N	F18	117	359	0	debitage	10	qrtzite	41	1	2	1	0	0	[illegible]	0
19	N	F18	118	357	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F18	117	358	0	tool	20	crypto-c	11	2	1	0	34	0	0	1
19	N	F18	115	359	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F18	117	360	0	debitage	12	crypto-c	19	3	1	5	0	0	[illegible]	0
19	N	F18	115	359	0	debitage	9	crypto-c	13	0	1	0	[illegible]	0	0	0
19	N	F18	117	357	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
19	N	F18	116	358	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
19	N	F18	118	359	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F18	116	359	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F18	117	358	0	debitage	10	crypto-c	11	1	1	2	0	0	0	1
19	N	F18	116	358	0	debitage	12	crypto-c	11	5	1	5	0	0	0	1
19	N	F18	117	356	0	debitage	9	crypto-c	11	1	2	0	0	0	0	1
19	N	F18	116	359	0	debitage	9	crypto-c	12	1	2	1	0	0	0	1
19	N	F18	117	360	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
19	N	F18	116	357	0	debitage	11	crypto-c	11	2	[illegible]	1		0	[illegible]	[illegible]
19	N	F18	117	356	0	debitage	12	crypto-c	11	4	[illegible]	5		0	[illegible]	1
19	N	F18	116	358	0	debitage	10	crypto-c	12	1	1	2	[illegible]	[illegible]		1
19	N	F18	115	357	0	debitage	9	crypto-c	11		1	0	[illegible]	[illegible]		1
19	N	F18	115	359	0	debitage	9	crypto-c	11	2	[illegible]	[illegible]		[illegible]	[illegible]	1
19	N	F18	117	357	0	debitage	10	crypto-c	12	2	[illegible]	1	[illegible]			1
19	N	F18	117	357	[illegible]	debitage	10	crypto-c	11	2	1	1			[illegible]	[illegible]
19	N	F18	117	[illegible]	[illegible]	debitage	12	crypto-c	11	2	[illegible]	5				
19	N	F18	[illegible]	[illegible]	[illegible]	debitage	11	crypto-c	[illegible]	2	[illegible]	[illegible]	[illegible]			[illegible]
19	N	F18	117	360	[illegible]	debitage	11	crypto-c	11	1	[illegible]	[illegible]				1
19	N	F18	117	359	[illegible]	debitage	9	crypto-c	[illegible]		[illegible]	0	[illegible]			[illegible]
19	N	F18	117	[illegible]	[illegible]	debitage	12	crypto-c	11	2	[illegible]	4		0	[illegible]	[illegible]

Table H.3 LA 25419 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	N	F18	118	359	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F18	117	357	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F18	118	358	0	debitage	10	crypto-c	11	2	1	2	0	0	0	1
19	N	F18	118	359	0	debitage	9	crypto-c	12	0	1	0	0	0	0	1
19	N	F18	115	358	0	debitage	11	crypto-c	11	4	1	5	0	0	0	1
19	N	F18	118	359	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F18	115	359	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	N	F18	118	360	0	debitage	10	crypto-c	11	1	1	2	0	0	0	1
19	N	F18	116	360	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F18	118	358	0	debitage	11	crypto-c	11	4	1	5	0	0	0	1
19	N	F18	116	360	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
19	N	F18	118	357	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	N	F18	116	358	0	debitage	12	crypto-c	11	3	1	4	0	0	0	1
19	N	F18	118	358	0	debitage	11	crypto-c	11	2	1	4	0	0	0	1
19	N	F18	117	359	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	F18	118	358	0	debitage	11	crypto-c	11	2	1	2	0	0	0	1
19	N	F18	117	359	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F18	118	356	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F18	118	358	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
