MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

RED LAKE TANK: THE EXCAVATION OF FOUR SITES EAST OF ROSWELL, NEW MEXICO

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ARCHAEOLOGY NOTES 250

SANTA FE 1999 NEW MEXICO

ADMINISTRATIVE SUMMARY

Between June 2 and July 11, 1997, the Office of Archaeological Studies, Museum of New Mexico, excavated portions of four sites in the Red Lake Tank area for the New Mexico State Highway and Transportation Department. Portions of LA 116502, LA 116503, LA 116504, and LA 116505 are within the project area of the planned improvements to U.S. 380 east of Roswell, New Mexico.

Two of the sites are short-term activity areas. LA 116502 dates to the late Archaic, and LA 116504 dates to the early Jornada Mogollon. Excavation at each of these sites revealed a single hearth and large amounts of discarded prehistoric artifacts. LA 116503 is a Jornada Mogollon structural site. One structure and four extramural features were also found at this site. The fourth site, LA 116505, proved to be redeposited cultural material eroding from outside of the project area.

MNM Project No. 41.6461 (Red Lake Tank)
NMSHTD Project No. SP-380-3(210)168, CN 2788, CO3541/98
New Mexico State Land Office Archaeological Excavation Permit AE-72

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INTRODUCTION

In February 1997, New Mexico State Highway and Transportation Department (NMSHTD) archaeologists identified the sites of LA 116502–LA 116505 along U.S. 380 east of Roswell in Chaves County, New Mexico (Fig. 1). The NMSHTD proposed to improve the highway, encompassing portions of the sites within the proposed right-of-way. All four sites were recommended for data recovery.

The data recovery plan and subsequent archaeological data recovery efforts were proposed and performed by the Office of Archaeological Studies, Museum of New Mexico. The principal investigator was R. Yvonne Oakes. The project director was Peter Y. Bullock. Field assistants were Jesse Murrell, Dixie Henry, and Steve Kopecky. Faunal analysis was conducted by Nancy Akins. The report was edited by Tom Ireland, graphics were drafted by Ann Noble, and photographs were printed by Warren Lieb.

All four sites are on State Trust Land. Site location information is included in Appendix 1, which has been removed from copies for public circulation.

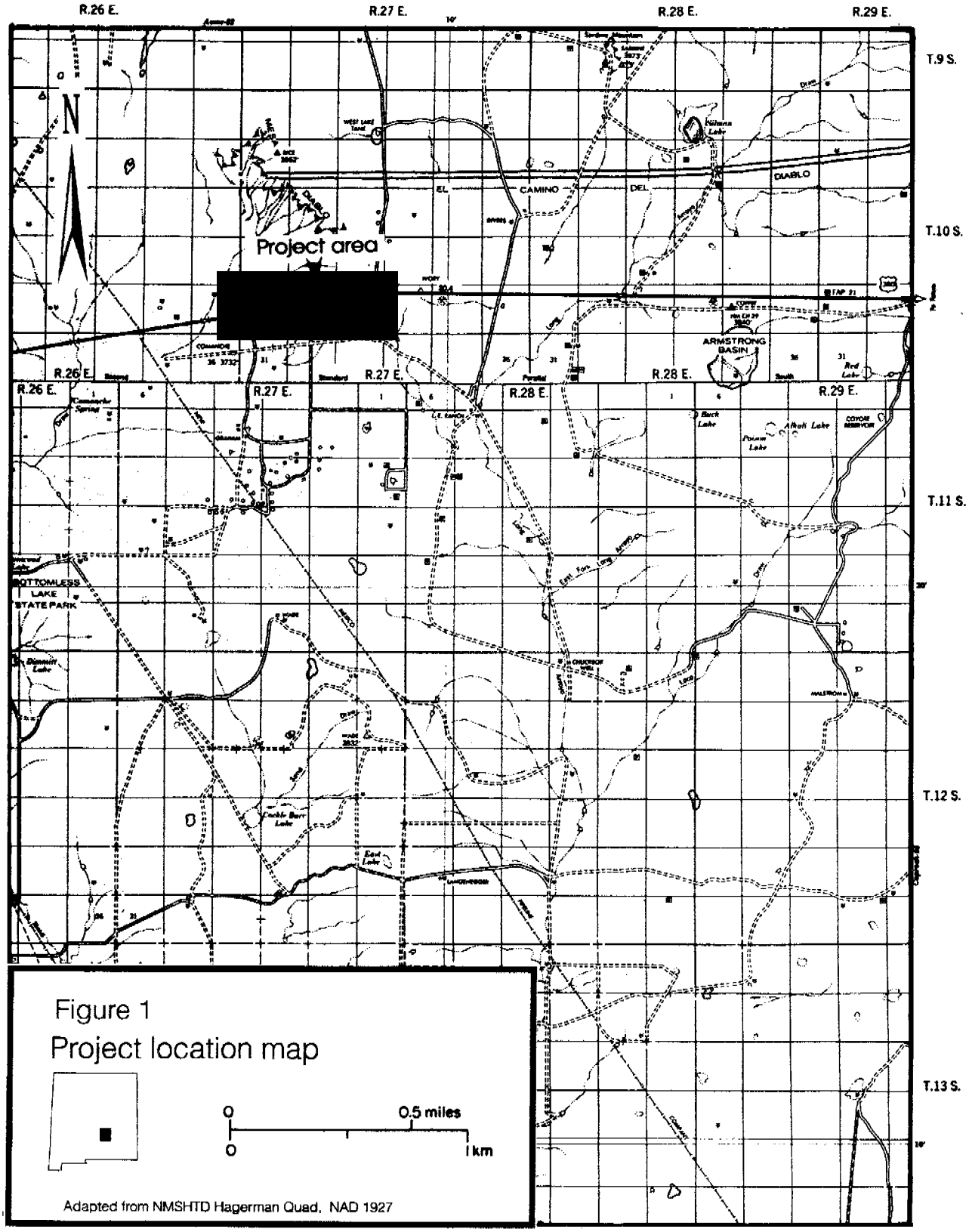

Figure 1
Project location map

ENVIRONMENT

The Red Lake Tank sites are situated above the eastern escarpment of the Pecos Valley. This area, known as the Mescalero Pediment, is within sight of the Llano Estacado or High Plains. The landscape of this region is relatively flat, sloping downward toward the west. However, a number of shallow drainages cross the area. This is the western edge of the Great Plains physiographic province (Fenneman 1931). Elevations on the Mescalero Pediment range from 1,128.7 m (3,703 ft) to 1,176.5 m (3,860 ft).

LA 116502 is east of Roswell within the Mescalero Pediment at an elevation of 1,128.7 m (3,703 ft). The site is on a southeast facing slope. LA 116503 is on the southwestern edge of Red Lake Tank, a large playa, also at an elevation of 1,128.7 m (3,703 ft). LA 116503 is on a northwestern facing slope at an elevation of 1,136.9 m (3,730 ft). The fourth site (LA 116505) is on the top and eastern side of a small hill at an elevation of 1,176.5 m (3,860 ft).

Geology

The site area is at the eastern edge of the Pecos Valley section of the Great Plains physiographic province (Fenneman 1931). The Pecos valley is characterized by a series of multiple pediment and terrace surfaces, with localized shallow bolson deposits, sand dunes, and exposed caliche crusts (Lovelace 1972).

Bedrock is composed of Permian and Triassic clastic red beds and evaporates. Depressions and sink holes, caused by the dissolution of the underlying rock, are common (Montgomery and Shuster 1997).

