The Datil Mountain Project: Archaic, Puebloan, and Athabascan Campsites along U.S. 60, near Datil, Catron County, New Mexico

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THE DATIL MOUNTAIN PROJECT: ARCHAIC, PUEBLOAN, AND ATHABASCAN CAMPSITES ALONG U.S. 60, NEAR DATIL, CATRON COUNTY, NEW MEXICO

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ADMINISTRATIVE SUMMARY

Between June 13 and August 26, 1994, the Office of Archaeological Studies (OAS), Museum of New Mexico, excavated three sites along U.S. 60, in Catron County, near Datil, New Mexico. LA 39998, LA 104381, and LA 104382 were investigated at the request of the New Mexico State Highway and Transportation Department (NMSHTD), due to the proposed reconstruction of U.S. 60 within the existing right-of-way.

LA 39998 is a multicomponent chipped stone and ceramic artifact scatter with no cultural features. Artifacts were collected from mixed soil deposits and could not be segregated into separate components. Projectile point types were similar to Middle and Late Archaic styles, and the ceramic assemblage contained protohistoric Athabascan and Piro Pueblo sherds, as well as a few indeterminate ceramics of Formative period Mogollon and Anasazi. Charcoal samples from general cultural fill provided radiocarbon dates of 300-215 B.C., A.D. 1310-1385, and A.D. 1505-1620. Radiocarbon, projectile point, and ceramic data support evidence for Late Archaic, Formative period, and protohistoric occupations of the site.

LA 104381 is a multicomponent chipped stone and ceramic artifact scatter. Excavation revealed three cultural features: two hearths and remains of a burned brush structure with a hearth. Charcoal samples collected from two features resulted in calibrated radiocarbon dates between A.D. 600 and A.D. 680. Artifacts were collected from mixed soil deposits and could not be placed into separate components. Projectile point types are similar in style to Late Archaic atlatl darts, Pueblo and Athabascan arrow points. The ceramics consisted of Formative period Mogollon brown wares and Anasazi white wares, as well as protohistoric Athabascan sherds. They imply a Reserve phase and protohistoric Athabascan occupation at this site. Radiocarbon samples from a burned area provided calibrated dates ranging from A.D. 1520 to 1630, implying an Athabascan occupation of this site.

LA 104382 is a chipped stone artifact scatter with no cultural features. The artifact assemblage consisted primarily of core and bifacial reduction flakes. A charcoal sample was collected from mixed soil deposits and provided a calibrated radiocarbon date of 7020 B.C. Because of its collection context, the radiocarbon date must be considered with caution. It implies, however, a Late Paleoindian or an Early Archaic period site occupation.

Submitted in fulfillment of Joint Powers Agreement DO4635 between the New Mexico State Highway and Transportation Department and the Office of Archaeological Studies, Museum of New Mexico, Office of Cultural Affairs.

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INTRODUCTION

In the spring of 1994, the New Mexico State Highway and Transportation Department (NMSHTD) requested that the Office of Archaeological Studies (OAS), Museum of New Mexico, investigate three sites that lie within the right-of-way along U.S. 60 in Catron County west of Datil, New Mexico.

A cultural resources survey was conducted by the NMSHTD for a proposed resurfacing, rebuilding of shoulders, and horizontal and vertical realignments of the road on March 23, 24, 25, 29, and 30, 1994 (Weidner et al. 1994). The survey covered 17.07 km (10.61 miles): 12.71 km (7.9 miles) of highway right-of-way obtained from private sources and 4.35 km (2.7 miles) of NMSHTD easement from USDA Cibola National Forest. At the beginning of the project (BOP) 1.1 km (0.7 miles) of additional area were surveyed, as well as 1.4 km (0.9 miles) at the end of the project (EOP) (Fig. 1). LA 104381, LA 104382, and LA 39998 were found within the right-of-way acquired from private sources, outside of the USDA Cibola National Forest (Appendix 6). No sites are recorded on the *National Register of Historic Places* or the *State Register of Cultural Properties* within the project area. A data recovery plan for LA 39998, LA 104381, and LA 104382 was prepared by Oakes (1994).

Between June 13 and August 26, 1994, staff from the OAS began the data recovery phase of LA 104381, LA 104382, and LA 39998. The principal investigator and project director was Yvonne R. Oakes. The project supervisor was Dorothy A. Zamora with assistants Lloyd Moiola and David Hayden. Field laborers were Chris Cordova, Terah Lindsey, and Antonio Torres.

LA 39998 is a multicomponent chipped stone and ceramic artifact scatter with diagnostic projectile points and sherds. No cultural features were recorded. Artifacts were collected from shallow, disturbed soil and could not be placed into separate temporal-cultural components. However, projectile points were collected that are similar in style to Middle and Late Archaic atlatl dart points, and the ceramic assemblage contained protohistoric period glaze wares from the Piro Pueblo area in association with Athabascan sherds, as well as a few indeterminate ceramics of Formative period Mogollon and Anasazi. Charcoal samples from general cultural fill provided radiocarbon dates of 300-215 B.C., A.D. 1310-1385, and A.D. 1505-1620. These samples are consistent with the projectile point and ceramic data suggesting Late Archaic, Formative period, and protohistoric occupations of the site, however, they must be considered with caution. Several possible site activities related to resource procurement (bifacial and expedient tool production, and processing of wild plant and animal foods) are indicated in the chipped stone and ground stone assemblages; however, these activities could not be related to any specific occupational episodes.

LA 104381 is a multicomponent chipped stone and ceramic artifact scatter with diagnostic projectile points and sherds. Excavation revealed three cultural features, chipped stone debris, ceramics, ground stone, and burned bone. Feature 1 is the charred remains of a brush structure with a hearth, and Features 2 and 3 are both extramural hearths. Charcoal samples collected from Features 1 and 2 resulted in calibrated radiocarbon dates between A.D. 600 and A.D. 680. Because cultural deposits were from mixed, shallow soil, the artifacts could not be segregated into distinctive components of temporal or cultural affiliation. Projectile points were identified during analysis as similar in style to Late Archaic atlatl dart points, and Puebloan and Athabascan arrow points. The ceramics consisted of Formative period Mogollon brown wares and Anasazi white wares, as well

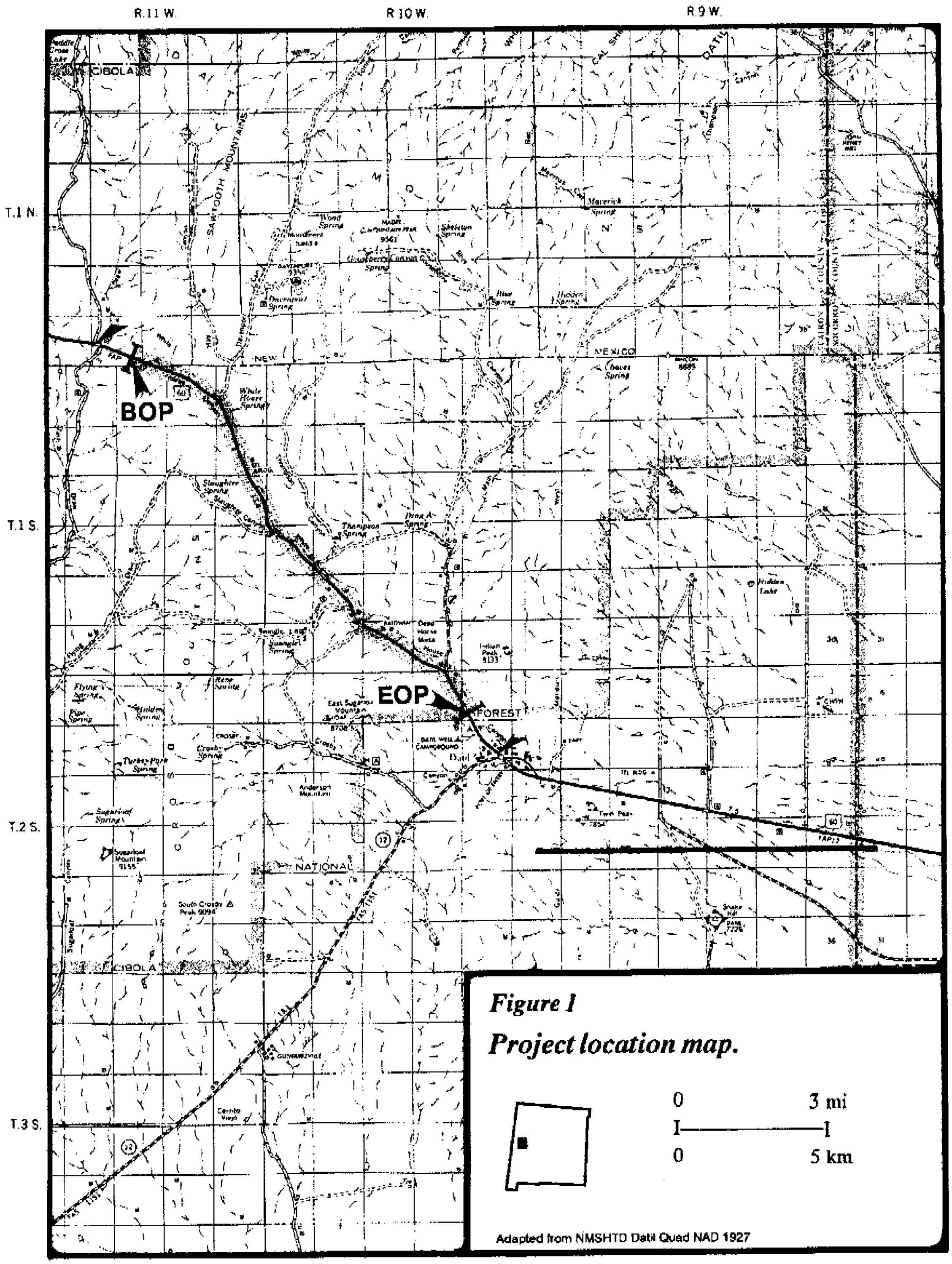

Figure 1
Project location map.

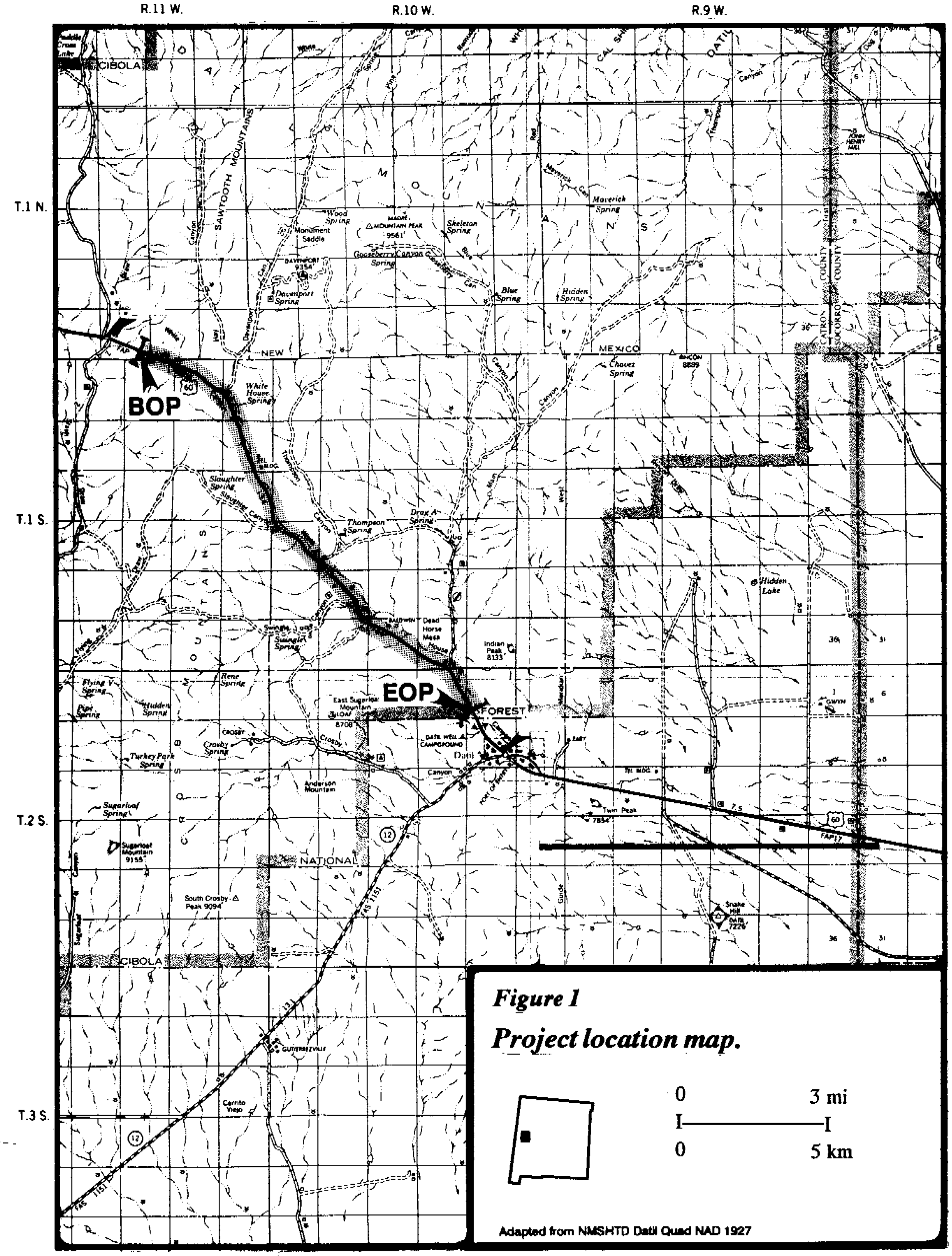

Figure 1

Project location map.

as protohistoric Athabascan sherds. They imply a Reserve phase and protohistoric Athabascan occupation for this site. Radiocarbon samples from a burned area provided calibrated dates ranging from A.D. 1520 to 1630. This site may have served as a seasonal Mogollon residence and a short-term Athabascan camp.

LA 104382 is a chipped stone artifact scatter with no identified diagnostic artifacts or features. The artifact assemblage consisted primarily of core and bifacial reduction flakes. Two large, unidentified projectile points were collected from the surface of the site, and are reminiscent of Late Archaic atlatl dart points. A charcoal sample was collected from shallow soil (not associated with any features) and provided a calibrated radiocarbon date of 7020 B.C. The radiocarbon date must be considered with caution, however it implies a Late Paleoindian or an Early Archaic period site occupation. The artifact assemblage suggests a single, short term occupation emphasizing bifacial tool manufacture or maintenance for this site.

ENVIRONMENTAL SETTING

Lloyd A. Moiola

LA 104381, LA 104382, and LA 39998 are located northwest of Datil, New Mexico, along U.S. 60 in White House Canyon. U.S. 60 runs the length of White House Canyon, which lies mostly within the Cibola National Forest, and is surrounded by the Datil Mountains to the north and the Crosby Mountains to the south. There are two springs in the canyon and an intermittent stream which flows southeast into Datil and on the Plains of San Agustín. The topography of the region is interspersed with narrow valley floors, canyon walls, escarpments, and steep mountain slopes with rounded ridge tops (Maker et al. 1972:27).

Physiography

The project area is located just east of the Continental Divide on the Mogollon Slope of the Colorado Plateau. The Mogollon Slope is a structural unit that consists of individual mountain ranges with southern sloping sedimentary deposits that are dominated by thick accumulations of Tertiary volcanic rock (Fitzsimmons 1959:114, 115) (Fig. 2).

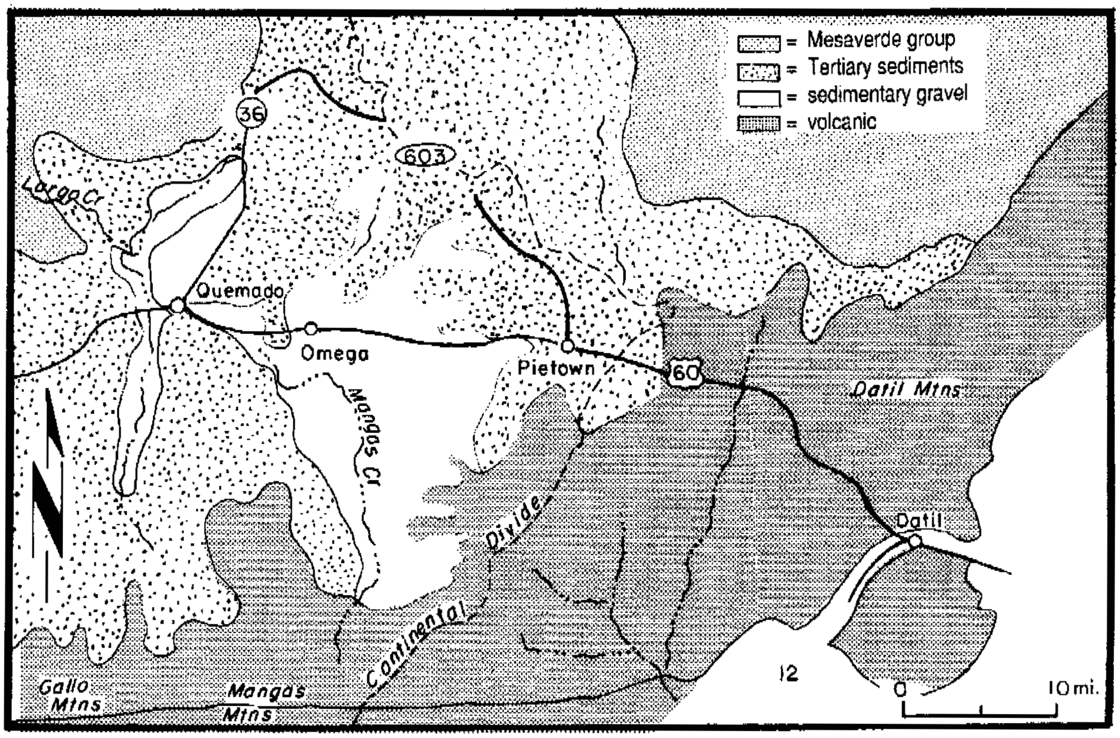

Figure 2. Datil region geology (adapted from Chronic 1987:58).

The sites range in elevation from 2,164 m to 2,438 m (7,100-8,000 ft). The Plains of San Agustín are 11.2 km (7 miles) southeast of the project area, and are the most prominent feature on the eastern edge of the Mogollon Slope. This region contains a large, enclosed, alluvium-filled basin formally covered by Pleistocene lake. The lake occupied 13 percent of the basin and covered an area of 660 km sq (255 sq miles) with a maximum depth of 50 m (165 ft). In the hills south of Horse Springs, remnants of the shoreline show up as wave-cut cliffs and gravel beaches (Fitzsimmons 1959:115).

The geology of the region is characterized by Tertiary sediments from welded and crystal rhyolite tuffs, andesite, latite breccias, and flow-banded latite (Dane and Bachman 1965). Soils associated with the area consist of the Motoqua-Datil-Abrazo and the Flugle-Loarc-Typic-Ustorthents series. Motoqua soils are loamy-skeletal, mixed, mesic lithic Arguistolls that are formed in residuum from volcanic rock. Flugle soils are fine-loamy, mixed, mesic Aridic Hapustalfs which are formed in alluvium. These soils are shallow to deep, well-drained, sloping sandy loams that occur on alluvial fans, hills, plains, and ridges (Johnson 1985:79, 90).

There are no perennial streams in the region and water resources are generally scarce. Available water sources consist of a few intermittent streams and several isolated springs that drain into White House Canyon from the Datil Mountains to the north and the Crosby Mountains to the south (see Fig. 1). All three sites are situated on the south side of an intermittent stream that originates in the Datil Mountains and flows through White House Canyon. This stream may have been one of the most important sources of water for prehistoric occupations in the area. Two springs in the canyon would have provided additional water resources: White House Spring is 110 m northeast of LA 39998, but no longer flows year round; and Thompson Spring lies 2.2 km (1.4 miles) northwest of LA 104381. The latter is still in use today, providing household water for the Cleveland ranch.

Flora

The vegetation over most of the area lies within the ecotone of the Upper Sonoran and Transitional zones. Both zones are characterized by certain forms of plant life and the differences between the two are determined by climate, elevation, soils, and slope. The Upper Sonoran life zone ranges in elevation between 1,371 m and 1,981 m (5,000-6,500 ft). Piñon and juniper are the dominant vegetation, yet growing amid them are oak, yucca, grasses, and various species of cacti. The Transitional life zone ranges in elevation from 1,981 m to 2,438 m (6,500-8,000 ft). Ponderosa pine and gambel oak mark the beginning of the Transitional Zone, which also contains birch, chokecherry, rabbitbrush, broom snakeweed, box elder, mountain mahogany, and bearberry (Berman 1979:7). On site vegetation consisted of piñon, juniper, ponderosa, oak, snakeweed rabbitbrush, various grasses, and cacti.

Fauna

The project area is abundant in wildlife. Small mammals that may be found include jackrabbit, cottontail, spotted skunk, rock squirrel, porcupine, and various small rodents. Birds and reptiles in the area consist of turkey, red-tailed hawk, piñon and scrub jay, quail, great horned owl, golden eagle, as well as snakes and lizards. Elk and mule deer are also numerous (Kayser and Carrol 1988:2-5). Natural predators include coyote, gray fox, bobcat, mountain lion, and black bear (Gerow 1994); grizzly bear and Mexican wolf were present in the area until the early twentieth century.

During the field season it was a daily occurrence to see numerous rabbit, turkey, deer, and herds of elk gathered near the few water resources in White House Canyon. Also, there are many pronghorn antelope on the nearby Plains of San Agustín. All three sites overlook the water supply of the canyon, and hence, the animals utilizing this area.

Table 1. Local Climate

Location	Elevation	Mean Temperatures		Mean Precipitation	Frost Period		Frost-Free Days
		Maximum	Minimum		Last	First	
Datil	2164 m	18 C	-1 C	323 mm	June 4	Sept. 29	117
Quemado	2096 m	19 C	-1 C	277 mm	June 7	Sept. 24	109

Climate

The climate of New Mexico is characterized by arid, semiarid, and subhumid-humid zones. The project area lies within the semiarid and subhumid-humid zones, due to its proximity to both the surrounding mountains and the Plains of San Agustín to the east. These are characterized by their differences in elevation, precipitation patterns, and vegetation. Semiarid zones are generally covered with shrubs and grasses, whereas subhumid-humid zones are made up of woodland cover (Tuan et al. 1973:186). Precipitation varies from one locality to another, but is heaviest during the months of July through September. Most of the moisture at this time comes from the Gulf of Mexico by means of orographic and convectional storms (Tuan et al. 1973:194). In the winter many storms generate from the Pacific Ocean. This is, however, generally a drier season with most of the precipitation falling on the higher elevations. The average annual precipitation for the project area is 304 mm (12 to 15 inches). The frost-free period is 115 to 160 days, with average annual temperatures ranging between 8 and 12 degrees C (47 to 54 degrees F) (Johnson 1985:1, 2, 77) (Table 1).

CULTURAL SETTING

David J. Hayden

The project area (Fig. 3), in the Datil Mountains within the Cibola National Forest, is part of a greater cultural region that includes several adjoining mountain ranges and the Plains of San Agustín. Within this general area, occupation is documented from the late Pleistocene era to present, and includes several overlapping cultural continua. The lack of archaeological work in the area most immediate to the project, in contrast to the more intense attention given to adjacent areas such as the Gila and Zuni vicinities, necessitates a broad chronology and explanation of occupation. Further, as an area of contact and overlap between different, contemporaneous cultural traditions, the boundaries of which are vague, the definition of temporal and cultural components is poorly understood.

Cultural Sequences

Paleoindian Period (9500 to 6000 B.C.)

Paleoindian culture is characterized by highly mobile people whose subsistence was based primarily on specialized hunting strategies in the context of climactic change (Cordell 1984). Early economies utilized now-extinct late Pleistocene fauna including camel, horse, tapir, mammoth, and *Bison antiquus* (Irwin-Williams and Haynes 1970). Later manifestations are associated with early Holocene species such as antelope, deer, and bison.

The majority of documented sites within the project area occur along the edges of playas

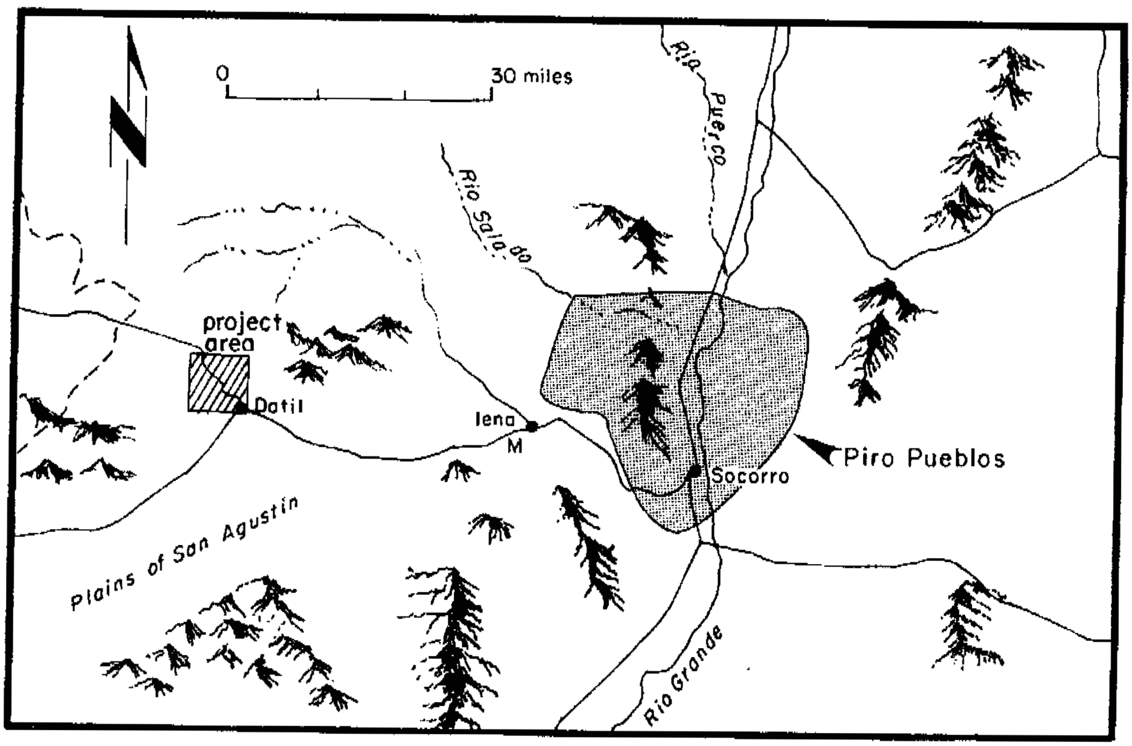

Figure 3. Datil area cultural resources map.

(Oakes 1989), as well as bordering low relief areas (Berman 1979). Although some sites have been recorded in montane areas such as the Sangre de Cristo Mountains to the north, occurrences of such sites are rare, and have not been noted locally in similar contexts (Berman 1979). No sites dating to this period have been documented in the Datil Mountain area; however, many of the recognized complexes have been identified in the adjoining San Agustín Plains (Kayser and Carroll 1988; Berman 1979; Beckett 1980).

With few exceptions, notably the AKE site (Beckett 1980) and Bat Cave (Dick 1965), Paleoindian components in the area have been identified exclusively by surface deposits and scatters. Because of this, cultural and temporal affiliations have most often been derived from the diagnostic characteristics of formal tools, particularly projectile points and knives.

The most frequently documented cultural complexes in the area include Clovis (9500 to 9000 B.C.), Folsom and Midland (8800 to 8300 B.C.), and Cody (7000 to 6000 B.C.) (Irwin-Williams 1973; Kayser and Carroll 1988). Sandia points, which have also been found in and near the study area, have previously been associated with dates much earlier than Clovis (Wormington 1957), although subsurface contexts are limited, and the dates are not broadly accepted (Berman 1979). Other complexes such as Plainview, Allen, Hell Gap, Concho, Agate Basin, Ventana, and Amargosa, may be present in and around the vicinity, but have not been documented (Kayser and Carroll 1988).

Archaic Period (6000 B.C. to A.D. 200)

The development of the Archaic period is characterized by a departure from the specialized hunting strategies of the Paleoindian period, and the adaptation of a more broad-based hunter-gatherer subsistence (Judge 1982; Kayser and Carroll 1988). It is thought that hunting remained the dominant subsistence investment throughout the early part of this period, but that by the Middle Archaic, plant resources began to play an increasingly significant role (Hogan et al. 1985). This development is indicated by increased use of manos, metates, mortars, and pestles (Kayser and Carroll 1988). By middle to late Archaic, there is evidence of the use of cultigens, including corn (Dick 1965; Hogan et al. 1985; Wills 1988).

Archaic sites and isolated artifacts have been recorded in a wide range of elevational and topographic contexts near the study area. The greatest number of occurrences has been noted in the Plains of San Agustín, particularly above the limits of former lake terraces and playas. They are also common in montane areas, including portions of the Cibola National Forest, especially along arroyo banks and streams, and near springs (Berman 1979). Cave and rock-shelter sites occur as well, and have yielded significant stratified deposits (Martin et al. 1952; Dick 1965). Temporal and cultural affiliations for this time period are defined primarily by the diagnostic characteristics of formal tools, particularly projectile points.

Two major cultural traditions have been identified in or near the study area: the Oshara, considered the forerunner of the Anasazi culture (Irwin-Williams 1973), and the Cochise, the equivalent for the Mogollon (Sayles and Antevs 1941; Sayles 1983). Each is characterized predominantly in terms of stylistic attributes in formal tools.

Oshara, as defined by Irwin-Williams (1973) consists of six temporal periods: the Jay Complex (5500 to 4800 B.C.), Bajada Complex (4800 to 3200 B.C.), San Jose Complex (3000 to 1800 B.C.), Armijo Complex (1800 to 800 B.C.), En Medio Complex (800 B.C. to A.D. 400), and the Trujillo Complex (A.D. 400 to 600).

The Cochise culture was originally defined by Sayles and Antevs (1941) in southeastern Arizona and later refined by Sayles (1983). Its development is defined temporally by four phases, which include: Sulphur Springs (10,500 to 9000 B.C.), Cazador (9000 B.C. to 6000 B.C.), Chiricahua (6000 to 1500 B.C.), and San Pedro (1500 B.C. to A.D. 1) (Sayles 1983). Other researchers, notably Irwin-Williams (1979), have eliminated the Cazador phase, particularly outside southeastern Arizona. Further, she presents a different chronology: Sulfur Springs (9000 to 6000 B.C.), Chiricahua (3500 to 1000 B.C.), and San Pedro (1000 B.C. to A.D. 200). Sulfur Springs components have not been documented in New Mexico (Hogan et al. 1985), and only Chiricahua and San Pedro have been identified in the vicinity of the project (Berman 1979).

Boundaries of these two traditions are vague and may in fact be quite fluid. Irwin-Williams (1967) places the Oshara roughly north of the Quemado area, and the Cochise to the south; generally, Oshara has been associated with the Colorado Plateau, and Cochise with areas further south. It is important to note that the stylistic attributes used to define the distinctness of these two traditions are often manifested with broad, overlapping variation.

The introduction of cultigens and the horticultural use of corn into the Chiricahua tradition near 3500 B.C. was suggested by Dick (1965) based on excavations near the study area at Bat Cave. This date has been challenged by several researchers including Wills (1988), and more recent interpretations of radiocarbon samples place associated strata at a later date. Corn, as well as other cultigens, have also been associated with the San Pedro phase, based on excavations at Tularosa Cave (Martin et al. 1952).

Pithouse and Pueblo Periods (ca. A.D. 1 to ca. A.D. 1600)

The Pithouse period, ranging roughly from A.D. 1 to 1000, with local variation, represents the development of the mobile, hunting and gathering groups of the Archaic period into increasingly sedentary and aggregated systems. Ultimately, it is defined by an intensification of cultigen-based subsistence strategies and the development of distinct pithouse architecture (Berman 1979). The beginning of this period is usually identified locally by the introduction of ceramic technologies (Stuart and Gauthier 1981).

The Pueblo period, beginning at about A.D. 1000, with earlier development in some areas, lasts until abandonment near A.D. 1350 in the Mogollon Highlands, and until historic times further north. Characterized by further emphasis on aggregated communities and cultigen-based subsistence, it also incorporates the widespread use of above-ground structures (Berman 1979).

Two cultural groups, presumably descendants of the Archaic groups mentioned above, seem to overlap in and around the Plains of San Agustín and the Datil-Quemado area. The Highland Mogollon, defined by Haury (1936b), occupied the Gila area and other montane areas throughout the southern portion of the study area. The Anasazi were generally based on the Colorado plateau to the north, and are represented within the study area with less intensity (Berman 1979).

The basic sequence and nature of developments within each cultural group is similar; however, the particular timing and manifestations vary somewhat. Further, because of their contemporaneous occupation in the area, their presumed interaction, and the perceived fluidity of cultural manifestations throughout the region, local representations of each cultural tradition diverge from the well-defined depictions developed in more distinct cultural areas (Danson 1957). For this reason, sites in the vicinity of the project can be difficult to classify in terms of cultural affiliation.

Haury (1936b) developed the following cultural phases for the Pine Lawn area of the Mogollon Highlands which are still followed today: Pine Lawn (ca. 150 B.C.-A.D. 500), Georgetown (A.D. 500-A.D. 700), San Francisco (A.D. 700-A.D. 900), Three Circle (A.D. 900- A.D. 1000), Reserve (A.D. 1000-A.D. 1100), and Tularosa (A.D. 1100-A.D. 1350). Fowler (1990) has recently presented a somewhat different chronology. He places the Pine Lawn phase later in time, at A.D. 1, and does not include a Georgetown phase, but rather combines it with the following San Francisco phase. The majority of the Mogollon area is abandoned at about A.D. 1350.

The Anasazi, considered to be the predecessors of groups north of the study area like Zuni and Acoma, as well as groups in the Rio Grande area to the east, such as the Piro, are defined in terms of the Pecos Classification System (Plog 1979; Berman 1979; Kayser and Carroll 1980; Marshall and Walt 1984). The cultural sequence is: Basketmaker II (ca. 100 B.C. to A.D. 400), Basketmaker III (A.D. 400 to 500-700), Pueblo I (A.D. 700 to 900), Pueblo II (A.D. 900 to 1100), Pueblo III (A.D. 1100 to 1300), and Pueblo IV (A.D. 1300 to 1600 or European contact).

Basketmaker II sites are often considered to be a late Archaic manifestation because ceramic technologies were not yet in use. Within the project area, and in the general study area, no Basketmaker II sites have been recorded. Further, only a few Pueblo IV sites have been recorded near the project, and those are primarily located in the Quemado-Fence Lake and Magdalena areas (Danson 1957; Berman 1979; McGimsey 1980; Marshall and Walt 1984).

Expanding on Berman (1979), the taxonomies of both cultural traditions are combined into a broader chronology that considers generalized development and eliminates terms that necessitate traditional cultural affiliation. She groups them as follows: early Pithouse period (Pine Lawn, Georgetown, and Basketmaker III), late Pithouse period (San Francisco, Three Circle, and Pueblo I), Early Pueblo (Reserve and Pueblo II), and late Pueblo (Tularosa and Pueblo III).

Ceramic technology and style have previously been considered important cultural distinctions between Anasazi and Mogollon groups (Martin and Rinaldo 1950). Earlier interpretations of ceramics were based on presumed differences in firing technologies. More recent research (Wilson 1993), however, has shown that this is not the case, and that distinct ceramic traditions are in fact due to the nature of local clays. According to Wilson (1993), Mogollon Highland clays are homogeneous throughout most of the region, are of colluvial deposits derived from igneous sources, and generally fire to brown colors. In contrast, clays from the Colorado Plateau are derived from shale and fire to a white or gray color. In the absence of more numerous excavations, cultural affiliations of sites near the project area are most frequently determined by the proportions of observable ceramic types in surface deposits.

Most researchers have claimed that Mogollon early Pithouse period sites were located almost exclusively in elevated areas, particularly on mesas, knolls, and ridge tops (Berman 1979). Current research of the settlement patterns in the area indicates that this is not necessarily the case (Yvonne Oakes, pers. comm. 1994). Architecture is variable, with no consistent patterning in post-holes or entryways. Pithouse size is largest in the Pine Lawn area (near Reserve, New Mexico), some approaching 30 sq m, however, size throughout the area generally decreases through time. Spatial organization of villages is loose and inconsistent; extramural hearths, storage pits, activity areas, and burials occur in and around structures with no consistent patterning. Later manifestations often incorporate surface structures, sometimes as square to rectangular contiguous blocks. As population increased in the area during the late Pithouse period, site locations are spread out and found in varying terrain.

Anasazi early Pithouse period sites exist in varying topography, including elevated areas, gentle slopes, and along drainages. Pithouses tend to be deeper than Mogollon structures, but are loosely clustered in a similar way. Later pithouses exhibit more defined architectural features and organization. Exterior storage cysts are frequently arranged in rows or arcs located northwest of the pithouses. Late Pithouse villages also incorporate the use of surface structures, in the form of square, contiguous blocks. Although surface structures sometimes appear in late Mogollon pithouse villages, they do not occur as consistently as those at Anasazi sites, and they are often considered to be an Anasazi trait (Berman 1979).

Site density increased dramatically during the early Pueblo phase, and previously uninhabited areas are occupied. Sites are particularly frequent along drainages (Danson 1957). In the Mogollon area, above-ground structures are common, and are usually arranged in L-shaped room blocks (Oakes 1989). Masonry consists of poorly modified or unworked river cobbles. Black-on-white ceramics from the Anasazi area become more common, and consistently represent 3 to 10 percent of Mogollon ceramic assemblages (Wilson 1995).

Late Pueblo sites in the Mogollon area are less numerous than earlier Pueblo sites, tend to be larger, and range in size from a few rooms to multistoried villages with hundreds of rooms. Masonry is often of worked, laminated sandstone and basalt (Danson 1957). Ceramic assemblages from late villages in the Pine Lawn area include White Mountain Redwares and some Zuni glazes (Stuart and Gauthier 1981), in addition to painted white wares and local brown wares (Berman 1979). The Pine Lawn area is abandoned sometime after A.D. 1300, and regional abandonment of the area occurs not long after.

It is difficult to discern the cultural affiliation of Pueblo period sites in the study area. Sites in and near the project area, particularly in the Gallinas Mountains (adjacent to the Datil Mountains) seem to reflect trends of the Pine Lawn area in terms of settlement patterns and architecture. However, ceramic assemblages have an increased variation, and include higher frequencies and more types of Anasazi sherds (Berman 1979). Extensive work is necessary to determine the effect and nature of cultural overlap within the area.

Protohistoric-Historic Period (ca. A.D. 1600 to Present)

The historic period is generally thought of as beginning in 1539, with Spanish contact in the Zuni area. During this time frame, the area was occupied intermittently by Athabascan groups, including Apache and Navajo bands, whose early history is not well documented. Pueblo groups were aggregated on the perimeter of the general project area, Zuni and Acoma to the north, and the Piro to the east near Magdalena and Socorro. In addition, there were varying degrees of settlement by Spanish colonists, and later by Euro-American settlers from the United States (Gillio 1979; Marshall and Walt 1984).

The Zuni claim the entire region as part of their ancestral use area, and currently use portions of it for various purposes. Traditional Zuni land use extends west to the San Francisco Peaks of

Arizona, south to Willow Mountain, east to the Magdalena Mountains, and north of the Zuni Mountains. This includes the entire Datil area, most of the Plains of San Agustín, as well as much of the traditional Pine Lawn Mogollon area to the south. Numerous locations throughout this original area of Zuni land use are still used for resource collection and ceremonial purposes, including some in the Datil and Gallinas mountains (Ferguson and Hart 1985).

Piro Pueblo groups were settled primarily in the Rio Abajo region of the Rio Grande Valley (generally the area surrounding the present-day town of Socorro, roughly 60 miles west of the project area); several large pueblos were occupied at the time of Spanish contact in 1541, and most were abandoned at the time of, or soon after, the Pueblo Revolt of 1680. Two large Colonial period (A.D. 1541 to A.D. 1680) Piro sites have been identified near the present town of Magdalena: Magdalena Pueblo (LA 284) and Bear Mountain Pueblo (LA 285). Magdalena Pueblo is a multistoried, six-room room block (about 209 rooms) settlement, with Rio Grande Glaze D through F (about 165 rooms) settlement, with Rio Grande Glaze E and F horizons. Both pueblos were active at Spanish contact, and are noted in Spanish Colonial documents (Marshall and Walt 1984; Mera 1940).

A cliff dwelling located "in the rim of a mesa 4 miles north of Datil, Socorro [Catron] county, N. Mex.," composed of five or six contiguous rooms, and with ceramics "resembling that from Magdalena, N. Mex., and stations on the Rio Grande" was recorded by Hough (1907:29). Although Piro use of the area surrounding the Datil Mountains has not been documented, the ceramics Hough describes might indicate such use. A cave located 200 m northwest of LA 104381 may be the remains of this site.

Historical accounts describe several Athabascan groups living in the areas surrounding the Rio Abajo region that traded with Piro groups into the early historic period (Opler 1983; Schroeder 1979). Athabascan occupations are not well documented in an archaeological context in the study area, or in most parts of the state, and information regarding their history is derived primarily from historical and ethnographic accounts (Opler 1983; Gunnerson 1979). Seven southern Athabascan and Apachean speaking groups have been identified historically in the Southwest, including the Chiricahua, Jicarilla, Kiowa-Apache, Lipan, Mescalero, Navajo, and Western Apache (Opler 1983). Historically, these groups have been confused by Pueblo, Spanish-Colonial, Mexican, and Euro-American groups, and historical references to distinct groups require interpretation (Marshall and Walt 1984; Opler 1983).

Like several other non-Puebloan groups in the Southwest, southern Apache occupations reflect adaptations resulting from the movement of Athabascan groups into areas earlier abandoned by the Anasazi and Mogollon. Subsistence among these groups was based primarily on mobile hunting and gathering, augmented by trade with more sedentary groups including several pueblos, and varying amounts of small-scale agriculture (Ford 1983). Domesticated sheep, introduced by the Spanish, became an important subsistence investment for some groups, particularly the Navajo.

Various Chiricahua Apache groups occupied a large area of southern and western New Mexico, including the Datil Mountains, from before Spanish contact to the late nineteenth century (Opler 1983). Spanish documents note Apache raids as early as 1640 at Zuni, Acoma, Hopi, and Piro villages, as well as skirmishes between the Spanish and Apache in the Plains of San Agustín and the Datil, Gallo, Gallinas, and San Mateo Mountains throughout the seventeenth and eighteenth centuries (Gerow 1994; Opler 1983; Schroeder 1963, 1974). Relations between the Navajo and Apache were inconsistent, and although on several occasions Navajos aided the Spanish in pursuing Apaches, they frequently joined the Apache on raids into Pueblo and Spanish settlements (Opler 1983; Schroeder

1974).

Following the American takeover of New Mexico as a territory in 1846, American military forces focused on Native American groups perceived as a threat. Navajo refugees from American campaigns in northern Arizona between 1858 and 1861 fled to several adjacent areas as well as the Datil Mountains, and were noted living or associating with Apaches by 1861; by 1864 only Navajos were reported as consistently living in the area (Schroeder 1974).

Euro-American settlers moved into the area around Datil in the late 1870s and early 1880s, and a U.S. Post Office was established near present-day Datil in 1886 (Agnew 1971). The original settlement was approximately 2 miles northwest of the current town, near a marshy area of "Datil Creek" (White House Canyon Drainage), and is frequently referred to as "Baldwin's" in historical references (Cleveland 1941). The remains of the post office were visible during the project.

U.S. troops frequented the area throughout this period in response to both perceived and real threats from Apache and Navajo groups. Several United States Army installations were established in the area, including Fort Tularosa (1872-74) in Apache Creek, the Ojo Caliente Post (1874), and Fort Conrad (1851-54) along the Rio Grande south of Socorro. In October 1885, a U.S. Army camp (Datil Creek) was established near the Datil Post Office, and was maintained until September 1886 (Dike 1958).