19	N	F18	116	359	0	tool	11	crypto-c	11	2	1	0	34	0	0	1
19	N	F18	116	360	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F18	118	359	0	debitage	11	crypto-c	11	2	1	2	0	0	0	1
19	N	F18	116	359	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
19	N	F18	116	360	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	N	F18	117	358	0	debitage	11	obsidian	1	1	1	4	0	0	0	0
19	N	F18	118	357	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
19	N	F18	118	359	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	F18	118	357	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F18	118	359	0	debitage	12	crypto-c	11	3	1	5	0	0	0	0
19	N	F18	116	357	0	debitage	11	crypto-c	11	1	1	2	0	0	0	1
19	N	F18	118	357	0	debitage	8	crypto-c	11	2	1	0	34	13	0	1
19	N	F18	118	357	0	debitage	9	crypto-c	12	0	1	0	0	0	0	1
19	N	F25	124	275	0	tool	20	basalt	3	2	0	0	0	0	0	0
19	N	F25	106	288	0	tool	20	crypto-c	11	1	1	0	0	0	0	1
19	N	F25	112	269	0	tool	20	obsidian	1	2	1	0	34	13	0	0
19	N	F25	106	281	0	tool	20	crypto-c	11	1	1	0	34	13	0	1
19	N	F25	127	288	0	tool	20	crypto-c	11	1	1	0	0	0	0	0
19	N	F25	116	269	0	tool	20	crypto-c	11	3	1	0	34	13	0	1
19	N	F25	129	291	0	debitage	7	obsidian	2	4	0	0	0	0	0	0
19	N	F25	110	259	0	tool	13	qrtzite	46	0	3	0	14	16	0	0
19	N	F25	137	276	0	debitage	11	obsidian	2	4	1	5	0	0	0	0
19	N	F25	145	290	0	tool	20	obsidian	2	2	1	0	34	15	0	0
19	N	F25	131	258	0	debitage	9	obsidian	1	0	1	0	15	13	0	0
19	N	F25	111	254	0	core	4	crypto-c	11	0	2	0	0	0	0	0
19	N	F25	123	263	0	debitage	11	obsidian	2	5	1	4	0	0	0	1
19	N	F30	289	265	0	tool	20	obsidian	1	2	1	0	34	15	0	0
19	N	F40	53	233	0	tool	22	crypto-c	12	1	1	0	0	0	0	0
19	N	F40	75	247	0	can	40	metal	70							
19	N	T6	114	351	20	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	T6	114	351	10	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	N	T6	114	351	10	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	N	T6	114	351	0	debitage	11	obsidian	1	2	1	2	0	0	0	0
19	N	T6	114	351	10	tool	20	crypto-c	11	4	1	0	34	0	0	1
19	N	T6	114	351	10	debitage	12	crypto-c	11	4	1	1	0	0	0	0

Table H.3 LA 25419 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	N	Tc	114	351	[illegible]	debitage	11	crypto-c	11	1	1	1	[illegible]	[illegible]	[illegible]	1
19	N	Tc	114	351	10	debitage	10	crypto-c	11	1	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]
19	N	Tc	114	351	10	debitage	9	crypto-c	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	N	Tc	114	351	10	debitage	9	crypto-c	11	1	1	[illegible]	12	[illegible]	[illegible]	[illegible]
19	N	Tc	114	351	10	debitage	11	crypto-c	11	3	1	4	[illegible]	[illegible]	[illegible]	[illegible]
19	S	F10	226	70	0	debitage	9	qrtzite	41	1	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	S	F10	226	64	0	debitage	10	qrtzite	41	4	1	1	[illegible]	[illegible]	[illegible]	[illegible]
19	S	F10	226	66	0	debitage	9	qrtzite	41	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	S	F10	226	62	0	debitage	10	qrtzite	41	[illegible]	1	1	[illegible]	[illegible]	0	[illegible]
19	S	F10	226	62	0	debitage	9	qrtzite	41	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	4	[illegible]	0	[illegible]	[illegible]
19	S	F10	226	62	0	debitage	11	qrtzite	41	1	1	2	[illegible]	0	[illegible]	[illegible]