The eastern portion of New Mexico experienced alternating periods of eolian erosion and deposition in the late Quaternary period (Davis 1989; Brunswig 1992). At least three periods of duning have been identified, the first at approximately 13,000 B.C., the second between 13,000 and 3,000 B.C., and the third after 3,000 B.C. (Melton 1940; Nials et al. 1977; Reeves 1965; Wendorf and Hester 1975). The origin of the dune material within the general region (including the project area) is the Pecos Valley (Montgomery and Shuster 1997).

Water, in the form of perennial springs, spring-fed lakes (or playas), and groundwater, was more plentiful than today in both prehistoric and historic times (Van Devender and Spaulding 1979; Davis 1989; Elias 1990). Although most drainages to the east of the Pecos were largely ephemeral, a number of them historically contained water throughout the year. A number of substantial spring-fed streams flowed into the Pecos River from both the east and the west. Speth's (1983) excavations in the general site area show the presence of permanent water in a now dry arroyo. Numerous seeps and springs were also present, both within the Pecos Valley and on the Mescalero pediment, and along the base of the caprock (Fielder and Nye 1933; Wedel 1983).

The presence of two aquifers in this area of New Mexico resulted in a water table that ranged in depth from 0 to 10 ft below the ground surface. Upward leakage from these aquifers (extending as far east as the Caprock escarpment), resulted in numerous springs and spring-fed streams and playas (or small lakes) (Maddox 1969; Wedel 1983). As the water table was lowered by the extensive drilling of water wells in the region, this upward leakage ceased, causing springs to go

dry (Maddox 1969). Declines in the height of the water table of as much as 230 ft have been recorded in the Roswell area (Wedel 1983). One of a number of playas in the general site area, Red Lake Tank, contained permanent water as late as 1957 (personal communication, Albert Day, 1997), but now it fills only during heavy rains.

The tendency of groundwater to flow toward areas of extensive drilling made the water table drop as the contents of the aquifers were drawn down. The springs as far east as the Caprock escarpment, as well as those feeding Red Lake Tank, also ceased to flow despite the low number of wells in the immediate area (Fielder and Nye 1933; Wedel 1983).

Soils within the project area reflect this series of erosional cycles. These soils are predominately shallow, gravely Paleorthids-Haplargids, varying in color and texture. In most areas, these are underlaid by strongly cemented caliche layers. Angular caliche fragments are common. Fine, silty, sandy soil deposits are present in areas of duning, the lower portions of which usually contain fine filaments and flecks of lime (Maker et al. 1974). Soils of this type are usually utilized as grazing for livestock.

Climate

The local climate is characterized as semiarid continental, with hot days and cool nights. Precipitation averages between 30.5 and 35.5 cm (12-14 inches), and most occurs as summer rain (Gabin and Lesperance 1977; Maker et al. 1974; Tuan et al. 1973). Frost-free days average 190 (Tuan et al. 1973), while the potential growing season for domesticated crops averages 260 days (Smith 1920). Prevailing winds are from the south and west (Montgomery and Shuster 1997).

Prehistorically there was an increase in precipitation in the A. D. 1000s, recorded across large areas of the Southwest (Haynes 1993; Brunswig 1992; Martin 1963). This was caused by a northward shift in the jet stream, allowing warmer, moisture-bearing air masses to move north in a trend that peaked by A.D. 1100. This was reversed between A.D. 1100 and 1200 as the jet stream moved south, allowing the return of northern cool dry air (Wendorf and Hester 1975; Van Devender and Spaulding 1979; Knight 1982:51; Pazzaglia and Wells 1990:429).

Flora and Fauna

The project area is in the mixed grassland biome, an area of short grasses and tall prairie grass. Black grama and bush muhly are present, as well as little and big bluestem, and galleta.

The vegetation of the general project area has been heavily modified by the grazing of livestock (Castetter 1956). Previously heavy grass cover has been largely eliminated. Mesquite, yucca, prickly pear, cholla, and sagebrush now dominate the local vegetation (Castetter 1956; Jelinek 1967). Yucca and cholla also occur in areas of disturbed or broken ground (Castetter 1956; Sebastian and Larralde 1989). To the east of the project occur low stands of shinnery oak (Wiseman 1993), and scattered stands of juniper are present along the caprock escarpment.

The vicinity of the project area supports the Plains complex of fauna, including pronghorn, jackrabbits, cottontail rabbits, prairie dogs, coyotes, and foxes. A variety of small mammals and birds are also present. Historically, bison were also present in the general Roswell area. Various

fish and shellfish species live in the Pecos River to the west (Jelinek 1967).

A range of environmental zones results in an increased variety of available plant and animal resources. While the resources of the Plains ecosystem appear limited, they are complimented by the riverine ecosystem of the Pecos River floodplain. This serves as a distinct linear oasis, providing habitat for plants and animal communities not normally associated with the steppe landscape of the plains.

The presence of permanent water at Red Lake Tank would have functioned similarly. Plants and animals not normally in the general area would have been attracted by the water. This in turn would have resulted in an enriched lake-shore environment. This added variety of plant and animal communities puts more species into closer proximity, although some species (such as migrating birds) would utilize both the Pecos River and Red Lake Tank areas only in a transitory manner.

CULTURAL BACKGROUND

A complete cultural history is beyond the scope of this report. This discussion is limited to the Paleoindian, Archaic, Puebloan, and Plains Indian periods. The reader is referred to Stuart and Gauthier (1981) and Sebastian and Larralde (1989) for a more detailed synthesis of Roswell area prehistory. Accounts of the historic period are available in Adams (1983) and Harlan et al. (1986).

Paleoindian

The Paleoindian period (10,000-5500 B.C.) was first recognized in 1926 at the Folsom site in northeastern New Mexico (Wormington 1947). A series of Paleoindian traditions have since been defined, beginning with Clovis and continuing through Plano (Sebastian and Larralde 1989). Originally defined on the plains of eastern New Mexico, the Paleoindian culture area has since been expanded to include virtually all of North America. Although originally believed to be dependent on big-game hunting, the importance of plant gathering and small-animal hunting to Paleoindian subsistence is now recognized (McGregor 1965; Willey 1966; Jennings 1968; Judge 1973; Wilmsen 1974; Frison 1978; Cordell 1979; Stuart and Gauthier 1981).

Paleoindian sites of any period are rare, but Paleoindian sites recorded in the region include the Clovis type site of Blackwater Draw, Locality No. 1, and Blackwater Draw, El Llano. Few sites have been recorded in the Pecos River area. One distinctive Clovis projectile point base has been recorded for the Pecos River Valley, southeast of Santa Rosa (Bullock 1995).

Folsom projectile points are recorded along the Pecos River north of Roswell (Jelinek 1967). Other late Paleoindian sites have been recorded near Kenna in Roosevelt County (Sebastian and Larralde 1989) and Guadalupe County (Bullock 1995). Other Paleoindian sites are probably present, buried under alluvial or eolian deposits (Cordell 1979).

Archaic Period

The Archaic occupation of the upper Pecos River Valley appears to have lasted quite late. Levine and Mobley (1975) define the Archaic occupation of northeastern New Mexico as lasting from 5000 B.C. until about A.D. 1000, but a local chronology has not been developed for this area. Projectile points in eastern New Mexico have been identified under a number of different schemes (Shelley 1994), including those of the Oshara Tradition (Irwin-Williams 1973) and chronologies used in central and western Texas (Johnson 1967).