Euro-American settlements in the area increased throughout the late nineteenth and early twentieth centuries, and ranching of both cattle and sheep, as well as mining near Magdalena and Socorro were the primary industries (Berman 1979). A railroad spur from Socorro to Magdalena was completed in 1885 (Berman 1979; Kelly 1988), and was later purchased by the Santa Fe railroad. The Magdalena Livestock Driveway was established by the U.S. Secretary of the Interior in 1917 in response to the increased closing of rangeland by homesteads (Berman 1979; Gerow 1994). The driveway was 125 miles long, 1 to 5 miles wide, and included two spurs (through Horse Springs toward Reserve and through Quemado toward the Arizona border) that joined at Datil, and continued east through the Plains of San Agustín to the Magdalena railhead (Berman 1979).

The establishment of federally managed public lands (including the USDA Forest Service and Department of Interior, Bureau of Land Management) in the early twentieth century closed much of the open range, and required permits for grazing rights. Cattle ranching, both on private and public land, is presently the main economy in the area.

Archaeological Resources

For purposes here, the project area is defined as approximately 238 sq miles, including the United States Geological Survey (USGS) 7.5' quadrangles of Cal Ship, Crosby Springs, Datil, and Madre Mountain. Although several areas adjacent to the project have received considerable archaeological attention (notably the Mogollon Highlands and Gila National Forest, Quemado area and Apache National Forest, Zuni, and Rio Abajo), very little work has been done in the area surrounding Datil. Previous work in the project area has been limited to surveys conducted for the Western New Mexico Telephone Company (Mallouf and Neely 1982; Nightingale and Neely 1983) for utility construction and maintenance projects, and by the USDA Forest Service (Garber and Gomez 1985; Izard 1992; Peralta and Gomez 1992; Redmond 1990; Wandsnider 1988) for construction or maintenance of USDA Forest Service roads, and the development of environmental resources.

New Mexico Cultural Resource Information System (NMCRIS) files include 35 identified sites, and an additional 29 are on file at the Magdalena District Office of the USDA Forest Service. These sites include 29 unspecified chipped stone scatters, 3 unspecified ceramic and chipped stone scatters, 6 Archaic chipped stone scatters, 9 early Pueblo sites, 2 late Pueblo sites, 4 Navajo sites, 1 unspecified Athabascan site, and 10 Historic (statehood to present) sites.

Identification of sites locally, in terms of cultural and temporal affiliation, may be problematic in several circumstances. General chipped stone scatters, for example, have in other areas been designated as Archaic when ceramic artifacts are absent—even when diagnostic artifacts such as projectile points are not located. Within the study area, any number of cultural groups may have conducted logistical forays resulting in aceramic artifact scatters, including Paleoindian and Archaic groups, but also Mogollon, Zuni, Piro, Acoma, Apache, Navajo, and Spanish Colonial. Further, it has been suggested that some groups, particularly Athabascans, used the archaeological landscape as a resource; useable artifacts may have been scavenged and either reworked or used in their current form (Basso 1971; Keur 1941). As a result, seemingly diagnostic artifacts located on sites within Athabascan use areas may be diagnostic only of the artifact's manufacturer, and not the group that last used it.

Athabascan sites may be difficult to discern in terms of more specific cultural affiliation, and may be biased toward Navajo assignment. Three of the sites categorized as Navajo were nonarchitectural, and were identified in terms of ceramic utility wares. Although this issue is dealt with more thoroughly in the Ceramic Analysis chapter of this report, it is arguable that ceramic forms of Apache and Navajo assemblages would be similar. Further, very few protohistoric Apache sites have been identified throughout the state in contrast to a much higher number of Navajo sites. Surveyor experience with Navajo sites, and more particularly Navajo ceramics, may encourage a default to this classification. Further, ethnographic information suggests a much broader Apache use of the project area than Navajo, particularly before the mid-nineteenth century.

It is difficult to establish useful site distribution information from either the USDA Forest Service or NMCRIS files that are available because of the context under which most of the sites were recorded. Although maps seem to suggest some concentration of sites near springs, for example, they also show high concentrations along utility lines and Forest Roads. Surveys have been related primarily to utility, infrastructural, and environmental development; particularly intensive focus has likely been applied to water sources such as springs because of their necessity for current ranching economies and public land and resource leases.

RESEARCH DESIGN

Yvonne R. Oakes

Introduction

The three archaeological sites recorded by the NMSHTD (LA 39998, LA 104381 and LA 104382) all appear to represent short-term campsites in different localities along White House Canyon near Datil, New Mexico. While there are similarities in that they may all have hearths or pits and lithic artifacts dispersed over the surfaces, there may be substantial differences. The sites may each be of a different cultural orientation or exhibit varying seasonality of use and varying mobility strategies.

Seldom has a study focused on campsites alone. Usually these small hearth and artifact scatters are embedded within the research programs of larger residential sites in an area. This study provides the opportunity to examine the site structure of short-term occupation camps, compare their artifact assemblages and subsistence adaptations, and relate these sites to their appropriate cultural context. Currently, only stratified Archaic cave sites to the southeast and pithouse and pueblo villages to the south and west have been excavated in the surrounding areas. There is a lack of smaller, open-air sites to balance the skewing of the existing data base. We believe the project sites have the integrity and the variety to provide such a balance.

Some questions may prove to be easily addressed through the implementation of the research plan. Were Archaic populations present in White House Canyon? Do sites indicate a seasonal taking of resources? What resources were used by the various groups in the area? Where were the brown wares and gray wares coming from? Were both made in the area? From how far away were lithic raw materials obtained?

Answers to these proposed research questions may be obtained through the compilation of appropriate data sets. Artifacts will be subject to traditional analyses and those proposed in this report. To address the question of mobility, analysis will also include a detailed study of biface manufacture and discard, following Kelly's (1988) model. We will also look at the amount of lithic manufacture versus the amount of lithic maintenance, the investment in storage facilities, length of site occupation, and amount of reuse or reconstruction.

Sourcing of resources (floral, faunal, lithic raw material, ceramics, and ceramic clays) is important for understanding the subsistence adaptations of each prehistoric group. When necessary, specialists will be employed to undertake these studies. Additionally, we will take palynological and macrobotanical samples from available pits, hearths, utilized surfaces, and cultural fill.

Data will be compared to other excavated prehistoric sites in surrounding regions in order to place these sites within a broader, contextual cultural milieu.

Theoretical Orientation

The Datil and Quemado (78 km to the west) areas lie topographically at the very core of the little-understood Mogollon-Anasazi contact zone. The northern region of the Mogollon Highlands lies 80 km (50 mi) to the southwest and the Cebolleta Mesa, of Anasazi affiliation, is 64 km (40 mi) to the north. Several testing and excavation projects have taken place in the Quemado area (Kayser and Dart 1977; Hogan et al. 1985; Oakes 1986). None has occurred in the Datil Mountain area.

Archaeological sites occurring south of U.S. 60 have generally been classified as Mogollon, while to the north they are Anasazi. However, there is much mixing of the gray and brown ware ceramic assemblages and there is some stylistic architecture overlap. The problem of which cultural groups occupied this interface zone has not been resolved. Many have offered opinions and presented provocative models to examine the problem.

Ruppé (1953) defines the Acoma Culture Province as an area of similar artifactual and cultural attributes. Dittert (1959) later divided it into six subregions, the south edge of which delineates the southern boundary of the Anasazi culture area. This southern border is just north of the project area. He considers most sites to be Anasazi because of the presence of gray wares and the accompanying Mogollon brown ware sherds to be intrusive, even though brown wares sometimes outnumbered gray wares. He believes Mogollon population from the highlands actually migrated to the Acoma culture area and brought with them their brown ceramics. Others say Anasazi populations moved southward. As Stuart and Gauthier (1981) indicate, it would be highly improbable for migration to have occurred simultaneously from both north and south at the same time. Tainter (1980) and Tainter and Gillio (1980) have devised an approach for examining the problem. Tainter (1980) believes we should look at these contact populations as local groups in an economic interaction sphere with areas to the north and south. A study of burial data in the Puerco area by Tainter found that populations were homogenous beginning at about A.D. 750 and does not suggest migrations of Mogollon peoples into the area. Stuart and Gauthier (1981:126) propose a wider study of burial data covering most of the southwestern quarter of New Mexico.

This blending of Mogollon and Anasazi traditions is readily apparent in the Datil area although very little work has been conducted here. Sites were recorded as Anasazi usually because of the presence of gray wares on them; however, brown wares are also found on many of these sites.

Because of the scant and poorly understood data base for the Datil area, our research orientation must focus on basic theoretical issues. Are there both Mogollon and Anasazi sites within this mountain region? If so, how have they been distinguished? Are the distinctions valid? Could both cultures be represented by a single population? Were Archaic and Apache or Navajo people also occupying the same zone? Given that the project sites are campsites of possibly differing time periods, how do artifact assemblages and site structure differ from period to period? Are adaptations through time similar or are the same resources being exploited at all sites? Is the high altitude of the project area at 2,255 m to 2,438 m (7,400 to 8,000 ft) restrictive for permanent settlements and does it explain their absence in the area? The dating of these sites is critical for addressing cultural variation and these specific questions.

The data recovery plan for the campsites of the Datil Mountains will focus on three areas of research:

1. Placement within temporal and cultural context.
2. Variability in artifact assemblages and site structure.
3. Subsistence adaptations.

These research foci will allow us to address the Mogollon-Anasazi issue, to some degree, and assess the structural nature and function of these short-term campsites in terms of site structure and subsistence activities.

Research Expectations

Temporal and Cultural Context

Determining the dates of occupation for the three campsites is critical for the implementation of this study to establish possible cultural continuity between the sites. Presently, we have only a few broadly dated sherds to indicate the time of occupation. Several chronometric controls can be used to provide a temporal context for the sites. Dendrochronological and radiocarbon samples can supply absolute dates. Hearths or surfaces that have burned thoroughly can also potentially produce archaeomagnetic dates for the sites. Obsidian hydration, even though its accuracy is sometimes questioned, can also be employed as a supplemental dating methodology. Finally, diagnostic artifacts, such as projectile points and sherds, may also be used to provide a relative date for the sites.

Establishing an accurate temporal framework for a site often leads to its placement within a specific cultural context. For example, very early dates often allow for classification of sites as Paleoindian or Archaic. However, for the Datil area, sites dating between ca. A.D. 200 and the mid-1800s are frequently considered of unknown cultural affiliation because Mogollon and Anasazi adaptations run the same gamut from early to late pithouses and from early to late pueblos within the same general time period. Apache and Navajo occupations are also roughly contemporary.

In order to establish cultural identity, archaeologists often look at diagnostic traits for the various groups. There are certain cultural characteristics that show up in this area that are assumed to be Mogollon in nature. These include the use of brown ware ceramics, square kivas, and masonry structures. Anasazi traits are identified by gray ware pottery, round kivas, and adobe structures. The greater the number of characteristics present in either of these two entities then places a site within that cultural group. This system of site classification is currently in use today in the area. We believe that this is a simplistic approach; it virtually ignores the less dominant assemblage and offers no explanation for the mixture.

We do not argue that diagnostic artifacts or architectural styles are useless but that, at times, they have limited utility. In this region of Mogollon-Anasazi blending, we must look for explication of this existing duality of cultural diagnostics. We must ask what it signifies and be open to several possibilities: (1) that there were migrations of people from the south and north meeting at the same time in this borderland area ; (2) that the people were of one group but adopted traits of the other for political or social-economic reasons; (3) or that a local population selectively adapted to characteristics of areas to both the north and south. Migration theories for this region are currently not thought to hold up under scrutiny, but must remain a distant possibility.

The three campsites do not represent a complete picture of any of the cultural groups possibly inhabiting the Datil area. They are at best, small portions of much larger socioeconomic systems. We cannot understand the whole system from the study of only one part, but we can learn about that one part, i.e., the role and function of campsites within the larger regional context.

Site Structure

Analysis of site structure will focus on structural diversity between the campsites. We expect that site structure should reflect short-term occupation of the three sites. Therefore, there should be expedient investment of labor in hearths, storage facilities, or any dwellings that may be present. Artifacts should be limited in their variability, consistent with short-term occupation patterns. Evidence of domestication of cultigens is not likely, although possible, given the high elevations of the sites. As campsites, only seasonal resources should appear in the archaeological record. As part of the studies, we must ask if there is a plan to site layouts. Are hearths formally constructed or do they exhibit expediency in preparation? Are there specific work areas?

Depending upon the subsistence strategies of site occupants, lithic assemblages may vary. Expedient lithic tool reduction is generally associated with sedentary populations of the Pithouse and Pueblo populations, while formalized tools are more characteristic of Archaic populations (Parry and Kelly 1987). The differences between these technological modes can be monitored and quantified for the sites.

The sites should represent either residential base camps or field camps for collection of resources. A residential base camp (when foraging groups move to a resource locale as part of a seasonal round [Binford 1980]), will exhibit a broad range of maintenance and production as well as food processing activities. There should be a concomitant low investment in habitation units or storage. Structures, if present, should be ephemeral and indicate short-term use. When residential camps are used for subsistence resources, they may have the same broad range of activities but with higher construction investment, indicating a longer, perhaps seasonal occupation. Field camps are temporary locales used for specialized activities (such as hunting) with no storage (except perhaps caching), and ephemeral structures if any.

Lithic artifacts may also be used to distinguish short-term camps of foragers versus those of collectors (Moore 1988:21). Moore affirms that biface manufacture in general reflects mobility in a group. Kelly's (1988) model, which examines variation in biface production, will be employed to compare the variations in site assemblages.

Length of site occupation may be determined from an examination of site structure, presence of seasonal resources, and from artifact analyses. A seasonal occupation might be evidenced by presence or absence of interior hearths, storage facilities, labor investment in structures, and types of resources recovered from the sites. Repeated use of a site may be evidenced by ample storage facilities, overlapping features, reconstruction of hearths, and varying occupation levels.

Subsistence Adaptation

The study of subsistence adaptation will focus on the type of resources used by each group of site occupants, whether the resources were expediently exploited, and whether food processing occurred on the sites. Seasonality of resource availability will be calculated and potential seasonal rounds proposed. At this point, archaeologists have not confirmed seasonal rounds between highland, such as the Datil Mountains, and lowland areas. Sourcing of specific resources, such as lithic raw material, clay beds for ceramics, and trade wares may provide information on the mobility of people and resources throughout a cultural system. We will also study the balance between utilized floral and faunal resources as a key to determining seasonal strategies. Variations in ceramic vessel form, ground stone assemblages, and lithic tool use will also aid in the determination of subsistence practices for each site.

If any of the groups were fully mobile, then subsistence activities should represent only the range of food resources immediately available or easily transported. However, if they employed a collecting strategy, a wider range of resources could be expected in site assemblages. Fully mobile people would tend to prepare items for immediate consumption or use, while those less mobile might be expected to cache or store resources.

Dependence on cultigens is not expected. However, cultigens are possible if casual horticulture was practiced. The materials from hearths and any pits will be carefully processed to ensure that any cultigens or other food items are recovered. The presence of storage pits should suggest repeated or seasonal use of a site and may be indicative of constrained mobility.

Ground stone implements may retain some of the materials that were ground. Hearths and interiors of ceramic vessels may also contain food residues.

The analysis of floral and faunal resources should help determine if these sites were used for short-term exploitation within a definite season of availability.

Site Specific Research

LA 39998

This is a widely dispersed lithic artifact scatter of unknown cultural association. There are several burned localities on the site that may indicate hearths or pits. These may contain floral and faunal remains that will identify types of resources used by the site occupants and allow for an assessment of the season of use. Each of the three prehistoric concentrations on the site will be stripped and dug with a minimum of two excavation units each to determine if subsurface remains are present. The historic can dump will be recorded in the field. Expansion of excavation units will depend upon preliminary findings.

Site structure studies and presence of expedient or formalized lithic tools should inform on residential mobility patterns. Evidence of site reuse will allow for estimates of occupation length, seasonal use or reuse, and labor-investment in the site.

Artifact analysis will be used to document site function and type of resources exploited. Sourcing of the lithic material assemblage will be attempted and compared with source areas for the other sites.

The several burned areas on the site should provide appropriate material for dating the site.

LA 104381

The site appeared to be a campsite dating within the broad Mogollon period, from ca. A.D. 200 to A.D. 1350. Several hearths are visible on the surface and more may be present. A minimum of 20-by-35 m of artifact concentration and features on top of the hill will be excavated or surface stripped.

A variety of Mogollon brown wares are present on the site. These will be placed within the appropriate Mogollon sequence upon analysis. An attempt to locate clay sources for these ceramics will also be made. LA 104381 should provide valuable site structure data in terms of seasonality of use, evidence of reuse or additional construction, and evidence of long-range planning.

Subsistence activities should be discernable from the number of artifact types present. Care will be taken to retrieve all possible subsistence items from cultural features. Tool use will be evaluated in terms of expediency versus long-range use. Raw material sources will be tracked. Ground stone will be examined for types of resources exploited.

Hearth areas will be carefully excavated in order to retrieve datable materials

LA 104382

LA 104382 may be buried beneath 50 to 60 cm of soil. Because of the presence of only lithic and ground stone artifacts, the site may represent an Archaic occupation (ca. 1500 B.C. to A.D. 200) of the area. The site provides an excellent opportunity to examine a site of this possible time frame in a highlands setting as compared to the numerous Archaic sites on the nearby Plains of San Agustín. Because of the small size and potential importance of this site, the entire 20-by-70-m area of dispersed artifacts will be excavated. Dating of this site is critical to its cultural placement. Hearth areas will be sampled for radiocarbon material and macrobotanical remains. If tree-ring and archaeomagnetic samples are not available, obsidian from the site will be submitted for hydration tests.

The chipped stone material will provide data for the comparative study of biface manufacture and maintenance following Kelly's model (1988). Tool function as related to hunting, foraging, or collecting strategies should be addressed with this assemblage. If subsistence items are recovered from the site, they should provide important information on resource use, seasonality of acquisition, and the question of long-range planning. Raw material sourcing of the lithic material will also be attempted.

FIELD METHODOLOGY

David J. Hayden

All three sites were mapped with an optical transit prior to excavation; magnetic north was applied. A main site datum was placed outside of major surface artifact concentrations, and elevation at this point was designated as 0 m. On LA 39998 and LA 104381, subdatums were placed where necessary for transit use. A 1-by-1-m grid system was established at each site by extrapolating baselines along the north-south and east-west axis intersecting at the main site datum. The coordinates of main site datum were 100 north and 100 east at all three sites, and increased to the north and east. Grids were designated by the northeast coordinates of their northwest corner, so that each grid was to the south and east of its designate. The elevation of the ground surface at each grid corner, relative to main site datum, was measured in centimeters with an optical transit prior to excavation.

Mechanical equipment was used at LA 104381 and 104382 to establish site stratigraphy, as well as determine site limits. A single trench was excavated at LA 104381, at the toe of the slope and terminus of surface deposits; no stratigraphy or subsurface cultural deposits were observed. Two trenches were excavated at LA 104382, one at either side of the main site concentration; no cultural deposits were encountered, and the stratigraphy that was identified proved to be well below the cultural deposits encountered elsewhere on the site. With the exception of these trenches, hand tools (trowels, shovels, picks, soil augers, brushes, and dental picks) were used for all excavations.

Fill was removed and its contents recorded in terms of excavation units. These units were defined by horizontal and vertical data, and were kept consistent in size to allow statistical comparability. All excavation was employed within 1-by-1 m grids, and, except where noted below, was conducted in vertical units of 10 cm. Since natural and cultural stratigraphic breaks were not encountered at any of the three sites within cultural deposits (except in cultural features), a system of general descriptive level numbers was applied to all fill, and was combined with actual depth to allow either general or specific vertical control during computer manipulation. General level designates included: (1) surface; (2) general fill; (3) feature fill; (5) floor (and 5 cm above); (7) cultural surface (and 5 cm above).

Standard excavation units of 10 cm were applied to each grid; a variable initial unit was used to create uniform levels between grids. Depths were based on site datum, and the bases of excavated units fell along horizontal planes bisecting the site, resembling artificial strata.

All fill was screened through either ¼ or ⅛ inch mesh. Although ¼-inch mesh is more efficient in terms of time, ⅛-inch mesh can, in some cases, provide a much better artifact recovery level. Using both screen sizes, several adjacent units were screened at each site during initial excavation, and the results were compared. Since LA 104382 showed a markedly higher recovery rate with ⅛-inch mesh, the remainder of the site was excavated using that size screen. Results from LA 39998 and LA 104381 showed that little else would be recovered using the smaller screen; ¼-inch mesh was used for data recovery at these two sites.

Cultural material was bagged and cataloged for each excavation unit and artifact type. All bone, charcoal, chipped stone, ceramic, and ground stone encountered within the excavated area was recovered. No human bone was encountered. Each grid was excavated until cultural deposits were exhausted, and until two excavation units with no cultural material present was removed. In several cases, especially during the initial stages of excavation, a soil auger was used at the base of a completed grid to ensure the limits of cultural deposits had been reached. Soil color was recorded for each excavation unit using the Munsell scale.

Cultural features were identified only on LA 104381, and were excavated in full. Prior to excavation, features were drawn in plan and photographed; during and after excavation, plans and profiles were drawn, and the features photographed. Artifacts recovered from features were documented by excavation unit, or within the horizontal-vertical boundaries of the feature, whichever was smaller. Charcoal was removed when possible to be used for radiocarbon dating. Macrobotanical and potential dendrochronological samples were removed, and a portion of all feature fill removed was collected for botanical flotation and pollen analysis.

SITE SUMMARIES

David J. Hayden and Lloyd A. Moiola

LA 39998

LA 39998 was originally recorded by the University of Texas in Cibola National Forest report 1982-03-23; the site was re-recorded by NMSHTD archaeologists in March of 1994 during a cultural resource survey for the reconstruction of U.S. 60, west of Datil, New Mexico. It was described as a lithic artifact scatter of unknown cultural or temporal affiliation with three possible hearths and a historic can dump. The site is located [redacted] west of Datil at [redacted]. Cultural materials were reported to cover an estimated 16,000 sq m on both sides of U.S. 60, however the main artifact concentration is on the south side of the highway.

LA 39998 was recommended for data recovery, which was conducted by OAS staff during the months of July and August 1994.

Setting

LA 39998 lies within and outside the existing U.S. 60 right-of-way at an elevation of 2,430 m (7,975 ft). The site is on a series of small, heavily wooded hills, which are divided by a ravine that flows into White House Canyon. The surrounding terrain is characterized by steep mountain slopes and ridges, and the site overlooks White House Spring, which is located 110 m to the northeast.

Vegetation consists primarily of ponderosa pine, and includes piñon, juniper, oak, various grasses, cactus, four-wing salt bush, and rabbit brush. Soils on the site are shallow, well drained, sloping sandy loams of the Motoqua-Datil and Flugle-Loarc series, which occur on alluvial fans, hills, and ridges (Johnson 1985:75, 90).

Excavation Results

Cultural deposits were found in both surface and subsurface contexts; the maximum depth (below ground surface) of cultural material was 50 cm, with a mean depth of 13 cm. A total of 1,187 excavation units were removed from 542 1-by-1-m grids (Fig. 4). No cultural features were identified during excavation, and the "hearths" recorded during survey were determined to be recent, natural burns.

Artifacts recovered include 2,078 pieces of chipped stone, 93 ceramics, 46 pieces of ground stone, and 63 pieces of animal bone. The chipped stone assemblage consisted of 520 pieces of angular debris and 1,232 core flakes (39 of which were utilized), 184 biface flakes, 18 cores, 1 cobble tool, 1 end scraper, 1 uniface, 2 drills, 64 undifferentiated bifaces, and 55 projectile points. The ceramic assemblage contained Mogollon brown wares (n = 3), Anasazi white wares (n = 6), protohistoric Athabascan utility wares (n = 61) and Rio Grande ceramics (n = 23) likely of Piro origin. The ground stone included 14 indeterminate fragments, 1 hammerstone, 12 manos (3 indeterminate and 9 one-hand), and 19 metates (5 indeterminate, 4 trough, and 10 slab). Small and medium mammal bones constituted most of the faunal remains. No human remains were encountered.

A small historic can dump was identified and excavated. No artifacts were encountered below the current ground surface. Analyzed in the field, these artifacts consisted of early 1960s containers for soup, vegetables, beer, chewing tobacco, motor oil, and anti-freeze.

Although no cultural features were identified, several charcoal samples were recovered from general cultural fill. Calibrated radiocarbon dates include: 300-215 B.C., A.D. 1310-1385, and A.D. 1505-1620. Since these samples were not associated with cultural features, and are from shallow, mixed soils, they must be considered with caution. They are, however, consistent with other data suggesting Late Archaic, Formative, and protohistoric occupations.

Summary

Radiocarbon, projectile point, and ceramic data suggest three (possibly four) occupations between the Late Archaic and protohistoric periods. Although this information confirms the presence of Archaic, Formative Mogollon-Anasazi, Athabascan, and possibly Piro Pueblo groups, it is not possible to distinguish these components within the overall assemblage.

LA 104381

LA 104381 was recorded by NMSHTD archaeologists in March of 1994 during a cultural resource survey for the reconstruction of U.S. 60, west of Datil, New Mexico. It was described as a lithic and ceramic artifact scatter with possible hearths. Surface artifacts included ground stone, flakes, flake tools, and ceramics that consisted of plain and corrugated brown wares, as well as a black on white sherd (Weidner et al. 1994). The artifacts covered an estimated 11,250 sq m on the south side of U.S. 60 at Milepost 72.75 (Appendix 6).

This site was recommended for data recovery, which was conducted by OAS staff, during June and July 1994.

Setting

LA 104381 is located in White House Canyon, within and outside the existing U.S. 60 right-of- way, [redacted] west of Datil, New Mexico. The site is on the lower ridge of a hill-slope at an elevation of 2,310 m (7,580 ft). The artifacts are distributed on both sides of the highway, but the main concentration is on the south side of the road.

This location overlooks a wide valley bottom within White House Canyon and is surrounded by steep rocky slopes and ridges. The terrain is interspersed with hills, mesas, and ravines. There is an intermittent stream 0.28 km northeast, a small drainage southeast of the site, and a perennial spring 2.2 km (1.4 miles) to the northwest.

Vegetation consists of piñon, juniper, ponderosa, oak, various grasses, cactus, four-wing

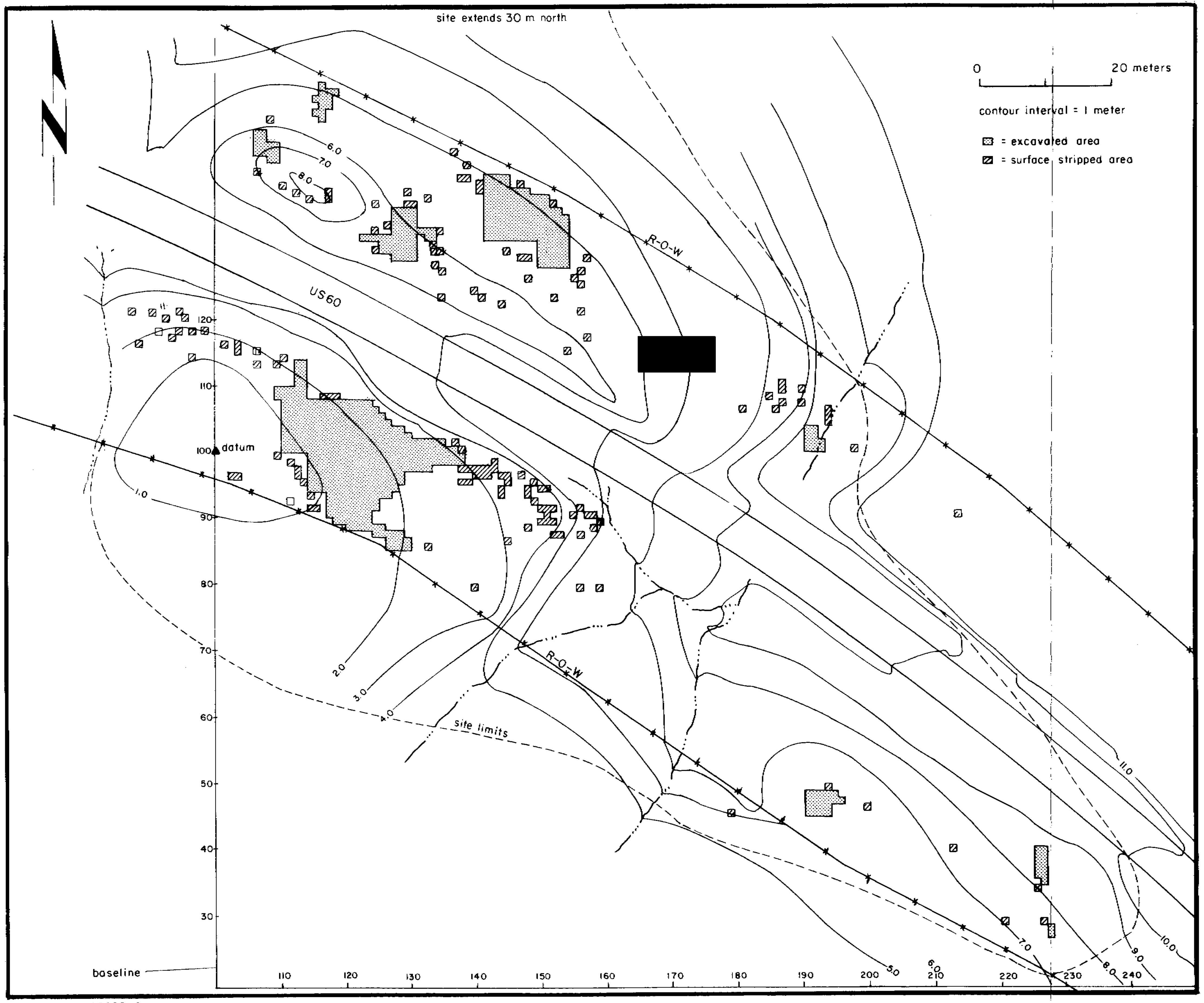

Figure 4. LA 39998 site map.

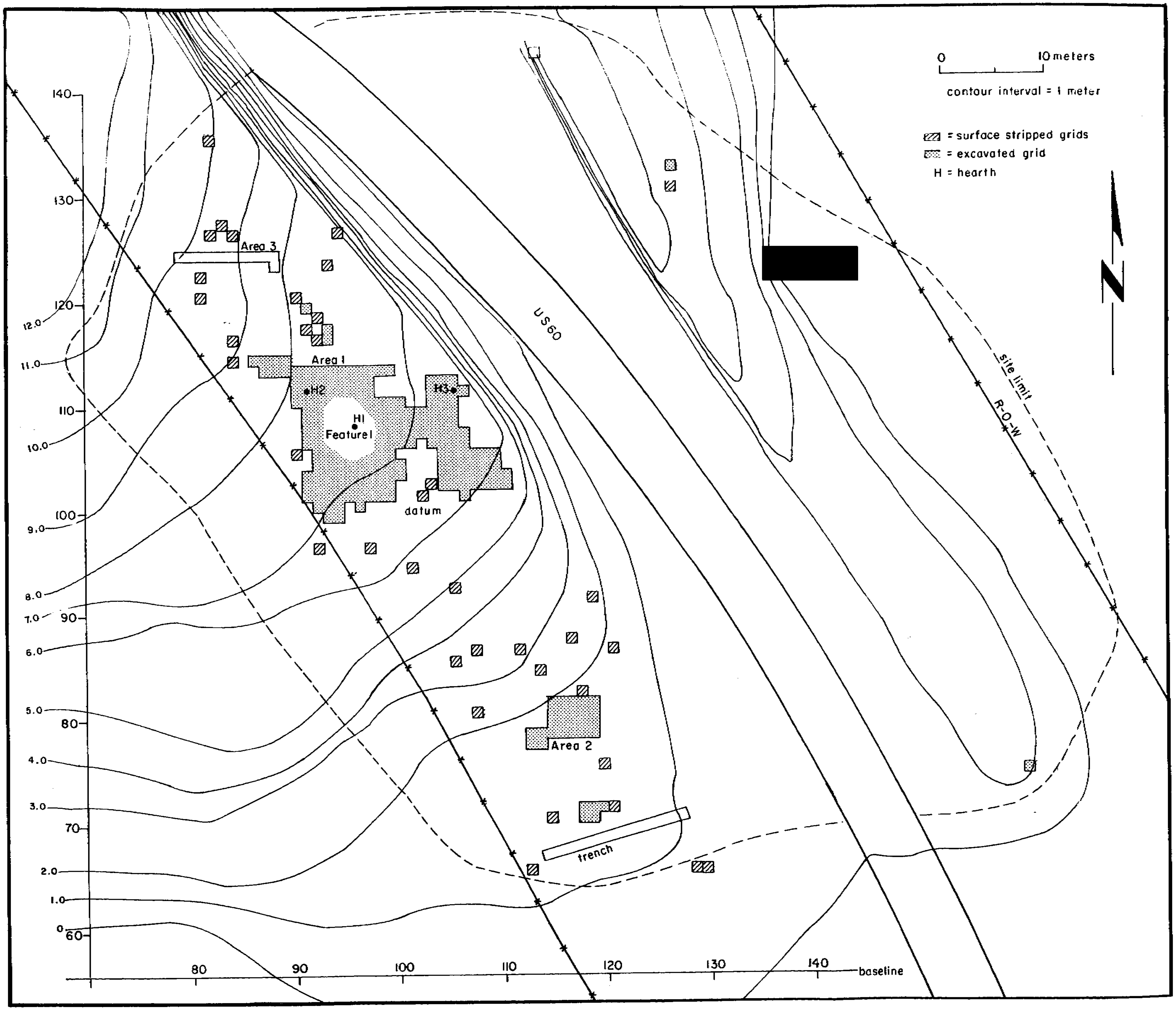

Figure 5. LA 104381 site map.

salt bush, and rabbit brush. Soils on the site are shallow and consist of the Motoqua-Datil and Flugle-Loarc series. These are well-drained, sloping sandy loams that occur on alluvial fans, hills, and ridges (Johnson 1985:75, 90).

Another site, a large lithic scatter (including several Archaic period projectile points), is located outside of the existing right-of-way, approximately 200 m upslope of this site. Although these two sites seem distinct, there may be some mixing of cultural material.

Excavation Results

Cultural deposits were both surface and subsurface; the maximum depth (below ground surface) of cultural material was 31 cm, with a mean of 8 cm. A total of 446 excavation units were removed from 239 1-by-1-m grids. In addition, a trench was mechanically excavated at the base of the hill to confirm the limits of cultural deposits and identify stratigraphy (Fig. 5). No cultural material was recovered in this trench, and soil was, in general, 10 to 50 cm above bedrock. Two artifact concentration areas were identified: Area 2 was located at the base of the slope, and Area 1 was in a semiflat area above it. Three cultural features were encountered during excavation.

Artifacts recovered include 598 chipped stone artifacts, 245 ceramics, 26 pieces of ground stone, and 489 animal bones. The chipped stone assemblage consisted of 115 pieces of angular debris, 424 core flakes (17 of which were utilized), 16 biface reduction flakes (1 utilized), 6 cores, 1 cobble tool, 20 undifferentiated bifaces, and 16 projectile points. The projectile point assemblage included some that were stylistically similar to Late Archaic dart points, and others similar to Pueblo and Athabascan arrow points.

The ceramics were primarily thin, protohistoric Athabascan utility wares (n = 175), although Formative period Mogollon brown wares and Anasazi white wares (n = 70) were also encountered. The ground stone included 10 manos (5 one-hand and 5 indeterminate) and 11 metates (8 slab, 1 basin, and 2 indeterminate), as well as 3 fragments, 1 shaped slab and 1 abrading stone. The majority of the faunal remains were burned, medium-sized mammal bones. Charcoal samples removed from cultural features and the general cultural fill provided radiocarbon dates. No human remains were encountered.

Cultural Features

Excavation revealed three cultural features within artifact area 1. Feature 1 is an area of burned earth, most likely the charred remains of a brush structure with an internal hearth. Features 2 and 3 are both hearths. Feature 2 is located 10 m northeast of subdatum 8 and Feature 3 is 5 m northwest of the same datum.

Feature 1 is a roughly circular-shaped area (6-by-5 m), composed of compact, charcoal-stained soil and a hearth (Figs. 6 and 7). The hearth is oval and measured 90 cm E-W by 65 cm N-S with a depth between 4 and 12 cm. Several large fire-cracked rocks were on the north and east edges of the hearth, and in the fill and surrounding the feature. One small fragment of a charred corn cob was recovered from the hearth fill. The surface around the hearth (and outlying feature stain) was hard, dark grayish brown (Munsell 10YR 4/2), and reddish gray clay (5YR 5/2) with embedded flecks of charcoal. Two possible postholes that contained burned wood were between the hearth

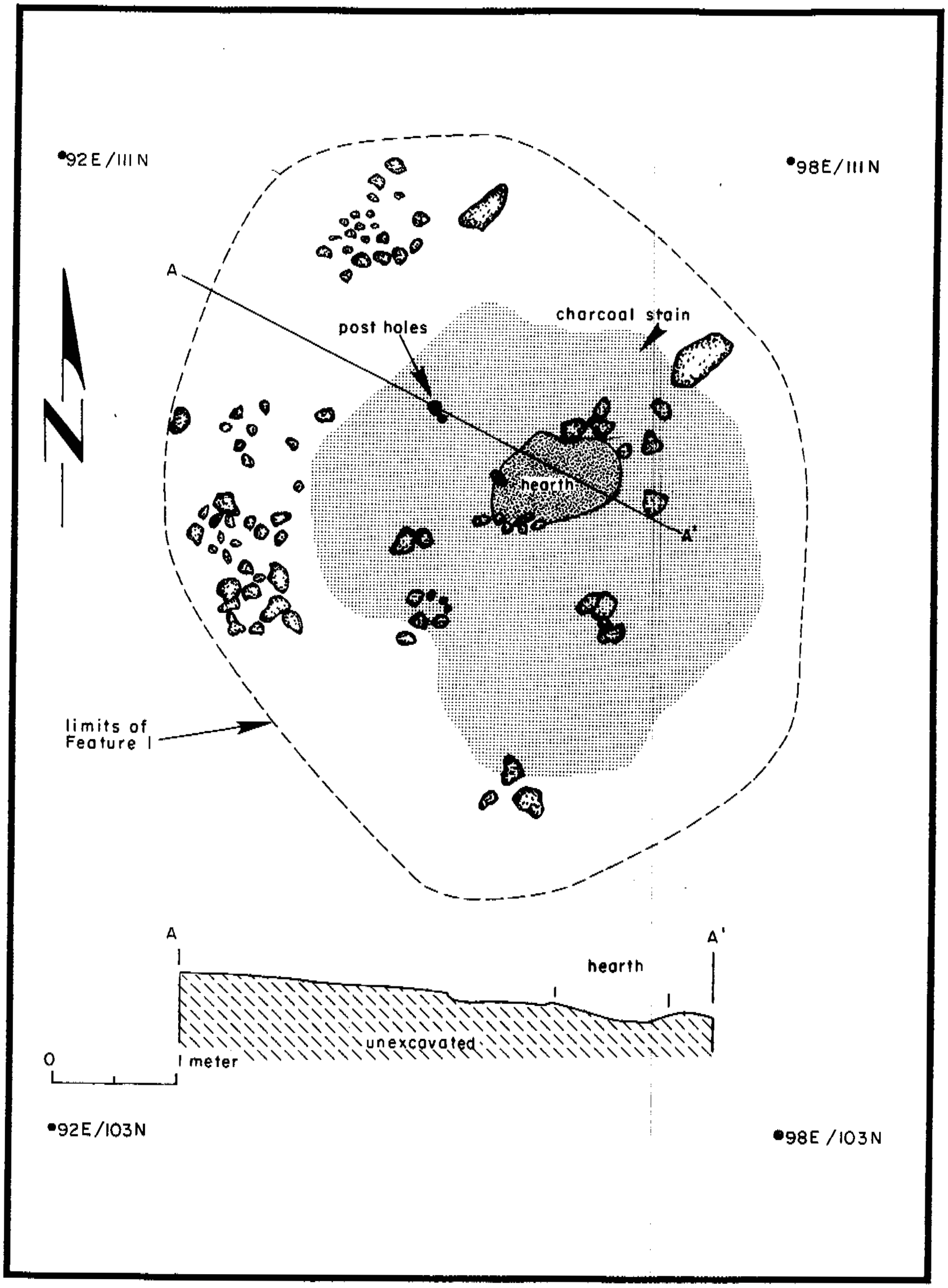

Figure 6. Feature 1, brush structure, LA 104381.

Figure 7. Feature 1, brush structure, LA 104381.

and the western edge of the feature. This edge is built up with large and small rocks in the form of a discontinuous arc. The rocks and the postholes may have served as a means of support for a brush structure, possibly a ramada or wickiup. Three charcoal samples recovered here provided calibrated radiocarbon dates ranging between A.D. 600 and A.D. 680.

Artifacts found within the confines of Feature 1 (surface and fill) include: 53 pieces of chipped stone (core flakes and angular debris), 42 ceramics (Reserve Corrugated and Athabascan Utility), 51 burned bone, and 7 ground stone (4 slab metates and 3 manos). The feature was just below the current ground surface, and the soil was disturbed by erosion. Most of the burned bone from this site was recovered in two dump areas along the outside edge of the structure. Spatial associations of these areas suggest seasonal, short-term use of the structure, but with habitations long enough to require site maintenance (see Chapter 10). With the exception of the ground stone, it was not possible to directly associate any other portion of the artifact assemblage with this feature.

Feature 2 (Figs. 8 and 9) is an oval-shaped hearth in the northeast corner of grid 112N/105E. The hearth measures 68 cm north-south by 55 cm east-west and has a depth between 5 and 10 cm. The northern and eastern edges of the hearth are lined with fire-cracked cobbles. Some fire-cracked rock was removed from the hearth fill, but the majority lay scattered east of the feature. The feature fill contained charcoal (which was collected) and ash. The interior of the hearth had sloping sides and the base was a reddish-gray (5YR 5/2), uneven, oxidized surface. The surface outside the hearth was a smooth, compact, sandy soil with embedded flecks of charcoal. A charcoal sample collected from this feature provided a calibrated radiocarbon date of A.D. 645. No artifacts were collected from within the hearth, but chipped stone debris, burned bone, and a mano were found in grids surrounding the feature.

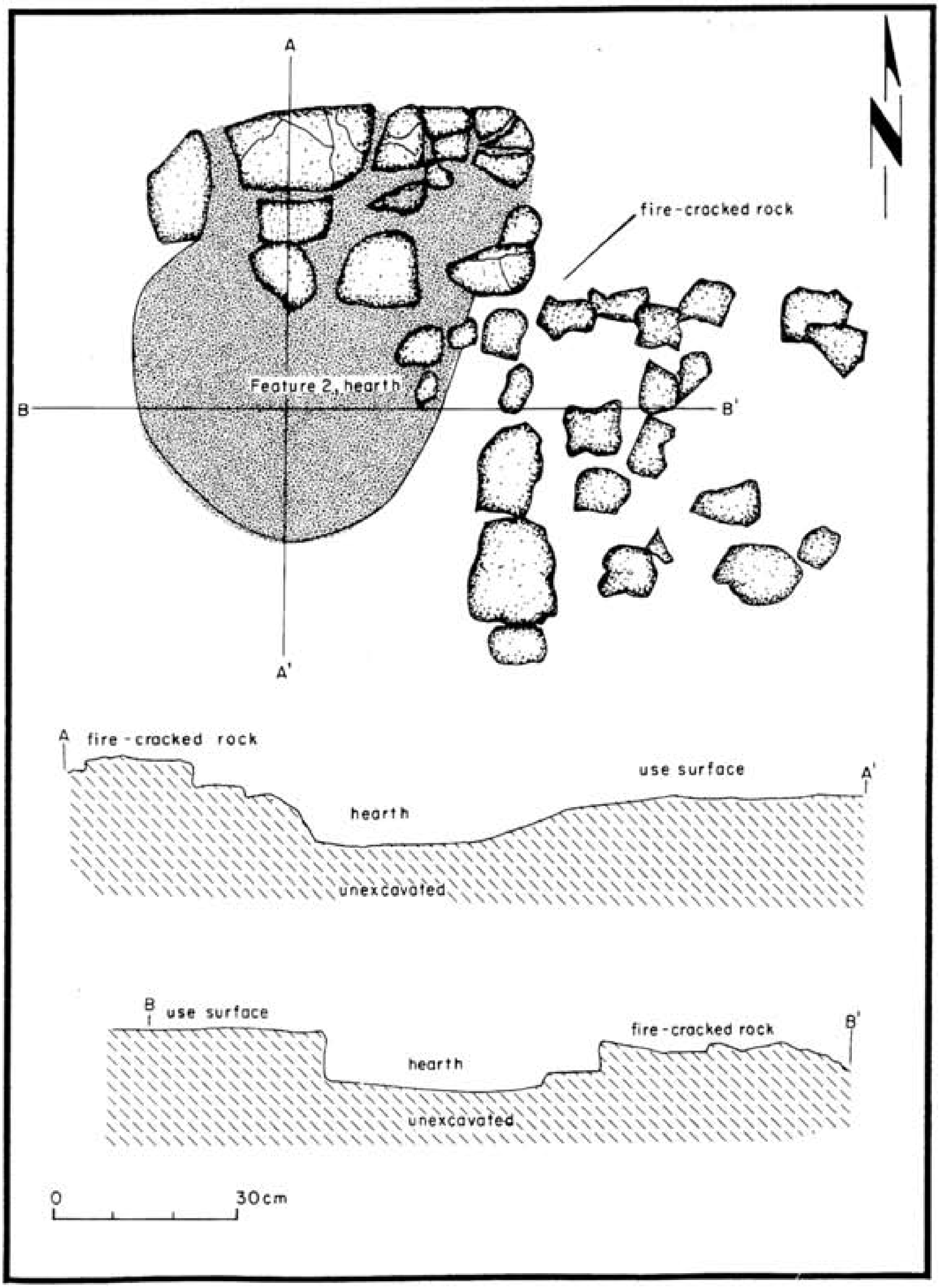

Figure 8. Feature 2, hearth, LA 104381.