19	S	F10	226	72	0	debitage	10	qrtzite	41	4	1	5	[illegible]	[illegible]	0	[illegible]
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	1	1	0	[illegible]	[illegible]	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	62	0	debitage	12	qrtzite	41	4	1	5	1	[illegible]	0	0
19	S	F10	226	68	0	debitage	10	qrtzite	41	4	5	5	0	0	0	0
19	S	F10	226	68	0	debitage	10	qrtzite	41	4	1	5	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	68	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	64	0	debitage	10	qrtzite	41	5	1	2	0	0	0	0
19	S	F10	226	70	0	debitage	10	qrtzite	41	2	2	4	0	0	0	0
19	S	F10	226	71	0	debitage	9	crypto-c	11	0	2	0	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	70	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
19	S	F10	226	67	0	debitage	11	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	70	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	72	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	68	0	debitage	10	qrtzite	41	1	2	1	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	2	2	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	64	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	62	0	debitage	11	qrtzite	41	2	1	2	0	0	0	0
19	S	F10	226	68	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	64	0	debitage	12	qrtzite	41	6	1	5	0	0	0	0
19	S	F10	226	[illegible]	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	65	0	debitage	10	qrtzite	41	[illegible]	2	1	0	0	[illegible]	[illegible]
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	2	1	0	0	[illegible]	[illegible]
19	S	F10	226	62	0	debitage	9	qrtzite	41	[illegible]	2	0	0	0	[illegible]	[illegible]
19	S	F10	226	72	0	debitage	10	qrtzite	41	1	1	1	0	0	0	[illegible]
19	S	F10	226	68	0	debitage	11	qrtzite	41	1	1	2	0	0	0	[illegible]
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	[illegible]	[illegible]	[illegible]	0	0	0
19	S	F10	226	67	0	debitage	10	qrtzite	41	1	2	1	0	[illegible]	0	[illegible]
19	S	F10	226	64	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
19	S	F10	226	62	[illegible]	debitage	11	qrtzite	41	1	1	4	0	0	0	0
19	S	F10	226	68	[illegible]	debitage	11	qrtzite	41	[illegible]	1	2	[illegible]	0	0	0
19	S	F10	226	64	[illegible]	debitage	10	qrtzite	41	1	1	1	[illegible]	0	0	[illegible]
19	S	F10	226	63	0	debitage	[illegible]	qrtzite	41	1	2	1	0	0	0	0
19	S	F10	226	65	[illegible]	debitage	10	qrtzite	41	1	2	1	0	0	0	0

Table H.3 LA 25419 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	S	F10	226	63	0	debitage	11	qrtzite	41	1	1	[illegible]	[illegible]	0	0	[illegible]
19	S	F10	226	66	0	core	2	qrtzite	41	0	2	1	0	[illegible]	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	70	0	core	1	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	71	0	debitage	11	qrtzite	41	2	1	2	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	64	0	debitage	10	qrtzite	41	2	1	2	0	0	0	0
19	S	F10	226	67	0	debitage	10	qrtzite	41	2	1	1	0	13	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	64	0	debitage	11	qrtzite	41	2	1	4	0	0	0	0
19	S	F10	226	65	0	debitage	9	qrtzite	41	0	1	0	0	13	0	0
19	S	F10	226	64	0	debitage	9	qrtzite	41	0	3	0	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	66	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	66	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	66	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	66	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	5	3	0	0	0	0