The Archaic period is best defined in northwestern New Mexico, where it is generally referred to as the Oshara Tradition (Irwin-Williams 1973). This period is distinguished by distinctive projectile points and lithic artifact scatters, including grinding implements, fire-cracked rock, and a lack of ceramics. Archaic subsistence adaptations are based on a highly mobile, broad-based economy characterized by a combination of seasonally scheduled hunting and gathering activities. A Late Archaic camp site is close to the general Red Lake Tank area (Parry 1979). The Oshara Tradition is divided into five phases: Jay (5500-4800 B.C.), Bajada (4800-3200 B.C.), San Jose (3200-1800 B.C.), Armijo (1800-800 B.C.), and En Medio (800 B.C.-A.D. 400) (Irwin-Williams 1973). Although centered in the northwestern area of New Mexico, Oshara Tradition projectile

points do occur as isolated occurrences as far east as the Pecos Valley.

A sequence of projectile points for central and western Texas was developed by Johnson (1967) based on stratified sites yielding radiocarbon dates. This sequence is divided into five overlapping periods: Period 1 (8350-4800 B.C.), characterized by Luna and Plainview projectile points; Period 2 (6810-1315 B.C.), characterized by Early Barbed, Pandale, Nolan, Travis, and Bulverde projectile points; Period 3 (4850 B.C.-A.D. 110), characterized by Shumla, Almagre, Langtry, Pedernales, and Montell projectile points; Period 4 (350 B.C.-A.D. 1245), characterized by Ensor, Frio, Darl, Figuero, and Godley projectile points; and Period 5 (A.D. 50-1710), characterized by Scallorn, Livermore, Bonham, and Perdiz projectile points. In a number of cases the same projectile point morphologies have been given different names based on location. A revised localized sequence for this section of the Pecos River Valley and adjacent areas has recently been developed by Shelley (1994).

Pueblo Period

Evidence of Puebloan use of the Roswell area is abundant, and several Pueblo sites with residential architecture have been recorded. A local pueblo traditional sequence is documented for the middle Pecos River Valley by Jelinek (1967). This tradition seems to develop in the late A.D. 800s out of the Jornada Mogollon. Anasazi or Anasazi-derived ceramics appear in the middle Pecos River Valley after A.D. 900 with the development of the Mesita Negra phase (Jelinek 1967:64-65). The presence of these structural sites suggests the gradual spread of sedentary subsistence based on maize agriculture east from the centers of both the Mogollon and Anasazi traditions. The eastern limits of this probably marginal area appear to have been the Pecos Valley (Jelinek 1967:145-147). These developmental sequences continue until the termination of the Roswell phase in the lower middle Pecos Valley between A.D. 1300 and 1400, and the termination of the Late McKenzie phase in the upper middle Pecos Valley about A.D. 1300 (Jelinek 1967:65-67).

A number of Pueblo sites are present in the area, however, that do not fit into Jelinek's chronology. Some of these sites fit better in the Eastern Jornada Mogollon sequence developed for the area of eastern New Mexico and west Texas (Corley 1965; Leslie 1979). The three phases in this sequence (Querecho, Maljamar, and Ochoa) roughly correspond to the Mesilla, Dona Ana, and El Paso phases of the Jornada Mogollon (Leslie 1979).

These sites include Bloom Mound, southwest of Roswell, generally assigned to the Lincoln phase (Kelley 1984); the Henderson site (Rocek and Speth 1986); and Rocky Arroyo (Wiseman 1985). Other structural sites, which also contain ceramics, are harder to assign to any of the existing chronologies (Wiseman 1981, 1991). A Jornada Mogollon cultural sequence for the Sierra Blanca region was developed by Kelley (1984). A summary of the various regional Jornada Mogollon sequences outside of the Pecos Valley area is available in Levine (1997). Generally in eastern New Mexico, however, prehistoric Puebloan sites where the utilitarian wares are brown are considered Jornada Mogollon sites, rather than Anasazi sites, where the utilitarian wares are gray.

It is now apparent that the general site area was actively exploited by Puebloan groups in a variety of ways. Seasonal use of wild plant and animal resources is evident from a growing number of habitation sites excavated in the general area (Bullock 1997). Short-term use areas, reflecting

a number of activities, are also now known to be more common in the general area than previously believed (Wiseman 1996).

The occasional occurrence of other ceramic types indicates regional trade and possible use of the area by Pueblo groups from western New Mexico, northern Mexico, and the Glorieta Mesa and Galisteo Basin areas. Although a variety of Pueblo sites have been found (Speth 1983), most Pueblo occupation of the area appears to end with the Ochoa phase, in A.D. 1350-1450 (Leslie 1979).

Plains Indian Period

Both Kiowa and southern Athapaskan groups appear to have moved into the eastern portion of New Mexico during the late Protohistoric period. Apachean sites are scattered throughout southeastern New Mexico as well as the central plains and may date anywhere from the late 1400s to the late 1800s (Harlan et al. 1986:52).

Questions exist concerning Kiowa origins. These center on their language, a version of the Tanoan language, Towa, spoken by Puebloan peoples of both Jemez and Pecos Pueblos (Jelinek 1967:162-163). Trager (1951) estimates the time of separation between these languages at approximately A.D. 1000. This suggests that the Kiowa could be descendants of the Puebloan colonizers of the Pecos Valley.

Shoshonean-speaking Comanches moved in the southern plains about 1700-1715. Most other Native American groups were driven from the area by these horse-mounted buffalo hunters, except for the closely politically allied Kiowas. Extermination of the buffalo herds and American military campaigns removed the Comanches, Kiowas, and other "Plains Indian" groups from the southern plains by 1875 (Schermer 1981). Sites identified as possibly Apache, Kiowa, Comanche, or other "Plains Indian" have been identified north of Santa Rosa at Los Esteros Lake (Levine and Mobley 1975).

DATA RECOVERY RESEARCH ORIENTATION AND GOALS

This section provides the orientation and goals or expectations for the research that guided the data recovery effort. It is primarily derived from the recovery plan for the Red Lake Tank sites (LA 116502–LA 116505) developed by Bullock (1997). In accordance with Bullock's data recovery plan, a number of specific goals were pursued at these sites.

Previous research in the general Roswell area has focused on the structure of specific Jornada Mogollon sites or non-culturally specific regional problems. While each of these lines of inquiry has contributed to an understanding of the region in its own way, their integration has the most potential for understanding the regional subsistence and procurement patterns represented by the Red Lake Tank sites.

Originally, the four Red Lake Tank sites were believed to contain a number of cultural components, representing a number of cultural affiliations. It was also felt that this use of the general area by a number of cultural groups represented different activities, or use of the landscape, depending on the culture represented. The four sites were also felt to reflect on a similar subsistence approach shared by various cultural groups operating within this single ecotone (Bullock 1997). Excavation proved this was not the case, and each site represented a single cultural component within the project area.

The focus of the data recovery efforts was therefore be to examine the Red Lake Tank sites as examples of resource procurement areas, and then compare their site structure at the cultural level. Of particular interest are the contrasts in site structure and use that may be exhibited by the Jornada Mogollon components at LA 116503 and LA 116504.

With this in mind, data recovery at the Red Lake sites focused on identification and resource utilization issues: site cultural identification, a determination of site activities and their relationship to site structure, and an assessment of how the Red Lake sites fit into the resource procurement activities pursued on the eastern plains of New Mexico. The goals and expectations of the data recovery effort were as follows:

1. Cultural affiliation and its application in the determination of site utilization and structure is dependent on an ability to assign the sites a cultural affiliation. This is usually accomplished through the use of diagnostic artifacts or ceramics. However, it has been demonstrated (Bullock 1996) that a site's cultural affiliation can sometimes be determined when diagnostic artifacts are absent.