Figure 9. Feature 2, hearth, LA 104381.

Feature 3 (Figs. 10 and 11) is a shallow, circular hearth in grids 112N/90-91E. The hearth measures 70 cm north-south by 65 cm east-west and is 3-10 cm deep. The fill contained minute charcoal flecks (not enough for radiocarbon dating) and dark gray (10YR 3/1) charcoal-stained soil. A few pieces of fire-cracked rock were on the base and edges of the feature. The base of the hearth was even, compact, dark reddish brown (5YR 4/2) soil. No artifacts were collected from within the feature, but surrounding grids yielded chipped stone, ground stone, and burned bone.

Summary

Multiple occupations during four time periods are suggested by radiocarbon dates and diagnostic artifacts; however, it is difficult to develop associations between these data and the overall artifact assemblage. A Late Archaic occupation is questionable, since an Archaic site has been identified nearby and is upslope. Two of the three cultural features date to the mid-seventh century based on radiocarbon data and are associated with most of the bone removed from the site. A Reserve phase Mogollon occupation is suggested by the ceramic assemblage, and is not supported by any other data. A protohistoric Athabascan occupation is evidenced by ceramic data, and is supported by a sixteenth-century radiocarbon date, and possibly four projectile points.

LA 104382

LA 104382 was recorded by NMSHTD archaeologists in March of 1994 during a cultural resource survey for the reconstruction of U.S. 60, west of Datil, New Mexico. It was described

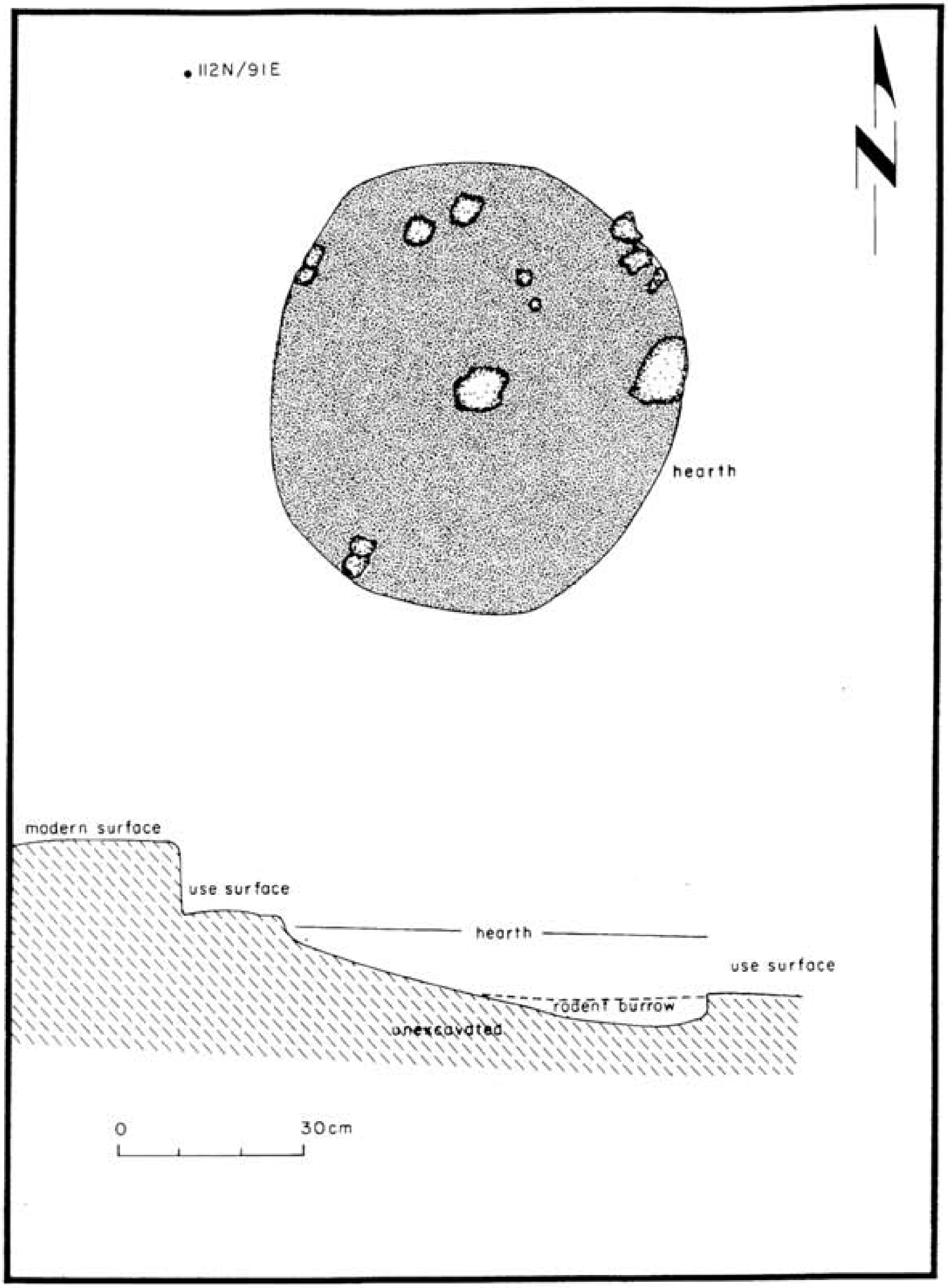

Figure 10. Feature 3, hearth, LA 104381.

Figure 11. Feature 3, hearth, LA 104381.

as a small lithic scatter of unknown cultural-temporal affiliation. Surface artifacts included chipped stone debris, a "chert knife" (actually a fine-grained rhyolite side-scraper), a unifacial mano, a slab metate fragment, and a chert biface fragment. Surface artifacts covered an estimated area of 245 sq m (804 sq ft), on the south side of U.S. 60 at Milepost 75.65 (Appendix 6) (Weidner et al. 1994).

This site was recommended for data recovery, which was conducted by OAS staff during June and July 1994.

Setting

LA 104382 is in White House Canyon within and outside the existing right-of-way of U.S. 60, west of Datil, New Mexico. Located on a low slope at the base of a mesa, and approximately 3 m above the canyon flood plain, this site is at an elevation of 2,262 m (7,420 ft), and approximately 0.4 km (0.25 mi) southeast of the confluence of Main Canyon.

This location overlooks a narrow valley, bordered to the southwest and northeast by rocky slopes and mesas. Main Canyon joins White House Canyon to the northwest, and White House Canyon broadens to the southeast toward the town of Datil. Both canyons have intermittent streams, the nearest (White House Canyon drainage) is approximately 200 m from the main site concentration.

Vegetation consists of piñon, juniper, various grasses, cactus, four-wing salt bush, and rabbit brush. Soils are well-drained, sloping, sandy loams of the Motoqua-Datil and Flugle-Loarc series, which occur on alluvial fans, hills, and ridges (Johnson 1985:75, 90).

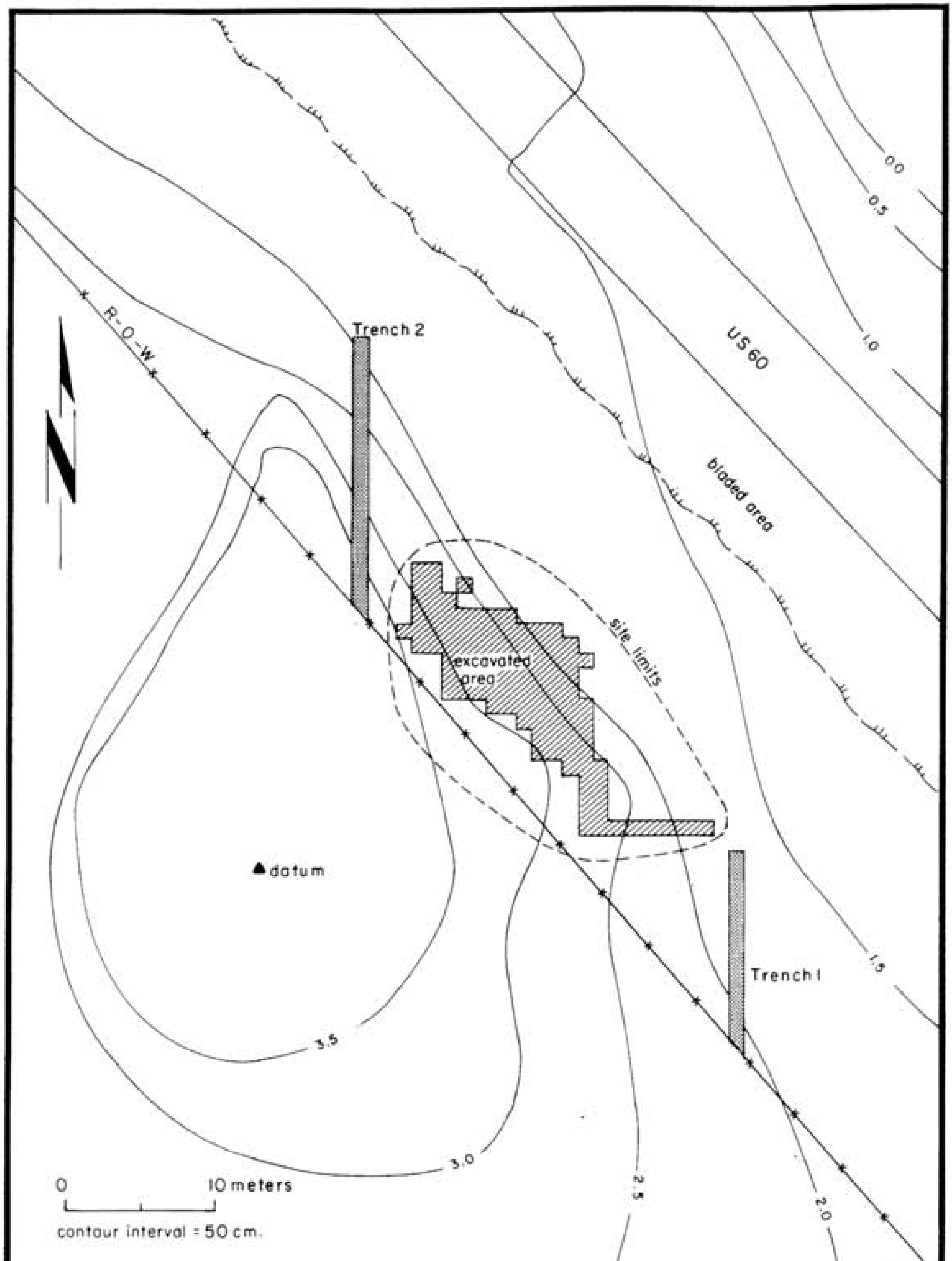

Figure 12. LA 104382 site map.

Excavation Results

A large portion of the cultural fill within the highway right-of-way may have been removed during construction of the existing highway. As a result, cultural deposits were mixed. Artifacts were encountered on the surface and subsurface; the maximum depth of cultural material (below ground surface) was 42 cm, and the mean depth was 13 cm. A total of 215 excavation units were excavated in 122 1-by-1 m grids. In addition, two trenches were excavated with mechanical equipment to establish natural-cultural stratigraphy, and verify site limits (Fig.12). Stratigraphy was limited to natural formations well below the vertical limits of cultural deposits; no cultural material was encountered within these trenches.

Artifacts recovered include 4 pieces of animal bone, 100 biface reduction flakes, 133 core flakes (3 utilized), 53 pieces of angular debris (2 utilized), a blade fragment (utilized), 2 projectile point fragments, a one-handed mano, a fragment of a slab metate, and a side-scraper. Both projectile points were nondiagnostic fragments, but appear to be portions of atlatl dart points. Faunal remains were from small and medium mammals, and were most likely not deposited in a cultural context. No human remains were encountered.

Although no cultural features were encountered, a small charcoal sample was removed from 12 cm below ground surface within the disturbed area of the site. This sample provided a calibrated radiocarbon date of 7020 B.C. Since it is not directly associated with a cultural feature, and is from mixed soil deposits, this date must be considered cautiously.

Summary

It is unclear what percentage of the original site artifact assemblage was recovered during excavation, however, the artifact assemblage collected suggests a single short-term occupation emphasizing bifacial tool manufacture or maintenance. Although both radiocarbon and projectile point data should be considered with caution, they imply a late Paleoindian or Early Archaic period occupation.

CHIPPED STONE ANALYSIS

David J. Hayden and Lloyd A. Moiola

Framework

A total of 2,966 chipped stone artifacts was recovered from three sites. In general, this analysis was designed to provide information regarding reduction strategies (including tool manufacture), informal and formal tool use, and material procurement. This chapter provides both descriptive and interpretive information regarding the analysis results.

Two general reduction strategies, systematic and nonsystematic, are addressed throughout this chapter. Systematic reduction refers to episodes of planned reduction, aimed at extracting the largest amount of useable edge from raw material, or the production of formal tool morphologies (bifacial and blade core reduction). Nonsystematic reduction refers to the reduction of raw materials in less formal contexts, where the intended use of each flake removed is of more consequence than the conservation of material.

Several researchers (notably Bamforth 1985, 1986; Binford 1973, 1977, 1979, 1980; Bleed 1986; Kelly 1988; and Torrance 1983) have discussed the relationship between applied core reduction techniques and overall strategy within chipped stone tool kits. Following Bamforth (1985), "expedient" reduction strategies produce informal tools, with minimal modification of raw debris morphology, based on need; tools are discarded after use, when no longer useable, or when no longer needed. "Curated" reduction systems incorporate a suite of traits that may include specific formal tool forms for specific uses, greater investment of time and resources in initial production, recycling of tools for other uses until no longer possible, and transportation of tools from one locality of use to another. Binford (1979) describes these differences as forming a continuum, in which both forms are incorporated into systems based on need. Both systematic and non-systematic techniques can be used to produce informal tools; although initial stages of formal tool production need not be systematic, later stages must.

Several factors, including resource availability and a related necessity for efficiency have been suggested as causal for the role of these strategies within overall systems (Bamforth 1986; Kelly 1988). Kelly (1988) presents a model for the use of bifaces as a curated technological form; although it is based on research in the Great Basin, analogous assemblages have been identified in the Southwest as well (Moore n.d.). Kelly (1988:718-723) outlines three generalized roles that bifaces play in technological systems: as cores for the production of both formal and informal tool forms; as long use-life tools that are resharpenable and thus recyclable; and as specialized forms.

Although the initial production of bifacial cores is wastefu —both in terms of the biface edge itself and the edge of flakes removed for use as informal tools (Kelly 1988; Moore n.d.)— they provide an exceptionally efficient use of raw material by providing the maximum length of useable edge per biface struck from the core. Further, bifacial cores are generalized forms that can be reduced into more specialized bifacial tools, such as projectile points, when needed. Kelly (1988) argues that the role of bifaces within a technological system may be related to mobility, and more particularly, resource distribution. Generalized bifaces, when used as cores, provide an efficient means of transport between raw material sources by reducing bulk and weight for transportation; further, they provide material for both anticipated and unanticipated need. As generalized tools, bifaces are particularly useful because of their capacity to be resharpened, and to be recycled into another tool form if necessary.

The identification of informal tools within an assemblage can be somewhat problematic and is based entirely on the observance of characteristics produced by utilization. These characteristics can be difficult to identify; since post-depositional processes can produce similar traits, many artifacts must be discounted because of their recovery context. Further, several raw material types available in this region may demonstrate observable use-wear patterns only after extended use (Elyea and Eschman 1985; Toll 1978). Toward that end, the informal tools identified within this analysis likely represent only a portion of the informal tools actually recovered.

Studies of raw material source, procurement, and use can provide insight into mobility and trade patterns, as well as technological differences. In this analysis, raw material studies were limited to identifying specific exotic types that had been previously described, and provides generalized descriptions of unknown materials. Unknown materials (e.g., "Chert Undifferentiated") were treated as locally occurring, although they may well be exotic to the area. Obsidians were visually sorted and samples identified through X-Ray Fluorescence (XRF).

Analysis Methodology

General Chipped Stone Analysis

Analysis was completed using the OAS *Standardized Lithic Artifact Analysis: Attributes and Variables Code Lists* (OAS Staff 1995). Each artifact was examined using a binocular microscope to aid in defining morphology and material type, examine platforms, and determine whether it was used as a tool. The level of magnification varied between 15x and 80x, with higher magnification used for wear pattern analysis and identification of platform modifications. Utilized and modified edge angles were measured in degrees with a goniometer; other dimensions were measured in millimeters with a sliding caliper. Analytical results were entered into a computerized data base using the Statistical Package for the Social Sciences Data Entry program. Table 2 lists the attributes examined during this study, and indicates which relate to each class of chipped stone artifact; Appendix 1 provides the codes used in this analysis.

A polythetic set was used in this analysis to discriminate biface reduction flakes from other debitage. A polythetic framework is one in which fulfilling a majority of conditions is both necessary and sufficient for inclusion in a class (Beckner 1959). The polythetic set contains an array of conditions, and rather than requiring an artifact to fulfill all of them, only a set percentage in any combination needs to be fulfilled. This array of conditions models an idealized biface reduction flake and includes information on platform morphology, flake shape, and earlier removals. The polythetic set used here (Table 3) was adapted from Acklen and others (1984). In keeping with that model, when a flake fulfilled 70 percent of the listed conditions, it was considered to be a removal from a biface. This percentage is high enough to isolate flakes produced during the later stages of biface production from those removed from cores, while at the same time it is low enough to permit flakes that were removed from a biface but do not fulfill the entire set of conditions to be properly identified. While not all flakes removed from bifaces could be isolated using the polythetic set, those that were can be considered definite evidence of biface reduction. Flakes that fulfilled less than 70 percent of the conditions were classified as removals from cores. Instead of rigid definitions, the polythetic set provided a flexible means of categorizing flakes and

Table 2. Correlation of Attributes Analyzed with Chipped Stone Artifact Categories

Attribute	Flakes	Angular Debris	Cores	Formal Tools
Material type	x	x	x	x
Material quality	x	x	x	x
Artifact morphology	x	x	x	x
Artifact function	x	x	x	x
Cortex	x	x	x	x
Cortex type	x	x	x	x
Portion	x	x	x	x
Platform type	x			
Thermal alteration	x	x	x	x
Wear patterns	x	x	x	
Modified edge angles	x	x	x	x
Dimensions	x	x	x	x
Core number	x	x	x	x

helped account for some of the variability seen in flakes removed during experiments.

Projectile Point Analysis

Projectile point analysis was based on the OAS standardized manual (OAS Staff 1995), and is designed to work in conjunction with the general standardized chipped stone analysis. Several attributes are recorded identically, and use the same value codes, including material type, material quality, cortex, cortex type, thermal alteration, and utilization. Additional attributes (see Appendix 2 for codes) included portion, break pattern (following Johnson 1979), preform morphology, reduction technique, flake scar pattern, extent of scarring, cross-section, blade shape, barbs, hafting element shape, tang, serrations, residues, resharpening, utilization, notch type, notch condition, and notch shapes. Measurements taken with a sliding caliper (in millimeters) included: overall length, overall width, overall thickness, overall blade length, edge length (base and each blade edge), notch length, notch width, basal width (neck), basal thickness, and basal length. An average edge angle was measured in 1-degree increments with a goniometer.

Material Selection

Raw Material Source

The local geology is primarily igneous, formed by components of the Datil Formation (Chamberlin et al. 1994; Dane and Bachman 1965), which includes deposits of basalts, latites, andesites, rhyolites, and tuff. North of the Datil Mountains, terminating just south of the Alamocita Creek and Salado River drainages, are deposits of Upper Cretaceous sandstones from the Mesa Verde Group.

Table 3. Polythetic Set for Distinguishing Manufacturing Flakes from Core Flakes

Whole Flakes

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

Broken Flakes or Flakes with Collapsed Platforms

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

Artifact is a Manufacturing Flake When:
-If whole it fulfills 7 of 10 attributes.
-If broken or platform is collapsed it fulfills 5 of 7 attributes.

Several raw materials suitable for chipped stone reduction are available locally, the most common of which is rhyolite. Ranging in material quality from aphanitic to coarse-grained and somewhat vesicular, rhyolite outcrops throughout the area. Other igneous materials, such as basalt, occur to the south and east of the sites, but are not substantially represented in these assemblages. Metamorphic materials, including quartzites, occur locally, and although no outcrops have been identified, they are available in most drainages throughout the area.

For the purposes of this analysis, unsourced cherts and chalcedonies have been grouped as "Cherts Undifferentiated." Although various chalcedonies were found in the assemblages, the qualities that define them (such as degree of opacity and grain quality) fall along a broad continuum of chertic materials; their distinction from cherts is in many cases subjective, and dependent on individual analysts. Chalcedonies are treated distinctly here only when they are associated with a specific, documented source. All of the cherts/chalcedonies categorized as "undifferentiated" are unsourced and are presumed to occur locally. Although we were unable to source any particular varieties of these materials locally, general reconnaissance showed that a broad range is available in the area. Sedimentary deposits with outcropping cherts and silicified woods are exposed on the north side of the Datil Mountains and gravels are available in virtually all of the local drainages. In addition, the andesite flows of the Datil Formation have been shown to yield chalcedonic inclusions in other areas (Warren 1972a, 1972b); presumably, these deposits yield similar, though perhaps not identical, materials locally.

Some of the materials identified as locally occurring (particularly the cherts, chalcedonies, and silicified woods) could be exotic. In the absence of thorough reconnaissance to identify local varieties, it is impossible to know which materials are indeed nonlocal—except in cases where an exclusive, localized material source is known outside the area. Exotic materials were defined as materials for which a distinct source, more than 20 km from the sites, has been identified. In this context, five exotic material types were identified, including three types of obsidian, Washington Pass chert and Luna blue agate.

Shackley (1988, 1992) describes the known obsidian sources for the Southwest; several of these (including Red Hill, Mule Creek, Gwynn Canyon, and Jemez obsidians from Rio Grande gravels) are within reasonable distance for primary procurement.

Washington Pass chert is described by Warren (1967) as originating in the Chuska Mountains in northwestern New Mexico and northeastern Arizona. It is composed of chalcedony and opal, ranging in color from pale orange-pink to red, yellow, and brown. Color banding and quartzitic inclusions are common. One piece was recovered and identified by comparison to raw material recovered from the Washington Pass (Narbona Pass) area. The two materials exhibited similar inclusion patterns, coloring, grain qualities, and fluorescence under short-wave ultraviolet light.

Luna blue agate, elsewhere called Apache Creek agate (Warren 1972a, 1972b), has been sourced to andesite flow inclusions in both the San Francisco Mountains near Luna, and the Gallo Mountains near Apache Creek (Warren 1972a, 1972b; Chamberlin et al. 1994). Luna blue ranges in clarity from opaque to somewhat clear, is generally pale blue-gray to gray-white in color, often banded, and is associated with druses and geodes of quartz crystals. It occurs in large quantities in drainages throughout the Luna, Reserve, and Apache Creek areas. Small amounts of Luna blue agate were recovered from all three sites.

Discussion

Twelve distinct material types were identified within the site assemblages, the majority of which fall into generalized categories (Table 4). Cherts and chalcedonies are the predominant materials in all three assemblages, and are referred to here as "Chert Undifferentiated." One fragment of Washington Pass chert was recovered from LA 104382 and small amounts of Luna blue agate are found at each site. LA 104382 is distinct from the other two sites in that is has a much higher percentage of obsidian, particularly compared with LA 104381, which had only 18 pieces. Rhyolite makes up only a small portion of the LA 104382 and LA 39998 assemblages (17.9 and 12.9 percent), but is nearly half of the LA 104381 assemblage. Other materials (silicified woods, undifferentiated igneous, basalts, undifferentiated sedimentary, undifferentiated metamorphic, quartzitic sandstone, and quartzites) consistently made up low portions of all three assemblages.

Table 4. Material Type by Site

Material Type	LA 39998		LA 104381		LA 104382		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated	1226	59.0	249	41.6	138	47.6	1613	54.4
Washington Pass Chert					1	0.3	1	0.0
Luna Blue Agate	25	1.2	8	1.3	7	2.4	40	1.3
Silicified Wood	39	1.9	6	1.0	3	1.0	48	1.6
Obsidian Undifferentiated	245	11.8	18	3.0	69	23.8	332	11.2
Igneous Undifferentiated	13	0.6	3	0.5			16	0.5
Nonvesicular Basalt	40	1.9	1	0.2	7	2.4	48	1.6
Rhyolite	269	12.9	259	43.3	52	17.9	580	19.6
Sedimentary Undifferentiated	4	0.2	16	2.7	2	0.7	22	0.7
Metamorphic Undifferentiated	51	2.5	1	0.2	2	0.7	54	1.8
Quartzite Undifferentiated	21	1.0	1	0.2	2	0.7	24	0.8
Quartzitic Sandstone	145	7.0	36	6.0	7	2.4	188	6.3
Total	2078	100.0	598	100.0	290	100.0	2966	100.0

Table 5. Obsidian Sources by Site

Obsidian Source	LA 39998	LA 104381	LA 104382
Antelope Creek/Mule Mts Chemical Group (Mule Creek)	X		X
Mule Mountains Chemical Group (Mule Creek)	X		
Banco Bonito (Jemez Caldera)	X	X	
Grant's Ridge	X	X	X

Nineteen obsidian samples were selected by visual characteristics for Energy Dispersive X-Ray Fluorescence (EDXRF) sourcing analysis. The analysis was conducted by M. Steven Shackley, University of California, Berkeley (Shackley 1995). Four obsidian source types were identified, including Mule Mountains Chemical Group, near Mule Creek, New Mexico; Antelope Creek/Mule

Mountains Chemical Group, near Mule Creek, New Mexico; Banco Bonito, Jemez Mountains, New Mexico; and Grants Ridge, near Grants, New Mexico (Table 5). Grants Ridge and Banco Bonito obsidians are likely available in Rio Grande gravels. Of eleven obsidian samples from LA 39998, eight were from the Mule Creek area, two from Grants Ridge, and one from Banco Bonito; of two LA 104381 samples, one was from Grants Ridge, and one was from Banco Bonito; and of six samples from LA 104382, two were from Grants Ridge, and four from the Mule Creek area.

Cortex Type and Material Source

Geologic material source is not necessarily an indicator of procurement location, since materials can be moved away from their original source in many ways. Frequently, they are transported long distances in cultural contexts, often through trade, or through curation during seasonal moves. Natural processes move raw materials as well, particularly through drainage transport; materials are frequently washed downstream from their geologic source. Evaluation of cortex types can indicate the type of natural processes a particular piece of material has been subjected, and is therefore indicative of the procurement context.

Three cortex types were distinguished during this analysis: waterworn, nonwaterworn, and undifferentiated (indeterminate). Waterworn cortex suggests that material has been transported by water away from its original source, and that procurement may have been in a secondary context. Nonwaterworn cortex indicates that minimal, or no water transport has taken place.

Table 6. Cortex Presence by Site

Site	Cortex Absent		Cortex Present		Total	
	(N)	(%)	(N)	(%)	(N)	(%)
LA 39998	1776	87.8	247	12.2	2023	100.0
LA 104381	476	81.8	106	18.2	582	100.0
LA 104382	269	93.4	19	6.6	288	100.0
Total	2521	87.1	372	12.9	2893	100.0

Table 7. Cortex Type by Material Type, LA 39998

Material Type	Waterworn Cortex		Nonwaterworn Cortex		Indeterminate Cortex		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated	104	81.9	8	6.3	15	11.8	127	51.8
Luna Blue Agate	1	50.0	1	50.0			2	0.8
Silicified Wood	4	80.0	1	20.0			5	2.0

Material Type	Waterworn Cortex		Nonwaterworn Cortex		Indeterminate Cortex		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Obsidian Undifferentiated	44	64.7	9	13.2	15	22.1	68	27.8
Igneous Undifferentiated	3 100.0						3	1.2
Nonvesicular Basalt					1	100.0	1	0.4
Rhyolite	9	90.0			1	10.0	10	4.1
Metamorphic Undifferentiated	10	83.3	1	8.3	1	8.3	12	4.9
Quartzite Undifferentiated	6	100.0					6	2.4
Quartzitic Sandstone	8	72.7	1	9.1	2	18.2	11	4.5
Total	189	77.1	21	8.6	35	14.3	245	100.0

Table 8. Cortex Type by Material, LA 104381

Material Type	Waterworn Cortex		Nonwaterworn Cortex		Indeterminate Cortex		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated	30	73.2	1	2.4	10	24.4	41	39.0
Luna Blue Agate	1	100.0					1	1.0
Obsidian Undifferentiated	2	66.7			1	33.3	3	2.9
Nonvesicular Basalt	1	100.0					1	1.0
Rhyolite	37	88.1	1	2.4	4	9.5	42	40.0
Sedimentary Undifferentiated	5	83.3			1	16.7	6	5.7
Metamorphic Undifferentiated	1	100.0					1	1.0
Quartzite Undifferentiated	1	100.0					1	1.0
Quartzitic Sandstone	6	66.7	1	11.1	2	22.2	9	8.6
Total	84	80.0	3	2.9	2	22.2	105	100.0

Table 9. Cortex Type by Material, LA 104382

Material Type	Waterworn Cortex		Nonwaterworn Cortex		Indeterminate Cortex		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated	5	100.0					5	26.3
Luna Blue Agate	1	100.0					1	5.3
Obsidian Undifferentiated	3	50.0	1	16.7	2	33.3	6	31.6
Rhyolite	4	80.0			1	20.0	5	26.3
Quartzite Undifferentiated	1	100.0					1	5.3
Quartzitic Sandstone					1	100.0	1	5.3
Total	14	73.7	1	5.3	4	21.1	19	100.0

Only a small portion of the materials recovered had cortical surfaces (Table 6), and cortex type distributions are biased in this respect. Tables 7, 8, and 9 provide cortex type distributions for all three sites; cortex is predominantly waterworn or indeterminate in each case (although the sample size is extremely small for LA 104382). The majority of the local materials with observable cortex was waterworn, suggesting procurement from drainage contexts—not surprising since all of the drainages adjacent to these sites had fair amounts of useable raw material cobbles during the project. Results were similar, though less robust for obsidians recovered from LA 39998; too few pieces of obsidian from LA 104381 and LA 104382 had observable cortex for adequate appraisal. Luna blue agate and Washington Pass chert also had very few cases where cortex could be observed, and no pattern was discernable.

Material Quality

Since materials fracture differently depending on mineral composition, grain size, and natural flaws (e.g., cracks, inclusions), physical characteristics within material types can determine their effectiveness in specific tasks (Elyea and Eschman 1985:246). Selection is frequently based on suitability for specific tasks and availability. Fine-grained or glassy materials (commonly cherts and obsidians, but also basalts and some rhyolites) are frequently selected for several formal tool forms (bifaces, unifaces, etc.) because their composition allows predictable fracturing. Fine-grained/glassy materials are quite brittle, however they provide extremely sharp and efficient edges for cutting and scraping activities in both formal and informal tool forms. Medium and coarse-grained materials (quartzites, some rhyolites, etc.) are less suited for delicate shaping (such as biface production), or tasks requiring sharp edges; more frequently they are used when a more durable cutting-scraping edge is required, or for heavier tasks that involve battering.

Fine-grained and glassy materials make up more than half of the debitage in all three site assemblages. This trend is strongest in the LA 104382 assemblage, which was composed almost .

Table 10. Material Type by Material Quality, LA 39998

Material Type	Glassy		Fine Grained		Medium Grained		Coarse Grained		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated			970	79.1	247	20.1	9	0.7	1226	59.0
Luna Blue Agate			25	100.0					25	1.2
Silicified Wood			37	94.9	2	5.1			39	1.9
Obsidian Undifferentiated	245	100.0							245	11.8
Igneous Undifferentiated			1	7.7	10	76.9	2	15.4	13	0.6
Nonvesicular Basalt			23	57.5	17	42.5			40	1.9
Rhyolite			192	71.4	70	26.0	7	2.6	269	12.9
Metamorphic Undifferentiated			12	23.5	38	74.5	1	2.0	51	2.5
Quartzite Undifferentiated			2	9.5	19	90.5			21	1.0
Quartzitic Sandstone			16	11.0	113	77.9	16	11.0	145	7.0
Total	245	11.8	1278	61.5	520	25.0	35	1.7	2078	100.0

Table 11. Material Type by Material Quality, LA 104381

Material Type	Glassy		Fine Grained		Medium Grained		Coarse Grained		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated			190	76.3	59	23.7			249	41.6
Luna Blue Agate			8	100.0					8	1.3
Silicified Wood			4	66.7	2	33.3			6	1.0
Obsidian Undifferentiated	18	100.0							18	3.0
Igneous Undifferentiated			2	66.7	1	33.3			3	0.5
Non-vesicular Basalt					1	100.0			1	0.2

Material Type	Glassy		Fine Grained		Medium Grained		Coarse Grained		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Rhyolite			147	56.8	100	38.6	12	4.6	259	43.3
Metamorphic Undifferentiated					1	100.0			1	0.2
Quartzite Undifferentiated					1	100.0			1	0.2
Quartzitic Sandstone			12	33.3	23	63.9	1	2.8	36	6.0
Total	18	3.0	365	61.0	202	33.8	13	2.2	598	100.0

Table 12. Material Type by Material Quality, LA 104382

Material Type	Glassy		Fine Grained		Medium Grained		Coarse Grained		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated			123	89.1	15	10.9			138	47.6
Washington Pass Chert			1	100.0					1	0.3
Luna Blue Agate			7	100.0					7	2.4
Silicified Wood			3	100.0					3	1.0
Obsidian Undifferentiated	69	100.0							69	23.8
Nonvesicular Basalt			6	85.7	1	14.3			7	2.4
Rhyolite			41	78.8	9	17.3	2	3.8	52	17.9
Metamorphic Undifferentiated			2	100.0					2	0.7
Quartzite Undifferentiated					2	100.0			2	0.7
Quartzitic Sandstone			5	71.4	2	28.6			7	2.4
Total	69	23.8	189	65.2	30	10.3	2	0.7	290	100.0

entirely of fine/glassy materials, most of which were cherts and obsidians (Table 10). LA 39998 (Table 11) and LA 104381 (Table 12) had high frequencies of fine-grained/glassy materials as well, however, medium and coarse-grained materials represented a larger portion than in the LA 104382 assemblage. Cherts, rhyolite, and quartzitic sandstone constitute the bulk of the medium and coarse-grained material categories in all three assemblages.

Debitage

Morphology

Debitage morphology can provide insight into the reduction episodes that produced it. Although flakes removed from a biface can have characteristics similar to core flakes and not meet the requirements of the polythetic set, for example, the reverse is less likely. The presence of biface reduction flakes is, therefore, indicative of bifacial reduction. Angular debris is most frequently associated with expedient core reduction, and to a lesser extent, with early stage bifacial reduction (Vierra 1985:160). Both are scenarios where less control over the material is necessary, or is difficult to maintain. Since different reduction activities produce distinct characteristics in debitage, morphological distributions are an important tool for understanding those activities and their role in site function.

LA 104382 is distinct from the other two sites in its comparatively high distribution (35 percent) of biface reduction flakes (Table 13). Biface reduction flakes are present in both the LA 39998 and LA 104381 assemblages, however, they represent a much smaller portion. Core flakes are the most common morphological form in all three assemblages while distributions are somewhat inversely correlated to that of biface reduction flakes in each case. Angular debris distributions vary across all three assemblages, but compared to the striking differences in biface reduction flake distributions, they are not remarkably different.

Table 13. Artifact Morphology by Site

Morphology	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Angular Debris	520	26.9	115	20.7	53	18.5
Core Flakes	1232	63.6	424	76.4	133	46.5
Biface Reduction Flakes	184	9.5	16	2.9	100	35.0
Blade Flakes					1	0.0
Total	1936	100.0	555	100.0	287	100.0

Table 14. Comparative Artifact Morphologies

	DATIL						LUNA/RESERVE			
	LA 39998		LA 104381		LA 104382		LA 43766		LA 45507	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Angular Debris	520	26.9	115	20.7	53	18.5	1053	17.1	474	22.6
Core Flakes	1232	63.6	424	76.4	133	46.5	3425	55.5	1475	70.3
Biface Reduction Flakes	184	9.5	16	2.9	100	35.0	1692	27.4	150	7.1

Two sites excavated as part of the NMSHTD-OAS Luna and Reserve projects in western Catron County may provide context to these distributions (Table 14). LA 43766 is a Late Archaic (San Pedro Cochise) camp along SR 12, near Reserve, New Mexico, and represents a temporary habitation. LA 45507 is a large, late Pithouse phase (Three Circle phase Mogollon) village, along U.S. 180 in Luna, New Mexico, and represents a long-term, residential occupation. In both cases, bifacial reduction has played a role in the creation of the debitage assemblage, however, the scope, and perhaps the nature of that role, is significantly different. The distribution of the LA 43766 assemblage is similar to that of LA 104382; in both cases, bifacial reduction flakes represent essentially a third of the entire debitage assemblage. Both sites appear to be quite narrow in terms of chipped stone activities—emphasizing biface production-maintenance. The LA 45507 assemblage has a much lower frequency of biface reduction flakes, which is more consistent with the LA 39998 and LA 104381 assemblages; a broader range of site activities is suggested.

Reduction Stage

The amount of dorsal cortex on a flake can indicate the reduction strategy applied since the exterior, cortical surfaces of raw material are generally removed during the initial stages of reduction (Moore n.d.; Chapman 1977). Core flakes can, therefore, be subdivided into generalized reduction stages based on dorsal cortex, providing more discrete information about reduction strategy. Core flakes have been placed into three general categories loosely related to stages of reduction (Table 15). Exterior flakes, those with dorsal cortex present, were divided into primary and secondary groups based on the cortical percentage of the total dorsal surface; flakes with 50 to 100 percent dorsal coverage were termed primary, those with 1 to 49 percent, secondary. Interior flakes, those with no dorsal cortex, were termed tertiary. Only *whole* flakes can be segregated in this manner since the entire dorsal surface must be observable to determine cortex coverage. As a result, distributions represent a sample of the core flake assemblage, selected entirely by portion assessment.

There is an apparent emphasis on interior reduction at all three sites, although LA 104381 has a slightly higher frequency of exterior flakes, all three distributions are very similar (Table 15). Chapman (1977:440) suggests that the initial reduction of raw materials at or near their collection source provides an advantage by reducing core mass for transportation; cores can then be reduced further as needed. He argues that chipped stone assemblages with high frequencies of external flakes are more likely to be near material sources. The reverse would hold true as well. Differential reduction patterns should be observable between local and exotic materials if this is a factor.

Table 15. Reduction Stage by Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Primary Flakes	39	6.7	21	9.0	7	10.8
Secondary Flakes	61	10.4	36	15.5	4	6.2
Tertiary Flakes	486	82.9	176	75.5	54	83.1
Total	586	100.0	233	100.0	65	100.0

Table 16. Core Flake Material Source by Reduction Stage

		Primary		Secondary		Tertiary		Biface Reduction Flakes		Total	
		(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
LA 39998	Local	30	5.1	39	6.7	439	75.2	76	13.0	584	85.3
	Luna Blue					3	100.0			3	0.4
	Obsidian	9	9.2	22	22.4	43	43.9	24	24.5	98	14.3
LA 104381	Local	21	8.9	35	14.8	172	72.9	8	3.4	236	96.7
	Obsidian			1	12.5	4	50.0	3	37.5	8	3.3
LA 104382	Local	5	6.3	2	2.5	39	49.4	33	41.8	79	68.7
	Luna Blue					2	66.7	1	33.3	3	2.6
	Obsidian	2	6.1	2	6.1	13	39.4	16	48.5	33	28.7

The results presented in Table 16 are mixed and do not entirely support this idea. In the LA 39998 assemblage, there is a high percentage of both cortical obsidian flakes and noncortical obsidian biface reduction flakes, suggesting that obsidian was not brought to the site exclusively in a prepared form. This stands in contrast to the LA 104381 assemblage, where there were few pieces of obsidian, only a small portion of which was cortical. Flake type distributions for obsidian (an exotic material) show evidence of primary and secondary reduction with at least as much frequency as local materials at all three sites. Luna blue, the only other exotic material with whole flakes present in the assemblages, provided too few cases to be useful.

Material Quality

Morphological distributions presented in Tables 17, 18, and 19 further support suggestions presented above regarding material selection and range of site activities. In all three assemblages, fine-grained and glassy materials represent at least half of the debitage. The LA 39998 and LA 104381 assemblages are quite similar; fine-grained/glassy materials represent roughly 60 to 70 percent of the core reduction debris (core flakes and angular debris), and nearly all of the biface reduction flakes. LA 104382 is distinct not only in its higher distribution of biface reduction flakes, but also in its emphasis on fine-grained/glassy materials for both reduction forms, suggesting less variability in the range of site activities.

Platform Types

The chipped stone analysis monitored for fourteen possible platform types, twelve of which were observed in this assemblage (Table 20). Cortical platforms occur when the flake is struck from a cortical surface and is common during early stages of reduction. Single-facet platforms can occur at any stage of reduction on either a core or biface reduction flake. Multifacet platforms indicate that previous flake scars existed on the core when the flake was removed—these are common during later

Table 17. Morphology by Material Quality LA 39998

	Fine/Glassy Material		Medium/Coarse Material		Total	
	(N)	(%)	(N)	(%)	(N)	(%)
Angular Debris	360	69.2	160	30.8	520	26.9
Core Flakes	870	70.6	362	29.4	1232	63.6
Biface Flakes	170	92.4	14	7.6	184	9.5
Total	1400	72.3	536	27.7	1936	100.0

Table 18. Morphology by Material Quality LA 104381

	Fine/Glassy Material		Medium/Coarse Material		Total	
	(N)	(%)	(N)	(%)	(N)	(%)
Angular Debris	80	69.6	35	30.4	115	20.7
Core Flakes	252	59.4	172	40.6	424	76.4
Biface Flakes	16	100.0			16	2.9
Total	348	62.7	207	37.3	555	100.0

Table 19. Morphology by Material Quality LA 104382

	Fine/Glassy Material		Medium/Coarse Material		Total	
	(N)	(%)	(N)	(%)	(N)	(%)
Angular Debris	49	92.5	4	7.5	53	18.5
Core Flakes	112	84.2	21	15.8	133	46.5
Biface Flakes	94	94.0	6	6.0	100	35.0
Blade Flake	1	0.0			1	0.0
Total	256	89.2	31	10.8	287	100.0

stages of both tool production and core reduction.