19	S	F10	226	65	0	debitage	11	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	62	0	core	4	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	64	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	63	0	debitage	12	qrtzite	41	5	1	5	23	13	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	66	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	2	5	3	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	74	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	63	0	debitage	11	qrtzite	41	1	1	2	0	13	0	0
19	S	F10	226	66	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	67	0	debitage	10	qrtzite	41	2	2	1	0	0	0	0
19	S	F10	226	71	0	debitage	12	qrtzite	41	3	1	5	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	73	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
19	S	F10	226	66	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	66	0	debitage	12	qrtzite	41	4	1	5	0	0	0	0
19	S	F10	226	62	0	debitage	11	qrtzite	41	2	2	2	0	0	0	0
19	S	F10	226	62	0	debitage	11	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	63	0	debitage	11	qrtzite	41	1	1	1	0	0	0	0

Table H.3 LA 25419 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	S	F10	226	65	0	debitage	[illegible]	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	64	0	debitage	10	qrtzite	41	2	1	4	[illegible]	0	[illegible]	[illegible]
19	S	F10	226	67	0	debitage	9	qrtzite	41	0	2	[illegible]	0	0	0	[illegible]
19	S	F10	226	64	0	debitage	9	qrtzite	41	0	3	2	0	0	[illegible]	[illegible]
19	S	F10	226	65	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	66	0	debitage	12	qrtzite	41	2	1	4	0	0	0	0
19	S	F10	226	68	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
19	S	F10	226	62	0	debitage	10	qrtzite	41	4	4	5	0	0	0	0
19	S	F10	226	64	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	2	1	1	0	0	0	0
19	S	F10	226	68	0	debitage	9	qrtzite	41	1	2	0	0	0	0	0
19	S	F10	226	71	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	62	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F10	226	64	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	68	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	62	0	core	4	qrtzite	41	0	2	0	0	0	0	0
19	S	F10	226	65	0	debitage	10	qrtzite	41	1	2	4	0	0	0	0
19	S	F10	226	63	0	debitage	10	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	64	0	debitage	10	qrtzite	41	1	3	1	0	0	0	0
19	S	F10	226	66	0	debitage	10	qrtzite	41	4	1	5	0	0	0	0
19	S	F10	226	67	0	debitage	11	qrtzite	41	1	1	2	0	0	0	0
19	S	F10	226	65	0	debitage	10	qrtzite	41	1	1	1	0	0	0	0
19	S	F10	226	63	0	debitage	9	qrtzite	41	0	1	0	0	0	0	0
19	S	F14	271	98	0	debitage	10	qrtzite	41	1	4	1	0	0	0	0
19	S	F14	271	98	0	debitage	10	qrtzite	42	3	1	4	0	0	0	0
19	S	F14	271	98	0	debitage	12	qrtzite	42	4	1	5	0	0	0	0
19	S	F14	271	98	0	debitage	10	qrtzite	42	2	2	1	0	0	0	0
19	S	F14	271	98	0	debitage	12	qrtzite	42	4	1	5	0	0	0	0
19	S	F14	271	98	0	debitage	10	qrtzite	42	1	3	1	0	0	0	0
19	S	F14	271	98	0	debitage	9	qrtzite	42	0	1	0	0	0	0	0
19	S	F14	271	98	0	debitage	9	qrtzite	42	0	1	0	0	0	0	0
19	S	F14	271	98	0	core	4	qrtzite	42	0	2	0	0	0	0	0
19	S	F14	271	98	0	debitage	10	qrtzite	42	1	2	4	0	0	0	0
19	S	F14	271	98	0	debitage	12	qrtzite	41	4	4	5	0	0	0	0