The lithic assemblages of all four sites was analyzed. When diagnostic artifacts were absent, special attention was given to four marker attributes. Specifically, the ratio of debitage to tools (including utilized debitage) and the percentages of flakes, cores, and bifaces within each assemblage was monitored. If diagnostic artifacts were not present at these sites, the focus of study was two trends that occurred through time: an increase in both the ratio of debitage to tools and the percentage of flakes within each assemblage, coupled with a corresponding decrease in the percentages of cores and bifaces.

Radiocarbon samples were collected from features at three of the four Red Lake Tank sites (LA 116502–LA 116504). These may enable the precise dating of the sites and serve as a means

of cross-checking the results of the lithic analysis.

Flotation samples collected from features at three of the four Red Lake Tank sites (LA 116502–LA 116504) will aid in determining site structure. Comparison of these samples may also reveal changes that occurred in site structure through time.

The ceramic assemblages from LA 116503 and LA 116504 were analyzed to produce data that will identify local pottery. This was accomplished through the study of tempers present and petrographic analysis. Both local and intrusive pottery may also be identified on the basis of paste, surface finish, and design elements. The frequencies of intrusive ceramic types through time should provide information about the regional social and economic organization.

The ceramic assemblages from LA 116503 and LA 116504, when compared with assemblages from other Jornada Mogollon sites in the Roswell area, enabled the establishment of relative site dates between sites within the Jornada Mogollon culture. Cultural change within the Jornada Mogollon may be documented in this way.

2. Site structure can be postulated based on the range of activities that were pursued at the locales. On-site activities at the Red Lake Tank sites can be understood by determining the location and function of site features and their relationship to site function. Feature function can be determined by describing the feature analyzing the associated artifacts and other material. Any relationship between site function and cultural affiliation may be gained by comparing these sites, once cultural affiliation is known.

Excavation of cultural features and deposits may yield faunal and macrobotanical remains. These remains were analyzed for anatomical portion, age, condition, and frequency to determine dietary information.

Pollen and macrobotanical samples enabled us to infer flora utilization and consumption. Pollen analysis also reveals information about the general prehistoric environment, including the suitability of agricultural conditions. The types of grinding implements present may also correspond to the sorts of gathered or cultivated foodstuffs.

Nonlocal lithic materials could provide information about social and economic organization. The presence of lithic materials with specific source areas may confirm or supplement the data obtained from the petrographic study of the pottery.

3. Differences in resource procurement may reflect discreet populations or different cultures. However, this may also be an indication of cultural change through time.

Changes in subsistence and settlement patterns on both the eastern New Mexican plains and Pecos Valley should be apparent by comparing known sites and their distribution through time and space. A combination of ceramically derived relative site dates and more precise radiocarbon dates will allow the seriation of sites in this area by age. This should make apparent any developmental resource procurement patterns within the cultures represented.

EXCAVATION METHODS

The first goal of the excavation was to collect surface artifacts within the right-of-way. This was accomplished by setting up a 1 by 1 m grid system across the right-of-way. A site datum was established as 0N/0E with an arbitrary elevation of 1.00 m. Grid numbers were assigned at the southwest corner of each unit. Each grid unit was examined for artifacts, which were bagged by grid. Surface artifacts were collected and bagged by grid number for the total site area of each site within the existing right of way.

Following the surface collection, the area of each recorded surface artifact concentration was surface stripped of overburden to locate subsurface features and deposits. This overburden layer (Stratum 1) averaged 10 cm thick, and, away from any features or structures, it was directly over culturally sterile clay.

Once a feature or structure was defined, half of the fill was removed to reveal the interior stratigraphy. The stratigraphy and the feature were profiled, photographed, and described on field journal forms. The remaining fill was removed by cultural strata.

All of the dirt excavated at the four sites (LA 116502–LA 116505) was sifted through 1/4-inch screen mesh. Artifacts were collected in paper bags that were labeled with vertical and horizontal provenience information.

All interior features at LA 116503 were excavated in a similar manner. Once the horizontal extent of the feature was defined, it was excavated in halves. The first half was used to identify natural or cultural stratum. The second half of each feature was excavated by natural strata. If stratified deposits were absent, the feature was excavated in 10 cm levels. Samples were taken from contexts that appeared likely to yield the most data on feature function and age. Each feature was drawn and profiled, photographed, and described on field journal forms.

Feature and site fill were described on field journal forms and grid forms. The forms included excavated depth in centimeters below site datum, information about soil color and texture, and artifact types and density. Soil colors were described using Munsell color notation.

After excavation was completed, each site was mapped with a transit and stadia rod, including the limit of the excavation and cultural features. After mapping, the excavation was backfilled.

Excavation defined two natural strata at three of these sites and one at the forth. These were assigned consecutive numbers at the site level that were used in the excavation notes and site and feature drawings. No intact cultural strata were found at any of the Red Lake sites outside of the cultural features or structures.

Stratum 1 is a tan, fine, silty loam, 5 to 12 cm thick. Eolian in origin, this material contains prehistoric artifacts and is present as a topsoil layer at three of the sites (LA 116502–LA 116504).

Stratum 2 is a reddish brown, caliche-flecked, fine-textured clay. This culturally sterile stratum is directly beneath Stratum 1 at the three sites where it occurs (LA 116502–LA 116504).

A single different strata of material is present at LA 116505. At this site, Stratum 1 is a sandy

red soil containing prehistoric artifacts and modern garbage (pieces of plastic, glass, and paper). This material combines eolian deposition and alluvial soil from the higher ridge adjacent to the right of way. Areas of exposed bedrock are also present. This stratum varies in thickness from 0.5 to 10 cm, and within the project area it is directly on top of a soft, red shale bedrock.

SITE DESCRIPTIONS

The Red Lake Tank sites are east of Roswell on the rolling plains of the Mescalero pediment. All four sites are in the vicinity of Red Lake Tank, a large playa also known locally as Coyote Tank. Red Lake Tank is on the north side of U.S. 380.

LA 116502

LA 116502 is at the west end of the project area. The site is on a flat, but not level, gentle west-facing slope (Fig. 2). The site area, comprised of a thin lithic artifact scatter, measures 75 by 15 m. The main site area is an artifact concentration adjacent to a single feature, a stone-lined hearth. This portion of the site measures 4 by 8 m, an area of 32 sq m (Fig. 3). There were eight lithic artifacts on the surface within the concentration, or 0.25 artifacts per square meter. All of the artifact concentration is within the existing right-of-way. Portions of the site may have been removed by scraping connected with earlier routine highway maintenance.

Feature 1 (Hearth)

Feature 1 is a small cobble-lined hearth in the area of a small, previously recorded lithic artifact scatter. It measures .71 by .41 m, covers .30 sq m, and is 5-10 cm deep. A small pile of fire-cracked rock suggested the presence of a feature at this site. Working outward from the pile of fire-cracked rock, a total of 29 sq m was surface-stripped to a depth of 10 cm, exposing the top of Feature 1.

Once the feature was defined, half of the fill was removed in a single arbitrary 10 cm level. The resulting profile of the feature was drawn, revealing a hearth containing a single layer of feature fill. The remaining fill was removed by stratigraphic layer.