Two types of preparation, abrasion and retouch, are commonly used to strengthen platforms and add control during flake removal. *Retouch* is the removal of small flakes along an edge by grinding perpendicular to its edge; *abrasion* results from parallel grinding.

Several absent platform categories have been designated to account for different presumed causalities. Absent (snap) indicates that the proximal portion of the flake, including the platform, is absent because of a snap fracture; absent (BIM) indicates a manufacture break. Collapsed platforms are instances where the platform has detached separately but flake measurements are still whole. Crushed platforms, shattered from the force applied but not detached, were also noted.

A significant number of platforms (between 50 and 65 percent) are absent, primarily because of manufacture breaks and collapsing (Table 20). LA 39998 and LA 104381 are distinct from LA 104382 in their comparatively higher numbers of cortical, single-facet, and multifacet platforms, as well as lower numbers of retouched and retouched/abraded. (Table 21, which shows the same data with missing categories removed, provides a more robust view of these trends.)

Platform types can be grouped into modified and unmodified categories (Table 22) based on the presence of abrasion or retouch. The former includes single-facet/abraded, multifacet/ abraded, retouched, abraded, and retouched/abraded. Absent categories (collapsed, crushed, snap, and manufacture breaks) have been removed. Unmodified platforms include cortical, single-facet, and multifacet. In this context, LA 39998 and LA 104381 are strikingly similar (77 percent of the observable platforms are unmodified). In contrast, more than half of the LA 104382 platforms are modified.

Moore (n.d.) suggests that although platform modification is sometimes used during core reduction, it is most frequently associated with systematic reduction, particularly bifacial reduction and tool manufacture. The relatively high number of biface reduction flakes recovered from LA 104382, associated with the high number of modified platforms, seems to indicate a stronger emphasis on systematic reduction than at the other two sites.

Table 20. Platform Type by Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Cortical	35	2.5	23	5.2	2	0.9
Single Facet	212	15.0	93	21.1	23	9.8
Single Facet and Abraded	16	1.1	14	3.2	3	1.3
Multifacet	200	14.1	56	12.7	17	7.3
Multifacet and Abraded	15	1.1	9	2.0	4	1.7
Retouched	44	3.1	18	4.1	18	7.7
Retouched and Abraded	51	3.6	10	2.3	16	6.8
Abraded	6	0.4			3	1.3
Collapsed	444	31.4	105	23.8	71	30.3
Crushed	1	0.1	2	0.5	2	0.9
Absent (snap)	78	5.5	14	3.2	8	3.4
Absent (Manufacture)	314	22.2	97	22.0	67	28.6
Total	1416	100.0	441	100.0	234	100.0

Table 21. Platform Type by Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Cortical	35	6.0	23	10.3	2	2.3
Single Facet	212	36.6	93	41.7	23	26.7
Single Facet and Abraded	16	2.8	14	6.3	3	3.5
Multifacet	200	34.5	56	25.1	17	19.8
Multifacet and Abraded	15	2.6	9	4.0	4	4.7
Retouched	44	7.6	18	8.1	18	20.9
Retouched and Abraded	51	8.8	10	4.5	16	18.6
Abraded	6	1.0			3	3.5
Total	579	100.0	223	100.0	86	100.0

Table 22. Platform Group by Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Unmodified	447	77.2	172	77.1	42	48.8
Modified	132	22.8	51	22.9	44	51.2
Total	579	100.0	223	100.0	86	100.0

Table 23. Core Morphology by Site

	LA 39998		LA 104381	
	(N)	(%)	(N)	(%)
Undifferentiated			1	16.7
Unidirectional	1	5.6		
Bidirectional	1	5.6		
Multidirectional	16	88.9	5	83.3
Total	18	100.0	6	100.0

Table 24. Material Type by Core Morphology, LA 104381

	Undifferentiated		Multidirectional		Total	
	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated			2	40.0	2	33.3
Rhyolite	1	100.0	1	20.0	2	33.3
Sedimentary Undifferentiated			1	20.0	1	16.7
Quartzitic Sandstone			1	20.0	1	16.7
Total	1	16.7	5	83.3	6	100.0

Table 25. Material Type by Core Morphology, LA 39998

	Unidirectional		Bidirectional		Multidirectional		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Chert Undifferentiated	1	100.0			11	68.8	12	66.7
Obsidian					2	12.5	2	11.1
Rhyolite					1	6.3	1	5.6
Metamorphic Undifferentiated			1	100.0			1	5.6
Quartzitic Sandstone					2	12.5	2	11.1
Total	1	5.6	1	6.5	16	88.9	18	100.0

Cores

Cores were recovered from LA 39998 and LA 104381, and seem to indicate an emphasis on expedient reduction. The majority of the cores (Table 23) have flakes removed from more than two platforms, and are classified as multidirectional. All of the cores on LA 104381 (Table 24) are of local cherts, igneous, or metamorphic materials. More than half of the cores on LA 39998 (Table 25) are local cherts, and three others are local metamorphic and igneous materials. Two obsidian multidirectional cores were also recovered from LA 39998.

Tool Use

Both formal and informal tool forms were identified within the assemblages. Unmodified flakes or angular debris that were utilized and exhibited edge damage or marginal retouch were classified as informal tools. Formal tools are artifacts that have been modified into a specific shape, or edge angle, for a particular use (e.g., unifaces, bifaces, and projectile points) (Moore n.d.).

Informal Tools

Utilized debitage was identified when edges exhibited patterns of use damage or marginal retouch. Wear patterns were carefully monitored, noted only for artifacts that appeared not to be affected by post-depositional processes, had consistent wear patterning, and were from a subsurface context.

The analysis identified nine different wear patterns including: unidirectional and bidirectional wear; unidirectional and bidirectional retouch; abrasion; unidirectional retouch and wear; bidirectional retouch and wear; unidirectional retouch and bidirectional wear; and bidirectional retouch and unidirectional wear. Flakes with consistent edge scars a minimum of 2 mm long were assigned to retouch categories. Flake or angular debris edges that appeared to be ground were considered abraded. Both unidirectional and bidirectional utilization may produce scars that include feathers, steps, and scallops less than 2 mm long. Moving an edge transversely across an object (scraping) is usually associated with the former and lateral (cutting) movements result in the latter.

Identifying informal tools can be problematic because it relies entirely on the identification of wear patterns along potential use surfaces. Several studies have shown that certain conditions (particularly raw material type, length of use prior to discard) can make these patterns difficult to observe. Three possible limitations to use-wear identification in the context of this analysis include: (1) insufficient magnification; (2) nature of tool use (Schutt 1980); and (3) limitations of material types (Foix and Bradley 1985; Toll 1978).

In order to evaluate wear patterns, Schutt (1980) performed a variety of informal tool experiments which simulated resource procurement and tool manufacturing activities. Flakes were used to process plant material, tan hides, flesh meat from bone, and make tools such as foreshafts and bone awls. The process of cutting and scraping yucca or hides produced little or no edge damage that could be considered use wear. Foreshafts were produced by scraping, slicing, and whittling pieces of hardwood. Some edge damage was noted, but no distinct wear patterns were visible. The only consistent edge damage occurred when lithic materials were worked intentionally against bone or other hard surfaces. The results of these experiments show that although flake tool utilization frequently (but not always) produces edge damage, it is not necessarily task specific. For example, unidirectional edge scars were the result of both cutting and scraping motions. The experiments did note that tools could be utilized longer by changing the angle in which they were worked against the medium, and that angles less than 40 degrees are better for cutting implements and those with over 40-degree angles were well suited for chopping.

Other experiments describe the difficulty in identifying use-wear patterns on informal tools in relation to material type and use. Rhyolite and quartzite have both proved to be effective and durable materials in resource procurement experiments, but often weather moderate use without demonstrating consistently observable patterns of wear (Foix and Bradley 1985; Toll 1978). Toward that end, identification of informal tools made from these materials may be problematic.

A small number of informal tools were identified in each of the three assemblages (Table 26). In each assemblage, there is evidence of both cutting (bidirectional wear) and scraping (unidirectional wear) activities, as well as marginal retouch indicating some level of tool preparation or maintenance.

Tables 27, 28, and 29 present data regarding raw material selection in these informal tool assemblages. Although medium-grained materials were utilized heavily on LA 104381, fine-grained materials have the most notable wear patterns and dominate the informal tool assemblages of each site.

More interesting is the relatively small number of informal tools recovered overall, particularly at LA 104381. Almost no evidence of bifacial, or any other systematic form of reduction is observable in the LA 104381 debitage assemblage. A reasonable assumption would be an emphasis on informal tool reduction, however of nearly 600 recovered chipped stone artifacts, only 18 showed evidence of wear. Further, with 43.3 percent of the assemblage composed of rhyolite (see Table 4) and 36 percent medium and coarse-grained materials (see Table 12), only seven informal tools of larger than fine-grained fabrics were identified. A similar argument can be constructed for the LA 39998 assemblage as well. We suggest that the limitations of rhyolite, in terms of wear-pattern development may have inhibited the identification of informal tools within these two assemblages, and that those identified likely represent a small sample of those actually recovered.

Edge angles of utilized edges were monitored as part of this analysis, and are presented in Appendix 3. No patterns concerning edge angles were identified that could be related to particular use-wear patterns, which is likely representative of our small sample size. Utilized debitage on LA 39998 had a mean edge angle of 44.5 degrees and a standard deviation of 13.7. LA 104381 had a mean of 52.7 degrees with a standard deviation of 14.1, and LA 104382 had a mean edge angle of 43 degrees and a standard deviation of 8.8.

Table 26. Utilized Debitage Wear Patterns

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Unidirectional Wear	19	48.7	7	38.9	2	33.3
Bidirectional Wear	6	15.4			2	33.3
Unidirectional Retouch	3	7.7	4	22.2	1	16.7
Bidirectional Retouch	2	5.1				
Unidirectional Retouch/ Unidirectional Wear	4	10.3	5	27.8	1	16.7
Bidirectional Retouch/ Bidirectional Wear	1	2.6	1	5.6		
Abrasion	3	7.7				
Bidirectional Retouch/ Unidirectional Wear	1	2.6	1	5.6		
Total	39	100.0	18	100.0	5	100.0

Table 27. Utilized Debitage Wear Pattern by Material Quality, LA 39998

	Glassy		Fine Grained		Medium Grained		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Unidirectional Wear	3	27.3	15	57.7	1	50.0	19	48.7
Bidirectional Wear	3	27.3	3	11.5			6	15.4
Unidirectional Retouch	1	9.1	2	7.7			3	7.7
Bidirectional Retouch	1	9.1	1	3.8			2	5.1
Unidirectional Retouch/ Unidirectional Wear			3	11.5	1	50.0	4	10.3
Bidirectional Retouch/ Bidirectional Wear			1	3.8			1	2.6
Abrasion	3	27.3					3	7.7
Bidirectional Retouch/ Unidirectional Wear			1	3.8			1	2.6
Total	11	28.2	26	66.7	2	5.1	39	100.0

Table 28. Utilized Debitage Wearpattern by Material Quality, LA 104381

	Glassy		Fine		Medium		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Unidirectional Wear	1	100.0	2	20.0	4	57.1	7	38.9
Unidirectional Retouch			3	30.0	1	14.3	4	22.0
Unidirectional Retouch and Unidirectional Wear			3	30.0	2	28.6	5	27.8
Bidirectional Retouch and Bidirectional Wear			1	10.0			1	5.6
Unidirectional Retouch and Bidirectional Wear			1	10.0			1	5.6
Total	1	5.6	10	55.6	7	38.9	18	100.0

Table 29. Utilized Debitage Wear Pattern by Material Quality, LA 104382

	Glassy		Fine Grained		Medium Grained		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Unidirectional Wear	1	100.0			1	50.0	2	33.3
Unidirectional Retouch			1	33.3			1	16.7
Bidirectional Wear			1	33.3	1	50.0	2	33.3
Unidirectional Retouch/ Unidirectional Wear			1	33.3			1	16.7
Total	1	100.0	3	100.0	2	100.0	5	100.0

Formal Tools (Figure 13)

All three formal tool assemblages are dominated by bifacial tool forms (Table 30). LA 39998 is the largest chipped stone assemblage overall, and has the most formal tools. One cobble tool (quartzite hammerstone), two unifaces (one local chert end scraper and one Luna blue middle stage uniface with no evidence of use), and two drills (both late stage, local chert bifaces with rotary wear) were recovered.

Undifferentiated bifaces were whole or broken bifaces for which no identified style or use could be defined. Patterns of wear other than those associated with manufacture were not observed, and did not meet criteria for classification in terms of function. Some biface fragments may be portions of projectile points, with further identification obscured because of breakage. Eighty-five undifferentiated bifaces were recovered from all three sites (Table 31), the majority are from LA 39998. Local materials (particularly cherts) are the most common materials. Obsidians and Luna blue agate were used as well.

Only a portion of the bifaces recovered were whole. Breakage forms were recorded and grouped as manufacture breaks (lateral snaps, reverse fractures, perverse fractures, outre passés, and edge bites) and snap fractures. Although manufacture breaks are distinct (caused by manufacture error), snap fractures can be caused by use, manufacture error, and post-depositional processes. While the number of manufacture breaks represents the number of fragments created directly by this activity, snap fractures represent a composite of possible factors, which in some cases may include manufacture or use.

Twenty-one (9.5 percent) of the bifaces recovered from LA 39998 were whole (Table 32); the majority of breaks were related to manufacture. LA 104381, which has a smaller assemblage (20 undifferentiated bifaces), has 6 manufacture breaks (30 percent). In both cases, bifacial tool manufacture is represented in breakage patterns.

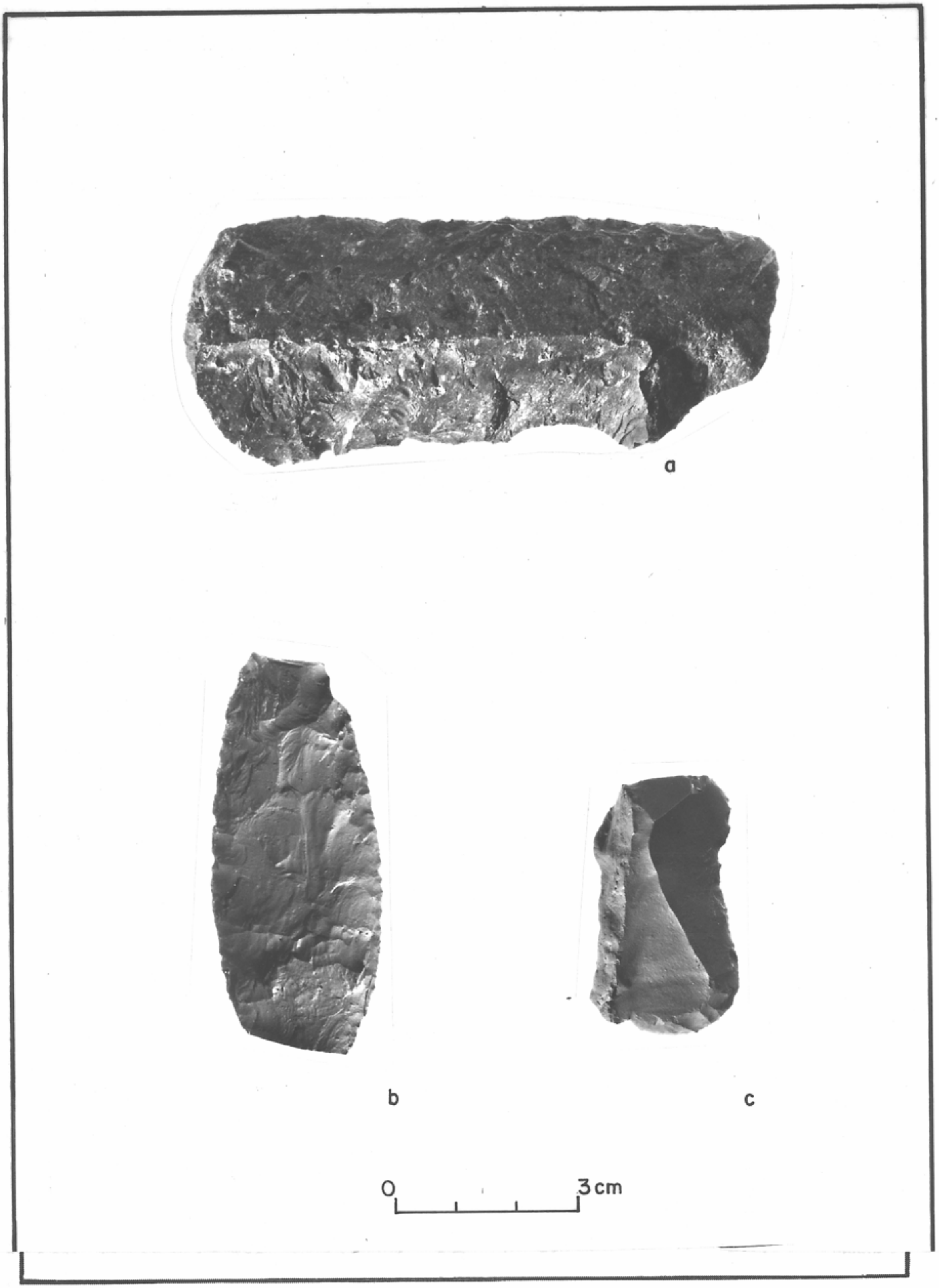

Figure 13. Selected formal chipped stone tools: (a) LA 104382, rhyolite side scraper; (b) LA 39998, chert undifferentiated biface; (c) LA 39998, chert end scraper.

Table 30. Formal Tool Morphologies

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Cobble Tool	1	0.8	1	2.7		
Side Scraper					1	33.3
End Scraper	1	0.8				
Uniface Undifferentiated	1	0.8				
Drill	2	1.7				
Biface Undifferentiated	64	52.0	20	54.1		
Projectile Points	55	44.0	16	43.2	2	66.7
Total	124	100.0	37	100.0	3	100.0

Table 31. Biface Material Type by Site

	LA 39998		LA 104381	
	(N)	(%)	(N)	(%)
Chert Undifferentiated	33	51.6	12	60.0
Luna Blue Agate	2	3.1	3	15.0
Silicified Wood	2	3.1	1	5.0
Obsidian	13	20.3	2	10.0
Igneous Undifferentiated	1	1.6		
Nonvesicular Basalt	3	4.7		
Rhyolite	10	15.6	2	10.0
Total	64	100.0	20	100.0

Table 32. Undifferentiated Biface Condition

	Whole		Broken				Total	
			Manufacture		Snap			
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
LA 39998	21	9.5	27	42.2	16	25.0	64	100.0
LA 104381	7	35.0	6	30.0	7	35.0	20	100.0
LA 104382	1	100.0					1	100.0

Projectile Points

The projectile point analysis used here includes a large number of qualitative and quantitative variables to allow comparison of different stylistic and functional elements. Although the projectile point assemblage from these sites is not large enough to effectively consider such comparisons, these variables were monitored to allow their incorporation into larger, regional data bases at a later point.

Seventy-three projectile points or point fragments were recovered during the project. Since the majority of the points were broken, most were unidentifiable (Table 33). Five traditional style categories were identified (En Medio, Chiricahua, San Pedro, San Augustin, and Small Mogollon Side Notched), and were based on descriptions provided by the OAS standardized analysis (OAS Staff 1995). These categories are not necessarily indicative of cultural and temporal affiliations. By assigning these categories, we imply only a stylistic consistency.

The assemblage from LA 39998 consists of 55 projectile points (12 whole and 43 fragments), the majority of which appear to be Archaic. Eighteen of these were classified under recognized Archaic (Oshara and Cochise Traditions) designations; Augustin (n = 3), Chiricahua (n = 4), San Pedro (n = 7), and En Medio (n = 4). Thirty-six projectile points were unidentified (Figs. 14 and 15). Fifteen (11 corner-notched) unidentified points are large fragments from probable Archaic dart points that did not fit into a recognized style. Five of the unidentified small points (3 of which were corner-notched) may have been arrows, and 16 unidentified points were too fragmented to assign size or possible function.

Sixteen projectile points were recovered from LA 104381 (6 whole and 10 fragments) 12 of which were unidentified. Among them were eight large points (five corner-notched and one side-notched) and four small points (three of which are side-notched) (Fig. 16). The four small unidentified projectile points are similar in style to "Cottonwood Triangular" and "Desert Side Notched" arrow points that have been associated with Navajo sites in the Four Corners Region (Brown and Hancock 1992); they may in fact be representative of general Athabascan styles. The assemblage also includes three Late Archaic style points (one En Medio, and two San Pedro), and one small arrow point (Small Mogollon Side Notched).

Two large projectile point fragments were recovered from LA 104382, both of which were unidentified (Fig. 17). These may be Archaic dart points, but were too fragmented to assign known styles. Both points were surface collected; one was recovered 30 m from the main artifact concentration, and may not be associated with cultural deposits from this site.

Projectile point breakage patterns were recorded and consist of manufacture breaks (lateral snaps, reverse fractures, perverse fractures, outrepasses, and edge bites), use breaks (impact fractures, haft snaps), and other (snap fractures) (Table 34). Manufacture breaks are distinct, and are caused only by manufacture or reduction error. Use break patterns are also distinct, however, snap fractures can be caused by use or manufacture error, or post-depositional processes. Manufacture categories represent the number of fragments caused directly by manufacture; use categories indicate those breaks caused directly by utilization; and other represents snap fractures, related to a composite of possible factors (including use or manufacture).

Portions (Table 35) were recorded either as whole, base, midsection, lateral/edge, tip, or tang. When combined with breakage patterns, discarded portions of projectile points can give some

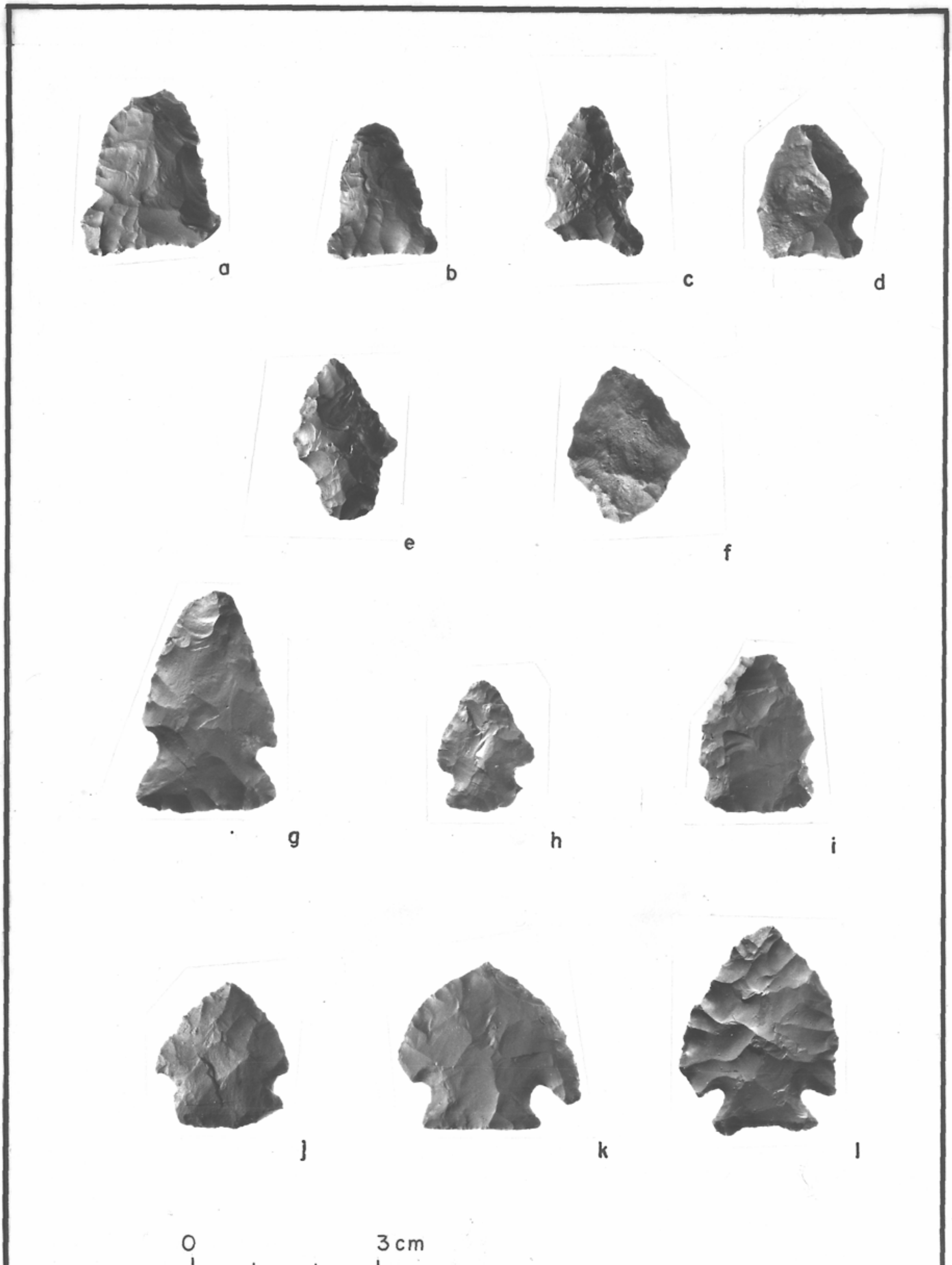

Figure 14. Selected projectile points, LA 39998; (a-d) Chiricahua points, (e-f) Agustín points, (g-i) San Pedro points, (j-l) En Medio points.

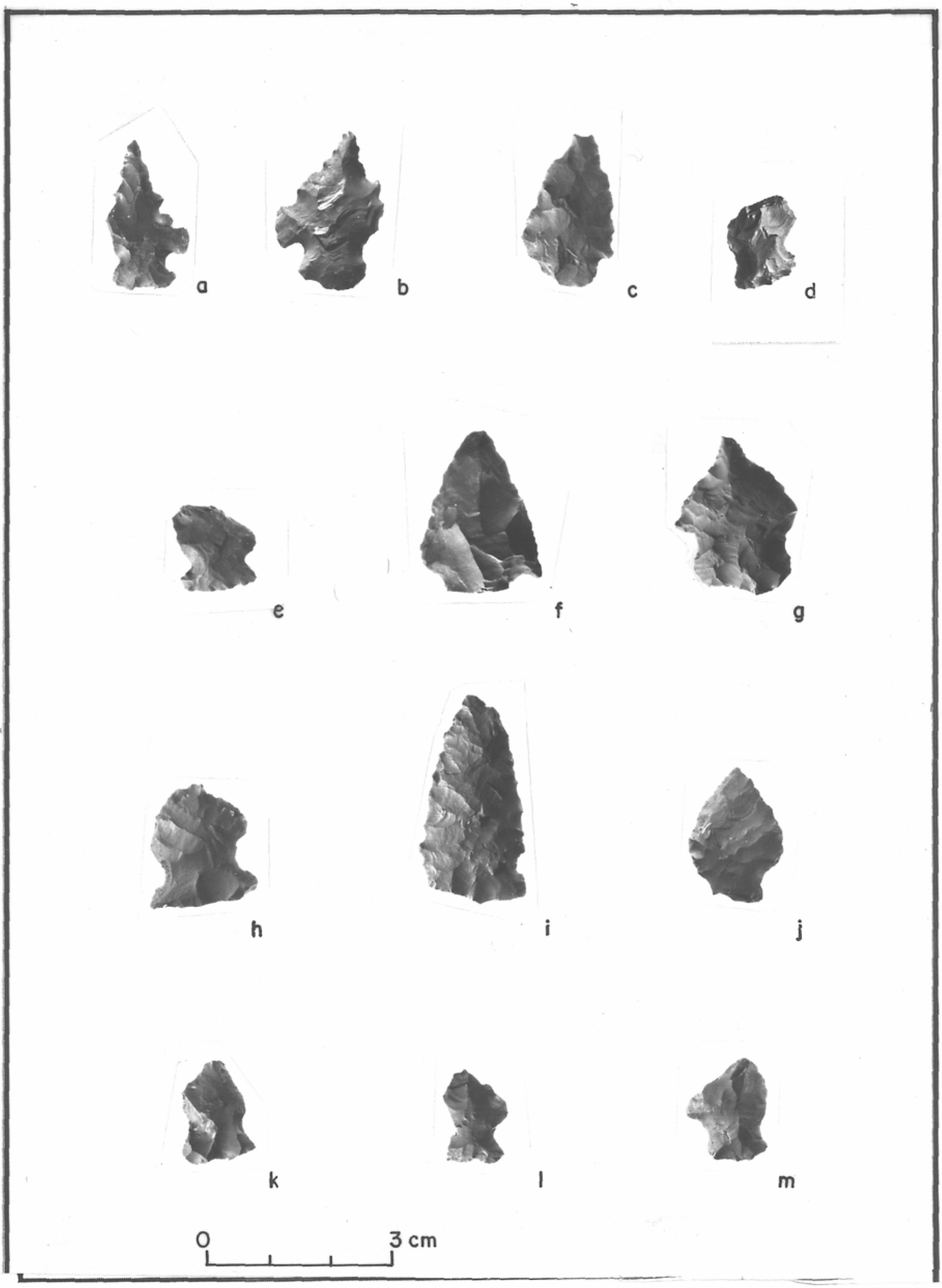

Figure 15. LA 39998 projectile points; (a-g) unidentified, (h-i) unidentified side-notched points, (j-m) unidentified small points.

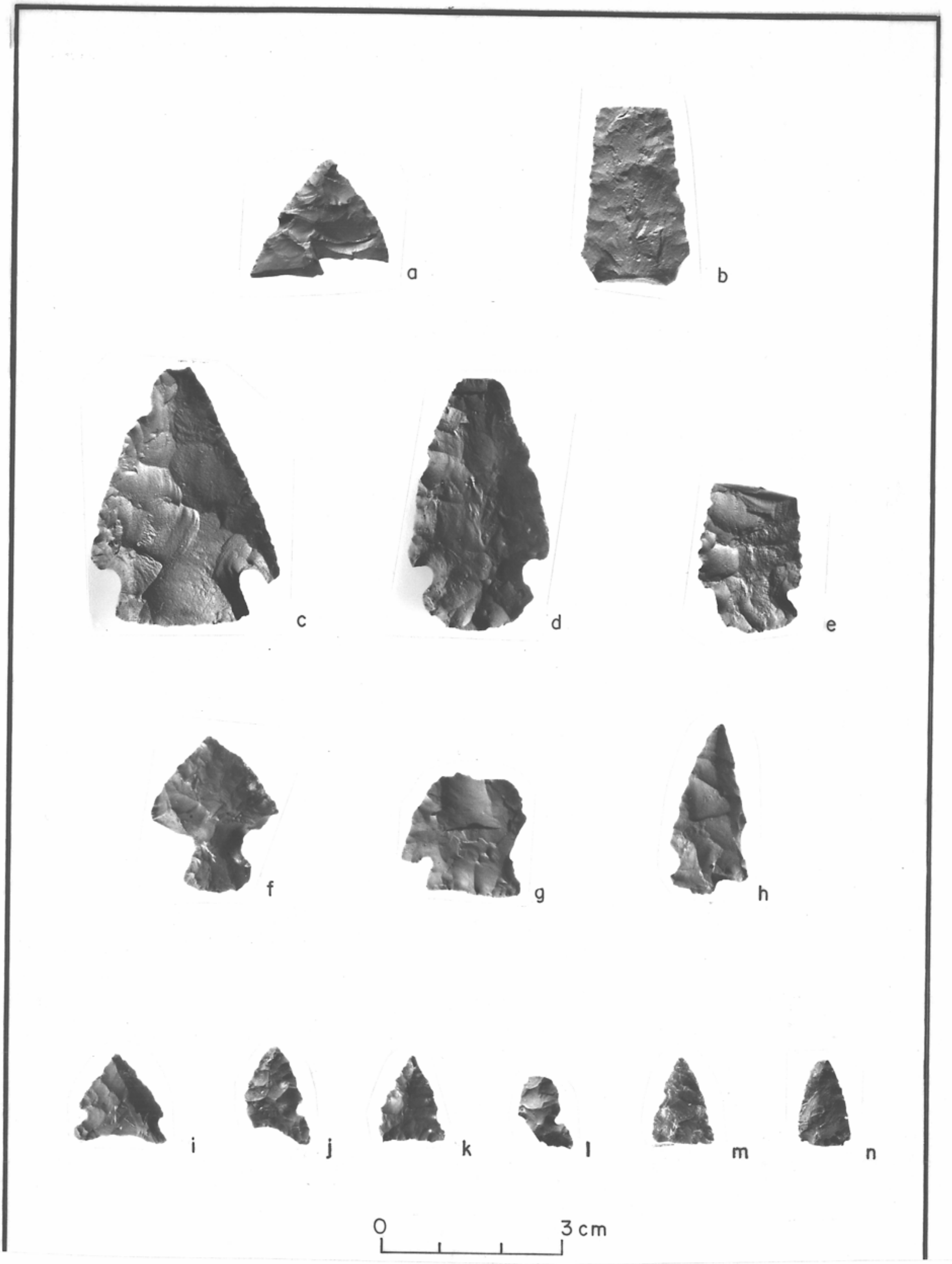

Figure 16. Projectile points; (a-b) LA 104382, unidentified large (atlatl) points, (c) LA 104381, En Medio point, (d-e) LA 104381, San Pedro points, (f-g) LA 104381, unidentified large corner-notched points, (h-i) LA 104381, unidentified corner-notched points, (j-k) LA 104381, Desert side-notched, (l-m) LA 104381, Cottonwood triangular, (n) LA 104381, Mogollon side-notched.

indication of site activities. Projectile point tips with use breaks such as impact fractures or haft snaps, for example, were most likely returned to a site in meat packages. Bases with haft snap fractures were likely removed from a shaft for retooling or hafting replacement after use (Keeley 1982).

Maintenance/reworking is evident on nine projectile points. One was renotched, eight were reworked along the blade edge, one of which had rotary wear on the tip and may have been utilized as a drill. Projectile point tips (n = 2) and midsection-tips (n = 3) were recovered, which could have been returned to the site in meat packages. The debitage from bifacial reduction that occurred on this site may also account for projectile point manufacture or maintenance.

LA 104381 showed little evidence of projectile point manufacture or maintenance. Two basal portions were recovered (Table 35), one had a use-related fracture, and one an indeterminate snap; all three base-midsection portions had impact fractures. The distal ends of both a tip and a tip-midsection are undamaged, and were separated from the midsection-basal portions by indeterminate snap fractures. One obsidian projectile point was reworked along the blade and appeared to be renotched.

One projectile point from LA 104382 had a manufacture break (lateral snap), and may have been broken during manufacture or maintenance. The other point was a midsection with an impact fracture and a haft snap, most likely broken in use.

Cherts are the most commonly selected material and with Luna blue agate make up 65.5 and 75 percent of the LA 39998 and LA 104381 projectile point assemblages (Table 36). Obsidians were used for 8 (14.5 percent) of the points recovered from LA 39998, and 2 (12.5 percent) of those from LA 104381. Other materials include basalt, rhyolite, and quartzitic sandstone. Point fragments from LA 104382 were made of local chert and rhyolite.

Table 33. Projectile Point Style by Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Preform	1	1.8				
Unidentified	36	65.5	7	43.8	2	100.0
Unidentified Small			4	25.0		
En Medio Style	4	7.3	1	6.3		
Chiricahua Style	4	7.3				
San Pedro Style	7	12.7	2	12.5		
San Augustin Style	3	5.5				
Small Mogollon Side Notched			1	6.3		
Total	55	100.0	16	100.0	2	100.0

Table 34. Projectile Point Break Pattern By Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Use	11	20.0	4	25.0	1	50
Manufacture	9	16.4	3	18.8	1	50
Other	24	43.6	4	25.0		
Whole	11	20.0	5	31.3		
Total	55	100	16	100	2	100

Table 35. Projectile Point Portion by Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Whole	12	21.8	6	37.5		
Base	6	10.9	2	12.5		
Base and Midsection	20	36.4	3	18.8		
Base and Midsection Lateral Fragment	1	1.8				
Base and Edge			1	6.3		
Midsection	10	18.2	2	12.5	1	50.0
Midsection and Tip	3	5.5	1	6.3		
Tip	2	3.6	1	6.3	1	50.0
Tang	1	1.8				
Total	55	100.0	16	100.0	2	100.0

Conclusions

Although LA 104382 appears to have been produced by a single, short-term occupation, LA 39998 and LA 104381 are composed of mixed deposits representing multiple occupations by different cultural groups in different temporal contexts. Radiocarbon data and diagnostic artifacts (ceramics and projectile points) provide strong implications for different occupational episodes, but, because of site conditions (deflation and erosion) cannot be tied spatially to the remainder of the artifact assemblages. As a result, these inferred cultural-temporal components cannot be treated in terms of their specific contribution to the overall artifact assemblage collected at each of these two sites. Because these assemblages are composited by differential and unrelated occupations, some evidence of the variety of site activities is likely masked.

Table 36. Projectile Point Material Type by Site

	LA 39998		LA 104381		LA 104382	
	(N)	(%)	(N)	(%)	(N)	(%)
Chert	29	52.7	10	62.5	1	50.0
Luna Blue Agate	7	12.7	2	12.5		
Silicified Wood	4	7.3				
Obsidian	8	14.5	2	12.5		
Basalt	2	3.6				
Rhyolite	3	5.5	2	12.5	1	50.0
Quartzitic Sandstone	2	3.6				
Total	55	100.0	16	100.0	2	100.0

LA 39998

The majority of the debitage suggests an emphasis on nonsystematic core reduction, although nearly 10 percent were classified as biface reduction debris. Platform modification was observed within the assemblage, but was not common, further suggesting limited emphasis on systematic reduction forms. Most of the raw material (87 percent) was from local sources, and cortex studies suggest that it was collected from drainage gravels.

Almost all of the formal tool assemblage was bifacially produced and included projectile points, undifferentiated bifaces, and drills. A unifacial end scraper and an undifferentiated uniface were also recovered. Several projectile points showed signs of maintenance/reworking, as well as both manufacture and use breaks. The majority of undifferentiated bifaces were fragmentary, and many showed evidence of manufacture breaks. This suggests that formal tools, particularly bifaces, were produced and maintained on the site. In addition, basal portions of projectile points with haft snaps indicate rehafting.

Diagnostic ceramics and radiocarbon data presented in other chapters suggest two distinct cultural-temporal occupation time frames, however, the chipped stone data does not necessarily support either, and instead implies a third. Projectile points were the only diagnostic tool form recovered, and suggest primarily middle and late Archaic occupations. Of 55 projectile points or point fragments, 18 were consistent with Archaic styles, and 15 unidentifiable fragments were from large points of possible Archaic origin. With the exception of five small, unidentified points (probably arrow points), no styles consistent with other temporal-cultural affiliations were identified within the assemblage. Although the cultural/temporal placement of the small points is not clear, they are most likely associated with a later time period.

Since cultural deposits were shallow and disturbed, occupational components were not distinguishable within the assemblage as a whole. As a result, it is difficult to ascertain potential site activities since differential site functions across occupational episodes are likely masked by the condition of the site. The reduction patterns imply an emphasis on nonsystematic core reduction which is often associated with expedient tool technologies; there is significant evidence to imply some production and maintenance of bifacial tools. The presence of biface reduction debris, manufacture breaks in generalized bifaces and bifacial tools, as well as evidence of repair or resharpening on projectile points indicates both the production and maintenance of these tool forms. Although only a small number of informal tools were recognized, it is likely many forms of wear were not observable within this analysis.

LA 104381

Data provided in other chapters imply multiple occupations with distinct temporal and cultural affiliations; radiocarbon and ceramic information have isolated at least three occupation periods including seventh century (unknown cultural affiliation), Reserve phase Mogollon, and proto-historic Apache. Because the cultural deposits on the site were mixed and quite shallow, it was not possible to discern components, spatially or within the nondiagnostic portions of the assemblage. Seven large projectile points were recovered, three of which were similar in style to late Archaic (San Pedro and En Medio) styles. One projectile point was stylistically consistent with a Mogollon Side Notched, and four small projectile points recovered near Feature 1 were similar in style to Cottonwood Triangular and Desert Side Notched style points; elsewhere the latter two styles have been associated with Athabascan groups (Brown and Hancock 1992).

All of the formal tools in the assemblage are bifacial (either undifferentiated bifaces or projectile points), yet the debitage indicates an emphasis on nonsystematic, or expedient, core reduction. Only a small portion of the assemblage (less than 3 percent) was classified as biface reduction material, and although platform preparation was noted, it was not common. Since almost none of the debitage can be associated with bifacial reduction or retouch, the maintenance or production of the recovered formal tools does not seem to have been a major site activity.

Expedient use of chipped stone materials would seem the most logical explanation for the debitage assemblage, although only a small number (n = 18) of debitage had observable wear patterns, and were classified as informal tools. The magnification available (15x to 80x) during this analysis was most likely insufficient to effectively monitor use-wear patterns. Further, a large portion of the debitage was local rhyolite, which is quite durable, and unlikely to show obvious edge damage with moderate use. Experimental data suggests that chipped stone materials consistently produce edge damage only when worked against hard materials such as bone or hardwood (Schutt 1980), and that materials such as rhyolite do not consistently accrue observable edge damage (Foix and Bradley 1985). Use of expediently produced tools in resource procurement activities, such as processing of plant or soft animal material, would not likely produce wear patterns observable in the context of this analysis.

LA 104382

Thirty-five percent of the debitage recovered from LA 104382 was classified as biface reduction flakes: coupled with a high frequency of modified platforms, morphological distributions suggest a strong emphasis on systematic, bifacial reduction. Within the debitage assemblage, only a very small portion shows evidence of utilization. Following Kelly (1988), this may indicate that bifacial reduction debris resulted from bifacial tool manufacture or maintenance rather than bifacial core use within a curated strategy.

Because of its small size, the formal tool assemblage does not defend or dispute this argument. Three formal tools were collected from a surface context, including two projectile point fragments and a large end scraper. Although both projectile point fragments are large, and are probably atlatl dart points, it is difficult to place this site temporally based on style. Further, the points are relatively dissimilar stylistically, and do not intuitively appear to be from similar traditions. Only one point was collected from the main site concentration, the other was collected 30 m from the main surface scatter of the site. The end-scraper does not lend any temporal or cultural information.

This site seems to have been a short-term, logistical camp, with primary emphasis placed on biface production and maintenance. Although one possible Archaic projectile point was collected from the main artifact concentration, it is difficult to assign temporal or cultural affiliation based on the assemblage characteristics.

GROUND STONE ASSEMBLAGE

Dorothy A. Zamora

The ground stone assemblage for the Datil project derives from three sites: LA 39998, LA 104381, and LA 104382. LA 39998 is a multicomponent site with Archaic and Pueblo projectile points, and Mogollon, Anasazi, and protohistoric ceramics and ground stone. LA 104381 is also a small multicomponent site with Mogollon brown wares, Athabascan ceramics, and Pueblo and Archaic projectile points. LA 104382 is a small lithic artifact site that contains lithic debris and small amounts of ground stone.

The ground stone analysis monitored several attributes (Table 37) adapted from the Standardized Ground Stone Artifact Analysis manual used by the Office of Archaeological Studies (OAS Staff 1994). The analysis form was modified slightly by adding some categories thought to be helpful in interpreting the function of the artifacts. These include Grid N and Grid E, ground surface length, ground surface width, ground surface area, and striations. Provenience information was also added.