19	S	F14	271	98	0	debitage	9	qrtzite	42	1	0	1	0	0	0	0
19	S	F14	271	98	0	debitage	12	qrtzite	42	4	2	5	0	0	0	0
19	S	F14	271	98	0	debitage	9	qrtzite	42	0	1	0	0	0	0	0
19	S	F14	271	98	0	debitage	12	qrtzite	42	4	1	5	0	0	0	0
19	S	F14	271	98	0	debitage	10	qrtzite	42	2	2	1	0	0	0	0
19	S	F14	271	98	0	debitage	9	qrtzite	42	0	1	0	0	0	0	0
19	S	F14	271	98	0	debitage	9	qrtzite	42	0	2	0	0	0	0	0
19	S	F2	307	228	0	debitage	10	crypto-c	11	1	1	2	0	0	0	1
19	S	F3	280	185	0	debitage	10	crypto-c	21	1	1	2	0	0	0	0
19	S	F3	284	195	0	debitage	12	qrtzite	41	4	1	4	0	0	0	0
19	S	F3	284	185	0	debitage	10	obsidian	1	1	2	4	0	0	0	0
19	S	F3	281	193	0	debitage	9	qrtzite	44	0	3	0	0	0	0	0
19	S	F7	272	191	0	debitage	9	crypto-c	20	0	2	0	0	0	0	0
19	S	F3	282	153	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
19	S	F3	274	167	0	debitage	9	crypto-c	17	0	2	0	0	0	0	0
19	S	F3	282	167	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
19	S	F3	273	152	0	debitage	11	qrtzite	41	3	1	5	0	0	0	0
19	S	F3	287	186	0	debitage	11	crypto-c	20	2	1	2	0	0	0	0

Table H.3 LA 25419 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	S	F3	275	183	0	debitage	11	obsidian	2	1	1	4	[illegible]	0	[illegible]	0
19	S	F3	284	1[illegible]	0	debitage	10	qrtzite	41	1	4	2	[illegible]	0	[illegible]	0
19	S	F3	281	184	0	debitage	11	qrtzite	42	2	[illegible]	4	0	0	0	0
19	S	F3	284	184	0	debitage	11	qrtzite	41	4	1	2	0	0	0	0
19	S	F3	280	182	0	debitage	10	crypto-c	21	5	1	1	0	0	0	0
19	S	F3	284	186	0	debitage	10	crypto-c	11	2	1	2	0	0	0	1
19	S	F3	280	189	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	S	F3	284	183	0	debitage	10	crypto-c	11	2	1	4	0	0	0	1
19	S	F3	276	187	0	debitage	11	crypto-c	21	2	1	1	0	0	0	1
19	S	F3	281	189	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
19	S	F3	278	176	0	debitage	11	crypto-c	11	1	1	2	0	0	0	0
19	S	F3	283	187	0	debitage	11	crypto-c	11	2	1	2	0	0	0	0
19	S	F3	278	191	0	debitage	9	crypto-c	21	0	1	0	0	0	0	0
19	S	F3	284	184	0	debitage	10	crypto-c	20	5	1	1	0	0	0	0
19	S	F3	278	182	0	debitage	11	crypto-c	11	1	1	4	0	0	0	0
19	S	F3	284	184	0	debitage	11	obsidian	2	2	1	2	0	0	0	0
19	S	F3	278	193	0	debitage	11	crypto-c	11	2	1	4	0	0	0	1
19	S	F3	282	193	0	debitage	11	qrtzite	41	2	1	1	0	0	0	0
19	S	F3	279	186	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
19	S	F3	284	186	0	debitage	12	qrtzite	41	6	1	5	0	0	0	0
19	S	F3	284	190	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	S	F3	266	184	0	debitage	9	qrtzite	41	0	3	0	0	0	0	0
19	S	F3	279	195	0	debitage	12	crypto-c	11	1	1	4	0	0	0	0
19	S	F4	262	146	0	grnd stn	42	qrtzite	44	1	0	0	0	21	1	0
19	S	F4	261	143	0	grnd stn	40	sedmntry	32	6	0	0	0	21	0	0
19	S	F40	93	236	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	S	F5	237	185	0	debitage	10	crypto-c	15	1	5	1	0	0	0	0
19	S	F5	245	190	0	debitage	9	crypto-c	19	0	2	0	0	0	0	0
19	S	F5	245	188	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	S	F5	240	186	0	can	40	metal	70							
19	S	F5	245	190	0	debitage	10	crypto-c	11	4	2	5	0	0	0	0
19	S	F5	251	185	0	debitage	9	crypto-c	11	0	2	0	0	0	0	0
19	S	F5	244	185	0	debitage	10	crypto-c	11	1	1	2	0	0	0	1
19	S	F5	246	188	0	debitage	10	crypto-c	11	1	5	1	0	0	0	0
19	S	F5	243	189	0	debitage	9	crypto-c	15	0	1	0	0	0	0	0
19	S	F5	238	182	0	tool	20	obsidian	2	1	1	0	34	13	0	0