Stratum 1, the only layer of fill, is a fine, gray, charcoal-stained deposit of eolian soil containing bits of charcoal. No artifacts were recovered from the contents of Feature 1.

Feature 1 is a cobble-lined hearth. It was constructed by digging a shallow pit in the ground. While the soil was still soft, broken pieces of cobbles were pressed into the interior sides of the hole, lining it. The shallow nature of this feature, combined with the single layer of fill and the lack of artifacts in the area, suggests that Feature 1 was used only once or for only a short period of time.

A pile of fire-cracked rock, 2.4 m away from the feature, is assumed to be associated with it. The presence of fire-cracked rock indicated that the feature may have served as a hearth or roasting pit. No associated use surface was found at LA 116502, although the base of the pile of fire-cracked rock should indicate the original ground surface.

LA 116503

LA 116503 is on the southwestern shore of Red Lake Tank. (Fig. 4). The site covers 190 by 170 m and is bisected by U.S. 380. The main remaining site area is to the north, between U.S. 380 and the playa edge, mainly outside of the project area. Earlier highway shoulder and ditch

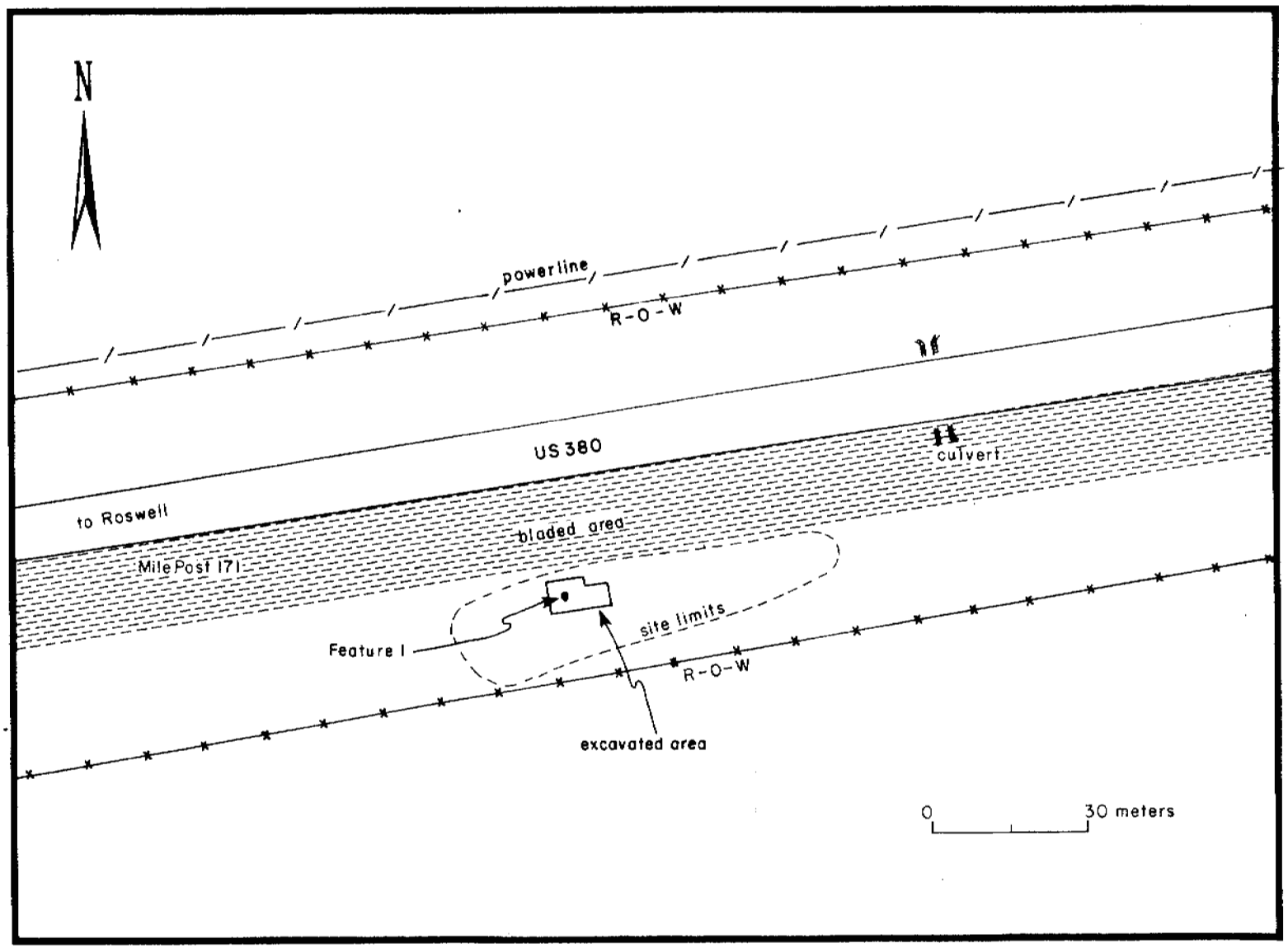

Figure 2. LA 116502 site map.