Table 37. Monitored Ground Stone Attributes

ATTRIBUTE ABBREVIATIONS	ATTRIBUTE DEFINITIONS
FS	Field Specimen Number
Le	Excavation Level
Grid N E	Designated grid number North and East
Mat Type	Material Type
Mat. Qual	Material Texture and Quality
Art. Morph	Artifact Preform Morphology
Shape	Type of Modification to shape raw material
Length / DC	Length of Artifact in cm and if dimension is complete
Width / DC	Width of Artifact in cm and if the dimension is complete
Thickness / DC	Thickness of Artifact in cm and if the dimension is complete
Weight	Weight of the Artifact in km
Met Dep	Metate Depth or depth of the ground surface
Mano CX	Mano Cross-Section Form
Plan View Form	Plan View Outline Form
Flkd Surf Marg	Flaked Surface or Margin Present
Heat	Presence or Absence of heat related changes
Use #	Number of use surfaces
Fun	Artifact Function
Grnd Surf CX	Ground Surface Cross-Section

ATTRIBUTE ABBREVIATIONS	ATTRIBUTE DEFINITIONS
Grnd Surf Shrp	Presence or Absence of ground surface sharpening
Grnd Surf Len	Ground Surface Length in cm
Grnd Surf Wid	Ground Surface Width in cm
Grnd Surf Area	Ground Surface in square cm
1st Wear	Primary Wear on the artifact
2nd Wear	Secondary Wear if any
Striat	Type of Striations
Alter	Any Type of Alterations made to the artifact
Adhes.	Any Material Adhering to the surface of the artifact

Table 38. LA 39998 Ground Stone and Raw Material Types

Count Row Percent Colum Percent	MATERIAL TYPE							ROW TOTAL
	Nonvesicular Basalt	Vesicular Basalt	Granite	Rhyolite	Sandstone	Quartzite Undifferentiated	Quartzitic Sandstone	
GROUND STONE TYPE								
Indeterminate fragment			1 7.1% 33.3%	6 42.9% 28.6%	7 50.0% 63.6%			14 100.0% 30.4%
Hammerstone	1 100.0% 25.0%							1 100.0% 2.2%
Mano, indeterminate	1 33.3% 25.0%		1 33.3% 33.3%			1 33.3% 33.3%		3 100.0% 6.5%
Mano, One-hand	2 22.2% 50.0%			2 22.2% 9.5%		2 22.2% 66.7%	3 33.3% 100.0%	9 100.0% 19.6
Metate, indeterminate				4 80.0% 19.0%	1 20.0% 9.1%			5 100.0% 10.9%
Metate, trough, indeterminate				4 100.0% 19.0%				4 100.0% 8.7%
Metate, slab		1 10.0% 100.0%	1 10.0% 100.0%	5 50.0% 23.8%	3 30.0% 27.3%			10 100.0% 21.7%
GRAND TOTAL	4 8.7% 100.0%	1 2.2% 100.0%	3 6.5% 100.0%	21 45.7% 100.0%	11 23.9% 100.0%	3 6.5% 100.0%	3 6.5% 100.0%	46 100.0% 100.0%

The mano type (one-hand or two-hand) was determined by plotting the length and the width of the whole artifacts. The plot did not show a bimodal distribution between the sizes of the whole manos, but it did show a gradient distribution that ranged from 8.2 cm to 11.9 cm in length and 5.3 cm to 12.5 cm in width. Since measurements indicate fairly short lengths, it is safe to say that the manos from the Datil ground stone assemblage are all one-hand manos. The metate type was determined by the shape and depth of the ground surface. Most common are the slab metates that were expediently used and very fragmented, possibly from weathering. Some trough metate fragments were also recovered but were usually small end fragments. One definite basin metate was recovered from LA 104381.

LA 39998

This multicomponent site produced 46 ground stone artifacts (12 manos, 19 metates, 1 hammerstone, and 14 indeterminate fragments). The artifacts were clustered in two distinct areas (Fig. 17). No features were found in either of the two areas, although charcoal was present in the fill. No differences in types of ground stone were found between the two areas. The excavated areas were no more than 25 cm deep in most cases. The most commonly used materials (Table 38) are rhyolite (44.7 percent) and quartzitic sandstone (23.4 percent). Both materials are readily available in the area. The quartzitic sandstone is found in the form of river cobbles in White House Canyon, and the rhyolite outcrops in the canyon walls. Much of the ground stone from LA 39998 was fragmented; however, in most cases the artifacts were identifiable. All of the manos were one-hand manos except for two that were too fragmented to determine and were therefore placed in the indeterminate category. In the metate category four fragments were indeterminate; the rest were either classified as slab or trough metates. There were also 14 indeterminate ground stone fragments that were too small to be placed in any of the above categories.

In addition to monitoring the wear, we also monitored the type of striations that were found on the artifact. Table 39 shows that 40 percent of the manos had widthwise striations and 53.3 percent of the metates exhibited lengthwise striations. One slab metate had circular wear patterns and one trough metate fragment showed both length and widthwise wear. Rotary grinding motion is assumed to be used in basin metates and back and forth motion for trough and slab metates (Zier 1981). Thermal modification was also monitored and 10.9 percent of the assemblage showed reddening or reddening and fracturing (Table 40), probably from being reused as hearth stones.

Table 39. LA 39998 Ground Stone Striations

	None		Lengthwise		Widthwise		Circular		Random		Lenght and Widthwise		(N)	(%)
	N	%	N	%	N	%	N	%	N	%	N	%		
GROUND STONE TYPE														
Indeterminate fragment	2	33.3	6	37.5	6	30.3	.	.	.	.	.	.	14	30.4
Hammerstone	1	16.7	.	.	.	.	.	.	.	.	.	.	1	2.2
Mano, indeterminate	.	.	.	.	3	15.0	.	.	.	.	.	.	3	6.5
Mano, one-hand	1	16.7	1	6.3	5	25.0	.	.	1	50.0	1	100.0	9	19.6
Metate, indeterminate	1	16.7	2	12.5	2	10.0	.	.	.	.	.	.	5	10.9
Metate, trough	.	.	2	12.5	1	5.0	.	.	1	50.0	.	.	4	8.7
Metate, slab	1	16.7	5	31.3	3	15.0	1	100.0	.	.	.	.	10	21.7
TOTAL	6	100.0	16	100.0	20	100.0	1	100.0	2	100.0	1	100.0	46	100.0

Table 40. LA 39998 Ground Stone with Heat Alterations

	HEAT								TOTAL	
	Indeterminate		None		Reddened		Reddened and Fractured		(N)	(%)
	Count		Count		Count		Count			
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)		
GROUND STONE TYPE										
Indeterminate, fragment	1	100.0	12	30.0	1	25.0	.	.	14	30.4
Hammerstone	.	.	1	2.5	.	.	.	.	1	2.2
Mano, indeterminate	.	.	3	7.5	.	.	.	.	3	6.5
Mano, one-hane	.	.	8	20.0	1	25.0	.	.	9	19.6
Metate, indeterminate	.	.	4	10.0	1	25.0	.	.	5	10.9
Metate, trough	.	.	3	7.5	.	.	1	100.0	4	8.7
Metate, slab	.	.	9	22.5	1	25.0	.	.	10	21.0
TOTAL	1	100.0	40	100.0	4	100.0	1	100.0	46	100.0

Use of Ground Stone at LA 39998

The ground stone from LA 39998 was probably used for processing seeds, nuts, and possibly fibers because of reasons discussed below. The flotation samples collected did not reveal the use of cultigens on the site. If we look at the metates on the site we find that 21.7 percent of the assemblage are slab metates and 8.7 percent are trough metates. All the metates were from unshaped and unprepared stone and exhibited expedient wear; it is not known if the trough metates are opened-ended because they are fragmented. The slab metates, as Lancaster (1983) states, are generally used for processing wild food. He also assumes that one-hand manos are also used for wild food processing. But what about the trough metates? If we accept the criteria that trough metates and two-hand manos are used for grinding corn (Hard 1990; Lancaster 1983; Phagan 1988), then we would have to assume that the site inhabitants were grinding corn. However, there is no corroborating evidence to support this hypothesis. It is possible that since the site is likely an Archaic/Athabascan camp site, the trough metates may have been already fragmented and the pieces curated from elsewhere by the site occupants. The information that we have collected from the research and analyses seems to support the hypothesis of one-hand manos and slab metates being used to process wild resources.

All the manos and some of the metates exhibited polishing. Adams (1988) has suggested that polishing can sometimes be a criterion of hide processing. After looking at the mano assemblage from LA 39998 it was determined that the manos were used for processing wild plant resources and not hides. According to Adams (1988:308), the stones used in processing hides should be half the length of manos used for other purposes and the grains should seem as though they have melted together.

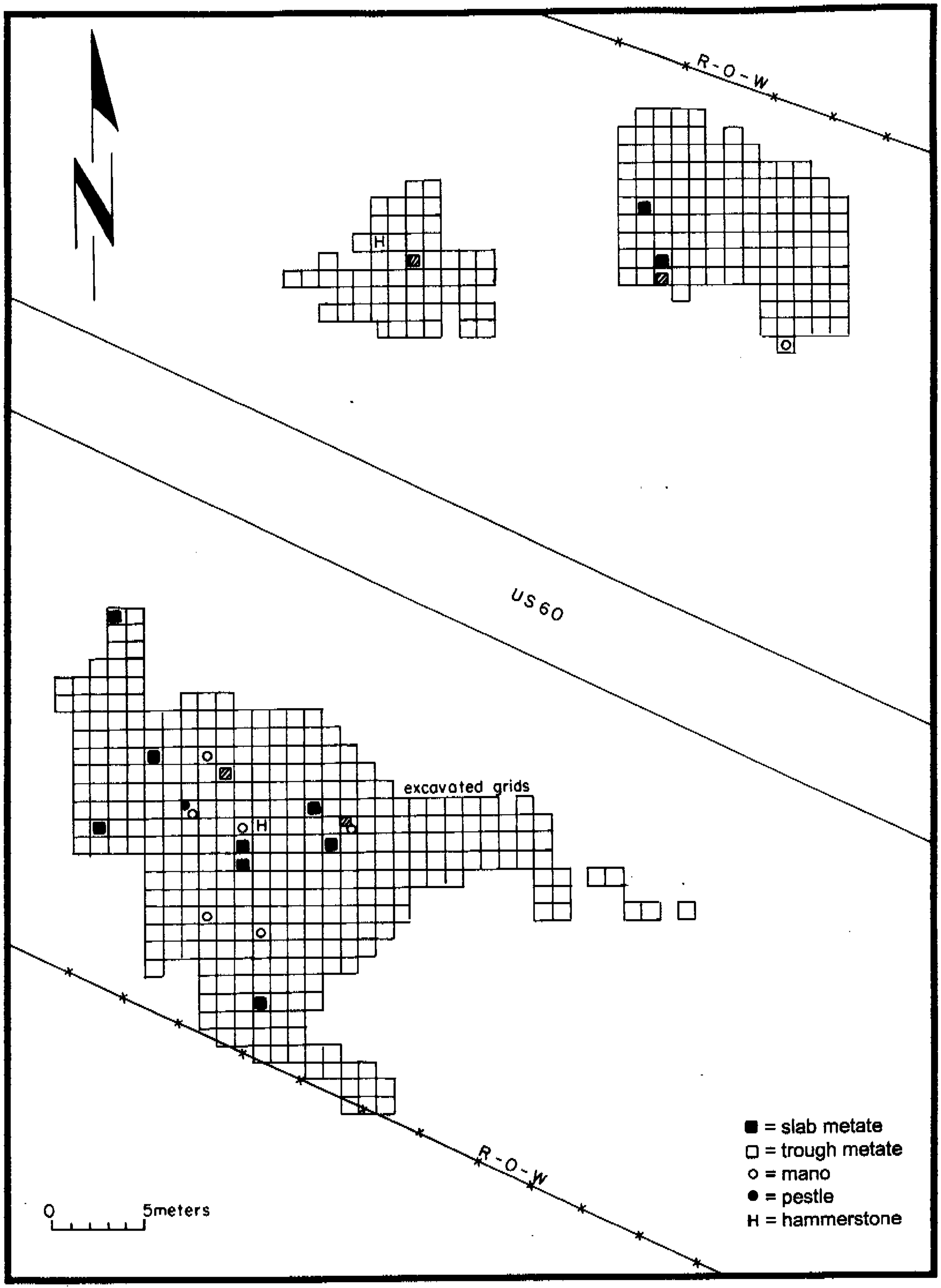

Figure 17. Ground stone distribution, LA 104381.

Three other ground stone artifacts were also examined during the analysis and consisted of two hammerstones and one pestle. The pestle is made of a micaceous schist and the hammerstones of basalt and of quartzite. The pestle is ground the length of the artifact and battered on one edge. The analyses of the hammerstones shows that they were originally one-hand manos that were later used as hammerstones. These artifacts exhibit extensive battering along the edges. We believe that these hammerstones may have been used for sharpening the metates and also for crushing seeds and nuts and not necessarily for flaking stone.

LA 104381

LA 104381 is divided into two areas. Area One, on the crest of the hill, contained a large, burned, use area and two surface hearths. Area Two is located downslope on a flat surface at the base of the hill. This area did not have any features. LA 104381 had half the amount of ground stone of LA 39998 with a total of 26 ground stone artifacts (10 manos, 11 metates, 1 shaped slab, 1 abrading stone, and 3 indeterminate fragments) recovered. On this site the most commonly used materials were basalt (46.2 percent) and sandstone (19.2 percent) (Table 41). Most of the ground stone clusters around the features on top of the hill. Feature 1 is a large burned use area that contained three slab metates and four one-hand manos. Feature 2 is a hearth that contained a one-hand mano, and Feature 3, another hearth, contained an abrading stone made of tuff and two one-hand manos and one slab metate. In the downslope area there were four ground stone fragments, of which three were on the edge of the road cut and one on the site surface (Fig. 18).

Table 41. LA 104381 Ground Stone Frequencies By Material Type

Material Type	Indeterminate Fragment	Abrading Stone	Shaped Slab	Mano, Indeterminate	Mano, One-Hand	Metate, Indeterminate	Metate, Basin	Metate, Slab	Total
Nonvesicular basalt	3 25.0% 100.0%	.	.	1 8.3% 20.0%	2 16.7% 40.0%	1 8.3% 50.0%	.	5 41.7% 62.5%	12 100.0% 46.2%
Vesicular basalt	.	.	.	.	.	.	1 100.0% 100.0%	.	1 100.0% 3.8%
Granite	.	.	.	.	.	1 100.0% 50.0%	.	.	1 100.0% 3.8%
Rhyolite	.	.	.	1 33.3% 20.0%	1 33.3% 20.0%	.	.	1 33.3% 20.0%	3 100.0% 11.5%
Tuff	.	1 20.0% 100.0%	.	.	.	.	.	.	1 100.0% 3.8%
Sandstone	.	.	1 20.0% 100.0%	1 20.0% 20.0%	1 20.0% 20.0%	.	.	2 40% 25.0%	5 100.0% 19.2%
Quartzitic Sandstone	.	.	.	2 66.7% 40.0%	1 33.3% 20.0%	.	.	.	3 100.0% 11.5%

Total	3 11.5% 100.0%	1 3.8% 100.0%	1 3.8% 100.0%	5 19.2% 100.0%	5 19.2% 100.0%	2 7.7% 100.0%	1 3.8% 100.0%	8 30.8% 100.0%	26 100.0% 100.0%

Use of Ground Stone from LA 104381

The ground stone from this site was probably used in processing wild foods rather than domesticates. The flotation samples from hearths yielded modern vegetation such as piñon, juniper, and modern weeds. However, one burned corn cob fragment was found in Hearth 1. There is no evidence that the occupants of the site were farming corn and the wear patterns on the ground stone do not exhibit the type of wear that is found in corn processing. The pollen from the basin metate contained grains of oak species, suggesting the processing of acorns. All the metates and manos are fragmented. The slab metates are irregularly shaped and the manos are oval one-hand manos. The basin metate is an irregular piece of basalt that has not been shaped. The basin depth is 45 cm. The concavity of the metate is the only place that shows grinding, exhibiting a circular use-wear pattern, consistent with use for acorn processing.

There was a large amount of fire-cracked rock present on this site. Also, 15 percent of the ground stone assemblage exhibited some type of heat alteration (Table 42). These artifacts were usually found in a hearth or around the hearth mixed with the fire-cracked rock. All of the ground stone that was heat altered was fire-cracked but it could still be identified. Some of the spalled fragments were pieced together and analyzed as one artifact.

Table 42. LA 104381 Ground Stone with Heat Alterations

	HEAT										TOTAL	
	Indeterminate		None		Reddened		Fractured		Reddened and Fractured		N	%
	N	%	N	%	N	%	N	%	N	%		
GROUND STONE TYPE												
Indeterminate fragment	.	.	2	14.3	1	33.3	.	.	.	.	3	11.5
Abrading stone	.	.	1	7.1	.	.	.	.	.	.	1	3.8
Shaped slab	.	.	1	7.1	.	.	.	.	.	.	1	3.8
Mano, Indeterminate	1	50.0	2	14.3	.	.	.	.	2	33.3	5	19.2
Mano, one-hand	.	.	3	21.4	.	.	.		2	33.3	5	19.2
Metate, indeterminate	.	.	2	14.3	.	.	.	.	.	.	2	7.7
Metate, basin	.	.	1	7.1	.	.	.	.	.	.	1	3.8
Metate, slab	1	50.0	2	14.3	2	66.7	1	100.0	2	33.3	8	30.8
TOTAL	2	100.0	14	100.0	3	100.0	1	100.0	6	100.0	26	100.0

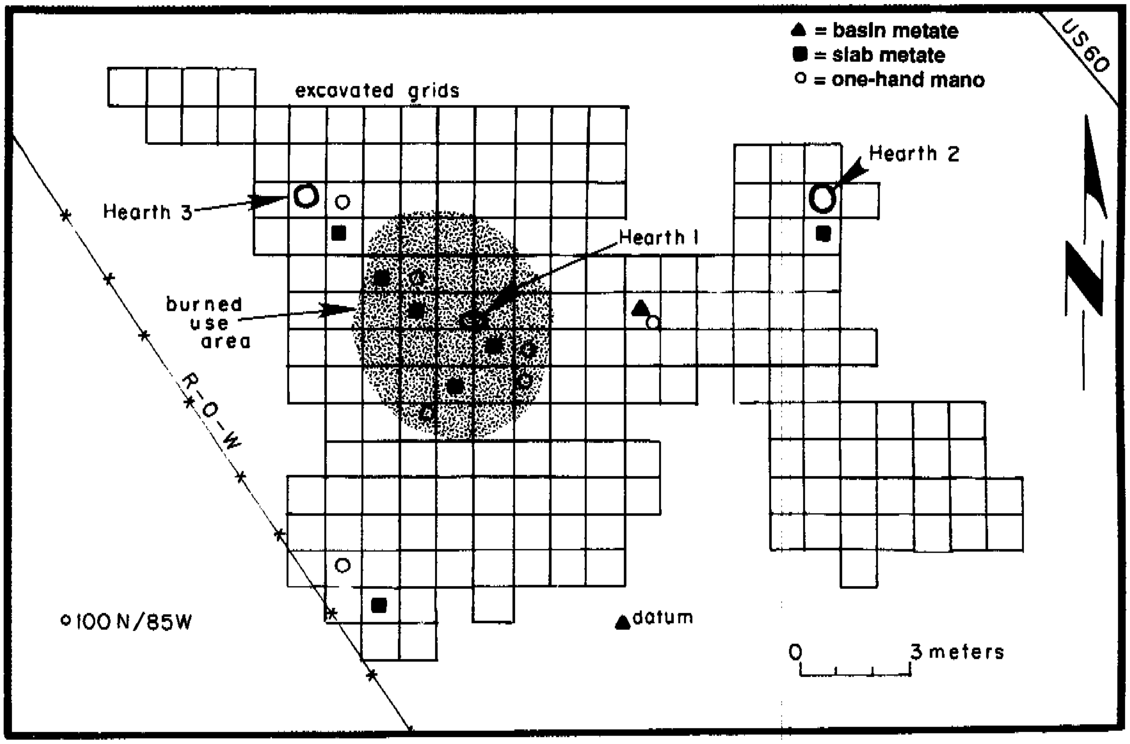

Figure 18. Ground stone distribution, LA 104381.

The artifacts consisted of mostly slab metates (30.7 percent) and one-hand manos (19.2 percent). Among the metates was a basin metate fragment. The wear patterns on the basin metate are circular; however, no manos exhibited this type of use-wear. Half of the mano assemblage (50 percent) have lengthwise striations and 42.3 percent of the assemblage show widthwise striations (Table 43). A small abrading stone made of tuff was also collected that exhibited widthwise striations.

Table 43. LA 104381 Striations on Ground Stone

	STRIATIONS								TOTAL	
	None		Lengthwise		Widthwise		Circular		N	%
	N	%	N	%	N	%	N	%		
GROUND STONE TYPE										
Indcterminate fragment	.	.	3	23.1	.	.	.	.	3	11.5
Abrading stone	1	100.0	.	.	.	.	.	.	1	3.8
Shaped slab	.	.	1	7.7	.	.	.	.	1	3.8
Mano, indeterminate	.	.	1	7.7	4	36.4	.	.	5	19.2
Mano, onc-hand	.	.	1	7.7	4	36.4	.	.	5	19.2
Metate, indcterminate	.	.	2	15.4	.	.	.	.	2	7.7
Metate, basin	.	.	.	.	.	.	1	100.0	1	3.8

Metate, slab	.	.	5	38.5	3	27.3	.	.	8	30.8
TOTAL	1	100.0	13	100.0	11	100.0	1	100.0	26	100.0

With the high percentage of slab metates, the one basin metate, and the one-hand manos, the same suggestion as discussed earlier of slab and basin metates being used to process wild resources instead of domesticated plants seems to also apply on this site.

LA 104832

This small site produced a one-hand mano and a thin, slab metate fragment. The mano is a small, oval, granite cobble that has been unifacially used and has battered edges. It measures 8-by-7 cm and has a ground surface area of 43.9 cm. The battering may suggest that the mano was later used as a hammerstone. The slab metate fragment was also made of granite with grinding on one surface and measured 6-by-4 cm.

Conclusions

Grinding activities at all three sites involved the processing of seeds, acorns, and possibly fibers. In all cases, slab metates and one-hand manos dominated the assemblage. Recently there have been arguments over the use of one-hand versus two-hand manos and basin, slab, and trough metates, and why there was a change to a larger grinding surface. Stone (1994) suggests that the longer mano lengths do not always imply reliance on agriculture but on the availability of material. She discovered that, at the Pueblo Grande site in Arizona, the mean mano length was 14.08 cm, a rather short length, but reliance on agricultural products was heavy. Hard (1990) argues that the change from a small grinding area to a larger grinding surface is because of the increased dependence on cultigens. He also states that terms such as one-hand mano are a misnomer since he believes all manos are used with two hands. Lancaster (1983) also concluded that there is a change in grinding surfaces with one-end-open and two-end-open trough metates from the Mimbres Valley. He states that slab and basin metates, along with one-hand manos, are used in processing wild foods. However, one-hand manos can be used for many tasks besides processing wild foods. They can be used for crushing pigment, grinding pottery clay, processing hides, and smaller manos are less likely to be involved in agriculture (Mauldin 1993). Measuring only the actual amount of ground surface area in centimeters, a mean ground surface was obtained for the Datil ground stone. At LA 39998 the complete one-hand manos had a mean ground area of 41.54 cm (n = 6) with a standard deviation of 11.75. At LA 104381, one complete one-hand mano was recovered with a ground surface area of 62.67 cm (n = 1) and at LA 104382 a one-hand mano was collected with a ground surface area of 43.9 cm. In comparing our data with Hard (1990) and Mauldin (1993), we see that the ground surface area from these Datil sites is considerably smaller than from Pithouse and Pueblo period sites in the Reserve area where the mean ground surfaces are 62 cm to 125 cm for one-hand manos. Because there is no lack of raw material in the area and there is a small mean grinding area, we are probably safe in assuming that the ground stone from the sites was being used for wild food resources rather than domesticated foods.

Zier (1981) states that grinding implements that are used to grind corn will show deeper striations on their surfaces. The surfaces from the Datil assemblage do not exhibit deep furrows in the striated surfaces but rather scratches. Polishing was also evident. We determined, however, that because the polishing did not fit the description for hide-working (Adams 1988), hides were not being processed. It is possible that yucca and other types of grasses were being utilized. Zier (1981) states that reduction of the surfaces and silica in the raw material can also cause polishing. Some of the manos also had battering along the edges and may have been used for either crushing the seeds during processing or sharpening the worn-down ground stone surfaces.

LA 39998

After examining the ground stone collection from the site we conclude that the most likely processing activity was that of preparing wild resources such as seeds, acorns, and possibly fibrous material. There is no evidence of any cultivated resources from the macrobotanical or palynological analyses which therefore likely rules out the possibility of processing of domesticates. The type of metates and manos present also do not lend themselves to cultigen processing if we accept the generally assumed functions for slab metates and one-hand manos. We suggest that the trough metate fragments were curated and reused.

The wear patterns of most of the metates exhibited lengthwise striations, with one exhibiting circular striations and another showing random striations. In all cases, the metates are ground on both sides, indicating a desire to get as much use out of the implements as possible. The manos are all small, oval or circular one-hand grinding stones that have widthwise and random striations and exhibit battering along the edges. The striations on the ground stone are not characteristic of those found when processing cultivated foods. The use-wear patterns are indicative of wild food processing rather than domesticates.

This assemblage, with small manos and expediently used metates, fits well with expected ground stone characteristics for either Archaic or nomadic Athabascan groups.

LA 104381

This site contains three features with associated ground stone. The assemblage on this site is basically the same as that of the previous site. The metates are irregular slabs with one irregular-shaped basin. The manos are oval or circular one-hand manos. The striations on the metates are mostly lengthwise with three that exhibit widthwise striations and one with circular striations. Of the 10 manos collected, 8 have widthwise striations and 2 have lengthwise striations. Three of the one-hand manos from the site are fire-cracked and one also has battering along the edges. Some of the manos were found in the hearths or among the fire-cracked rock on the site. The ground stone of LA 104381 has characteristics common for wild food processing as described above. The flotation samples revealed that corn was present on the site; however, the ground stone did not show evidence of corn processing. The pollen samples indicated that acorn processing was present. Thus, the ground stone fits the pattern of use expected for Archaic and Athabascan groups.

LA 104382

There were two ground stone artifacts found on this site. They include a small one-hand mano and a slab metate fragment (both typical of Archaic assemblages) with probable use for wild food processing. Although there is minimal ground stone present on the site it is possible that these artifacts were used and discarded after the grinding process was completed. The small number may also suggest that this site is a very short-term campsite.

CERAMIC ASSEMBLAGE

C. Dean Wilson

This chapter presents information resulting from the analysis of 245 sherds from LA 104381 and 93 sherds from LA 39998 recovered during recent investigations near the town of Datil, New Mexico. Given the short-term or seasonal occupation of these sites, pottery represented a very small part of the total archaeological material recovered. Still, information concerning ceramic patterns and distributions from both of these sites provides an opportunity to examine a number of issues. These include the dating of ceramic-bearing components, determining cultural affiliation or traditions, identifying the movement or exchange of pottery vessels between separate areas, and characterizing activities or functions for which various vessel forms may have been employed. In order to examine these issues, both descriptive attributes and typological categories were recorded. Attributes and categories recorded for sites in the Mogollon Highlands are briefly discussed here, but many of these categories are described in more detail in a ceramic analysis manual (Wilson n.d.) presently being prepared for the northern Mogollon Highlands based on recent investigations of the Luna and Reserve projects by the Office of Archaeological Studies. Typological and attribute categories recorded during analysis of sherds recovered during investigations of Datil Project sites are presented in Appendix 4.

Descriptive Attributes

Descriptive attributes recorded for all sherds include temper, pigment, surface manipulation, slip, and form. Attributes described for smaller subsamples of sherds include paste characteristics, refired color, rim profile, and sherd thickness.

In addition, clay samples from six sources in the Datil area were collected and described. Refired paste color and inclusions associated with these clays were compared with those noted for sherds recovered from sites in the Datil area. These examinations indicate that clay sources exhibiting a wide range of color are found in this area. Information concerning these clays samples are presented in Appendix 5. Locally available sources include both self-tempered pedogenic clays weathered from surrounding volcanic formations similar to those utilized in other areas of the Mogollon Highlands (Wilson 1994), as well geological shale sources, with low iron content, similar to those commonly utilized in the Colorado Plateau to the north.

Temper

Temper categories were identified by examining freshly broken sherd surfaces through a binocular microscope. Temper, as defined here, refers to either aplastic particles that may have been intentionally added to the clay as well as fragments naturally occurring in the clay that would have served the same purpose as added temper. Temper categories were recognized based on distinctive combinations of color, shape, fracture, and sheen of observed particles.

Many of the sherds examined during the present study contain fine particles that may have been derived from volcanic outcrops dominating the Mogollon Highlands (Wilson 1994; Ratte and Finnel 1978; Rhodes and Smith 1976). The presence of this temper may reflect either inclusions commonly occurring in local pedogenic clays or the addition of fine volcanic rock as temper. Temper reflecting these sources generally contain a combination of reflective light colored igneous rocks, dull light color tuff, and sand derived from volcanic clastic formations. Petrographic analysis verified the presence of a suite of volcanic rock types in both Mogollon and Athabascan sherds classified with this temper (Hill, this volume). As volcanic outcrops containing materials similar to those noted in these ceramics dominate the geology of this area, the dominance of volcanic tempered ceramics is not surprising. Temper derived from such sources were divided into one of three groupings based on the dominant type of particle.

Sand and sherd particles were added to vessels produced over much of the southern Anasazi country. Sand refers to rounded or subrounded, white to translucent well-sorted medium to coarse quartz sand grains. Sherd refers to the use of crushed potsherds as tempering material, and is identified as angular to subangular particles that are relatively small and usually white, buff, gray or orange in color. Small reflective lithic particles may occur inside or outside the sherd fragments. Sand and sherd refers to a mixture of sand and crushed sherd.

The other basic temper type identified during the present study consisted of angular basalt fragments, and is similar to that found in ceramics produced by the southern Pueblos located along the Rio Abajo region of the Rio Grande in the general area of the modern town of Socorro (Marshall and Walt 1984; Shepard 1942). Crushed basalt consists of dark angular particles. These particles are usually small and gray, black, or dark gray in color. Basalt exhibiting a sugary appearance was also identified. While petrographic analysis of two glaze ware sherds from LA 39998 and two sherds from Magdalena Pueblo to the east all contained basalt temper with similar characteristics, the sherds appeared to have slightly different compositions (Hill, this volume). Basalt and sherd refers to the mixture of these tempers.

Paint

Paint pigment categories were recorded for interior and exterior surfaces. Different pigment categories were differentiated by surface relief, delineation, and color (Shepard 1965). Matte mineral refers to the use of ground minerals as pigments, usually iron oxides. Mineral pigments consist of a physical layer, resting on the vessel surface, and are often thick enough to exhibit visible relief. Mineral pigments were usually dull in appearance, and cover or obscure surface polish and irregularities. Matte mineral consists of the use of iron oxides applied as powdered compounds with an organic binder, and exhibit a dull appearance. Glaze pigments contain a fluxing agent such as lead resulting in a vitrified or glassy appearance. Glaze pigments may be black or green in color. Indeterminate pigments were assigned to cases where remnants of an organic binder were present but the original pigment type could not be determined.

Manipulation

Manipulation refers to surface treatments resulting from the presence or type of coiled construction, and subsequent surface textured decoration and polishing. Basic manipulations were recorded for both interior and exterior surfaces. Categories noted include missing, plain unpolished, plain polished, plain polished, incised, unindented fine plain corrugated, and dimpled or smeared.

Slip

Slips are defined here as the intentional application of a distinctive clay, pigment, or organic deposit over the entire vessel surface. Such applications may be used to achieve black, white, or red surface colors, not obtainable using paste clays or methods normally employed. Categories recognized include no slip present, white slip, red slip, smudged, and indeterminate surface.

Vessel Form

Vessel form categories were assigned to all sherds based on observed shapes of rims or location of polished or painted decorations on interior and exterior surfaces. Our ability to recognize a specific form is often dependent on sherd size and portion of vessel represented. For example, rim sherds can usually be placed into a specific form as indicated by vessel shape, while body sherds are usually placed into much more general categories. Vessel forms recognized during the present study include bowl rim, bowl body, jar body, cooking storage rim, cooking/storage neck, indeterminate forms, and seed jar rim forms.

Typological Categories

The assignment of pottery to various ceramic traditions, ware groups, and type categories plays an important role in the dating of sites and recognition of various patterns. Each sherd was assigned to a typological category based on a series of decisions. First, an item was placed into a spatially or culturally distinct tradition based on temper, paste, paint, and technological characteristics. Next, it was assigned to a particular ware group based on surface manipulation, and finally to a specific type using temporally sensitive surface textures or design style.

Distributions of ceramic types at Datil project sites indicate at least two temporally distinct occupations and traditions. The earliest ceramic occupation is indicated by the presence of Mogollon Brown Utility, Anasazi Gray Utility, and Anasazi decorated White Wares, and reflects the utilization of the Datil area by prehistoric formative groups such as the Mogollon or Anasazi. The latest ceramic occupation is identified by the presence of thin utility wares probably produced by Apache groups, as well as utility and glaze wares produced by protohistoric Puebloan groups in the Rio Abajo region of the Rio Grande. Ceramic traditions and types recognized during the analysis of ceramics recovered during the Datil project are described below (Table 44).

Table 44. Distribution of Ceramic Types from Datil Project Sites

Ceramic Type	LA 39998		LA 104381	
	N	%	N	%
Alma Brown	3	3.2		
Reserve Plain Corrugated			58	23.7
Reserve Indented Corrugated			1	0.4
Reserve Indented Corrugated Smudged			2	0.8

Ceramic Type	LA 39998		LA 104381	
	N	%	N	%
San Francisco Red			1	0.4
Gray Body	2	2.2		
Early Painted White	2	2.2		
Late Polished White	1	1.1	2	0.8
Reserve Black-on-white			2	0.8
Early Polished White			4	1.6
Socorro Black-on-white	1	1.1		
Thin (Athabascan) Utility	18	19.4	175	71.4
Incised Utility (Athabascan)	1	1.1		
Thin Polished Athabascan	7	7.5		
Thick Brown Paste (Utility)	33	35.5		
Basalt Tempered (Gray Utility)	2	2.2		
Sherd Temper Red Slipped	1	1.1		
Red Slipped Exterior (Piro)	3	3.2		
Red Slipped Interior (Piro)	1	1.1		
Red Slipped Glaze Pt (Piro)	2	2.2		
White Slipped Interior (Piro)	3	3.2		
Polished No Slip (Piro)	5	5.4		
White Slipped Exterior (Piro)	4	4.3		
White Interior (Piro)	3	3.2		
White Slipped Exterior (Piro)	1	1.1		
Total	93	100.0	245	100.0

Mogollon Types

Mogollon Brown Ware types are distinguished by fine igneous temper, and pastes and surfaces that are brown in color. In addition, surfaces are often polished or smudged (Haury 1936; Rinaldo and Bluhm 1956; Wilson n.d.). Four Mogollon Brown Ware types were identified based on surface manipulation and slip treatment. Alma (or Plain Polished) Brown exhibits plain and polished surfaces. Reserve Plain Corrugated (or Fine Corrugated Brown) was identified by the presence of very fine unindented coils on the exterior surface. Reserve Indented Corrugated (or Indented Corrugated Brown) included sherds exhibiting fine coils with regular indentations on the exterior surface. Reserve Indented Corrugated Smudged (or Corrugated Indented Brown Smudged) consisted of sherds exhibiting similar exteriors with the addition of polished and smudged interior surfaces. San Francisco Red exhibits plain surfaces with a distinct polished red slip on at least one surface. All the brown ware sherds identified exhibit fine volcanic temper and pastes with high iron content. Examinations of local clay sources indicate that these brown wares could have been produced using local pedogenic clays. Similarities in the temper pastes of Mogollon Brown Ware ceramics from other areas of the northern Mogollon indicate that sherds recovered from the Datil area could have originated over a very wide area of this region (Wilson 1994). Petrographic characterization of a single Reserve Plain Corrugated sherd indicate the probable use of a self- tempered clay with volcanic inclusions (David Hill, pers. comm. 1994).

Anasazi Types

White and gray ware sherds assigned to southern Anasazi types were distinguished by white to light gray pastes, surface treatment, and sand or sherd temper indicative of ceramics produced in the southern Colorado Plateau. White wares were differentiated from gray wares by the presence of polishing or painted decoration on one surface. Gray body refers to plain unpolished gray body sherds, and is similar to body sherds that may have been previously classified as Lino Gray. Polished white sherds are classified as white wares on the basis of at least one polished surface, but do not exhibit painted decorations. Early Polished was distinguished from Late Polished White by a less polished surface, and the presence of sand rather than sherd temper. Reserve Black-on-white contains similar manipulations described for Late Painted with distinctive painted decorations consisting of opposed combinations of hatched and solid motifs (Fowler 1993). Socorro Black-on-white was distinguished from other Southern Anasazi white wares by a vitrified gray paste and vitrified paint (Sundt 1979).

Protohistoric Utility Wares

Ceramic types associated with protohistoric occupations were present at both LA 39998 and LA 104381. These included utility wares possibly of both Athabascan and Puebloan origin as well as Puebloan glazed wares.

The dominant protohistoric type noted was classified as Thin (Athabascan) Plain Utility. This type category was distinguished from other utility wares by the presence of a dark paste and very thin walls (2 to 4 mm). Pastes fire to red colors when exposed to oxidation conditions, and indicate the use of high iron clays and a reduction atmosphere. Surfaces were usually plain, but sometimes smeared or incised. A single incised sherd was assigned to a separate variety described as Plain Incised Athabascan, but is similar to forms noted for vessels of probable Apachean origin (Ferg 1988; Gifford 1980). Temper of Athabascan sherds usually consisted of angular volcanic rock. This combination of temper and high iron clays may indicate the use of similar pedogenic clays occurring in the Mogollon Highlands, containing detrital and volcanic clastic material, that were utilized in the production of Mogollon Brown Wares. While the apparent use of self-tempered clays makes it very difficult to determine the exact source or origin of these ceramics, it is very possible that similar ceramics could have been locally manufactured in the Datil area as well as in other areas of the Mogollon Highlands yielding similar clays with volcanic inclusions. It may also be possible to use the presence of similar volcanic inclusions to distinguish pottery produced by local Chiricahua Apaches or other Athabascan groups residing in the Mogollon Highlands from those produced by other western Athabascan groups, such as the Navajo residing in the Colorado Plateau, where tempering material with different characteristics would have been available (Hill 1995).

With the exception of possible differences in temper, sherds and vessels exhibiting similar characteristics appear to occur at early historic Apache or Navajo sites found throughout much of the Southwest (Brugge 1982; Gunnerson 1979). While Apachean ceramics do not appear to have been previously documented for the Mogollon Highlands of New Mexico, including the Datil area, this region was historically occupied by the Chiricahua Apache. Small amounts of pottery are assumed to have been produced and utilized by the Chiricahua and other southern Apache groups (Brugge 1982; Opler 1983). The thin utility wares described here, while similar to ceramics associated with Athabascan occupations found throughout the Southwest (Brugge 1982) appear to most closely resemble pottery described for historic western Apache occupations in Arizona. These vessels are also very thin and may contain similar volcanic temper (Ferg 1988; Gifford 1980). Sherds assigned to this category appear to differ from utility wares described from nearby protohistoric Puebloan sites such as Piro, Acoma, and Zuni Pueblos (Kintigh 1985; Marshall and Walt 1984), which appear to be thicker, polished, and are often smudged.

Other utility wares, associated with protohistoric occupations, were placed into other categories because of the presence of polishing and thicker vessel walls. These sherds were assigned to descriptive types including Plain Thin Dark Paste Polished and Thick Brown Paste. These contain similar temper as noted for the thinner utility vessels, and some of these sherds may simply represent a variation of that technology. Other sherds could have been derived from Puebloan utility vessels. A single plain unpolished utility ware sherd contained basalt temper similar to that noted in glaze wares from Piro sites in the Rio Abajo area, and is assumed to have derived from a vessel produced in that area.

Pueblo Glaze Wares

Other protohistoric sherds identified exhibit a polished or painted decorated surface and a red to brown paste and crystalline basalt temper. These sherds are similar to ceramics from Piro Pueblo sites in the Rio Abajo of the Rio Grande (Marshall and Walt 1984; Shepard 1942). Surfaces in unslipped areas were brown, but a white or light gray slip was usually present on one surface and a dark red slip often occurred on the other. The few glaze rim forms exhibit a Glaze B or Glazed E rim shape (Mera 1933). This combination of temper, paint, paste, and slip characteristics noted in these sherds is very similar to a late variant of Socorro briefly described by Shepard (1942). This variant and related types are assumed to have been produced by Piro Pueblos along the lower Abajo (Marshall and Walt 1984; Mera 1940). An examination of sherds stored at the Laboratory of Anthropology and from sites discussed by Mera (1940) from Piro pueblos in the Socorro and Magdalena areas indicate that the associated glaze wares from protohistoric Piro pueblos are very similar to the slipped, polished, and glaze painted wares from the Datil area. These sherds were placed into descriptive type categories of a Piro Pueblo ceramic tradition based on combinations of slipped treatments, pigments, and rim shapes. In addition to the Piro tradition sherds, a single sherd exhibiting a bright red slip and sherd temper may have been produced at Zuni or Acoma (Harlow 1973; Woodbury and Woodbury 1966), although sherd temper and similar slips and pastes may have been sometimes employed at other pueblos in the southern Rio Grande (Shepard 1942).

Interpretation of Ceramic Data

Distributions of ceramic attributes and types from LA 39998 and LA 104381 provide an opportunity to characterize various trends associated with small seasonal occupations in the Datil Mountains. A combination of ceramic and lithic evidence indicates the possible presence of Archaic

Table 45. Temper Type by Site

	Type	Mogollon Lithic		Mogollon Tuff		Mogollo n Sand		Sand		Sherd		Sand & Sherd		Basalt		Basalt, Sand, & Sherd		Basalt & Sherd		Basalt & Sandstone		Leucocratic Igneous		Total	
		N	%	N	%	N	%	N	%	N	%			N	%			N	%			N	%	N	%
LA 39998	Mogollon Brown	3	10.3																					3	3.2
	Anasazi Gray							2	66.7															2	2.2
	Anasazi White							1	33.3					1	50.0			2	10 0.0					4	4.3
	Proto Utility	26	89.7	32	100.0	1	10 0.0															2	8.7	61	65.6
	Late Pueblo Glaze									1	100.0			1	50.0									23	24.7
	Total	29	31.2	32	34.45	1	1.1	3	3.2	1	1.1			2	2.2			2	2.2			23	24.7	93	100. 0
LA 10438 1	Mogollon Brown	4	2.9	52	73.2	6	10 0.0																	62	25.3
	Anaszi White									4	100.0	3	100.0			1	100. 0							8	3.3
	Proto Utility	13 3	97.1	19	26.8															2 3	100. 0			175	71.4
	Total	13 7	55.9	71	29.0	6	2.4			4	1.6	3	1.2			1	0.4			2 3	9.4			245	100. 0

components, as well as ceramic-yielding formative and protohistoric occupations. Both LA 39998 and LA 104381 are located in areas still rich in game such as elk, and may explain the persistence of the use of these locations as camp sites. While ceramic-yielding occupations of formative periods are well documented for surrounding areas of the Mogollon Highlands and Colorado Plateau (Berman 1979, 1989; Bluhm 1960; Danson 1957; Gerow 1994; Fowler 1990; McGimsey 1980), almost nothing is known concerning these occupations in the Datil area. Thus, an examination of ceramic distributions from these sites offers a fairly unique opportunity to examine patterns associated with both the prehistoric formative as well as protohistoric occupations of this area. Evidence concerning ceramic dating and examination of various ceramic trends are discussed for both prehistoric and protohistoric components.

Ceramic Evidence of Formative Period Occupations

Very few archaeological investigations of any kind have been reported for the Datil area. The little information available indicates that while artifact and lithic scatters may be fairly common in the Datil area, permanent habitation sites are very rare. In contrast, surrounding areas in much of the Mogollon Highlands and Colorado Plateau were the focus of larger sedentary populations during the formative period, particularly during the later Pueblo periods (Berman 1979, 1989; Bluhm 1960; Danson 1957; Gerow 1994; Fowler 1990; McGimsey 1980). Therefore, the occurrence of prehistoric Mogollon or Anasazi ceramic types at seasonally occupied sites may reflect the use of an area for hunting or other seasonal activities by surrounding agricultural groups. Such groups may have increasingly relied on hunting and gathering trips in relatively unoccupied areas to supplement needs for populations that may have already depleted much of their immediate wild plant and game resource base.