19	S	F5	242	190	0	core	4	crypto-c	11	0	3	0	0	0	0	0
19	S	F5	248	186	0	debitage	9	crypto-c	22	0	1	0	0	0	0	0
19	S	F5	253	187	0	debitage	9	crypto-c	11	0	4	0	0	0	0	0
19	S	F5	245	184	0	debitage	9	qrtzite	41	0	3	0	0	0	0	0
19	S	F5	239	189	0	debitage	9	crypto-c	20	0	4	0	0	0	0	0
19	S	F7	189	165	0	debitage	7	crypto-c	11	2	1	0	34	13	0	1
19	S	F7	195	188	0	debitage	11	crypto-c	11	5	1	2	0	13	0	0
19	S	F7	189	184	0	debitage	10	crypto-c	14	3	2	5	0	0	0	0
19	S	F8	309	189	0	tool	21	crypto-c	11	2	1	0	34	15	0	1
19	S	F8	299	164	0	tool	20	obsidian	2	4	1	0	34	13	0	0
19	S	F8	301	184	0	can	40	metal	70							
19	S	F8	299	219	0	tool	28	crypto-c	11	1	2	0	34	13	0	1
19	S	F8	312	201	0	debitage	11	obsidian	2	2	1	4	0	13	0	0
19	S	F8	300	170	0	debitage	10	crypto-c	12	1	5	1	13	13	0	0
19	S	F8	310	205	0	debitage	9	crypto-c	11	0	2	0	0	0	0	0
19	S	F8	303	175	0	debitage	8	crypto-c	11	1	1	0	34	0	0	1
19	S	F8	305	184	0	can	40	metal	70							
19	S	F8	306	190	0	core	4	crypto-c	11	0	1	0	0	0	0	0

Table H.3 LA 25419 Artifacts

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	S	F8	[illegible]	216	[illegible]	tool	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	[illegible]	0	[illegible]
19	S	F8	[illegible]	[illegible]	0	debitage	7	obsidian	[illegible]	[illegible]	1	[illegible]	14	[illegible]	0	
19	S	F8	[illegible]	222	0	debitage	11	crypto-c	12	[illegible]	1	[illegible]	[illegible]	13	[illegible]	0
19	S	F8	[illegible]	[illegible]	[illegible]	core	4	crypto-c	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
19	S	F8	296	212	0	tool	20	obsidian	[illegible]	5	1	[illegible]	14	[illegible]	0	[illegible]
19	S	F8	308	186	0	debitage	10	crypto-c	11	7	1	4	[illegible]	0	0	[illegible]
19	S	L1	308	218	0	debitage	9	crypto-c	11	[illegible]	1	[illegible]	[illegible]	[illegible]	0	[illegible]
19	S	L1	309	220	0	debitage	7	obsidian	2	5	1	[illegible]	[illegible]	13	0	0
19	S	L1	309	220	0	debitage	12	obsidian	2	3	1	5	[illegible]	11	0	0
19	S	L1	306	217	0	tool	20	crypto-c	17	1	1	0	14	[illegible]	0	1
19	S	L1	309	217	0	debitage	9	crypto-c	11	[illegible]	1	0		[illegible]	0	0
19	S	L1	307	218	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
19	S	L1	309	220	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
19	S	L1	307	220	0	debitage	11	crypto-c	20	1	1	2	0	11	0	0
19	S	L1	309	220	0	debitage	9	crypto-c	11	0	1	0	0	0	0	0
19	S	L1	307	220	0	debitage	12	crypto-c	11	4	1	5	0	0	0	1
19	S	L1	309	220	0	debitage	12	obsidian	1	4	1	5	0	0	0	0
19	S	L1	307	218	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
19	S	L1	309	220	0	debitage	10	crypto-c	11	1	1	1	0	0	0	1
19	S	L1	307	219	0	debitage	11	crypto-c	11	2	1	2	0	0	0	0
19	S	L1	309	217	0	debitage	10	obsidian	2	5	2	2	34	0	0	0
19	S	L1	308	217	0	debitage	10	crypto-c	11	2	1	2	0	0	0	1
19	S	L1	309	219	0	debitage	12	obsidian	2	4	1	5	0	0	0	0
19	S	L1	308	217	0	debitage	11	obsidian	2	1	1	4	0	0	0	0
19	S	L1	309	219	0	debitage	10	crypto-c	11	5	1	2	0	0	0	1
19	S	L1	308	220	0	debitage	10	crypto-c	11	1	1	4	0	0	0	1
19	S	L1	309	220	0	debitage	12	crypto-c	11	4	1	5	0	0	0	0
19	S	L1	308	218	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	S	L1	306	220	0	tool	24	obsidian	1	5	1	1	11	13	0	0
19	S	L1	309	219	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
19	S	L1	308	217	0	debitage	11	obsidian	2	1	1	6	0	0	0	0