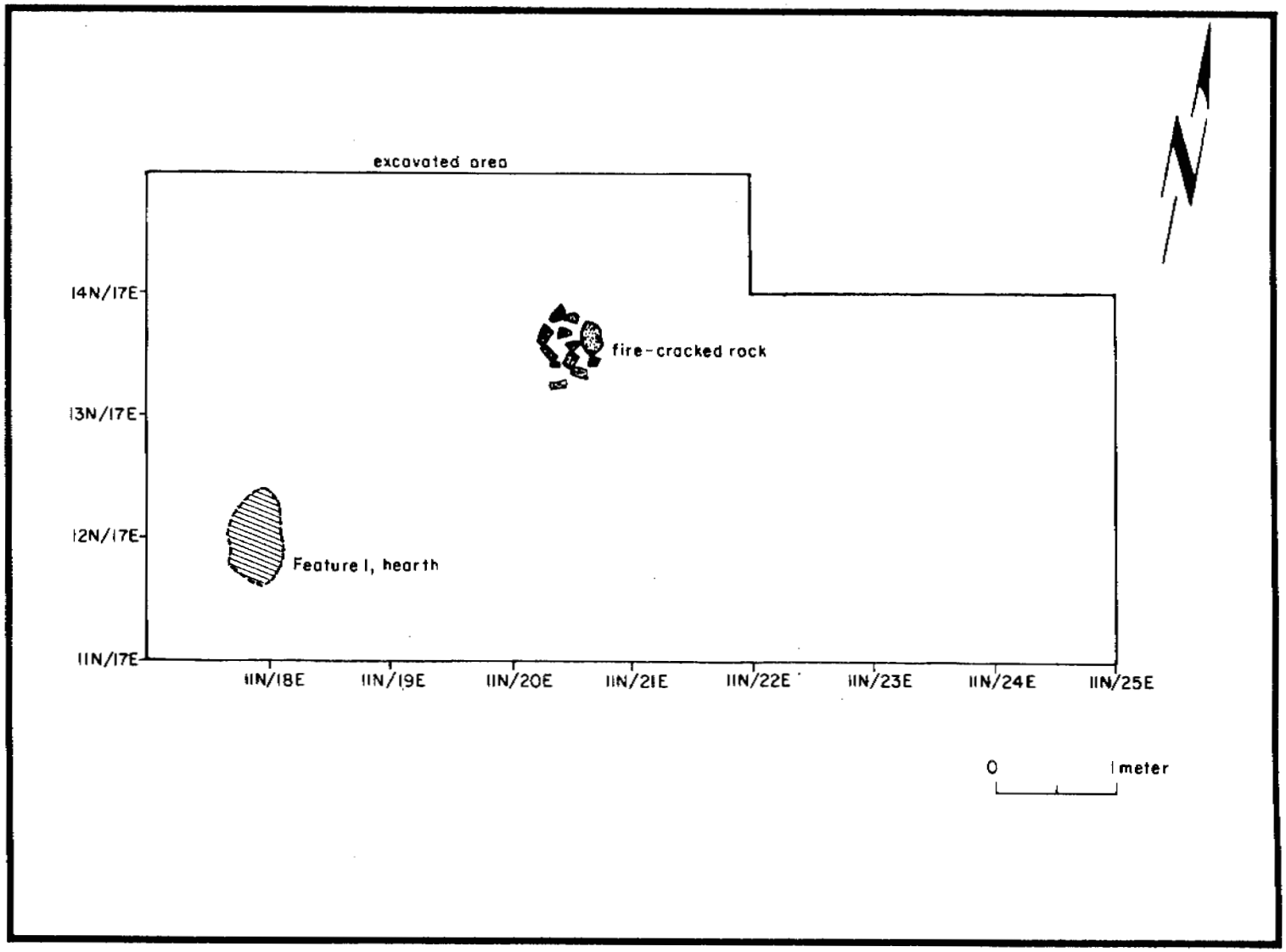

Figure 3. Area of excavation, LA 116502.

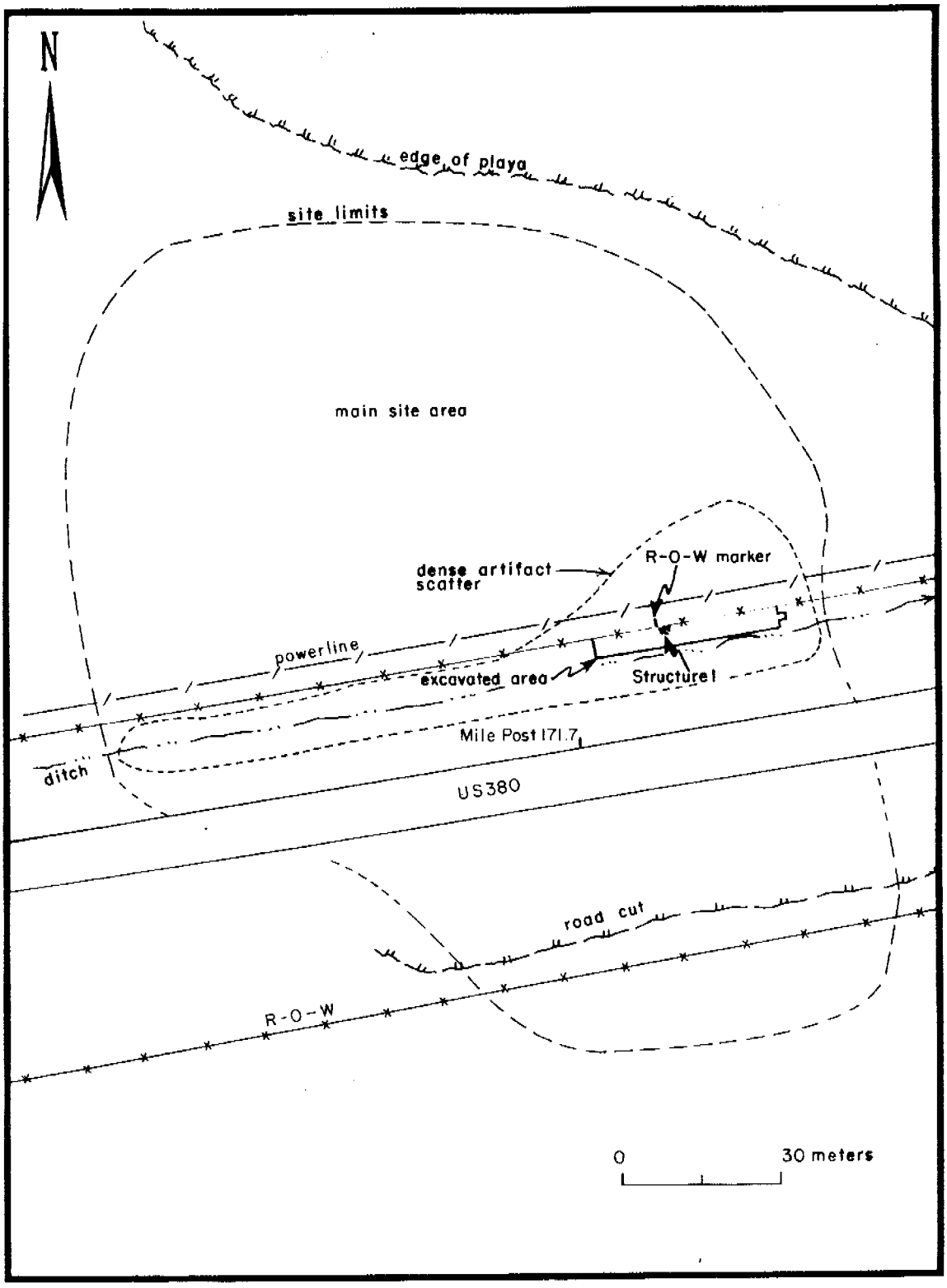

Figure 4. LA 116503 site map.

maintenance has removed portions of the site within the right-of-way north of U.S. 380. South of U.S. 380, all of the site area has been removed by earlier highway construction.

Within the project area, the site area is composed of a prehistoric surface structure with an associated concentration of surface ceramic and lithic artifacts and four extramural features (Fig. 5). This portion of the site measures 3 by 33 m, an area of 99 sq m. Surface artifacts within the artifact concentration totaled 35 ceramic and 137 lithic artifacts, a site density of 1.74 artifacts per square meter. The main artifact concentration extends north out of the existing right of way, as far as the playa edge.

Beginning with the area of the highest surface artifact concentration, an area of 99 sq m was surface-stripped to a depth of 10 cm. One surface structure and four extramural features were found within the area of the previously recorded ceramic and lithic artifact scatter. All four of the extramural features are hearths. No other indications of the features were present prior to excavation.

Once the feature was defined, half of the fill was removed. The resulting profile of the feature was drawn, revealing a hearth containing two layers of feature fill. The remaining fill was removed by stratigraphic layer.

Features 1, 3, 4, and 5

Features 1, 3, 4, and 5 are small extramural hearths. All four features are east of Feature 2 (Structure 1), the surface structure. All four features are shallow pits dug into the prehistoric ground surface and used without further preparation.

None of the features show any evidence of having been lined, and each appears to have been used for only a short time. Three of the four features are circular and have bowl-shaped interiors. Although Feature 4 has a more irregular shape, it has a generally bowl-shaped interior. Little oxidation is present in each of these features. An eolian deposit in Feature 4 indicates that it stood empty between the time it was dug and the time it was used. Feature 5 may have been used as a roasting pit. Artifacts are present in only two of the features. Lithic artifacts are present in Feature 1, and both ground stone and lithic artifacts in Feature 3.

Feature 1 (Hearth)

Feature 1 is a small unlined hearth to the east of Structure 1. It measures .41 by .44 m, covers an area of .18 sq m, and is 11 cm deep. This feature is a small circular depression with sloping sides. It is within the previously recorded site area. However, there were no indications of its presence prior to the removal of the top 10 cm of soil.