A total of 70 sherds from LA 104381 belonging to a minimum of 5 vessels represents the strongest evidence of activities by prehistoric formative groups at sites investigated during the Datil project. Pastes and temper characteristics indicate a combination of Mogollon and Anasazi types found in much of the northern Mogollon region (Table 45). Ceramic types (see Table 44) associated with this occupation include Reserve Plain Corrugated (58 sherds), Reserve Indented Corrugated Smudged (2 sherd), Reserve Indented Corrugated Brown (1 sherd), San Francisco Red (1 sherd), Late Polished (2 sherds), Early Polished (2 sherds), and Reserve Black-on-white (4 sherds). This combination of Mogollon Corrugated Brown Ware types and Anasazi White Ware types is similar to that noted at other assemblages associated with Reserve phase sites of the Mogollon (Berman 1979, 1989; Bluhm 1957; Martin and Rinaldo 1950). This indicates utilization of this site sometime during the eleventh or early twelfth centuries. Contemporary occupations by Anasazi groups from nearby areas of the Colorado Plateau exhibit a combination of similar white ware types, but are dominated by southern Anasazi corrugated types rather than Mogollon Brown Ware types (Danson 1957). The use of seasonal sites by Mogollon groups during the Reserve phase may reflect increasing population pressures during this time and resulting extension of the territory exploited by the Mogollon. It not presently possible to determine whether these vessels were produced by local Mogollon groups who may have resided in or near the Datil area or if they were carried from a greater distance. While the low number of artifacts and lack of architectural features associated with this occupation reflects a short seasonal occupation, the presence of cooking jars, white ware jars, and bowls may indicate that ceramic vessels were used in a variety of activities including cooking, serving, and storage (Table 46). This may indicate that the exploitation of this campsite by Mogollon groups involved a variety of activities and was fairly well organized.

Table 46. Vessel Form by Site

	Type	Indet. Body, Polished		Bowl Rim		Bowl Body		Jar Body		Cooking Jar Rim		Cooking Jar Neck		Indeterminate		Seed Jar Rim		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
LA 39998	Mogollon Brown					2	10.5					1	8.3					3	3.3
	Anasazi Gray							2	4.3									2	2.2
	Anasazi White					3	15.8	1	2.2									4	4.3
	Proto Utility					4	21.1	42	91.3	2	100.0	11	91.7			1	100.0	60	65.2
	Late Pueblo Glaze			6	100.0	10	52.6	1	2.2					6	100.0			23	25.0
	Total	0	0.0	6	6.5	19	20.7	46	50.0	2	2.2	12	13.0	6	6.5	1	1.1	92	100.0
LA 104381	Mogollon Brown			1	100.0	1	25.0	34	18.8	8	61.5	18	40.9					62	25.3
	Anasazi White					3	75.0	5	2.8									8	3.3
	Proto Utility	2	10 0.0					142	78.5	5	38.5	26	59.1					175	71.4
	Total	2	0.8	1	0.4	4	1.6	181	73.9	13	5.3	44	18.0					245	100.0

A total of 9 sherds from LA 39998 also reflects minimal use of this site by formative groups. This is indicated by the presence of sherds classified as Plain Brown (3 sherds), Gray body (2 sherds), Early Painted (2 sherds), Late Polished (1 sherd), and Socorro Black-on-white (1 sherd). This combination of sherds indicates slight use of this area by formative groups sometime between A.D. 600 and 1300, although the small size and general lack of distinctive types limit further interpretations.

Ceramic Evidence of Protohistoric Occupations

Ceramic distributions from both LA 39998 and LA 104381 indicate occupations dating sometime to the late prehistoric or early historic periods, probably relating to the use of this area by Apachean groups. The Chiricahua Apache are one of seven Southern Athabascan speaking or Apachean tribes documented historically. Various Chiricahua Apache bands are known to have occupied a large area including much of southwest New Mexico including the Datil Mountains, as well as parts of southeastern Arizona, northern Mexico, and west Texas (Opler 1983). Information about early Apachean occupations in this area is almost exclusively based on ethnographic and historical accounts indicating a continual occupation from the arrival of the Spanish in the sixteenth century to the late nineteenth century (Opler 1983; Earls 1992; Gunnerson and Gunnerson 1971). Unfortunately, almost nothing is known about the archaeology of Apachean sites in this area (Brugge 1982; Gunnerson 1979). As is the case for many other non-Puebloan occupations in the Southwest, the southern Apache occupations resulted from the movement of Athabascan groups into areas earlier abandoned by the Anasazi and Mogollon. These include the Chiricahua Apache who resided in a broad area located immediately to the west and south of some of the southernmost historic Pueblos. Such groups appear to have modified their economy as the result of contact with Puebloan groups and focused on hunting and gathering as well as the occasional addition of limited agriculture (Ford 1983; Opler 1983).

Evidence of the protohistoric occupation at one site (LA 104381) consisted solely of Athabascan sherds. Evidence of the protohistoric occupation at another site (LA 39998) consisted of Athabaskan pottery along with Puebloan pottery.

The protohistoric sherds from LA 104381 are represented by a total of 175 Thin Utility Ware of probable Athabaskan origin. Rim and neck sherds derived from jars with slightly curving necks and relatively wide rim diameters, indicating that these sherds probably came from cooking jars. The characteristics of the volcanic temper indicate these vessels could have been manufactured with locally occurring clays and tempers.

The possible time of the protohistoric occupation at LA 104381 depends mainly on the dating of Apache or Athabascan ceramics within this area. Arguments for the dating of western Apache ceramics are based on data from other areas occupied by Athabascan-speaking groups particularly the Navajo (Brugge 1982, 1992; Gunnerson 1979). While it is suspected that Western Apache groups, including the Navajo, Mescalero, Chiricahua, and western Apaches, must have arrived in the region soon after its abandonment by prehistoric Mogollon and Anasazi groups at about A.D. 1300 (Brugge 1992; Eddy 1966), until recently it has been generally thought that Apachean sites would have been largely invisible until the late sixteenth century. This was based on the belief that ceramics and other traits allowing for the archaeological recognition of early Athabascan occupations were not present in these areas until after the Pueblo Revolt in the late seventeenth century (Baugh and Eddy 1987; Brugge 1963, 1982; Carlson 1965). More recent investigations of early Navajo sites indicate that pottery similar to that found in later Navajo and Apachean sites may have been widely produced by Athabascan groups by the beginning of the sixteenth century (Brown and Hancock 1992; Reed and

Reed 1992; Winter and Hogan 1992). Closer to the Datil project area, sherds classified as Navajo Utility Ware were recovered from a hearth west of Quemado yielding radiocarbon dates in the late sixteenth to mid-seventeenth century (Oakes 1986). While it is probably not possible to presently determine whether these sites actually represent early Navajo or Apache occupations, they support the presence of pottery-bearing occupations most likely associated with Athabascan groups in west-central New Mexico at a relatively early date.

Similar pottery was also manufactured by Navajo and western Apache groups as late as the late nineteenth century. Given the lack of historic materials at LA 104381, it is likely that the protohistoric component dates before the middle nineteenth century. Differences in the temper and other characteristics of Athabaskan sherds recovered from this site and LA 39998 compared to Navajo pottery near the Alamo Navajo Reservation (David Hill, pers. comm. 1994) seem to contradict a historic Navajo association. Radiocarbon dates recovered from structures at LA 104381 yielded date intercepts at A.D. 1520, 1570, and 1630 (Oakes, this volume). Thus, the Athabascan utility ware at this site probably indicates an occupation during the early historic period, possibly sometime between 1500 and 1750.

A wider range of ceramic types and forms are associated with the protohistoric occupation at LA 39998. Temper, paste, and surface characteristics indicate a mixture of Athabascan and southern Puebloan pottery types (see Table 45 for temper distributions).

A total of 26 sherds from at least 5 vessels appear to represent Athabascan pottery. While most of these vessels exhibit smoothed or obliterated surfaces, a single rim sherd exhibits parallel rows of fingernail-shaped incised decoration, similar to that noted on other Apachean ceramics. Additional utility wares are represented by 33 sherds from thicker or polished vessels from a minimum of 3 vessels. While some of these sherds may have been produced in the surrounding protohistoric pueblos, it is also possible that some may represent variation of Athabascan pottery. A single gray ware sherd contains basalt temper similar to that noted in Pueblo glaze ware, and is assumed to be of Puebloan origin. Most of these utility ware sherds at site LA 39998 appear to have been derived from jar forms, probably representing cooking or storage jars.

The remaining protohistoric sherds from LA 39998 represent polished, slipped, or painted pottery types produced by protohistoric Puebloan groups. A total of 22 sherds representing at least 3 vessels exhibit a combination of reddish to brown pastes, basalt temper, surface manipulations, and rim forms described for decorated pottery from protohistoric Piro Pueblos. This is not surprising as several Piro villages are not that far away from Datil. These include several large sites near the modern towns of Socorro and Magdalena (Marshall and Walt 1984; Mera 1940). While rim shape and surface manipulation indicate most of these sherds derived from bowls, a few are from jars (see Table 46). A single sherd exhibited a red slip and sherd temper. Sherd temper appears to have been utilized in both the Acoma and Zuni areas (Harlow 1973; Kintigh 1985).

The presence of combinations of various protohistoric utility and decorated types identified at LA 39998 raises some interesting possibilities concerning both the dating and cultural association of the protohistoric occupations of this site. The earliest possible date for both the Apache utility ware and Puebloan decorated types described is about A.D. 1500 and may date as late as the nineteenth century. An end date of 1680 can be assigned to Piro ceramics, based on the time of abandonment of Piro pueblos (Earls 1992). If the Apachean and Piro Puebloan sherds are associated with the same component, this would indicate the production of pottery by western Apache groups prior to A.D. 1680.

An examination of pottery from protohistoric pueblos near the towns of Socorro and Magdalena collected by Mera indicated that the basalt-tempered Puebloan sherds recovered from LA 39998 could have originated from these pueblos. In contrast, the utility ware from LA 39998, classified here as Thin (Athabascan) Utility was very distinct from the utility ware found in these pueblos, which tended to be thicker and exhibit polished and slipped surfaces and sand temper. Thus, while most of the decorated sherds recovered from LA 39998 appear to have originated from Piro sites to the east, with the exception of one sherd, the utility wares appear not to be of Puebloan origin.

An important factor in interpreting the significance of protohistoric ceramics from LA 39998 is whether the Apachean and Puebloan sherds are contemporaneous. If they are contemporaneous, their mutual association may indicate that the late occupation of this site reflect the presence of Apachean groups who obtained vessels through trade or raid from surrounding Piro Pueblos and possibly other Puebloan groups. Even though such an association has not been previously noted archaeologically, it is supported by historical accounts involving interaction between Apaches and Piro Pueblos. Thus, it is possible that this combination of ceramic types indicates the use of LA 39998 by Apachean groups sometime during the sixteenth and seventeenth centuries.

Another interpretation regarding this mixture of ceramic types is that two distinctive temporal components dating to different periods of the protohistoric or historic period are represented. The first would be represented by Pueblo utility and decorated wares, and may indicate the use of LA 39998 by groups from Piro Pueblos sometime during the late prehistoric or protohistoric period. In this scenario, the presence of thin (Apachean) utility ware may reflect later occupation by Apachean groups during the historic period. The possibility of occupation by protohistoric Pueblo groups in this area is raised by a site described by Hough (1907) located 7 km (4 miles) north of the town of Datil. While Hough observed that few ruins occurred in the Datil area, he described a cliff house of five or six contiguous rooms. He noted that the pottery from this site was "dull gray and brown in color and of crude manufacture resembling that from near Magdalena, New Mex., and stations of the Rio Grande" (Hough 1907:29). He also notes that the size, location and plan of this ruin was similar to many ruins in the mountains of southern New Mexico and Arizona. It is possible that this site could represent a small settlement of Piro Pueblo groups in the Datil area. If this is the case, such sites could represent the source of the Puebloan sherds at LA 39998. It is also possible that the cliff dwelling described by Hough could represent a structure, similar to the pueblitos constructed by the Navajo to the north, built and occupied by local Athabascan groups. An Athabascan component at an earlier Mogollon or Anasazi Pueblo could also be reflected.

My opinion is that Athabascan and Pueblo sherds from LA 39998 are part of the same component, and reflect part of a seasonal round by Apache groups during the sixteenth or seventeenth centuries. Further investigation of protohistoric sites in this region, however, will be required to determine which scenario is the case.

Conclusion

In conclusion, the presence of small numbers of sherds from two sites investigated during the Datil project (LA 39998 and LA 104381) provide information and insights concerning the utilization of seasonal sites in the northernmost areas of the Mogollon Highlands. Ceramic associations indicate that quality hunting locations, which may have been earlier used by Archaic groups, continued to be utilized by both formative groups associated with the Anasazi and Mogollon traditions and protohistoric Apachean or Puebloan groups. While limited ceramic evidence indicates that LA 39998 was occasionally used by formative groups, the period and cultural association is unknown. LA 104381 appears to have been utilized by Mogollon groups during the Reserve phase sometime during the eleventh or early twelfth centuries. The presence of Athabascan ceramics with associated radiocarbon dates at LA 104381 indicates that this site was utilized by protohistoric Apachean or Navajo groups sometime between A.D. 1500 and 1750. The combination of Apachean and Puebloan ceramics at LA 39998 indicates a protohistoric occupation dating sometime between A.D. 1500 and 1680. Thus, while LA 104381 lacks glaze wares, it is quite possible that it may be at least roughly contemporaneous to LA 39998. While it is very possible that the Apachean and Pueblo ceramics are contemporaneous and indicate an Apachean occupation dating between A.D. 1500 and 1680, the possibility of earlier use by protohistoric Puebloan groups and later use by Apache groups cannot be ruled out.

It is very likely that the patterns of use of highland hunting sites by formative and protohistoric groups noted at these sites is part of a larger pattern in the Mogollon Highlands and other areas of the Southwest. Similarities in the ceramics found at this site and historic ceramics from western Arizona (Gifford 1980; Ferg 1988) might indicate occupations ancestral to the better-known historic Apache groups to the west. The present absence of evidence of similar occupations in this area is the reflection of the general lack of work in this area, and constraints limiting the identification of these types of sites and temporal components. Hopefully, further work in this area will result in a better understanding of the use of highland hunting and gathering sites not only by earlier Archaic but by agricultural-practicing formative and highly mobile protohistoric groups who reoccupied this region.

PETROGRAPHIC ANALYSIS

David V. Hill

Introduction

The petrographic sample for this project was derived from two sites that produced both prehistoric and protohistoric sherds, related to the Mogollon, Athabascan, and Puebloan ceramic traditions. A single Mogollon utility ware sherd and two protohistoric Athabascan sherds were examined from LA 104381. Four Athabascan and two Rio Grande Glaze Ware sherds were examined from LA 39998. In addition, two Rio Grande Glaze Ware sherds from LA 284 (Magdalena Pueblo) were analyzed for comparison with the glaze ware sherds from LA 39998. A single fired clay sample from the Datil area was also examined to see if it contained a natural tempering agent comparable to any of the ceramics in the sample or in any way resembled the paste of any of the sherds.

The analysis was conducted by the author using a Nikon Optiphot-2 petrographic microscope. The analysis was conducted in three stages. The first stage consisted of examining each slide and writing a cursory description of each one. A second more intensive phase was conducted where unusual minerals were identified and the size of the inclusions was measured. This was done by measuring 10 grains using a graded optical renticle. The third stage of analysis involved adding additional comments to the thin-section descriptions and comparing the paste and inclusions of the different sherds to one another.

Petrographic Analysis

LA 104381

Sample 321-1: Reserve Indented Corrugated

The paste of this sherd is a strong brown color with a distinctive sandy texture provided by the abundant fine plagioclase grains, black opaque fragments, brown biotite, augite, and brown hornblende. The plagioclase laths are often altered to opacity. Some of the black opaque fragments represent biotite that has altered to hematite and clay minerals.

Ceramic clay is derived from extrusive volcanic rocks. The use of a naturally tempered clay is suggested by the abundance of isolated mineral grains similar in composition to those found in the rock fragments and continuous size grading from fine to coarse of the rock fragments. The most abundant volcanic rock type observed in the sherd is andesite porphyry. The groundmass of the andesite is cryptocrystalline and made up of kaolinized feldspars and dark opaque mineral. Andesine plagioclase, brown hornblende, and brown biotite usually altered to hematite and clay minerals are porphyritically contained. The next most common rock type is a rhyolitic tuff. Spherulitic and axiolitic texture are common in the gray or occasionally reddish tuff grains. Several of the tuff fragments porphyitically contain sanidine or volcanic quartz. Secondary chalcedony is also present in some of the tuff fragments. The third rock type observed is a fine-grained trachyitic basalt. The basalt consists primarily of andesine. Occasional interstitial yellow olivine, usually altered to hematite around their margins, or brown glass is present in the basalt fragments as a ferro-manganese cubes.

148-1 Athabascan Ware

The paste of this sherd ranges from a dark brown to gray color. Abundant silt-sized to fine black opaque grains are present. One void is present, probably resulting from the combustion of organic material based on the oxidation of the clay surrounding the void. The overall abundance, the variety of rock and mineral grains and their continuous size grading from fine to coarse. Feldspars and quartz make up the majority of the isolated mineral grains. In general, the feldspars are highly altered to sericite and clay minerals, often to the point of opacity. The most common rock type is a highly altered dacite or grano-diorite. The groundmass is gray, cryptocrystalline, highly weathered, and contains a small amount of brown biotite. A few rhyolitic tuff fragments are present and display axiolitic texture. Also present are a few fragments of a fine-grained trachyitic basalt. The basalt consists of andesine plagioclase, with abundant fine ferro-manganese cubes, often altered to hematite around their margins.

349-1 Athabascan Ware

The paste of this sherd is an opaque black color. The opacity of the paste makes dark colored fine-grained rock fragments difficult to recognize. As in the case of the previous specimen, the abundance and continuous size grading of the mineral grains and rock fragments suggests that the clay may have been self-tempered. The most common isolated mineral grain is andesine plagioclase. This mineral is usually fresh in appearance, although a few grains display alteration to sericite and clay minerals. Also present as isolated mineral grains in order of abundance were brown hornblende, sanidine, quartz, and pyroxene. The most obvious rock type in this sherd is a dark brown tuff. The tuff fragments display axiolitic texture and show little compaction. Sparse volcanic quartz is also present in these tuff grains. Also present, but less common than the tuff, were diorite fragments. The essential feldspar was andesine plagioclase. The groundmass was highly variable in terms of granularity from aphanitic to coarse grained. Ferro-manganese cubes were present in the groundmass of these rock fragments. These diorite fragments porphyritically contained brown hornblende or plagioclase.

LA 39998

19-1 Athabascan Ware

The paste of this sherd is a strong brown color. The paste contains very abundant silt to medium-sized individual mineral grains and a few rock fragments. The abundance of mineral grains suggests that the paste of this sherd was self-tempered. The most common mineral observed was plagioclase, followed by sanidine, brown hornblende quartz, and biotite. Of the few rock fragments present, the most common was an andesite porphyry. The andesite had a brown cryptocrystalline groundmass and porphyritically contained andesine plagioclase and brown hornblende. A coarse-sized fragment of a well-sorted fine-grained volcaniclastic sandstone was also observed.

1130-2 Athabascan Ware

The paste of this sherd is a strong brown color and slightly birefrengent. The paste contains abundant subangular to rounded isolated mineral grains. The paste of this sherd was either tempered with an arkosic sand or the clay was self-tempered. The most common grain type is plagioclase with a minor amount of sanidine and quartz. The feldspars were clouded through alteration to sericite and clay minerals.

1039-1 Athabascan Ware

The paste and temper are very similar to that observed in Sample 1130-2. The mineral grains in this sample appear to be slightly more rounded and altered than those in the previous specimen.

436-1 Athabascan Ware

The paste of this sherd is a light brown color and contains abundant isolated mineral grains. The size grading and composition of these grains is similar to Sample 19-1. However, there are fewer coarse-sized plagioclase laths in this specimen than in Sample 19-1.

1065-1 White slip, glaze paint

The paste of this sherd grades from a reddish brown to gray mottled to grayish white. This mottling is the result of in situ alteration of feldspars to clay minerals, leaving an angular gray smudge.

The paste contains abundant coarse to very coarse basalt fragments. The basalt is highly variable in texture and composition. Some of the basalt grains are fine-grained with a distinctive trachyitic texture and abundant ferro-manganese minerals. Other basalt fragments have a glomerophyric texture with discrete phenocrysts of plagioclase and pyroxene. Most basalt fragments contain intergranular augite. A few basalt grains contain dark brown glass. The degree of alteration observed on some basalt and isolated feldspar grains indicates that the paste of this was not tempered in the traditional sense but that the clay contained an abundant natural tempering agent.

822-1 Unidentified Glaze Polychrome

The paste of this sherd is a light brown color. The paste contains abundant isolated mineral grains predominantly quartz. The quartz occurs as fine to medium subrounded grains often displaying an undulose extinction, suggesting a metamorphic source. Also present in nearly the same proportion as the quartz are abundant volcanic rock fragments. The sand grains are a uniform medium size while the basalt fragments range from medium to coarse. These rock fragments are similar in their range of variation to those observed in Sample 1065-1. The paste of this vessel may also be self-tempered.

LA 284

Sample 1: Glaze Polychrome

The paste of this sherd is a reddish brown and contains abundant silt-sized to fine grains of plagioclase and black angular opaque fragments.

This sherd was tempered using crushed intergranular medium to coarse-grained basalt. The basalt fragments range in size from medium to coarse. The plagioclase falls in the andesine- bytownite range of composition. Augite is contained between the plagioclase laths. Dark brown glass or altered augite is present in some of the basalt fragments.

Sample 2: Red exterior slip with brown-green glaze on light brown paste

The paste of this sherd is a reddish brown mottled with gray. The paste is sparsely self-tempered with a fine-grained basalt. The plagioclase falls within the andesine-bytownite range of composition. The basalt contains intergranular augite or pale brown glass. These fragments range in size from fine to medium.

Datil Area

Sample 3: Refired alluvial clay

The clay fired to a bright reddish brown. The clay contains a moderate amount of silt-sized quartz, biotite, and brown hornblende grains. A few fine rounded quartz grains are also present. The sample of fired paste did not resemble the paste of any of the sherds analyzed.

Discussion

Assigning a local source for any of the ceramic material in this environment of high potential source variability is problematic at best. The process of recognizing local sources of ceramic material is further complicated by the use of pedogenic clays that contain detrital volcaniclastic material for the production of the Mogollon, Athabascan, and Puebloan ceramics examined during this analysis. These suggestions should eventually be assessed through a program of clay sampling and additional ceramic analysis.

The Datil area is located on the northern margin of the Mogollon-Datil Volcanic field (Elston 1976). The surficial geology of the Datil area consists of a complex series of basalts, andesitic-debris flows, volcaniclastic sedimentary rocks, tuffs, and ignimbrits along with Quaternary valley fill (Chamberlin et al. 1994; Lopez and Barnhorst 1979). LA 104381 and LA 39998 lie near the contact between the middle Spears Group and the lower Spears group (Chamberlin et al. 1994). The middle Spears group consists of conglomeratic and tuffaceous sandstones and ignimbrites. The lower Spears group consists of andesitic-debris flow deposits that grade into silty sandstones. Consequently, the presence of a suite of igneous rock types and minerals in the Mogollon sherd from LA 104381 and the Athabascan ware sherds from LA 104381 and 39998 is not surprising. Sample 148-1 from LA 104381 contains fragments of dacite. Dacite has been reported only from a single source some 20 miles southwest of Datil (Ratté et al. 1994).

The similarity of the Samples 19-1 to 436-1 and 1130-2 to 1039-1 indicate that each of the two matching samples could have been made using the same raw materials. These vessels could have been made in the immediate area or transported together to the site where they were recovered.

All four of the Rio Grande Glaze Ware sherds contained basalt. Like the Mogollon and Athabascan sherds, it is likely that they were made using pedogenic clays derived from volcanic sources. While all of these sherds contained basalts with similar characteristics, the sherds appeared to have slightly different compositions. Sample 1065-1 from LA 39998 has a highly variable suite of volcanic rock fragments while Sample 822-1 contained abundant quartz sand in addition to the basalt grains.

The two samples from Magdalena Pueblo (LA 284) were also different from one another. Sample 1 contained a greater amount and larger grains of basalt than did Sample 2. The larger basalt fragments observed in Sample 1 contained augite, an uncommon mineral in the smaller basalt grains in Sample 2, where the major inclusion was brown glass.

Limited petrographic study of basalt-tempered glaze ware ceramics from the Socorro area has been conducted (Shepard 1942). As part of this study Shepard examined sherds from LA 284, which formed a part of her Late Glaze Ware group. These ceramics were tempered using a crushed basalt having an intersertal texture where the interlaced laths of plagioclase contain augite, magnetite, or a dark brown opaque material. The glaze ware sherds from LA 39998 and those from LA 284 both contain basalts that are similar to those reported by Shepard. However, their is a high degree of variability in the pastes of the four glaze ware sherds analyzed during this project. Whether this variability is a quality of the ceramic resources near LA 284 or reflects more than one source of basalt-tempered glaze ware in the Magdalena Pueblo or lower Rio Grande area would require additional petrographic analysis for comparative material.

FAUNAL ASSEMBLAGE

Linda S. Mick-O'Hara

Introduction and Overview

During the project, 556 pieces of bone were recovered from various contexts. Table 47 presents the recovered faunal assemblage by taxonomic category for each of the sites investigated. A small amount of bone was recovered from general context at LA 39998 (n = 63). The majority of the faunal remains recovered were from around the feature areas at LA 104381 (n = 489), especially from two areas outside of the probable structure. Only a few pieces of bone were isolated from general excavation contexts at LA 104382 (n = 4). Remains from all sites were highly fragmented with the number of identifiable specimens and the general level of identification reduced because of the extent of the fragmentation.

The amount of bone identifiable only to the general class of mammals and divided into small, medium, and large comprises 92.1 percent of the overall faunal assemblages (n = 512). This is an extremely high percentage of bone only identifiable to general categories. Usually between 60 and 70 percent of any sample falls into this category (Mick-O'Hara 1994:33). In faunal assemblages, this ‘unidentifiable’ or ‘generally identifiable’ segment of the faunal sample should reflect the identifiable remains. That is true in these samples as well, but the increased fragmentation suggests intensive processing and disposal methods resulting in these heavily reduced faunal assemblages. This interpretation is supported if the articular end to diaphysis ratios are considered using the estimates for bone reduction established by Todd and Rapson (1988).

A review of the processes of carcass reduction and disposal of faunal materials from each site is included in the following report. Each site is reviewed separately with an assessment of both the 'generally identifiable' fragmented remains and the identified bone. Each sample is evaluated for level of assemblage fragmentation, identification, and burning along with evidence of butchering marks and environmental impact to the assemblage. The mixing of components at LA 39998 and at LA 104381 precludes any temporal comparisons but site assemblages are compared with general Archaic and Athabascan patterns of faunal use.

Of the three sites investigated, two provided enough faunal material for an analysis of species use and environmental and cultural effects on the assemblage. The third site, LA 104382, produced only four pieces of bone, but the other sites produced small faunal samples from contexts that include the Archaic period through later Athabascan occupations.

Most of the artifactual materials from these sites, including the faunal materials recovered, could not be separated temporally by excavation level. Due to the mixing of deposits and the lack of features, the faunal remains at LA 39998 can only be presented from general site context. LA 104381 also produced mixed assemblages, but feature associations at the site provide a contextual framework for the larger number of faunal remains recovered. The faunal remains from each site are presented in the following sections. Table 47 shows the frequency of bone by taxon for each site considered.

Table 47. Faunal Remains by Taxonomic Frequency from the Datil Project

	LA 39998		LA 104381		LA 104382		Total	
	N	%	N	%	N	%	N	%
Indeterminate mammal	3	4.8	25	5.1	.	.	28	5.0
Small mammal	4	6.3	27	5.5	1	25.0	32	5.8
Medium mammal	43	68.3	368	75.3	1	25.0	412	74.1
Large mammal	5	7.9	35	7.2	.	.	40	7.2
Cynomys ludovicianus Black-tailed prairie dog	.	.	.	.	1	25.0	1	0.2
Sylvilagus audubonii Desert cottontail	.	.	.	.	1	25.0	1	0.2
Lepus californicus Black-tailed jackrabbit	1	1.6	.	.	.	.	1	0.2
Procyon lotor Raccoon	.	.	2	0.4	.	.	2	0.4
Order Artiodactyla	5	7.9	31	6.3	.	.	36	6.5
Odocoileus sp. Deer	.	.	1	0.2	.	.	1	0.2
Antilocapra americana Pronghorn	2	3.2	.	.	.	.	2	0.4
Total	63	100.0	489	100.0	4	100.0	556	100.0

Methodology

All faunal remains recovered during the project were returned to the Office of Archaeological Studies for processing and analysis. The faunal materials were dry brushed to remove dirt from all surfaces so muscle attachments, other identifiable surface features, and processing marks would be visible if present.

The remains were then identified to the most specific level possible using the comparative faunal materials housed at the Museum of New Mexico, Office of Archaeological Studies, Santa Fe, and the Museum of Southwest Biology, University of New Mexico, Albuquerque. Identifications were also aided by using guides to the taxonomic and element identification of mammals and birds (Olsen 1964, 1968; Gilbert et al. 1985; Gilbert 1990). Guides were used only for preliminary identification and all specimens were specifically compared to osteological specimens for final identification.

Identification of all specimens included taxonomic level, element, portion, completeness, laterality, age, and developmental stage. In addition, each specimen was assessed for any environmental, animal, or thermal alteration that may have been present. Finally, any butchering marks (cuts, impacts, etc.) (Olsen and Shipman 1988) were noted along with any apparent modification for tool manufacture or use (Semenov 1964; Kidder 1932).

The data recorded for these variables were then entered into an SPSS database and used in the analysis of the faunal remains in this report.

LA 39998

The excavations at LA 39998 did not identify any cultural features, but 63 pieces of bone were recovered. These faunal remains were recovered from mixed contexts and could be associated with any of the numerous short-term occupations inferred from the artifactual remains at this locality. Table 47 presented the NISP and percent occurrence for the faunal remains recovered from LA 39998 with 55 bone fragments, 87.3 percent of the site sample, only generally identifiable. Bone recovered from LA 39998 was identified to those general categories and to the Order Artiodactyla (even-toed hoofed mammals), *Lepus californicus* (black-tailed jackrabbit), and to *Antilocapra americana* (pronghorn). These taxa represent species hunted and consumed by the site occupants during one of the short-term occupations represented at the site. Though only one individual is represented for each species in the remains identified there are certainly more individuals represented in the highly fragmented remains encountered. So few specimens could actually be identified to order or species that it is hard to make any further inference about these identifications.

Fragmentation. As stated in the introduction, the large percentage of bone fragments in this faunal assemblage from LA 39998 suggests that carcasses were reduced by cultural or natural processes (Schiffer 1976; Binford 1978) to a greater extent than seen in the processing and discard behavior apparent at Anasazi sites (Mick-O'Hara 1994; J. Olsen 1990). On the average this faunal assemblage has approximately 20 percent more bone fragments reduced to the point that they were only generally identifiable. This pattern of marked bone reduction is seen in both the Archaic period (Bayham 1979; Mick-O'Hara n.d.) and at Navajo sites (Mick-O'Hara 1995). This pattern is reinforced by the amount of bone that was thermally altered. Burned bone often occurs in both Archaic and Athabascan assemblages and may be part of the pattern of reduction noted.

Burning. Table 48 presents the burning by type and frequency for the bone recovered from LA 39998. If all thermal alteration is considered, 65.1 percent of the sample exhibits some evidence of burning. There is a direct relationship between the amount of bone recovered for any taxon and the amount of burned bone present suggests that burning was not associated with the processing of a certain species but was relevant to general processing and disposal patterns. The majority of the burned bone showed light to heavy (black) discoloration (46.0 percent). This would be consistent with the roasting of meat on the bone (Whalen 1994) and perhaps further reduction to obtain marrow and bone grease (Binford 1978). The remainder of the burned bone in this assemblage is burned black to calcined (22.2 percent) indicating disposal into an active fire prior to secondary discard into the general trash.

Table 48. Burning Frequency and Type by Taxon from LA 39998

Taxon	None		Light, Tan-Brown		Light to Heavy		Heavy, Black		Heavy to Calcined		Total	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Indeterminate mammal	3	13.6	.	.	.	.	.	.	.	.	3	4.8
Small mammal	2	9.1	.	.	2	9.1	.	.	.	.	4	6.3

Taxon	None		Light, Tan-Brown		Light to Heavy		Heavy, Black		Heavy to Calcined		Total	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Medium mammal	10	45.5	5	100.0	15	68.2	2	100.0	11	91.7	43	68.3
Large mammal	2	9.1	.	.	3	13.6	.	.	.	.	5	7.9
Lepus californicus	.	.	.	.	.	.	.	.	1	8.3	1	1.6
Order Artiodactyla	3	13.6	.	.	2	9.1	.	.	.	.	5	7.9
Antilocapra americana	2	9.1	.	.	.	.	.	.	.	.	2	3.2
Total	22	100.0	5	100.0	22	100.0	2	100.0	12	100.0	63	

Summary. The faunal materials recovered from LA 39998 indicate the intensive use of a few species. Fragmentation and burning decreased the identifiable component of this sample but these processes do provide evidence for inference about processing, consumption, and discard. Most of the processing of carcasses involved initial reduction into units that were roasted producing the majority of the thermal alteration noted on the bone. Subsequently, bone was further reduced, probably to extract marrow and grease resulting in the heavily reduced segment of this sample. Finally, some bone was discarded into active fires producing the blackened and calcined bone recovered. This bone was recovered from general trash and not from hearth features, suggesting that some hearth maintenance was occasionally done during the limited occupational periods at the site. This faunal assemblage has provided identification of only a few taxa but the rate of fragmentation and the rate and types of burning allow some insights into the consumption and discard behavior of the various short-term occupations.

LA 104381

The excavations at LA 104381 concentrated on a group of three features, two exterior hearth areas, and a structure (Feature 1) with an interior hearth. Though two bone fragments were recovered from general scatter encountered in other areas of the site, the majority of the 489 bones recovered were associated with this group of features. The bone, as a whole, is heavily fragmented and burned and shows the reduction of predominantly medium and large mammal remains. The level of fragmentation and other evidence of processing along with the burning apparent on these remains provide evidence of processing, consumption, and discard behavior at the site. In addition, the distribution of faunal materials can offer some insight into the associational context of the remains, the discard sequence involved, and maintenance behavior in the occupations with which these remains were associated.

Of the 489 bones recovered, 455 or 93.1 percent of the site sample could only be generally identified as small, medium, or large mammal remains and the majority of these remains were assigned to medium mammal (368 or 75.3 percent of the sample). The overall fragmentation in this assemblage and the extent of the burning resulted in the assignment of many of the bone fragments to medium mammal on the basis of cortical tissue thickness when they may represent the reduction of artiodactyla elements. This assignment is probably due to the damaging effects of fire on these fragments resulting in their placement in a smaller size category and may not represent the original cortical thickness (Lyman 1994:384-389) or the relative size of large mammals actually contributing to the sample.

The identified faunal remains from LA 104381 include only three taxa. Two hind limb elements were identified as *Procyon lotor* (raccoon). A number of lower limb elements, teeth, and other element fragments were assigned to the order Artiodactyla (even-toed hoofed mammals) and one partial humerus could be identified to the genus *Odocoileus* (deer) (see Table 47). The identification of deer provides support for the assumption that the more fragmentary remains are the product of deer carcass reduction and disposal patterns.

Fragmentation. Faunal samples routinely result in 'generally identifiable' or 'unidentifiable' segments that comprise 60-70 percent of the sample. It is clear that the remains recovered from LA 104381 with 93.1 percent of the sample included in this category have at least 20 percent more remains reduced to a size that are no longer identifiable beyond looking at probable circumference and cortical thickness. The general reduction of articular ends along with shafts would suggest that the few animals taken were reduced to very small fragments in an intensive processing and cooking strategy (Todd and Rapson 1988). A review of the processing evidence exhibited on these remains may provide additional clues about the patterns of processing that resulted in the type of remains recovered.

Processing. Table 49 provides a table of the types of processing marks recorded on the LA 104381 faunal assemblage. Spiral fractures and transverse splitting was noted on a few specimens in the sample. These processing marks would be associated with the reduction of the carcass into segments for cooking (Binford 1978; Lyman 1994:160). The majority of processing evidence on the faunal assemblage from LA 104381 involved the longitudinal splitting of elements (88.1 percent of the total assemblage) with subsequent fragmentation related to the reduction of bone that was no longer covered with meat (Binford 1978; Gifford-Gonzales 1989). This type of reduction opens the marrow cavity for the extraction of marrow from long bones (Binford 1978, 1981) and further reduction suggests that bone may have been boiled to extract bone grease. This processing evidence indicates an intensive pattern for the use of faunal remains. The burning evidence supports this inference and provides evidence for disposal context and site maintenance at LA 104381.

Burning. Table 50 presents the burning frequencies by taxa and types for the remains recovered at LA 104381. The majority of the bone recovered exhibited some form of thermal alteration (425 fragments or 87.0 percent of the total sample) and of these 337 pieces of bone (68.9 percent of the total sample) were burned black to calcined. The 'tanned' bone and those elements with graded discoloration would indicate that thermal alteration probably took place while meat was covering the bone, especially when discoloration was darker toward articular ends (Lyman 1994: 388-389; Gifford-Gonzales 1989:193). The bone fragments burned black or calcined were thermally altered after flesh was removed from the bone. These fragments had been reduced and subsequently discarded into an active fire causing the partial or complete combustion of the organic matrix of the bone (Buikstra and Swegle 1989). Bone identified to the order Artiodactyla was generally less intensively burned and fragmented and thus, remained more 'identifiable' than other more intensively reduced remains. Their presence in the sample, again, suggests that the smaller fragments were also the result of artiodactyla processing and consumption.

Distribution. The distribution of faunal remains at LA 104381, in conjunction with the patterns of processing and burning, can provide evidence for the initial context of the majority of these remains, season of occupation, and the level of site maintenance during the occupation. The majority of the

Table 49. Evidence of Processing by Taxon and Element for LA 104381

Taxon	Spiral, Midshaft		Split, Long		Split, Transverse		Total	
	NISP	%	NISP	%	NISP	%	NISP	%
Mammal								
Indeterminate	.	.	6	1.4	.	.	6	1.4
Indeterminate fragment	.	.	1	0.2	.	.	1	0.2
Long bone fragment	.	.	2	0.5	.	.	2	0.5
Rib	.	.	1	0.2	.	.	1	0.2
Small mammal								
Indeterminate fragment	.	.	21	4.9	.	.	21	4.8
Rib	.	.	4	0.9	.	.	4	0.9
Medium mammal								
Indeterminate fragment	1	50.0	341	79.1	.	.	342	78.4
Rib	.	.	4	0.9	.	.	4	0.9
Phalange, general	.	.	1	0.2	.	.	1	0.2
Large mammal								
Indeterminate fragment	.	.	34	7.9	.	.	34	7.8
Order Artiodactyla								
Indeterminate fragment	1	50.0	1	0.2	.	.	2	0.5
Tooth	.	.	2	0.5	3	100.0	5	1.1
Tibia	.	.	1	0.2	.	.	1	0.2
Metatarsal, nfs	.	.	1	0.2	.	.	1	0.2
Metapodial	.	.	3	0.7	.	.	3	0.7
Phalange, general	.	.	7	1.6	.	.	7	1.6
Odocoileus sp.								
Humerus	.	.	1	0.2	.	.	1	0.2
Total	2	100.0	431	100.0	3	100.0	436	100.0

Table 50. Burning Frequency and Type by Taxon from LA 104381

Taxon	None		Light, Tan-Brown		Light to Heavy		Heavy, Black		Heavy to Calcined		Total NISP	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%		
Indeter. mammal	7	10.9	.	.	3	3.5	.	.	15	5.3	25	5.1
Small mammal	2	3.1	.	.	6	7.0	2	3.8	17	6.0	27	5.5
Medium mammal	45	70.3	1	50.0	57	66.3	47	88.7	218	76.8	368	75.3
Large mammal	5	7.8	.	.	3	3.5	1	1.9	26	9.2	35	7.2
Procyon lotor	.	.	.	.	2	2.3	.	.	.	.	2	0.4
Order Artiodactyla	4	6.3	1	50.0	15	17.4	3	5.7	8	2.8	31	6.3
Odocoileus sp.	1	1.6	.	.	.	.	.	.	.	.	1	0.2
Total	64	100.0	2	100.0	86	100.0	53	100.0	284	100.0	489	

Table 51. Distribution of Faunal Remains within Features at LA 104381

Taxon	Structure		General Scatter		Total	
	NISP	%	NISP	%	NISP	%
Indeter. Mammal	10	6.3	15	4.5	25	5.1
Small mammal	5	3.2	22	6.6	27	5.5
Medium mammal	116	73.4	252	76.1	368	75.3
Large mammal	7	4.4	28	8.5	35	7.2
Procyon lotor	.	.	2	0.6	2	0.4
Order Artiodactyla	20	12.7	11	3.3	31	6.3
Odocoileus sp.	.	.	1	0.3	1	0.2
Total	158	100.0	331	100.0	489	100.0

faunal remains recovered were in association with a single excavated structure (Feature 1) which had an interior hearth. No bone was associated with the other two exterior hearths to the northwest and northeast of the structure.

The faunal remains were recovered from a general "smeared" area within the fill of the structure (Table 51, structure and see Fig. 19) and from two concentration areas to the east and west of the structure that were, probably the origin of the postdepositional diffusion of materials into structural fill. These areas are part of the "general scatter" bone in Table 51. The distribution by taxon in Table 51 shows a similar pattern of species occurrence inside and outside the structure and would tend to support the idea that the bone within the structure diffused from these concentrations and the general trash scatter.

The two concentrations of heavily fragmented burned bone appear similar to the doorside dumps noted by Hayden and Cannon (1983) for "cool weather" occupations and mentioned by Binford (1983:146) in talking about the Palangana site. Expedient dumps from interior activities suggest that exterior temperatures would not make these dumps immediately noxious, indicating a cool season occupation. The blackened and calcined state of the faunal remains, as mentioned earlier, also suggests that food consumption took place inside with bone being discarded into the hearth as a maintenance measure. The occurrence of this bone in dumps outside the structure would also suggest that occupation was long enough to warrant hearth cleaning (Binford 1983:189).

Summary. The majority of the bone recovered from LA 104381 was heavily fragmented and burned. Though the majority of these fragments were identified as medium mammal by the thickness of cortical tissue, it is suggested that the burning would reduce the cortical thickness of bone and that most of these fragments are a product of the reduction of deer killed by the site occupants. The identifiable remains are predominately Artiodactyla with only one humerus identified as deer. The presence of this order and genus is used, however, to support inferences made about the more heavily reduced bone fragments.

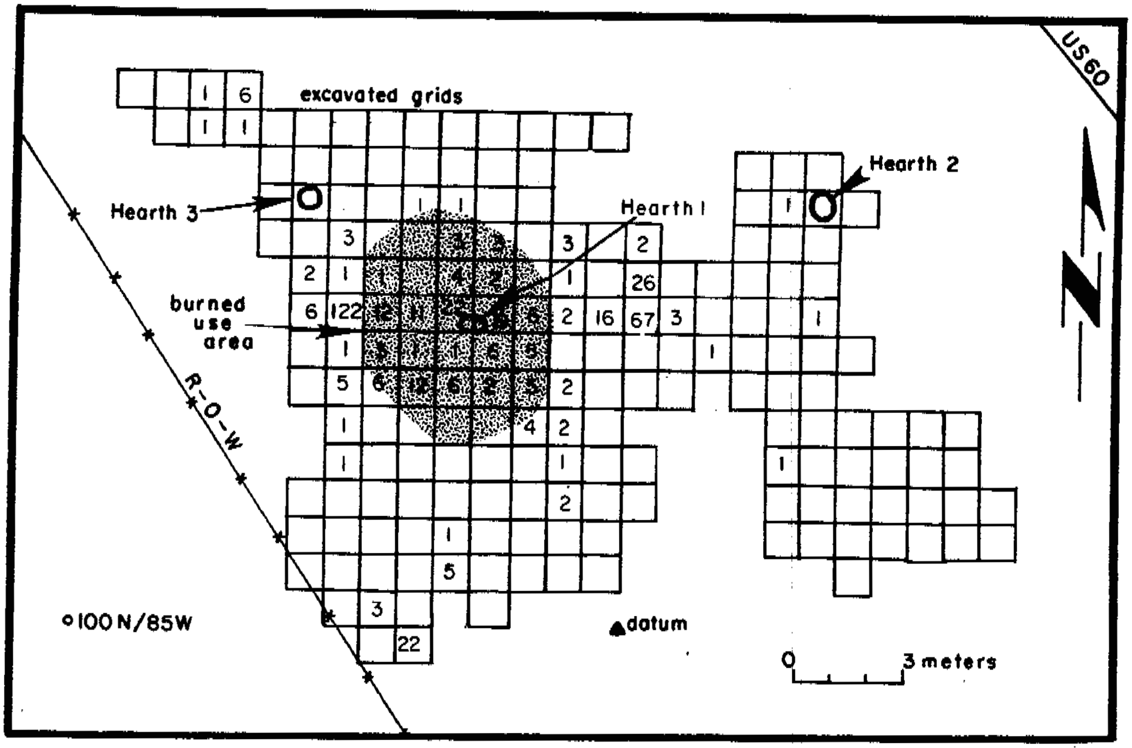

Figure 19. Bone distribution in feature area, LA 104381.