19	S	L1	309	219	0	debitage	7	obsidian	2	2	2	0	34	0	0	0
19	S	L1	308	220	0	debitage	10	obsidian	2	2	5	1	0	0	0	0
19	S	L1	306	218	0	core	1	obsidian	1	1	2	1	0	0	0	0
19	S	L1	308	218	0	debitage	10	crypto-c	12	1	1	2	0	0	0	0
19	S	L1	307	218	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
19	S	L1	308	220	0	debitage	11	obsidian	1	3	1	5	0	0	0	0
19	S	L1	307	220	0	debitage	10	crypto-c	12	1	5	1	0	0	0	0
19	S	L1	308	218	0	debitage	12	crypto-c	11	4	3	5	0	0	0	1
19	S	L1	307	219	0	debitage	12	crypto-c	11	1	1	4	0	0	0	0
19	S	L1	309	219	0	debitage	11	obsidian	1	1	1	4	0	0	0	0
19	S	L1	307	219	0	debitage	10	qrtzite	45	1	1	1	0	0	0	0
19	S	L1	308	220	0	debitage	12	obsidian	2	4	1	5	0	[illegible]	0	0
19	S	L1	307	219	0	debitage	11	obsidian	1	1	1	4	0	[illegible]	0	0
19	S	L1	308	220	0	debitage	10	obsidian	2	1	2	4	0	[illegible]	0	0
19	S	L1	306	220	0	debitage	10	crypto-c	11	1	1	1	0	0	0	0
19	S	L1	308	217	0	debitage	9	crypto-c	11	0	2	0	0	0	[illegible]	0
19	S	L1	308	217	0	debitage	9	crypto-c	11	0	2	0	0	[illegible]	0	1
19	S	L1	308	217	[illegible]	debitage	9	crypto-c	11	0	2	[illegible]	0	[illegible]	0	[illegible]
19	S	L1	309	217	[illegible]	debitage	6	obsidian	2	4	1	[illegible]	34	13	0	[illegible]
19	S	L1	306	[illegible]	[illegible]	debitage	10	crypto-c	11	1	1	1	0	0	[illegible]	[illegible]
19	S	L1	308	220	[illegible]	debitage	9	obsidian	2	0	1	0	[illegible]	[illegible]	0	0
19	S	[illegible]	[illegible]	[illegible]	[illegible]	tool	20	obsidian	2	4	1	0	34	13	0	0
19	S	[illegible]	275	188	20	debitage	9	qrtzite	47	0	1	0	0	0	0	0

Site No.	Site Portion	Provenience Type	Site Grid East	Site Grid North	Depth	Artifact Type	Artifact Type Code	Material Type	Material Type Code	Portion	Cortex	Platform	Retouch	Wear	Recycle	Heat
19	S	T2	273	183	0	grnd stn	40	sedmntry	32	5	0	0	0	21	0	[illegible]
19	S	T2	273	182	20	debitage	9	qrtzite	47	0	1	0	0	0	0	0
19	S	T3	227	176	0	debitage	10	crypto-c	20	5	1	1	0	0	0	0
19	S	T4	309	217	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	S	T4	309	217	0	debitage	12	obsidian	2	2	1	4	0	0	0	0
19	S	T4	309	217	10	debitage	11	crypto-c	11	1	1	4	0	0	0	0
19	S	T4	309	217	20	debitage	11	obsidian	2	2	1	1	0	0	0	0
19	S	T4	309	217	10	debitage	9	crypto-c	17	0	2	0	0	0	0	0
19	S	T4	309	217	10	debitage	12	crypto-c	11	3	1	5	0	0	0	0
19	S	T4	309	217	10	tool	24	obsidian	2	0	1	0	15	13	0	0
19	S	T4	309	217	0	debitage	11	obsidian	1	1	1	4	0	0	0	0
19	S	T4	309	217	20	debitage	12	obsidian	2	6	1	5	0	0	0	0
19	S	T4	309	217	0	debitage	9	obsidian	1	0	2	0	0	0	0	0
19	S	T4	309	217	20	debitage	11	crypto-c	12	1	1	1	0	0	0	1
19	S	T4	309	217	0	debitage	12	crypto-c	11	3	1	5	0	0	0	1
19	S	T4	309	217	0	debitage	9	crypto-c	11	0	1	0	0	0	0	1
19	S	T4	309	217	10	debitage	10	crypto-c	12	2	1	2	0	0	0	0
19	S	T4	309	217	10	debitage	9	crypto-c	11	0	0	0	0	0	0	0
19	S	T4	309	217	10	debitage	9	crypto-c	11	0	2	0	0	0	0	0
19	S	T4	309	217	10	debitage	12	obsidian	2	3	1	5	0	0	0	0
19	S	T5	295	171	16	debitage	12	obsidian	2	2	1	5	0	0	0	0
19	S	T5	295	171	15	debitage	10	obsidian	2	1	1	1	0	0	0	0
19	S	T5	295	171	10	debitage	12	obsidian	2	4	1	5	0	0	0	0
19	S	T5	295	171	0	grnd stn	40	sedmntry	32	5	0	0	0	21	1	0
19	S	T5	295	171	16	debitage	12	obsidian	2	2	1	5	0	0	0	0
19	S	T5	295	171	10	grnd stn	41	sedmntry	32	1	0	0	0	21	0	0

END
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