Two layers of fill are present within Feature 1. Stratum 1 is a fine, grayish brown, charcoal-stained deposit of eolian soil. Stratum 2 is a very darkly stained soil containing charcoal. Artifacts recovered from Feature 1 included three pieces of faunal bone and five lithic artifacts (two of which are the bases of projectile points).

Feature 1 is a small hearth or thermal feature. It was constructed by digging a shallow, circular

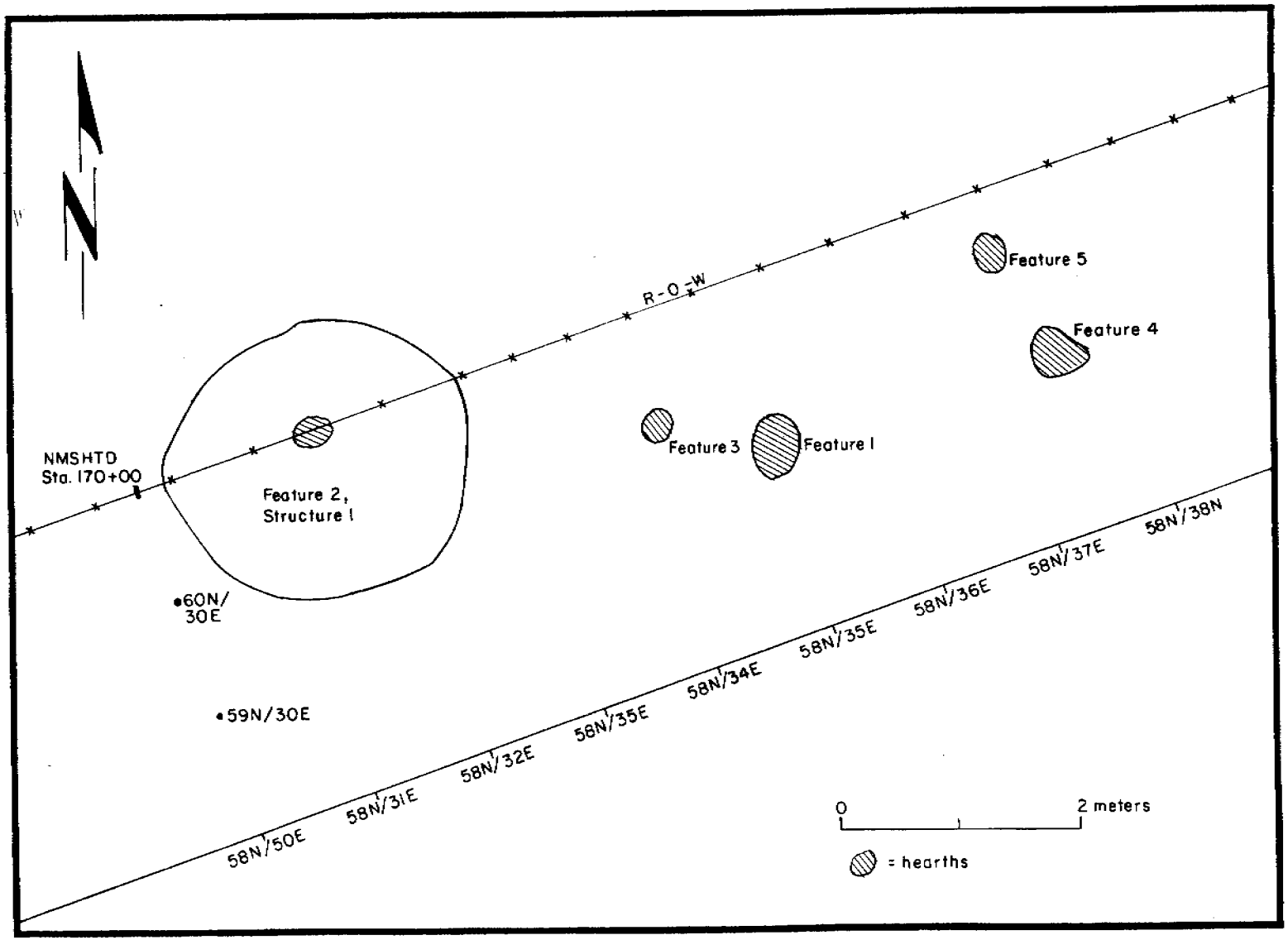

Figure 5. LA 116503 features.

pit in the ground. This pit was not modified prior to use as a hearth. The shallow nature of this feature suggests that it was used only once or for only a short period of time. The presence of an upper eolian layer in Feature 1 indicates that the hearth stood empty after use.

Feature 3 (Hearth)

Feature 3 is a small unlined hearth also to the east of Structure 1. It measures .28 by .28 m, covers an area of .08 sq m, and is .11 m deep. This feature is a small circular depression, with sloping sides. It is within the previously recorded site area. However, there were no indications of its presence prior to the removal of the top 10 cm of soil.

Once the feature was defined, half of the fill was removed. The resulting profile of the feature was drawn, revealing a hearth containing a single layer of feature fill. The remaining fill was removed by stratigraphic layer.

Stratum 1, the only stratigraphic level, is a fine, grayish brown, charcoal-stained deposit of eolian soil. Four lithic artifacts and a whole one-handed mano were recovered from the fill of Feature 3.

Feature 3 is a small hearth or thermal feature. It was constructed by digging a shallow, circular pit in the ground. The pit was not modified prior to use as a hearth. The shallow nature of this feature suggests that it was used only once or for only a short period of time.

Feature 4 (Hearth)

Feature 4 is a small unlined hearth to the east of Structure 1. It measures .46 by .49 m, covers an area of .23 sq m, and is .9-.12 m deep. This feature is a small irregular depression with sloping sides. It is within the previously recorded site area. However, there were no indications of its presence prior to the removal of the top 10 cm of soil.

Once the feature was defined, half of the fill was removed. The resulting profile of the feature revealed a hearth containing a single layer of feature fill. The remaining fill was removed by stratigraphic layer.

Two layers of fill are present within Feature 4. Stratum 1 is a fine, grayish brown, charcoal-stained deposit of eolian soil containing large amounts of charcoal. Stratum 2 is a lightly mottled, stained soil, eolian in origin. No artifacts were recovered from the fill of Feature 1.

Feature 4 is a small hearth or thermal feature. It was constructed by digging a shallow, circular pit in the ground. This pit was not modified prior to use as a hearth. The shallow nature of this feature suggests that it was used only once or for only a short period of time. The presence of a lower eolian layer in Feature 4 indicates that the hearth stood empty for a period of time after the hole was dug, but prior to use. A portion of the wall may have collapsed during this period, causing its irregular shape.

Feature 5 (Hearth)

Feature 5 is a small unlined hearth to the east of Structure 1. It measures .43 by .27 m, covers an area of .12 sq m, and is .08 m deep. This feature is a small circular depression with sloping

sides. Feature 5 is within the previously recorded site area. However, there were no indications of its presence prior to the removal of the top 10 cm of soil.

Once the feature was defined, half of the fill was removed. The resulting profile of the feature was drawn, revealing a hearth containing a single layer of feature fill. The remaining fill was removed by stratigraphic layer.

Stratum 1, the only layer of fill, is a fine, grayish brown, charcoal-stained soil containing large amounts of charcoal. No artifacts were recovered from Feature 5.