The intensive reduction of the faunal remains indicates a processing strategy that included the longitudinal splitting of elements to obtain the marrow and further reduction and boiling to extract bone grease. A few processing marks indicate that carcasses were segmented for cooking and "tanning" and mottling on a small number of remains would suggest that roasting was one of the cooking methods used by the occupants.

These reduced animal remains were then discarded into and around an active fire with secondary disposal into two bone concentration areas just to the east and west of the structure (Feature 1). This secondary disposal of faunal remains into doorside dumps supports the inference that this was a "cool" season occupation with some maintenance activities taking place.

LA 104382

The excavations at this small lithic scatter produced only four pieces of bone. Two long bone fragments could be identified only as small mammal and medium mammal respectively. The other two elements could be identified to species. A single left tibia was assigned to *Sylvilagus auduboni* (desert cottontail) and a single innominate could be identified as *Cynomys ludovicianus* (black-tailed prairie dog). Only the single long bone fragment identified as medium mammal was burned.

The paucity of remains from this site precludes any inference about hunting or processing strategies used by the former occupants. The only statement that can be made is that both small and large mammals were probably used as food resources.

Conclusions

The three sites investigated show intensive use of animals taken from the surrounding environment. The few bones recovered from the small lithic site (LA 104382) only suggest that animals were used from the adjacent landscape and that both small and large mammals played a part in the diet. The species identifications from LA 39998 and LA 104381 provided the same information about these sites but the fragmentation and burning present allowed inference about processing, cooking, and discard of animal remains.

LA 39998 produced a small number of highly fragmented remains that exhibited varying degrees of burning. Reduction of the faunal remains into small fragments is a pattern observed at both Archaic and Athabascan sites in the Southwest so that any temporal inference from this assemblage was not possible. The sample illustrates the intensive use of all animals, and all remains appear to have been reduced to extract marrow and bone grease when possible.

Burning noted on the remains suggests that some burning was the result of roasting meat and caused varying discoloration on the bone. Blackened and calcined bone resulted from the discard of defleshed and broken bone into hearth areas as a maintenance measure. These types of burning in the LA 39998 faunal assemblage suggest that cooking included roasting and that a small amount of site maintenance was being done during the short-term occupations at LA 39998.

The faunal materials recovered from LA 104381 indicate the use of similar species and processing methods to those being used at LA 39998. Both sites produced mixed assemblages but the association of the majority of faunal remains at LA 104381 with a structure allowed some additional inferences about the use and discard of animal bone. Faunal remains were recovered from two concentration areas to the east and west of the structural feature and appeared similar to ethnographic accounts of doorside dumps. This comparison and the proximity of refuse to the structure were used to suggest a "cooler weather" occupation at this site. The dumps also indicate that a level of site maintenance was being done suggesting that the structure was being used for more than a few days.

The heavily reduced faunal assemblages recovered from these sites show that fragmentation and burning can provide insight into behavioral parameters at prehistoric campsites even when species identification is minimal.

DATING THE SITES

Yvonne R. Oakes

When archaeologists refer to sites as being Archaic or Athabascan, these assertions are often based upon the presence of diagnostic Archaic projectile points or Athabascan pottery. Sites lacking these distinctive markers are almost impossible to assign a cultural affinity. Absolute dates for these two types of sites are difficult to acquire because of the usually surficial nature of cultural remains found on them. The Datil Project was extremely fortunate in obtaining radiocarbon dates for all three sites. All dates were recovered from wood charcoal and a $13^{C}/12^{C}$ value calculated.

LA 104381

Seven radiocarbon dates were obtained for this campsite which produced a mixture of Mogollon-related sherds and Athabascan ceramics. The radiocarbon dates validate two such occupations for the site (Table 52).

Table 52. Radiocarbon Dates from LA 104381

Unit	Beta Sample	Radiocarbon Age B.P.	Calibrated 1 Sigma	Calibrated 2 Sigma	Radiocarbon Date	Context
112/105	77835	1840±110	A.D. 70-340	45 B.C.-A.D. 30	A.D. 110	Burn Area-L2
112/105	77836	1420±70	A.D. 600-670	A.D. 535-720, A.D. 735-760	A.D. 530	Hearth (F2), L3
109/96	77837	1330±70	A.D. 650-775	A.D. 615-875	A.D. 620	Hearth (F1) ,L3
109/95	77838	1490±70	A.D. 535-645	A.D. 425-670	A.D. 460	Burn Area-L3
109/95	77839	1870±80	A.D. 70-245	20 B.C.-A.D. 370	A.D. 80	Burn Area-L3
109/94	77840	1450±70	A.D. 560-660	A.D. 450-690	A.D. 500	Burn Area-L3
111/98	77841	340±110	A.D. 1445-1665	A.D. 1410-1950	A.D. 1610	Burn Area-L2

The two early dates with radiocarbon ages of 1870 ± 80 B.P.: cal A.D. 70-245 and 1840 ± 110 B.P.: cal A.D. 70-340 are rejected because, in both cases, they are immediately overlain by later dates from the same provenience, suggesting an "old wood" problem with these dates.

Four radiocarbon dates range between A.D. 460 and A.D. 620. These are from an isolated hearth (Feature 2) and a hearth surrounded by a large burned area (Feature 1) on the crest of the low knoll. The dates suggest an occupation during the early Mogollon Pithouse period. However, there are very few Mogollon Brown Ware sherds on the site that would associate with this period. Several later Pueblo sherds (Reserve Black-on-white and Reserve Corrugated) indicate some utilization of the area between A.D. 1000 and 1200, for which no radiocarbon dates were obtained. The burned area that produced the early dates is believed to be the remnants of some type of jacal or ramada-like structure (see site description). Together with the hearths, we thus have evidence for a short-term A.D. 600s occupation with minimal architecture but few or no ceramics. It is tempting to postulate that perhaps these were not pottery-producing Mogollon peoples who occupied the site at this time, but rather those elusive remaining hunters and gatherers with an Archaic lifestyle that archaeologists suggest may have been present in much of the Southwest well after the introduction of pottery.

The presence of Athabascan sherds on the site is confirmed by the corrected radiocarbon date of A.D. 1610. The samples were obtained from a heavily burned area 10-30 cm below ground surface and away from the possible jacal area. While Athabascan sites have been identified to the west near Quemado (Oakes 1986) and Fence Lake (Hogan et al. 1985), this is the first documented confirmation of Athabascans in the Datil area.

LA 104382

This small, disturbed site contained lithic artifacts scattered throughout the cultural fill to a depth of 42 cm below ground surface. No hearths or activity loci were present, although artifacts were clustered in one general area. A single radiocarbon date was obtained from charcoal present at 12 cm below the surface (Table 53), in fill containing several other artifacts.

Table 53. Radiocarbon Date from LA 104382

Unit	Beta Sample	Radiocarbon Age B.P.	Calibrated 1 Sigma	Calibrated 2 Sigma	Radiocarbon Date	Context
113/118	77842	8060 ± 60	7040-6995 B.C.	7075-6735 B.C.	6110 B.C.	General Fill, Level 2

The site evidences many lithic characteristics found generally on Archaic sites. The radiocarbon date of 8060 ± 60 B.P. (7075-6735 cal B.C.) places the site within the early Archaic period. While this date is possibly correct, it is a single date acquired from not far below the site surface, and we cannot be certain that there was no contamination or old wood problem. This site is, in all likelihood, of Archaic age; however, the corrected 6110 B.C. date should be used with caution particularly since strong diagnostic evidence, such as projectile points, is lacking.

LA 39998

This is a multicomponent campsite as manifested by the various radiocarbon dates (Table 54) and the range of diagnostic artifacts. Its location on a low knoll overlooking a small valley with running water and a spring made it extremely attractive for hunters from all time periods. The artifacts recovered include Archaic projectile points, smaller Pueblo-style points, Mogollon wares, Athabascan sherds, and Piro pueblo ceramics. The site is very shallow, and frequent reuse by prehistoric peoples has created a palimpsest effect. However, the radiocarbon dates do support the artifactual data for all of these groups being present.

Table 54. Radiocarbon Dates from LA 39998

Unit	Beta Sample	Radiocarbon Age B.P.	Calibrated 1 Sigma	Calibrated 2 Sigma	Radiocarbon Date	Context
134/129	77830	120±70	A.D. 1635-1775, A.D. 1800-1945	A.D. 1655-1950	A.D. 1830	Level 2
137/141	77831	2220±70	380-180 B.C.	400-60 B.C.	270 B.C.	Level 2
133/143	77832	100±80	A.D. 1675-1770, A.D. 1800-1940	A.D. 1655-1950	A.D. 1850	Level 1
99/125	77833	360±60	A.D. 1455-1640	A.D. 1435-1660	A.D. 1590	Level 1
96/127	77834	630±70	A.D. 1290-1410	A.D. 1270-1430	A.D. 1320	Level 2

The two corrected radiocarbon dates of 1830 and 1850 are from a log found just under the site surface and of more recent origin. A radiocarbon date of 2220 ± 70 B.P. (380-180 cal B.C.), recovered from charcoal flecks at 15-30 cm below ground surface, would explain the presence of the late Archaic projectile points on the site. However, the various types of Archaic points suggest repeated use by different mobile groups during this period. The corrected radiocarbon date of 630 ± 70 B.P. (cal A.D. 1290-1410) corresponds with the Socorro Black-on-white and the Reserve Corrugated sherds on the site.

Most impressive is the corrected radiocarbon date of A.D. 1590, 360 ± 60 B.P. with a calibrated range of cal A.D. 1455-1640, from cultural fill containing charcoal in the vicinity of the Athabascan and Piro sherds. These dates suggest that the Athabascan or Piro pueblo sherds, or both, were deposited during this time. Because of the dispersed nature of the artifacts, it is not possible to connect the dates with only Athabascan or only Piro sherds. However, the dates are excellent for either, particularly in the case of the Piro artifacts because of the abandonment of the Piro pueblos in 1680. There is an argument to be made for the two distinctive sherd types to have been deposited by Athabascans who are documented to have conducted periodic trade with the Piro Pueblos.

Conclusions

While the radiocarbon dates for the Datil Project are relatively few, they are archaeologically remarkable for several reasons. They exhibit good congruence with what was found on the ground and they are the first absolute dates to be obtained from the Datil Mountain area. We can now articulate with more decisiveness about who were some of the peoples present in the region and at what time. We are also now aware that populations were here on several occasions during the Archaic period, early Mogollon, later Anasazi, Athabascan, and Piro times. Defining two Athabascan occupations in the 1500 and 1600s through both pottery and radiocarbon dates is of major importance in archaeological studies of the areal ranges and associated dates for these people. Also, of equal import, is the presence of Piro-dated sherds at some distance from the Rio Grande area, perhaps as trade ware in Athabascan possession or possibly as the remains of a Piro hunting group. The sixteenth-century occupation of the Datil Mountains by Athabascan groups is one of the earliest, though not unexpected, validated dates for this region of New Mexico.

ETHNOBOTANICAL ANALYSIS

Mollie S. Toll

Introduction

Flotation samples from three sites in and near White House Canyon, just west of Datil, New Mexico, provide indications of the quality and quantity of subsistence information we can expect from very shallow, disturbed sites in this region. Sampled sites include a small lithic scatter (LA 104382), and two extensive lithic and ceramic scatters. LA 104381, with a possible structure and hearth dating to the A.D. 600s, formative period Mogollon brown wares, and Anasazi white wares, was likely a seasonal Mogollon residence. Athabascan utility wares and a radiocarbon date of cal A.D. 1610 point to a later use of this site as a short-term camp. LA 39998 was largely disturbed by previous construction activities. Ceramics in the remaining portion of the site suggest trade contacts between local Apache and Piro pueblo groups of the lower Rio Grande Valley in the sixteenth and seventeenth centuries, and a cluster of radiocarbon dates with a mean of A.D. 1590 concurs with this period of activity.

Botanical remains visible and recognizable during excavation consisted only of charcoal. The charcoal was identified to species in the OAS Ethnobotany Lab, before submission for carbon-14 dating. Soil samples were collected for flotation analysis at two sites. At LA 39998, cultural deposits in Level 2 were sampled from nine different grid locations. At LA 104381, five samples were taken to document the possible structure (Feature 1), three samples came from the hearths (Features 2 and 3), and two were from Level 2.

Methods

The 19 soil samples collected during excavation were processed at the Museum of New Mexico's Office of Archaeological Studies by the simplified "bucket" version of flotation (see Bohrer and Adams 1977). Samples ranged from 1.0 to 4.0 liters in volume, with a mean of 2.6 liters (c.v. .324). Each sample was immersed in a bucket of water, and a 30-40 second interval allowed for settling out of heavy particles. The solution was then poured through a fine screen (about 0.35 mm mesh) lined with a square of "chiffon" fabric, catching organic materials floating or in suspension. The fabric was lifted out and laid flat on coarse mesh screen trays, until the recovered material had dried. Each sample was sorted using a series of nested geological screens (4.0, 2.0, 1.0, 0.5 mm mesh), and then reviewed under a binocular microscope at 7-45x. Some "floated" samples were large and required subsampling some screen sizes; an estimated number of seeds for each taxon was calculated, using the proportion of total weight examined in the subsample. After full-sorting nine samples at LA 104381, it was clear that shallow, mixed site deposits had resulted in significant numbers of intrusive seeds, and very little cultural subsistence debris. From that point, analysis switched to scanning the flotation samples (three from LA 104381 and nine from LA 39998).

In scanning, flotation samples are first separated by screening into major particle-size categories that correspond generally with taxonomic divisions. Material larger than 1.0 mm was full-sorted (but very little was recovered in this size range). Botanical remains larger than 1 mm generally include cultivars (corn kernels and cob fragments, and more rarely, bean or squash remains), juniper twigs and seeds or berries, piñon nutshell and cone fragments, yucca, squawberry and pricklypear seeds, and grass and weed seeds with particularly large seeds, such as ricegrass and beeweed. In this project, scanning was most useful in reducing the time spent on smaller screen sizes, where enormous numbers of annual weed seeds (nearly all unburned and likely modern) were present. The 0.5 mm screen was examined partially in the scanning procedure, and only *examples* of each taxon were pulled out. Scanning accurately picks up the presence of higher-frequency weed taxa, such as the chenopods, pigweed, purslane, and tansymustard. Among particles smaller than 0.5 mm (not examined in a scan sample), botanical remains are often completely absent or else consist of fragments of seed types encountered in larger screens. For the time invested, then, scanning provides relatively reliable presence/absence flotation data, as well as general information about relative quantities of specific taxa and about whether carbonized specimens are present. Indicators of post-depositional disturbance (modern roots and other vegetative parts, insect exoskeleton fragments, rodent and insect scats) are also noted.

All Datil charcoal samples were collected as such in the field (no flotation samples contained sufficient charcoal for identification of a 20-piece sample). Wood and charcoal samples were first screened through a 2-mm screen to remove dirt and charcoal dust. Pieces were snapped to expose a fresh transverse section, and examined under an incident light binocular microscope at 90x. The first-level observation involved the presence or absence of resin ducts (Minnis 1987:126; Puseman 1993:2). Specimens lacking resin ducts were labeled *Juniperus* if late wood bands were *very* brief, consisting of only 1-3 rows of cells, and *Abies* if late wood bands were broader and developed more gradually. *Pinus edulis* sports abundant resin ducts with a distinctive morphology (moderate size, stout cell walls, surrounded by neatly arranged, robust supporting cells); the resin ducts are distributed throughout the growth rings. *Pinus ponderosa* has large, thinner walled resin ducts, with loosely organized support cells, and the ducts congregate in the later end of the growth ring. I had to put many specimens in the category of Undetermined Conifer as specimen quality often left some ambiguity as to one taxon vs. another. Identity of resin ducts was a problem since root holes were common in the Datil assemblage, in addition to the routine situation of small pieces whose lack of resin ducts might be due to sampling error. Carbonized green wood with wildly distorted morphology was a particular problem at LA 104382 (FS 93), and one piece of 'punky' unburned wood with degenerated cell structure composed a significant part of the array in FS 95 at LA 39998.

Results

LA 39998

A glance at Tables 55 and 56 shows the preponderance of unburned botanical materials at LA 39998. Purslane seeds are abundant in three adjacent and one nearby grids; goosefoot occurs in the same grids and is numerous in one of them. Weed seeds (tansymustard, spurge, wild buckwheat, composite family) are otherwise scattered in low numbers among the samples. Given that cultural deposits are shallow and disturbed, and that all these species produce large numbers of tiny and broadly dispersed seeds, we had best consider these unburned seeds as likely intrusives. Carbonized plant materials at LA 39998 include a single goosefoot seed (Grid 96N/119E) in one of the larger soil samples from this site (FS 781; 3.0 liters), a small (e.g., probably another weedy annual) unidentifiable seed (Grid 102N/125E, FS 884), and the base of a bundle of three pine needles (Grid 105N/126E, FS 860). *Pinus* species in the Datil area with needles in bundles of three include *P. ponderosa* (needles mostly 4-9

Table 55. Flotation Scan Samples: LA 39998, Level 2, Relative Abundance of Seeds, Fruits, and other Plant Part(s)

			FS 593	FS 781	FS 786	FS 791
Cultural	Annuals					
		Chenopodium	.	*	.	.
Noncultural	Annuals					
		Chenopodium	*	***	*	*
		Cheno-am	.	*	*	.
		Descurainia	.	.	*	*
		Euphorbia	.	*	*	*
		Polygonaceae	.	.	*	*
		Portulaca	.	***	***	***
	Perennials	Juniperus	.	.	.	**
		Pinus	.	*	.	*

* = 1-10, ** = 11-25, *** => 25

Table 56. Flotation Scan Samples: LA 39998, Level 2, Relative Abundance of Seeds, Fruits, and other Plant Parts

			FS 827	FS 860	FS 884	FS 945	FS 1003
Cultural	Annuals						
		Unidentifiable Seed	.	.	*	.	.
	Perennials	Pinus	.	*	.	.	.
Noncultural	Annuals						
		Chenopodium	.	*	*	*	*
		Compositae	*	*	*	*	*
		Euphorbia	*	*	.	*	.
		Polygonaceae	.	.	.	.	*
		Portulaca	*	*	*	**	*
		Unidentifiable Seed	**	*	*	.	.
	Perennials	Juniperus	.	*	.	.	.
		Pinus	.	.	*	.	.

* = 1-10, ** = 11-25

Table 57. Species Composition of Charcoal Submitted for Carbon-14 Dating

Site/Sample	*Juniperus* Juniper	*Pinus* sp. Pine	*Pinus edulis* Piñon	*P. ponderosa* Ponderosa Pine	*Abies* Fir	Undetermined Conifer	Unknown	TOTAL
LA 39998 FS 95		2.33g 31%		.40g 5%	3.06g 41%	1.68g 23%		7.47g 100%
FS 465	1.21g 15%				3.79g 46%	3.15g 39%		8.15g 100%
LA 104381 FS 66/86	.85g 33%		.46g 18%			1.30g 49%		2.61g 100%
FS 130	2.28g 76%		.42g 14%	.08g 3%		.22g 7%		3.00g 100%
FS 316	.35g 30%		.41g 36%	.02g 2%	.19g 17%	.17g 15%		1.14g 100%
LA 104382 FS 93						.35g 69%	.16g 31%	.51g 100%

inches long), and two species whose distribution is mostly farther south but may be found here: *P. leiophylla* or Chihuahua pine, with needles 2-4 inches long, and *P. cembroides*, the Mexican piñon, with needles under 2 inches. Charcoal at this site (Table 57) includes some ponderosa pine and a sizable component identifiable only as *Pinus* species. Significantly, LA 39998 has significant portions of fir charcoal, reflecting the higher elevation of this site relative to other sites in this project.

LA 104381

Here also, unburned annual weed seeds are the predominant element of the flotation assemblage (Table 58). Again, purslane is most numerous, particularly in two Feature 1 samples (FS 60 and 211), and goosefoot is found consistently but in smaller numbers. Low frequency occurrences include spurge and composite family seen at LA 39998, and two new taxa, pigweed and patata. Juniper debris was most evident in FS 60 (five unburned seeds, scale leaves and twig fragments, and male pollen-bearing cones), but turned up again in another Feature 1 sample, FS 155 (more male cones), and in Feature 2 (FS 128; a seed and male cones). One unburned pine needle in FS 60 was the only nonwood correlate of pine-species wood found at LA 104381.

Carbonized plant remains recovered by flotation were limited to pine bark fragments in four samples, all from Feature 1 (FS 155 and 211; Table 59). Two species of pine charcoal were recovered in several instances at LA 104381. Piñon was most abundant, ranging from 14 to 36 percent of the wood assemblage, from fill (FS 66/86), Hearth 2 (FS 130), and associated with a sherd (FS 316). Ponderosa pine constituted 0-3 percent of wood in these proveniences. Juniper was a prominent element of charcoal at this site, ranging from 30 to 76 percent.

Table 58a. Flotation Full Sort Samples, Seeds and Fruits, Frequency per Liter

	FS 60	FS 155, Bag 1	FS 155, Bag 2	FS 211, Bag 1	FS 211, Bag 2	FS 128	FS 129
NONCULTURAL							
Annuals							
Amaranthus	.	2.0	.03	2.8	6.7	.	.
Chenopodium	13.8	3.0	2.7	11.3	13.7	12.9	2.9
Cheno-am	.	.	.	1.3	.	.	.
Compositae	0.3	0.3	.	1.5	8.3	0.6	.
Euphorbia	6.3	.	.	1.5	8.3	0.6	.
Monolepis	1.3	0.3	.	.	.	.	.
Portulaca	255.5	20.7	20.7	88.0	257.7	2.9	.
Perennials							
Juniperus	1.3	.	.	.	.	0.6	.
Total	278.3	26.3	23.7	194.8	286.3	17.6	2.9

Table 58b. Flotation Full Sort Samples, Other Plant Parts, Abundance

	FS 60	FS 155, Bag 1	FS 155, Bag 2	FS 211, Bag 1	FS 211, Bag 2	FS 128
Cultural						
Perennials Pinus	.	1	11	1	1	.
Noncultural						
Perennials						
Juniperus	21	.	1	.	.	1
Pinus	1	.	.	.	.	.

Table 59. Flotation Scan Samples: LA 104381

			Feature 1	Level 2	
			FS 297	FS 359	FS 362
Possibly Cultural	Annuals				
		Physalis	.	*	.
Noncultural	Annuals				
		Amaranthus	*	*	.

		Chenopodium	***	***	***
		Cheno-am	.	.	*
		Euphorbia	*	*	*
		Helianthus	.	.	*
		Portulaca	***	**	.
	Perennials	Juniperus	***	**	.
		Pinus	*	.	.

* = 1-10, ** = 11-25, *** => 25

LA 104382

The single charcoal sample from this site consisted of tiny pieces adding up to only 0.51 g. Radial distortion and splits indicated that much of this wood was likely burned when still green, making accurate identification difficult or foolish. About two-thirds of the sample could be identified as being coniferous, with the remaining third not even distinguishable at that broad level.

Discussion

Datil flotation remains are limited to seeds of weedy annuals (nearly all unburned, and probably intrusive), and piñon, pine, and juniper debris (both burned and unburned) that likely relates to the utilization of wood of these taxa. Despite the array of wild plant taxa showing up in the Datil samples, it is important to realize that we have very little information about wild plant species utilized at these sites. No cultivars were found in any of the 19 flotation samples examined, and one carbonized cob fragment turned up with charcoal in Hearth 1 fill at LA 104381 (FS 156). Given the resiliency and archaeological pervasiveness of corn cob parts, this general absence would indicate that site occupants were not farmers, and suggests that this lone recovery relates to corn more likely acquired by trade.

No dicot tree or shrub wood was encountered in the Datil wood and charcoal examined (six sample proveniences, from a total of three sites). Project location in Great Basin Conifer Woodland (dominated by juniper and piñon) and close proximity of Petran Montane Conifer Forest (pine and fir forests above approximately 2,250 m on high plateaus and mountains; Brown 1982) are reflected in the taxa recovered (juniper, piñon, ponderosa pine, pine species, and fir). The Plains of San Agustín to the south and east of Datil presented a nearly uninterrupted mixed or short-grass community in the prehistoric era (dominated by blue grama and various dropseed grasses; Potter 1957). Grazing and fire suppression have resulted in considerable invasion of juniper, sandsage, soapweed, mesquite, and shinnery oak in the twentieth century (Buffington and Herbel 1965).

Comparison of Datil's floral recoveries with those from Gila Cliff Dwellings (Adams and Huckell 1986) reveals as much about varying deposition patterns and recovery methodologies as about real differences in subsistence adaptations. Areas of overlap between these two studies include only the general cultural area (the northern, mountainous Mogollon) and habitat (piñon-juniper woodland, with nearby higher-elevation areas of ponderosa pine, Douglas fir, and fir, and shrub-grassland bottomlands). Chronologically, the two studies have little to do with each other: minor Archaic occupation is clear at the Gila complex and a possibility at Datil, but the main Gila Cliff occupation (Tularosa phase, A.D. 1270-1290) predates Datil's Piro and Apache settlements by several centuries. Perhaps most importantly, the Gila Cliff dwellings are in dry shelters, allowing the preservation of large quantities of organic materials usually vulnerable to decomposition in open sites.

Some differences between the two assemblages, such as the near-lack of weedy annuals at Gila Cliff, can be attributed to recovery techniques (flotation was not used at Gila Cliff, but produced nine weed seed taxa at Datil). Since Gila Cliff's plentiful record of perennial plant use (agave, yucca, pricklypear, devil's claw) consists of vegetative plant parts categorically absent due to very different preservation conditions at Datil, we cannot yet be sure whether this striking difference in the archaeological record represents any adaptive difference at all between the two project areas. We can be more secure in there being an adaptive significance in other areas of discontinuity in the archaeobotanical record here. Numerous corn, squash, gourd, and cotton remains at Gila Cliff certainly point to agricultural dependence in the Tularosa phase, while their absence at later Datil sites point to nonfarming adaptations of Athabascan nomads, or seasonal camps of Piro puebloans peripherally (or intermittently) involved in farming for a living.

Wood from the Datil sites is all coniferous, differing only in the predominance of juniper-piñon woodland species at the lower elevation site LA 104381, and predominance of ponderosa pine and fir at the higher elevation site, LA 39998. By contrast, a small sample (n=45) of unworked wood from Gila Cliff contains only 16 percent conifers, and a robust variety of tree and shrubs species (Kuckacha in Adams and Huckell 1986, Table 60). Riparian species (cottonwood and willow) comprise 27 percent of the assemblage, and several stream corridor and canyon bottom species (ash, alder, walnut, grape) make up another 11 percent. Shrubby species total nearly half (47 percent) of the specimens; these include several members of the rose family (mountain mahogany, rock-spirea, Apache plume), as well as oak and snowberry.

Table 60. Comparative Botanical Remains at Two Very Different Mogollon Area Projects: Gila Cliff Dwellings and Datil

Plant Taxa	Gila Cliff Dwellings (Adams and Huckell 1986)	Datil (this study)
WEEDY ANNUALS	*Helianthus* sunflower	*Chenopodium* goosefoot *Amaranthus* pigweed *Portulaca* purslane Compositae composite family *Descurainia* tansymustard *Physalis* groundcherry *Helianthus* sunflower *Euphorbia* spurge *Monolepis* patata

Plant Taxa	Gila Cliff Dwellings (Adams and Huckell 1986)	Datil (this study)
PERENNIALS	*Agave/Yucca* (inc. artifacts) *Opuntia* pricklypear Proboscidea (devil's claw capsule) *Juniperus* (juniper seeds, berry, bark) *Pinus edulis* (piñon nuts, cones, needles) *Pinus ponderosa* (ponderosa pine bark) *Quercus* (acorn nuts, shells, caps) *Juglans* (walnuts) *Prunus* spp. (chokecherry pits) *Datura meteloides* jimson weed seeds	*Quercus* **pollen**[1]
GRASSES	Gramineae (abundant stems and leaves) *Muhlenbergia* muhly *Sporobolus* dropseed *Oryzopsis* ricegrass *Phragmites* reedgrass	
CONIFER WOOD	*Cupressus* cypress *Pinus* pine *Pseudotsuga* Douglas-fir	*Juniperus* juniper *Pinus edulis* piñon pine *Pinus ponderosa* ponderosa pine *Abies* fir
DICOT WOOD	*Populus* cottonwood *Salix* willow *Alnus* alder *Fraxinus* ash *Juglans* walnut *Vitis* grape *Cercocarpus* mountain mahogany *Fallugia* Apache plume *Holodiscus* rock-spirea *Quercus* oak *Symphoricarpos* snowberry	
DOMESTICATES	*Zea mays* (corn ears, cobs, leaves, stems, roots, shanks, tassels) *Phaseolus vulgaris* (common beans, pods) *Phaseolus acutifolius* tepary bean *Cucurbita* inc. *C. mixta, moschata, pepo* (squash seeds and peduncles) *Gossypium hirsutum* (cotton fibers)	

[1]found on a metate at LA 104381 (Holloway this volume)
Plant parts are wood in the case of WOOD, and seeds when not otherwise specified.

Summary

Shallow, disturbed deposits at the three Datil sites produced flotation remains consisting largely of unburned seeds of weedy annuals, including goosefoot, pigweed, purslane, tansymustard, knotweed, spurge, sunflower, stickleaf, and groundcherry. Other than a single carbonized goosefoot seed at LA 39998, carbonized (and hence likely cultural) materials consisted of charcoal (all coniferous), pine needles and bark, and juniper seeds, twigs, and male pollen-bearing cones.

Comparison with the plant materials from the nearby Gila Cliff dwellings (largely Tularosa phase deposits) was instructive; these collections are about as different as two assemblages from the same general geographic range could be. The special preservation conditions of dry shelters netted abundant vegetative plant parts of perennial and grass species (stems, leaves, cactus pads, fibers, roots, bracts) both as raw materials and as artifacts at the Gila Cliff dwellings; this category of plant materials was essentially absent at Datil, except for tiny fragments of charcoal. Very different wood assemblages reveal taphonomic as well as different wood use patterns. The charred wood from Datil sites points to consistent selection of resinous, high-heat value conifers for fuel, while 14 riparian, canyon bottom, and dryland shrub taxa (84 percent *non*-conifer) imply a broader source of woody raw materials for a wide range of construction and manufacturing uses at Gila Cliff.

POLLEN ANALYSIS

Richard G. Holloway

Introduction

A total of nine samples, obtained from two archaeological sites (LA 39998 and LA 104381), were sent for pollen analysis to the Castetter Laboratory for Ethnobotanical Studies (CLES) at the University of New Mexico (UNM). Site LA 39998 is an extensive multicomponent artifact scatter on a knoll overlooking White House Canyon. The samples submitted for analysis were all pollen washes of ground stone artifacts and were present in either Level 1 or Level 2 of the site. LA 104381 is a small site with some Athabascan association. The site is located on a knoll within the right-of-way of U.S. 60, near Datil, New Mexico. A single pollen wash sample from a metate and two soil samples for pollen analysis were submitted from this site. I have not personally visited the two archaeological sites.

Methods and Materials

Chemical extraction of pollen samples was conducted at the Palynology Laboratory at the Castetter Laboratory for Ethnobotanical Studies (CLES) at the University of New Mexico (UNM) using a procedure designed for semi-arid Southwestern sediments. The method, detailed below, specifically avoids use of such reagents as nitric acid, bleach, and potassium hydroxide, which have been demonstrated experimentally to be destructive to pollen grains (Holloway 1981).

From each soil pollen sample submitted, 25 grams (g) of soil were subsampled. Prior to chemical extraction, three tablets of concentrated *Lycopodium* spores (batch #710961, Department of Quaternary Geology, Lund, Sweden; 13,911 marker grains per tablet) were added to each subsample. The addition of marker grains permits calculation of pollen concentration values and provides an indicator for accidental destruction of pollen during the laboratory procedure.

The samples were treated with 35 percent hydrochloric acid (Hcl) overnight to remove carbonates and to release the *Lycopodium* spores from their matrix. After neutralizing the acid with distilled water, the samples were allowed to settle for a period of at least three hours before the supernatant liquid was removed. Additional distilled water was added to the supernatant, and the mixture was swirled and then allowed to settle for 5 seconds. The suspended fine fraction was decanted through 250μ mesh screen into a second beaker. This procedure, repeated at least three times, removed lighter materials, including pollen grains, from the heavier fractions. The fine material was concentrated by centrifugation at 2,000 revolutions per minute (RPM).

The fine fraction was treated overnight in cold 48 percent hydrofluoric acid (HF) to remove silicates. After completely neutralizing the acid with distilled water, the samples were treated with a 1 percent solution of tri-sodium phosphate (Na_3PO_4) and repeatedly washed with distilled water and centrifuged (2,000 RPM) until the supernatant liquid was clear and neutral. This procedure removed fine charcoal and other associated organic matter and effectively deflocculated the sample.

Heavy density separation ensued using zinc chloride ($ZnCl_2$), with a specific gravity of 1.99-2.00, to remove much of the remaining detritus from the pollen. The light fraction was diluted with distilled water (10:1) and concentrated by centrifugation. The samples were washed repeatedly in distilled water until neutral and were treated with glacial acetic acid to remove any remaining water.

Acetolysis solution (acetic anhydride: concentrated sulfuric acid in 8:1 ratio) following Erdtman (1960), was added to each sample. Centrifuge tubes containing the solution were heated in a boiling water bath for approximately 8 minutes and then cooled for an additional 8 minutes before centrifugation and removal of the acetolysis solution with glacial acetic acid followed by distilled water. Centrifugation at 2,000 RPM for 90 seconds dramatically reduced the size of the sample, yet from periodic examination of the residue, did not remove fossil palynomorphs.

The material was rinsed in methanol stained with safranin, rinsed twice with methanol, and transferred to 2-dram vials with tertiary butyl alcohol (TBA). The samples were mixed with a small quantity of silicone oil (1,000 cks) and allowed to stand overnight for evaporation of the TBA. The storage vials were capped and are permanently stored at CLES.

A drop of the polliniferous residue was mounted on a microscope slide for examination under an 18-by-18-mm cover slip sealed with fingernail polish. The slide was examined using 200x or 100x magnification under an aus-Jena Laboval 4 compound microscope. Occasionally, pollen grains were examined using either 400x or 1,000x oil immersion to obtain a positive identification to either the family or genus level.

Abbreviated microscopy was performed on each sample in which either 20 percent of the slide (approximately four transects at 200x magnification) or a minimum of 50 marker grains were counted. No full counts were conducted as they were not requested. Regardless of which method was used, the uncounted portion of each slide was completely scanned at a magnification of 100x for larger grains of cultivated plants such as *Zea mays* and *Cucurbita,* two types of cactus *(Platyopuntia* and *Cylindropuntia),* and other large pollen types such as members of the Malvaceae or Nyctaginaceae families. Because corn pollen was very common in many of these samples, corn grains were tabulated during the scans only if an unequal distribution of this taxon on the microscope slide was observed.

Total pollen concentration values were computed for all taxa. Statistically, pollen concentration values provide a more reliable estimate of species composition within the assemblage. Traditionally, results have been presented by relative frequencies (percentages) where the abundance of each taxon is expressed in relation to the total pollen sum (200+ grains) per sample. With this method, rare pollen types tend to constitute less than 1 percent of the total assemblage. Pollen concentration values provide a more precise measurement of the abundance of even these rare types. The pollen data are reported here as pollen concentration values using the following formula:

$$\mathbf{PC} = \frac{\mathbf{K}^*\sum_p}{\sum_L{}^*\mathbf{S}}$$

Where: PC = Pollen Concentration

K = *Lycopodium* spores added

$\sum_p$ = Fossil pollen counted

$\sum_L$ = *Lycopodium* spores counted

S = Sediment weight

The following example should clarify this approach. Taxon X may be represented by a total of 10 grains (1 percent) in a sample consisting of 1,000 grains, and by 100 grains (1 percent) in a second sample consisting of 10,000 grains. Taxon X is 1 percent of each sample, but the difference in actual occurrence of the taxon is obscured when pollen frequencies are used. The use of "pollen concentration values" are preferred because it accentuates the variability between samples in the occurrence of the taxon. The variability, therefore, is more readily interpretable when comparing cultural activity to noncultural distribution of the pollen rain.

The pollen concentration values for pollen wash samples, when present, were calculated using a modification of the above formula. This modification involved the substitution of the area of the artifact washed for the sediment weight (S) variable from the denominator in the equation because the sample was originally in liquid form. The resulting concentration value is thus expressed as estimated grains per cm^2. The resulting pollen concentration values from pollen wash samples are treated independently of those from soil samples in the results and discussion sections, although the data are presented with the other samples in the tables. The use of pollen concentration values from these particular samples are preferred, as explained above, in order to accentuate the variability between pollen wash samples.

Variability in pollen concentration values can also be attributed to deterioration of the grains through natural processes. In his study of sediment samples collected from a rock-shelter, Hall (1981) developed the "1,000 grains/g" rule to assess the degree of pollen destruction. This approach has been used by many palynologists working in other contexts as a guide to determine the degree of preservation of a pollen assemblage and, ultimately, to aid in the selection of samples to be examined in greater detail. According to Hall (1981), a pollen concentration value below 1,000 grains/g indicates that forces of degradation may have severely altered the original assemblage. However, a pollen concentration value of fewer than 1,000 grains/g can indicate the restriction of the natural pollen rain. Samples from pit structures or floors within enclosed rooms, for example, often yield pollen concentration values below 1,000 grains/g.

Pollen degradation also modifies the pollen assemblage because pollen grains of different taxa degrade at variable rates (Holloway 1981, 1989). Some taxa are more resistant to deterioration than others and remain in assemblages after other types have deteriorated completely. Many commonly occurring taxa degrade beyond recognition in only a short time. For example, most (about 70 percent) Angiosperm pollen has either tricolpate (three furrows) or tricolporate (three furrows each with pores) morphology. Because surfaces erode rather easily, once deteriorated, these grains tend to resemble each other and are not readily distinguishable. Other pollen types (e.g., Cheno-am) are so distinctive that they remain identifiable even when almost completely degraded.

Pollen grains were identified to the lowest taxonomic level whenever possible. The majority of these identifications conformed to existing levels of taxonomy with a few exceptions. For example, Cheno-am is an artificial, pollen morphological category which includes pollen of the family Chenopodiaceae (goosefoot) and the genus *Amaranthus* (pigweed) which are indistinguishable from each other (Martin 1963). All members are wind pollinated (anemophilous) and produce very large quantities of pollen. In many sediment samples from the American Southwest, this taxon often dominates the assemblage.

Pollen of the Asteraceae (sunflower) family was divided into four groups. The high spine and low spine groups were identified on the basis of spine length. High spine Asteraceae contains those grains with spine length greater than or equal to 2.5μ while the low spine group have spines less than

2.5μ in length (Bryant 1969; Martin 1963). *Artemisia* pollen is identifiable to the genus level because of its unique morphology of a double tectum in the mesocopial (between furrows) region of the pollen grain. Pollen grains of the Liguliflorae are also distinguished by their fenestrate morphology. Grains of this type are restricted to the tribe Cichoreae which includes such genera as *Taraxacum* (dandelion) and *Lactuca* (lettuce).

Pollen of the Poaceae (grass) family are generally indistinguishable below the family level, with the single exception of *Zea mays*, identifiable by its large size (about 80μ), relatively large pore annulus, and the internal morphology of the exine. All members of the family contain a single pore, are spherical, and have simple wall architecture. Identification of noncorn pollen is dependent on the presence of the single pore. Only complete or fragmented grains containing this pore were tabulated as members of Poaceae.

Clumps of four or more pollen grains (anther fragments) were tabulated as single grains to avoid skewing the counts. Clumps of pollen grains (anther fragments) from archaeological contexts are interpreted as evidence for the presence of flowers at the sampling locale (Bohrer 1981). This enables the analyst to infer possible human behavior.

Finally, pollen grains in the final stages of disintegration but retaining identifiable features, such as furrows, pores, complex wall architecture, or a combination of these attributes, were assigned to the Indeterminate category. The potential exists to miss counting pollen grains without identifiable characteristics. For example, a grain that is so severely deteriorated that no distinguishing features exist, closely resembles many spores. Pollen grains and spores are similar both in size and are composed of the same material (Sporopollenin). So that spores are not counted as deteriorated pollen, only those grains containing identifiable pollen characteristics are assigned to the Indeterminate category.

Thus, the Indeterminate category contains a minimum estimate of degradation for any assemblage. If the percentage of Indeterminate pollen is between 10 and 20 percent, relatively poor preservation of the assemblage is indicated, whereas Indeterminate pollen in excess of 20 percent indicates severe deterioration to the assemblage.

In those samples where the total pollen concentration values are approximately at or below 1,000 grains/g, and the percentage of Indeterminate pollen is 20 percent or greater, counting was terminated at the completion of the abbreviated microscopy phase. In some cases, the assemblage was so deteriorated that only a small number of taxa remained. Statistically, the concentration values may have exceeded 1,000 grains/gm. If the species diversity was low (generally these samples contained only pine, Cheno-am, members of the Asteraceae [sunflower] family and Indeterminate category), counting was also terminated after abbreviated microscopy even if the pollen concentration values slightly exceeded 1,000 grains/g.

Results

Table 61 provides the provenience data for all samples from sites LA 39998 and LA 104381. The raw pollen counts are provided in Table 62 with the estimated concentration values in Table 63. As explained later, the estimated maximum concentration value for target taxa is also provided in Table 62.

Table 61. Pollen Sample Provenience Data

Site	FS#	Grid	Level	Depth	Sample	CLES#
LA 39998	91	101N/197E	1	surface	mano	94415
LA 39998	96	91N/213E	1	surface	mano	94414
LA 39998	594	103N/116E	2	140-146 cm	mano #1	94409
LA 39998	594	103N/116E	2	140-146 cm	mano #2	94410
LA 39998	790	96N/120E	2	160-170 cm	mano	94412
LA 39998	952	102N/119E	2	160-170 cm	mano	94413
LA 104381	361	109N/100E			metate	94411
LA 104381	363	109N/100E	2	111-124 cm	pollen #2	94417
LA 104381	360	109N/100E	2	111-124 cm	pollen #1	94416

Table 62. Raw Pollen Counts

Site	FS#	Pinus	Picea	Quercus	Poaceae	Cheno-am	Aster, High spine	Aster, Low spine	Indet.	Sum	Transects
LA 39998	91	25	1							26	11
	96	10				1		1		12	6
	594	4				3		1	1	9	7
	594	16								16	6
	790	82				3		2		87	4
	952	14				2		1		17	2
LA 104381	361	26		1		3		6		36	6
	363	67			1			2	2	72	3
	360	107				6	1	2	2	118	4

Site	FS #	Marker	Area	Concentration	Estimated Maximum Concentration
LA 39998	91	27	109.00	368.7	7.09
LA 39998	96	51	48.00	204.6	4.65
LA 39998	594	57	96.00	68.6	2.54
LA 39998	594	53	18.75	671.9	11.45
LA 39998	790	60	206.00	293.8	0.56
LA 39998	952	80	163.36	54.3	0.32
LA 104381	361	82	113.10	162.0	1.17
LA 104381	363	57		2109	
LA 104381	360	58		3396	

Table 63. Pollen Concentration Values

Site	FS #	*Pinus*	*Picea*	*Quercus*	Poaceae	Cheno-am	Aster, High Spine	Aster, Low Spine	Indeterminate
LA 39998	91	355	14	0	0	0	0	0	0
LA 39998	96	170	0	0	0	17	0	17	0
LA 39998	594	31	0	0	0	23	0	8	8
LA 39998	594	672	0	0	0	0	0	0	0
LA 39998	790	277	0	0	0	10	0	7	0
LA 39998	952	45	0	0	0	6	0	3	0
LA 104381	361	117	0	5	0	14	0	27	0
LA 104381	363	1962	0	0	29	0	0	59	59
LA 104381	360	3080	0	0	0	173	29	58	58

LA 39998

Two artifacts were recovered from Level 1. Both samples were from manos. The mano obtained from FS 91 contained a total pollen concentration value of 368.7 grains/cm^2. Only *Pinus* (355 grains/cm^2) and a single grain of *Picea* (14 grains/cm^2) were present from this sample.

FS 96 contained a total pollen concentration value of 204.6 grains/cm^2. *Pinus* (170 grains/cm^2) pollen was present in addition to Cheno-am and low spine Asteraceae (17 grains/cm^2 each).

Two manos were recovered from the 140-146 cm level of Level 2, both from FS 594. Mano 1 contained only 68.6 grains/cm^2 total pollen concentration. *Pinus* (31 grains/cm^2), Cheno-am (23 grains/cm^2), low spine Asteraceae and Indeterminate (8 grains/cm^2 each) were present. Mano #2 contained 671.9 grains/cm^2 total concentration with *Pinus* the only taxon recovered.

FS 790 was a mano and contained 293.8 grains/cm^2 total pollen concentration. *Pinus* (277 grains/cm^2) dominated the assemblage with small amounts of Cheno-am (10 grains/cm^2) and low spine Asteraceae (7 grains/cm^2) present.

FS 952 was also a mano and contained 54.3 grains/cm^2 total concentration. *Pinus* (45 grains/cm^2), Cheno-am (6 grains/cm^2), and low spine Asteraceae (3 grains/cm^2) were present in the assemblage.

LA 104381

Sample FS 361 was a pollen wash from a metate and contained 162 grains/cm^2 total concentration. *Pinus* (117 grains/cm^2) dominated the assemblage. *Quercus* (5 grains/cm^2), Cheno-am (14 grains/cm^2), and low spine Asteraceae (27 grains/cm^2) were also present from this artifact.

Samples FS 360 and 363 were both soil samples taken from 15 cm below the ground surface of Grid 109n/100e. Both samples produced well-preserved assemblages. FS 363 contained 2,109 grains/g total concentration. Pinus (1,962 grains/g) dominated the assemblage with low amounts of Poaceae (29 grains/g) and low spine Asteraceae (59 grains/g). Indeterminate pollen was present in amounts of 598 grains/g.

FS 360 contained 3,396 grains/g total concentration. *Pinus* (3,080 grains/g) dominated the assemblage. Cheno-am (173 grains/g) was present along with high spine (29 grains/g) and low spine (58 grains/g) Asteraceae. Indeterminate pollen was present in quantities of 58 grains/g.

Discussion

The two soil samples contained similar pollen assemblages. Both were dominated by *Pinus* pollen. This is not surprising since the site was located above 7,200 ft in elevation. The presence of small amounts of Poaceae and Cheno-am pollen suggest a more typical pine dominated forest environment with open areas, which is typical in this area and at this elevation.

The only metate submitted from this suite of artifacts was from LA 104381. The pollen concentration values were fairly low. The presence of trace amounts of *Quercus* pollen from the metate suggests at least the presence of this taxon in the area. This is consistent with the pine forests in this portion of the state. However, it is also likely that *Quercus* pollen could have been deposited during processing of materials. Whatever the source, the presence of *Quercus* pollen suggests the presence of this taxon in the area, and it is quite likely that acorns were being utilized.

The pollen assemblages from the manos from LA 39998 were all dominated by *Pinus* pollen. This is not unexpected given the high elevation for the site. The presence of Picea pollen, in small amounts, is also not unexpected given the elevation. Primarily, the remainder of the pollen assemblages consist of either Cheno-am or low spine Asteraceae pollen. These remaining taxa are all in fairly low amounts. The likely presence of a pine forest in the vicinity suggests that these other taxa could have easily been deposited naturally onto the artifacts. While we cannot exclude the possibility that these artifacts were used in processing some of these materials, the simpler explanation is that the pollen assemblage is reflecting the local plant community.

Unfortunately, no diagnostic economic type pollen was recovered from the samples from these sites. This may be due to the fact that these economic pollen types are absent from the assemblages. Alternatively, they may be present in such small concentrations that their presence could be missed by counting or examining only a single slide. To test for this possibility, I computed the maximum estimated concentration value for any target taxon. Assuming that the next grain counted on a second slide would be one of the target grains, then 1 can be used for the pollen sum in the numerator of the pollen concentration formula. By computing the average number of marker grains encountered in the transects counted, and multiplying this for the total number of transects on the first slide, and using this number as the number of marker grains counted in the formula, a maximum potential concentration value was obtained. Mano #2 from FS 594 showed that this maximum concentration was 11.45 grains/cm^2 while all other manos were less than 7 grains/cm^2. In two samples (FS 790 and FS 952) the maximum concentration was less than 1 grain/g. Even in the metate from LA 104381, the maximum concentration was below 1.17 grains/cm^2. This strongly suggests that other economic taxa were not present in these assemblages. This computation was not conducted for the soil samples.

Conclusions

The pollen assemblages from these two sites suggest the presence of high elevation pine forest communities in the vicinities of these sites. These appear to be typical pine stands with open areas of grass or other small herbaceous components. The presence of *Quercus* pollen from the metate from LA 104381 may suggest the processing of oak materials. Undoubtedly this taxon was present and in all likelihood the acorns would have been widely utilized.

No other economic type pollen was present in these assemblages. However, as the calculation of maximum potential pollen concentration values indicated, this absence was probably real and not reflective of sampling error. The other constituents of the pollen assemblages, notably Cheno-am and low spine Asteraceae, probably reflect more of the local environment than of plant processing. It is very likely that a variety of plant materials were processed by these artifacts; unfortunately, evidence of such has not been preserved.

SYNTHESIS

David J. Hayden and Lloyd A. Moiola

LA 39998

Discussion

The cultural deposits at this site were mixed and represent an accumulation of material during several occupations over a broad time period. Diagnostic artifacts were identified, and indicate occupations by at least three distinct cultural groups in three general time frames, however it is not possible to discern cultural differences within the nondiagnostic artifact assemblage. There was no evidence to suggest spatial associations between artifacts; erosion seems to have disturbed much of the cultural fill. Several general site activities are indicated though association with specific occupations is not possible in most cases. No cultural features were identified. Several charcoal samples recovered from general cultural fill provided radiocarbon dates. Because of their recovery context, however, these dates must be considered with caution.

The chipped stone assemblage implies an overall emphasis on nonsystematic core reduction, primarily of local materials. Very few informal tools were identified, although this is likely reflective of limitations in the analysis as well as the characteristics of local materials such as rhyolite. In addition, breakage patterns in the formal tool assemblage, and the presence of some bifacial reduction flakes, indicate episodes of bifacial reduction.

Two-thirds of the projectile points (n=36) were culturally and temporally nondiagnostic, yet most were consistent in size with atlatl points most frequently associated with Paleoindian and Archaic period occupations. Eighteen projectile points were similar to specific Middle and Late Archaic styles, including: San Augustin, Chiricahua, San Pedro, and En Medio. No other styles were identified within the projectile point assemblage, although five small points were likely used for arrows.

Morphological criteria and wear pattern analysis of ground stone and palynological and macrobotanical data suggest processing of wild resources such as seeds, acorns, and perhaps some fibrous materials. No evidence of cultigens was identified. A small assemblage of burned animal bone was recovered, and indicates use of medium and large mammals for food; some projectile point fragments also support the idea that meat packages were brought back to this site.

At least three distinct periods of occupation are represented by ceramic, projectile point, and radiocarbon data. A Middle-Late Archaic period occupation is implied by projectile point styles and calibrated radiocarbon dates of 350, 300, and 215 B.C. Breakage patterns in the projectile point assemblage suggest retooling or resharpening of weapons and perhaps game processing during this time frame. It is unclear whether this assemblage represents a single occupation or a series of occupations.

Small numbers of Formative period (Mogollon/Anasazi) ceramics, including Alma Plain, early painted white wares, late polished white wares, and Socorro Black-on-white, indicate a brief occupation, or series of brief occupations between A.D. 600 and A.D. 1400. Although five small projectile points (arrow points) may be related, no other artifacts or site activities could be associated.

Protohistoric (Apache or Piro) occupations are indicated by Athabascan utility wares and Rio Grande (Piro) ceramics. Although the Athabascan pottery was produced until at least the nineteenth century, Piro groups abandoned the Rio Grande and Magdalena areas soon after 1680. It is possible that these assemblages represent distinct occupations. However, it is more likely that both are the result of Apache occupations; historic accounts indicate frequent trade between the Apache and Piro, and intense Apache control over the Datil area during the protohistoric period. It is not clear if this assemblage represents a single occuation or a series of occupations. Five unidentified small projectile points (arrow points) may be related, but no other artifacts or site activities could be associated with this period.

Cultural features were not identified. Several charcoal samples were recovered from general cultural fill. Calibrated radiocarbon dates include 300-215 B.C., A.D. 1310-1385, and A.D. 1505-1620. Since these samples were not associated with cultural features, and are from shallow deposits of mixed soils, they must be considered with caution. They are, however, consistent with other data suggesting Late Archaic, Formative, and protohistoric occupations.

Conclusion

The chipped stone, ground stone, and faunal assemblages indicate several site activities, including hunting and game processing, bifacial tool manufacture or maintenance, informal chipped stone tool production, and processing of wild plant resources. Because of the lack of discrete cultural deposits, these activities cannot be associated with any particular occupation.

Radiocarbon, projectile point, and ceramic data suggest multiple occupations by three (possibly four) groups that included Archaic, Formative Mogollon/Anasazi, Athabascan, and possibly Piro Pueblo populations, though it is not possible to distinguish these components within the majority of the artifact assemblage. Further, it is not clear how many occupational episodes are represented across these time periods. The proximity of the site to a consistent water source, as well as its view of the valley make it an ideal location for resource procurement and continual re-occupation seems likely.

LA 104381

Discussion

A number of artifacts (including projectile points and ceramics) were diagnostic of distinct temporal or cultural affiliations, but distinguishing these components within the general artifact assemblage was not possible. With the exception of Feature 1 (a burned brush structure), there was little evidence to suggest spatial associations between artifacts; erosion seems to have disturbed much of the cultural fill.

The chipped stone assemblage suggests an emphasis on nonsystematic core reduction, primarily of local materials. The assemblage is indicative of informal, expedient tool manufacture and use, although wear pattern analysis did not support this conclusion. Very few informal tools were identified. This, however, is likely reflective of limitations in the analysis as well as the characteristics of local materials such as rhyolite. Several undifferentiated bifaces were broken during manufacture and projectile point breakage patterns indicate discard because of use-related breaks or rehafting.

The majority of the projectile points were fragmentary and nondiagnostic, yet several were similar to Late Archaic styles, including San Pedro and En Medio. In addition, five arrow points were identified, including a Mogollon Side Notched and four points similar to Desert Side Notched and Cottonwood Triangular. Mogollon Side-Notched points are most often associated with Highland Mogollon Pithouse and Pueblo period occupations; Desert Side-Notched and Cottonwood Triangular points have been associated with Athabascan occupations in the Four Corners region of New Mexico.

Most of the ground stone recovered from the site was associated with the structure and two external hearths. The assemblage consisted primarily of slab metates and one-handed manos. Pollen analysis of samples removed from the ground stone suggest acorn processing, an activity which is supported by wear pattern analysis. Although one fragment of a corn cob was recovered from the structure's hearth, there is no other evidence to suggest that cultigens were utilized on the site.

An assemblage of 489 animal bones was recovered primarily from two dump areas adjacent to and associated with the structure. The assemblage is highly fragmented and burned, and suggests intensive nutritional recovery and primary disposal in an active fire. Secondary dumping was in close proximity to the structure and demonstrated a discard pattern that may indicate a short-term, cold season occupation or series of occupations.

Four occupational episodes are suggested by projectile point, ceramic, and radiocarbon data. These occupations include possible Late Archaic, seventh century (Mogollon/Anasazi Pithouse Period), Reserve phase Mogollon, and protohistoric Athabascan (most likely Apache). Several projectile points are consistent with Late Archaic styles, although their relationship to this site is uncertain since their presence may be the result of erosional processes or redeposition from an Archaic lithic scatter upslope.

Charcoal samples from the structure and its indoor hearth provide calibrated radiocarbon dates ranging between A.D. 600 and 680. Feature 2, a small hearth, provides a calibrated radiocarbon date of A.D. 645. Concentrations of faunal material associated with the structure suggest game procurement during this time period, however, no projectile point assemblage with attributes indicating a temporal association (with the possible exception of the Mogollon Side-Notched point) were identified. It is possible that several points and point fragments identified as Late Archaic atlatl points were in use at this time, and are associated with this occupation.

The ceramic assemblage indicates two distinct occupational episodes, including Reserve phase Mogollon and protohistoric Athabascan. The former occupation is represented only by ceramic data (although the Mogollon Side-Notched point could be related). The latter occupation is supported by a charcoal sample recovered from a burned area that was not designated as a cultural feature; this provided a calibrated radiocarbon date ranging between A.D. 1520 and 1630. In addition, four projectile points (Desert Side-Notched and Cottonwood Triangular) are likely associated with this occupation. Historic documents concerning Athabascan groups indicate that Chiricahua Apaches occupied the Datil Mountain region from before European contact until the mid-nineteenth century when Navajo refugees began replacing them. It seems most likely that the Athabascan occupation at this site is Chiricahua Apache (Opler 1983; Schroeder 1974).

Conclusion

Multiple occupations during four time periods are suggested by radiocarbon dates and diagnostic artifacts, including Late Archaic period, seventh century (unknown cultural affiliation), Reserve phase Mogollon, and protohistoric Athabascan (Apache). It is difficult, however to develop associations between these data and the overall artifact assemblage. Since an Archaic site has been identified nearby, and is upslope, artifacts attributed to this period may be intrusive. It is also possible that these artifacts are associated with the seventh-century occupation.

Two of the three cultural features date to the mid-seventh century based on radiocarbon data, and are associated with most of the bone removed from the site. This suggests game processing and hunting activities during this occupation. Late Archaic style projectile points and much of the ground stone may also be associated with this time period.

A Reserve phase Mogollon occupation is suggested by the ceramic assemblage, and is not supported or rejected by any other data. A protohistoric Athabascan occupation is evidenced by ceramic data, supported by a sixteenth-century radiocarbon date, and suggested by four projectile points.

Several general site activities are implied, including bifacial tool (including projectile point) manufacture or maintenance, hunting, and processing of wild plant foods. With the exception of faunal and ground stone associations from the seventh-century occupation, few associations between occupations and the nondiagnostic portions of the artifact assemblage could be made. The majority of the cultural material recovered cannot be associated with any cultural group or time frame. Most of the chipped stone material is suggestive of expedient tool reduction, although very few informal tools were identified. It likely represents an accumulation of material from all the occupations considered above.

LA 104382

Discussion

A relatively small amount of cultural material was removed from LA 104382, almost all of which was chipped stone debitage. This assemblage suggests an emphasis on systematic, bifacial reduction; 35 percent of the assemblage was bifacial reduction debris, and a large number of intact platforms were modified by retouch or abrasion. Following Kelly (1988), such a pattern, in the absence of frequent examples of expedient tool use, may indicate an emphasis on formal, bifacial tool manufacture and/or maintenance, rather than bifacial core reduction for informal tool use. The absence of an adequate tool assemblage (either informal or formal) makes defending or refuting such an argument difficult.

Assigning temporal or cultural affiliation to this site is difficult as well. Based on the size of the assemblage and the lack of cultural features (or any evidence of extended occupation), it is tempting to view this site as a very short-term, single occupation, logistical camp. Although this interpretation is likely accurate, it is difficult to be sure how much of the site (and what cultural manifestations) exists outside of the right-of-way. Some portion of the site may have been removed during the initial construction of U.S. 60. The majority of this site was likely subsurface prior to initial road construction since almost all of the artifacts observed during the project were eroding out of subsurface fill. Very few surface artifacts were observed outside of the existing right-of-way, although excavation units along the right of way fence yielded significant numbers. It is difficult, therefore, to thoroughly define site limits, and impossible to determine what portion of the cultural material was recovered. As a result, the perceived uniformity and small size of the assemblage may be more a consequence of the site portion that was excavated than the total range of site activities.

Of two projectile point fragments recovered, one was collected away from the main artifact concentration and may not be associated with the rest of the assemblage. Neither projectile point is culturally or temporally diagnostic, although their size suggests that they were probably atlatl dart points, most likely associated with Paleoindian or Archaic groups.

Short-term logistical camps, of which this site is reminiscent, intuitively seem more likely during these periods of high mobility. A calibrated radiocarbon date of 7020 B.C. was obtained, although the context of the sample's recovery prescribes a very cautious application. Further, it is important to realize that many other groups utilizing this area throughout history (including Piro, Zuni, Acoma, Apache, and Navajo) made use of chipped stone, bifacial tools, and conducted extensive logistical forays.

Conclusion

It is unclear what portion of the site was recovered during excavation, however, the artifact assemblage collected suggests a single, short-term occupation emphasizing bifacial tool manufacture or maintenance. Although both radiocarbon and projectile point data should be considered with caution, they imply a late Paleoindian or Early Archaic period occupation.

General Overview

The data acquired from this project provides general information regarding prehistoric and protohistoric use of the Datil Mountains. Although the condition of each of the three sites excavated precludes extensive, discrete evaluation of individual cultural continuums in the area, they provide confirmation of the presence of several cultural groups across broad temporal periods. With one exception, the relationship between site activities and cultural context is vague, however, the data obtained suggest a broad use of the Datil Mountain area for short-term habitations related to resource procurement over long periods of time. More archeological research in the area is necessary to determine the range of cultural manifestations in the region.

Archaic Period Use

Several Archaic period sites have been documented during cultural resource surveys within and near the project area, although relatively few have been excavated (notably Beckett 1980; Dick 1965; Hannaford 1985; Martin et al. 1952; and Wills 1988) Prior to this project, no Archaic period sites are known to have been excavated in the Datil Mountains.

All three sites excavated during this project show some evidence of an Archaic period occupation. Despite the fact that temporal/cultural assignment is guarded, LA 104382 is distinct because it represents a single, short-term occupational episode. The artifact assemblage suggests an emphasis on bifacial reduction, probably in the form of tool manufacture or maintenance. Most likely this site served as part of a logistical foray for resource procurement (hunting).

The Archaic period manifestations at LA 39998 and LA 104381 are less clear, because both sites have multiple components and mixed cultural deposits. Several projectile points similar to Middle and Late Archaic styles were recovered from LA 39998, and a charcoal sample recovered from general cultural fill provided a radiocarbon date of 350-215 B.C. Breakage patterns and portions indicate that several Archaic style points may have been manufactured, reworked, or rehafted on site, and that some fragments may have been brought back to the site in meat packages. Since nondiagnostic cultural materials could not be separated, more specific site activities could not be associated with this occupation.

An Archaic period occupation is suggested at LA 104381 only by the presence of diagnostic projectile point styles, though their relationship to other cultural deposits is problematic. A large unrecorded chipped stone artifact scatter (with several Archaic style points) is located upslope. Although these sites seem to be separate, erosion may have mixed some deposits. Further, there is evidence to suggest that some of the projectile points recovered might be associated with a seventh-century (A.D. 600-680) structure, outside the traditional temporal frame for Archaic occupations. What this relationship implies about cultural affiliation or overall subsistence strategy is unclear.

Formative Period Use

Formative occupations are suggested at two sites by radiocarbon and ceramic data. As described above, an occupation during the early Formative period is suggested by radiocarbon data for LA 104381; the lack of diagnostic materials traditionally associated with this time frame makes clarifying cultural affiliation difficult. Further, the possible association of Late Archaic style atlatl points suggests a departure from the general culture descriptions of this time period. Data from cultural features, faunal remains, and ground stone associated with this occupation indicates an emphasis on procurement and processing of both plant and animal resources.

Ceramics recovered from mixed cultural deposits indicate a Reserve phase Mogollon occupation, however, no other supporting data is available. No features associated with this component were identified, and it was not possible to associate any portion of the nondiagnostic artifact assemblage.

A small portion of the ceramic assemblage from LA 39998 suggests a possible late Formative period Anasazi/Mogollon occupation. A charcoal sample collected from mixed cultural deposits provided a radiocarbon date of A.D. 1310-1385. Since no cultural features could be identified on this site, and cultural deposits were mixed, the nature of this occupation is unclear.

Surveys within the project area have identified several artifact scatters associated with Formative period occupations, which have not been excavated. Few of the architectural features most frequently associated with residential manifestations of this time period, including both pithouse and pueblo units, have been identified within the project area. In this respect, this area is unique from adjacent locations such as the Gallo Mountain/Quemado, Gila, and Magdalena areas, however, further archaeological research is necessary.

Protohistoric Use

Spanish Colonial and Euro-American documents describe several Apachean groups occupying the Datil Mountain area from at least the late sixteenth century until the mid-nineteenth century (Gerow 1994; Opler 1983; Schroeder 1974); it is likely that they began entering the area as early as the 1400s (Brugge 1992). Although references to specific groups are somewhat vague and inconsistent, it is likely that these inhabitants were Chiricahua Apache. Trade ties were maintained between the Apaches and Pueblos (particularly Piro), however, relations are depicted as strained, and it is unlikely that groups other than the Apache utilized this area consistently.

Only a few sites recorded in the project area have been identified as possible Athabascan, and these are most likely Navajo sites from the late nineteenth century. It is likely that a large number of sites recorded as "unspecified lithic scatters," or even as Archaic period sites are of Apachean origin.

Both LA 39998 and LA 104381 showed evidence of protohistoric Athabascan use. The ceramic assemblage from LA 39998 included a significant number of both Athabascan utility and Rio Grande (Piro) sherds. The historical context of Piro/Apache relations suggests that these ceramics represent an occupation by Apachean groups whose tool kit included trade wares from the Piro area. No cultural features were identified, and cultural deposits were mixed, however, a charcoal sample from general cultural fill provided radiocarbon dates of A.D. 1505-1620. No other artifacts could be associated with this occupation.

Most of the ceramic assemblage from LA 104381 consisted of Athabascan utility wares. One charcoal sample recovered from general cultural fill provided a radiocarbon date of A.D. 1520-1630 In addition, four small arrow points were similar to Desert Side-Notched and Cottonwood Triangular styles, both of which have been associated with Athabascan sites elsewhere. No features or other artifacts could be related to this occupation.

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APPENDIX 1
LITHIC ANALYSIS ATTRIBUTE AND VARIABLE CODES
DATIL MOUNTAIN PROJECT

Material Type

000 unknown
001 chert, undiff.
002 Pedernal chert
003 Tecolote chert
004 Washington Pass chert
005 Brushy Basin chert
006 Baldy Hill chert
007 Alibates chert
008 Tecovas chert
009 clastic chert
010 San Andreas chert
011 Santa Fe chert
012 Hueco chert

080 chalcedony, undiff.
081 Luna Blue agate

100 silicified wood, undiff.
101 Zuni wood
102 Variety 1
103 Variety 2

200 obsidian, undiff.
201 Jemez, generic
202 Polvadera Peak
203 Grants Ridge
204 Red Hill
205 Antelope Wells
206 Mule Creek

300 igneous, undiff.
310 nonvesicular basalt
320 vesicular basalt
330 granite
340 rhyolite
341 chertic rhyolite

400 sedimentary, undiff.
410 limestone
420 sandstone
430 siltstone
431 Variety 1 (Hueco?)
440 mudstone
450 shale

500 metamorphic, undiff.

510 quartzite, undiff.
530 quartzitic sandstone
540 schist
541 serpentine
542 micaceous schist

600 mineral, undiff
630 quartz crystal
631 massive quartz

999 other

Material Texture and Quality

1 glassy
2 glassy and flawed
3 fine-grained
4 fine-grained and flawed
5 medium-grained
6 medium-grained and flawed
7 coarse-grained
8 coarse-grained and flawed

Artifact Morphology Categories

00 indeterminate
01 angular debris
02 core flake
03 biface flake
04 resharpening flake
05 notching flake
06 bipolar flake
07 blade
08 hammerstone flake
09 channel flake
10 potlid

11 strike-a-light flake

20 tested cobble
21 core, undifferentiated
22 unidirectional core
23 bidirectional core
24 multidirectional core
25 pyramidal core

30 cobble tool, undifferentiated
31 cobble tool-unidirectional
32 cobble tool-bidirectional

40 uniface, undifferentiated
41 uniface-early stage
42 uniface-middle stage
43 uniface-late stage

50 biface, undifferentiated
51 biface-early stage
52 biface-middle stage
53 biface-late stage

90 reworked tool, undiff.
91 reworked early stage uniface
92 reworked middle stage uniface
93 reworked late stage uniface
94 reworked early stage biface
95 reworked middle stage biface
96 reworked late stage biface

100 unworked cobble

Artifact Functional Categories

001 utilized debitage
002 retouched debitage
003 utilized/retouched debitage
005 utilized core

010 hammerstone
011 chopper
012 plane
013 axe
014 pecking stone
015 hoe
016 maul
017 tchamahia
018 axe/hoe

050 drill
051 graver
052 spokeshave (notch)
053 denticulate

075 core-chopper
076 scraper-graver
077 chopper-hammerstone

080 strike-a-light flint
081 gun flint

090 unutilized angular debris
091 unutilized flake
092 unutilized core
093 unutilized cobble tool

100 uniface, undifferentiated
101 end scraper
102 side scraper
103 end/side scraper
104 thumbnail scraper

150 biface, undifferentiated
151 knife
152 Cody knife
153 projectile point preform

200 unidentified projectile point
201 unidentified large projectile point
202 unidentified small projectile point
203 unidentified stemmed projectile point
204 unidentified large stemmed projectile point
205 unidentified small stemmed projectile point
206 unidentified corner-notched projectile point
207 unidentified large corner-notched projectile point
208 unidentified small corner-notched projectile point
209 unidentified side-notched projectile point
210 unidentified large side-notched projectile point
211 unidentified small side-notched projectile point
212 unidentified fluted point

220 unidentified Paleoindian projectile point

221 Clovis point
222 Folsom point
223 Midland point
224 Plainview point
225 Firstview point
226 Jimmy Allen point
227 Meserve point
228 Agate Basin point
229 Hell Gap point
230 Belen point
231 Milnesand point
232 Eden point
233 Scottsbluff I point
234 Scottsbluff II point
235 Frederick point

300 unidentified Archaic projectile point
301 Jay point
302 Bajada point
303 San Jose point
304 Armijo point
305 En Medio (Basketmaker II) point
306 Chiricahua point
307 San Pedro point
308 Augustin point
309 Pelona point
310 Gypsum Cave

400 Basketmaker III point
401 Pueblo side-notched point
402 small side-notched point, long and narrow, Mogollon
403 Pueblo corner-notched
404 small Mogollon side-notched
500 Athabascan side-notched point

600 eccentric
601 three side-notches

900 fire-cracked rock

Flake Platform Type

-- not applicable
01 cortical
02 cortical and abraded
03 single facet
04 single facet and abraded
05 multifacet
06 multifacet and abraded
07 retouched
08 retouched and abraded
09 abraded
10 collapsed
11 crushed
12 absent
13 broken-in-manufacture
14 obscured

Portion

0 indeterminate fragment
1 whole
2 proximal
3 medial
4 distal
5 lateral
6 collapsed platform

Platform Lipping

-- not applicable
1 present
2 none present

Cortex Type

-- not applicable
1 waterworn
2 nonwaterworn

Thermal Alteration

-- not applicable
01 potlids-ventral surface
02 potlids-dorsal surface
03 potlids-other surface
04 crazed
05 crazed and 01
06 crazed and 02
07 crazed and 03
08 crazed and 09
09 potlids-ventral and dorsal surfaces
10 potlid
11 color change
12 luster variation

13 luster var./color change

Wear Patterns

-- not applicable
01 unidirectional utilization
02 bidirectional utilization
03 unidirectional retouch
04 bidirectional retouch
05 rounding
06 rounding and 01
07 rounding and 02
08 rounding and 03
09 rounding and 04
10 noncultural edge damage
11 bidirectional retouch and abrasion
12 battering
13 rotary
14 unidirectional retouch and unidirectional wear
15 unidirectional retouch and battering
16 bidirectional retouch and battering
17 bidirectional retouch and wear
19 abrasion
20 unidirectional wear and working edge abraded
21 serrated-denticulate
22 unidirectional retouch and bidirectional wear
23 bidirectional utilization and working edge abraded
24 bidirectional retouch and unidirectional utilization
25 unidirectional retouch and abrasion

50 biface edge
51 uniface edge
52 projectile point blade edge
53 projectile point base edge
54 drill shaft edge
55 biface edge-abraded for platform preparation
56 cobble tool edge
57 strike-a-light flint edge
58 gunflint edge
59 axe edge

APPENDIX 2
PROJECTILE POINT ANALYSIS ATTRIBUTE AND VARIABLE CODES
DATIL MOUNTAIN PROJECT

Material Type

000 unknown

001 chert, undiff.
002 Pedernal chert
003 Tecolote chert
004 Washington Pass chert
005 Brushy Basin chert
006 Baldy HIll chert
007 Alibates chert
008 Tecovas chert
009 clastic chert
010 San Andreas chert
080 chalcedony, undiff.
081 Luna Blue Agate
100 silicified wood, undiff.
101 Zuni wood

200 obsidian, undiff.
201 Jemez, generic
202 Polvadera Peak
203 Grants Ridge
204 Red Hill
205 Antelope Wells
206 Mule Creek

300 igneous, undiff.
310 nonvesicular basalt
320 vesicular basalt
330 granite
340 rhyolite

400 sedimentary, undiff.
410 limestone
420 sandstone
430 siltstone
440 mudstone
450 shale

500 metamorphic, undiff.
510 quartzite, undiff.
530 quartzitic sandstone
540 schist
541 serpentine

600 mineral, undiff
610 turquoise
620 azurite
621 malachite
630 quartz crystal
631 massive quartz
632 mica
633 gypsum
634 calcite
635 selenite
640 galena
641 hematite
650 coal
651 jet
660 fossil, undiff.
661 crinoid stem
670 concretion, undiff.
671 concretion, sandstone
672 concretion, hematite

999 other

Material Texture and Quality

1 glassy
2 glassy and flawed
3 fine-grained
4 fine-grained and flawed
5 medium-grained
6 medium-grained and flawed
7 coarse-grained
8 coarse-grained and flawed

Artifact Morphology Categories

50 biface, undifferentiated
51 biface-early stage
52 biface-middle stage
53 biface-late stage

90 reworked tool, undiff.
91 reworked early stage uniface

92 reworked middle stage uniface
93 reworked late stage uniface
94 reworked early stage biface
95 reworked middle stage biface
96 reworked late stage biface

Artifact Functional Categories

153 projectile point preform

200 unidentified projectile point
201 unidentified large projectile point
202 unidentified small projectile point
203 unidentified stemmed projectile point
204 unidentified large stemmed projectile point
205 unidentified small stemmed projectile point
206 unidentified corner-notched projectile point
207 unidentified large corner-notched projectile point
208 unidentified small corner-notched projectile point
209 unidentified side-notched projectile point
210 unidentified large side-notched projectile point
211 unidentified small side-notched projectile point
212 unidentified fluted point
220 unidentified Paleoindian projectile point
221 Clovis point
222 Folsom point
223 Midland point
224 Plainview point
225 Firstview point
226 Jimmy Allen point
227 Meserve point
228 Agate Basin point
229 Hell Gap point
230 Belen point
231 Milnesand point
232 Eden point
233 Scottsbluff I point
234 Scottsbluff II point
235 Frederick point

300 unidentified Archaic projectile point
301 Jay point
302 Bajada point
303 San Jose point
304 Armijo point
305 En Medio (Basketmaker II) point
306 Chiricahua point
307 San Pedro point
308 Augustin point
309 Pelona point
400 Basketmaker III point
401 Pueblo side-notched point

500 Athabascan side-notched point

600 eccentric
601 three side-notches

Cortex

Estimate in 10 percent intervals.

Cortex Type

-- not applicable
1 waterworn
2 nonwaterworn

Portion

00 indeterminate fragment
01 whole
02 proximal (base)
03 medial (midsection)
04 distal (tip)
05 lateral (edge)
06 proximal & medial
07 medial & distal
08 proximal & lateral
09 distal & lateral
10 proximal-medial-lateral
11 distal-medial-lateral
12 barb
13 tang

Break Pattern

. not applicable
1 impact fracture
2 haft snap

3 lateral snap
4 reverse fracture
5 perverse fracture
6 crenated fracture
7 snap fracture

Thermal Alteration

-- not applicable
01 potlids-ventral surface
02 potlids-dorsal surface
03 potlids-other surface
04 crazed
05 crazed and 01
06 crazed and 02
07 crazed and 03
08 crazed and 09
09 potlids-ventral and dorsal surfaces

Preform Morphology

0 indeterminate
1 flake
2 biface

Reduction Technique

. not applicable
1 all percussion
2 much percussion, some pressure
3 some percussion, mostly pressure
4 equal amounts of percussion and pressure
5 all pressure

Regularity of Scarring

1 irregular
2 regular
3 parallel
4 transverse
5 herringbone
6 collateral
7 ribbon

Extent of Scarring

. not applicable
1 100% of surfaces flaked
2 75% of surfaces flaked
3 50-75% of surfaces flaked
4 25-50% of surfaces flaked
5 >25% of surfaces flaked
6 100% of one surface flaked, marginal flaking on other side

Blade Shape

. not applicable
01 triangular
02 rectangular
03 ovate
04 diamond
98 absent
99 irregular

Cross-Section

01 edged oval
02 thick convex
03 convex
04 lenticular
05 thin lens
06 thin lens-raised center
07 lenticular-raised center
08 median ridged
09 circular
10 narrow ovate
11 narrow median ridge, scooped edges
12 narrow median ridge, rounded edges
13 diamond
14 wide diamond
15 round face, scooped edges
16 flat face, scooped edges
17 rectangular edged
18 rhomboid-left
19 rhomboid-right
20 trapezoidal
21 airfoil
22 fluted unifacially
23 fluted bifacially
24 twisted
25 flat
26 concave-convex
27 flat face-convex

28 flat face-triangular scooped edges
29 flat face-triangular
30 flat face-mounded
31 flat face-delta

Barbs

. none
1 absent (broken)
2 pointed-perpendicular
3 pointed-diagonal
4 squared

Overall Blade Length

length of blade, <u>not</u> blade edges

Hafting Element Shape

0 absent
1 stemmed-parallel sides
2 stemmed-contracting
3 stemmed-expanding
4 notched-parallel sides
5 notched-contracting
6 notched-expanding
7 notched-expanding/ contracting
8 lanceolate-unstemmed
9 bifurcated

Tang

. none
01 absent (broken)
02 horizontal
03 pendant
05 flared upward
06 flared downward
07 flared outward
08 cropped
09 straight-sided
10 curved inward
11 pointed
12 asymmetrical

Hafting Element Measurements

width and thickness.

Measurements

Overall length, width, and thickness.

Edge Element

1 indeterminate
2 blade
3 base

Edge Shape

1 indeterminate
2 straight
3 convex
4 concave
5 convex-concave
6 irregular

Serrations

1 present
2 not present

Residues

1 present
2 not present

Resharpening

1 absent
2 present
3 beveled

Edge Length

blade or basal edge length

Utilization

-- not applicable
01 unidirectional utilization
02 bidirectional utilization
03 unidirectional retouch
04 bidirectional retouch
05 rounding
06 rounding and 01
07 rounding and 02
08 rounding and 03
09 rounding and 04
10 noncultural edge damage
11 bidirectional retouch and abrasion
12 battering
13 rotary
14 unidirectional retouch and unidirectional wear
15 unidirectional retouch and battering
16 bidirectional retouch and battering
17 bidirectional retouch and wear
18 edge abraded for platform preparation
19 abrasion
20 unidirectional wear and working edge abraded
22 unidirectional retouch and bidirectional wear

Edge Angle

Average angle in 1 degree increments

Notch Type

0 no notch
1 corner-notched
2 side-notched
3 basal-notched
4 corner and basal-notched
5 side and basal-notched
6 eccentric

Notch Condition

1 intact
2 one tang broken
3 both tangs broken
4 one barb broken
5 both barbs broken
6 one tang and one barb broken
7 one tang and both barbs broken
8 both tangs and one barb broken
9 both tangs and both barbs broken

Notch Shape

. no notches
1 V-shaped
2 U-shaped
3 C-shaped
4 rectangular
5 contracting C-shaped

Notch Measurements

notch depth
notch width

APPENDIX 3
UTILIZED CHIPPED STONE DEBITAGE

Site	Field Specimen	Artifact Number	Material Type	Artifact Morphology	Artifact Function	Wear Pattern	Edge Angle
39998	456	2	1	1.00	1	2	50
	565	1	1	1.00	1	4	56
	265	2	1	1.00	1	24	59
	269	3	1	2.00	1	1	25
	818	2	1	2.00	1	1	30
	184	1	1	2.00	1	1	38
	1109	2	1	2.00	1	1	40
	728	1	1	2.00	1	1	47
	890	1	1	2.00	1	1	49
	327	1	1	2.00	1	1	56
	355	3	1	2.00	1	1	56
	398	4	1	2.00	1	1	63
	521	2	1	2.00	1	1	73
	998	2	1	2.00	1	2	43
	992	1	1	2.00	1	2	48
	37	1	1	2.00	1	3	38
	540	1	1	2.00	1	14	51
	977	2	1	2.00	1	14	57
	439	1	1	2.00	1	14	64
	1013	2	1	2.00	1	14	65
	996	1	80	1.00	1	17	53
	1156	1	1	1.00	1	1	46
	164	1	80	2.00	1	1	28
	244	1	80	2.00	1	1	39
	185	1	80	2.00	1	1	51
	187	1	80	2.00	1	3	31
	1049	2	100	2.00	1	1	40
	470	1	200	1.00	1	2	36
	176	1	200	1.00	1	19	10

Site	Field Specimen	Artifact Number	Material Type	Artifact Morphology	Artifact Function	Wear Pattern	Edge Angle
	784	2	200	2.00	1	1	23
	247	2	200	2.00	1	1	27
	1104	1	200	2.00	1	1	51
	255	1	200	2.00	1	2	33
	785	1	200	2.00	1	2	53
	425	1	200	2.00	1	3	53
	16	2	200	2.00	1	4	31
	333	2	200	2.00	1	19	32
	492	1	200	2.00	1	19	35
	567	1	500	2.00	1	1	57
104381	476	2	1	2.00	1	1	63
	5	1	1	2.00	1	3	65
	312	1	1	2.00	1	14	36
	465	5	1	2.00	1	22	41
	131	11	80	1.00	1	3	50
	421	4	80	1.00	1	17	42
	493	2	80	2.00	1	1	65
	350	5	80	3.00	1	1	25
	350	6	200	2.00	1	1	37
	384	1	340	2.00	1	1	42
	35	1	340	2.00	1	1	80
	531	1	340	2.00	1	3	60
	4	7	340	2.00	1	3	62
	203	1	340	2.00	1	14	44
	39	1	340	2.00	1	14	61
	542	4	340	2.00	1	14	61
	38	1	340	2.00	1	14	67
	68	2	400	2.00	1	1	48
	66	3	1	1.00	1	2	40
	106	1	80	1.00	1	2	58
	118	1	200	3.00	1	50	63

Site	Field Specimen	Artifact Number	Material Type	Artifact Morphology	Artifact Function	Wear Pattern	Edge Angle
	16	2	200	7.00	1	1	21
	2	2	340	2.00	1	14	35
	61	4	510	2.00	1	1	40
	66	4	530	2.00	1	3	42

APPENDIX 4
CERAMIC ANALYSIS CODES

Site Number on Top

F.S. Number from bag

PP Not used

Lot Consecutive numbers for each F.S.

Temper

4	Angular clear volcanic lithic sometimes with sand
5	Tuff dominated sometimes with sand and angular lithic
6	Sand tempered dominated with angular igneous
11	Sand
12	Sand and Sherd
13	Sherd
18	Basalt
19	Basalt and Sherd
26	Crystalline Basalt

Ceramic Types

Mogollon Brown Ware

2102	Alma Brown (Plain Polished Body)
2112	Reserve Plain Corrugated (Plain Fine Corrugated Brown)
2114	Reserve Plain Indented (Indented Corrugated Brown)
2115	Reserve Indented Smudged (Smudged Indented Brown)
2301	San Francisco Red

Anasazi Gray and White Wares

5101	Gray Body
5201	Polished White
5202	Early Painted White
5203	Late Polished White
5204	Late Painted White
5209	Reserve Black-on-white
5217	Socorro Black-on-white

protohistoric Utility

8102	Thin (Athabascan) Plain Utility
8103	Thin Incised Utility (Athabascan)
8104	Plain Thin Polished (Athabascan?)
8105	Thick Brown Paste

Sherd Tempered Slipped Red

5305	Unpainted Indeterminate

Piro (Basalt Tempered) Pueblo Utility and Decorated

9101	Basalt Tempered Utility
9301	Red Slipped Exterior, White Slipped Interior
9302	Red Slipped Interior, White Exterior, Matte Paint Exterior
9303	Red Slipped, Glaze Painted Interior, White Slipped Interior, Glaze E Rim
9304	White Slipped Interior, Red Slipped Exterior
9305	Polished No Slip
9306	White Slipped Exterior
9307	White Interior, Red Exterior, Glaze Painted
9308	White Slipped Exterior Glaze Paint

Pigment Type

1	None
2	Mineral Black
10	Glaze (Black)

Manipulation

0	Missing
1	Plain Unpolished
2	Plain Polished
4	Incised
10	Unindented Fine Plain Corrugated
25	Dimpled or smeared

Slip

1	None
2	White Slip
3	Red Slip
4	Smudged
6	Indeterminate

Vessel Form

2	Bowl Rim
3	Bowl Body
4	Jar Body
5	Cooking Storage Rim
6	Cooking/Storage Jar Neck
10	Indeterminate
11	Seed Jar Rim

Vessel Appendages

1 None

Modification

1 None

Count

Weight

APPENDIX 5
CLAYS COLLECTED FROM THE DATIL MOUNTAIN AREA

LS 1 is located 8 miles from Forest Road 6 turnoff. Sample is from the lower shale lens from outcrop
Form Chunky Shale, Very Sandy, Fairly Plastic but fired samples are extremely fragile
Natural Color Red Brown
Refired Color 5YR 7/4
Inclusions Siltsize sand grains, with tiny mica flecks

LS 2 is located 8 miles from Forest Road 6 turnoff. Sample is from the upper lens of outcrop.
Form Chunky Sale Very Sandy, Fairly Plastic
Natural Color Red Brown
Refired Color 2.5YR 7/6
Inclusions No distinct inclusions except tiny mica flecks

LS 3 is just south of samples 1 and 2.
Form Upper Soil Layer
Natural Color Dispersed Green and Red Brown
Refired Color 5YR 6/4
Inclusions Silt size sand grains and tiny mica flecks

LS 4 is a mixture of gray to reddish shale exposed at surface near previously collected samples. Good Plasticity
Form Soft Shale
Natural Color Gray to red
Refired Color 7.5YR 8/4
Inclusions Sporadic sandstone grains with tiny micah flecks

LS 5 is near sample 4.
Form
Natural Color
Refired Color
Inclusions

LS 6 was collected near road one mile west of Datil.
Form Chunky, good plasticity
Natural Color Gray brown
Refired Color 2.5YR 5/6
Inclusions Small angular igneous rock fragments