Feature 5 is a small hearth or thermal feature. It was constructed by digging a shallow, circular pit in the ground. The pit was not modified prior to use as a hearth. The shallow nature of this feature suggests that it was used only once or for only a short period of time. A number of burnt caliche rocks are in the fill of this feature, suggesting it may have served as a roasting pit.

Feature 2, Structure 1 (Surface Structure)

Feature 2 (Structure 1) is a shallow surface structure within the area of an earlier recorded ceramic and lithic artifact scatter. It measures 2.2 by 2.4 m, covers an area of 5.28 m, and is .12-.18 m deep. No other surface indications of the structure were present. Working out from the initial area of exposed structural fill, 9 sq m were surfaced stripped to a depth of 10 cm to expose the total area of the surface structures. Once the structure was defined, it was bisected, and the southern half taken out in arbitrary 10 cm levels to culturally sterile soil. These arbitrary levels cut across the temporal stratigraphy of the structural fill. The resulting profile of the structure's contents revealed a single floor and three strata of fill (Fig. 6). The remaining fill was removed by stratigraphic layers, each stratum as a single unit.

The slightly oval structure has a unprepared floor that slopes downward toward the center hearth, forming a shallow saucer. Fourteen internal features are within Feature 2 (Structure 1). These include the central hearth and 13 postholes. The postholes form an irregular oval within the area of the structure.

The fill of Feature 2 (Structure 1) is a combination of eolian soil and prehistoric trash deposits. There are three strata of material within the fill of Structure 1. These are described in descending order from the modern ground surface to Floor 1. Stratum 1 was a finely textured sandy loam. Eolian in origin, it is 12-15 cm thick. Material in this stratum comprised the modern ground surface.

Stratum 2 was a dark gray, charcoal-stained soil containing artifacts and a large quantity of processed faunal bone. Two Harrell projectile points, one whole and one base, were found in the stratum. This stratum began 20 cm in from the edge of the structure, sloping downward toward the structure's center. Stratum 2 was thickest in the center of the structure and had a thickness of 10 cm.

Stratum 3 was a fine brown eolian sandy silty soil. This material was directly on the floor of the structure. No artifacts were recovered from Stratum 3. Culturally sterile soil was present beneath Stratum 3.

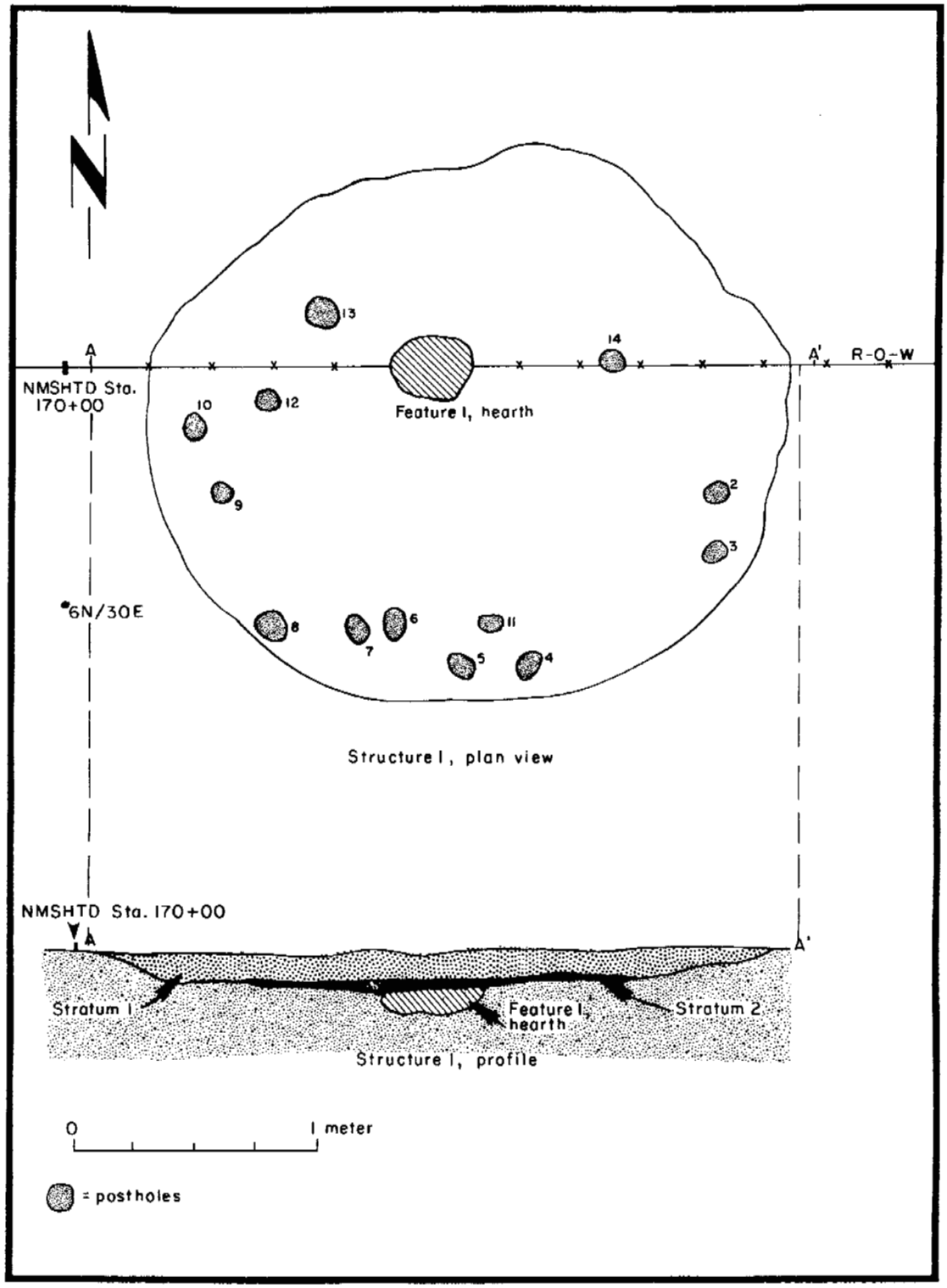

Figure 6. Plan and profile of Structure 1, LA 116503.

Structure 1, Feature 1 (Hearth)

This feature hearth is just north of center within Structure 1. It measures .20 by .38 m, covers and area of .08 sq m, and is .10 m deep. The feature is positioned in the lowest area of the structure and served as the central hearth. It has vertical walls and a flat base. There is no evidence of a lining. No oxidation was apparent on the interior of the feature. The single stratum of material within Feature 1 was a fine, dark gray, charcoal-stained, sandy soil. No artifacts were recovered from the feature fill.

Features 2-14 (Postholes)

Features 2-14 are postholes within Structure 1. They measure from .06 to .11 m in diameter and 5 to 10 cm deep. They form a rough ring around the interior of the structure. Two postholes (Features 2 and 3) are in the eastern portion of the structure. Features 9 and 10 form a corresponding pair in the western portion of the structure. Six postholes (Features 4-8 and 11) form a rough line just within the southern edge of the structure. The remaining three postholes (Features 12-14), are irregularly spaced in the northern portion of the structure, some distance from the structure's edge. The overall pattern of the postholes is an irregular oval within the structure's floor depression.

A single similar stratum of fill was present within Features 2-14. This was a brown sandy soil identical in appearance to the lowest stratum of the structure's fill. This suggests that the posts were pulled at abandonment and that all of the interior features filled at the same time during the same fill episode.

Structure 1

Structure 1 is a surface structure with a prepared floor and interior hearth. The structure was slightly round and, like most round structures (Hard 1983), it probably had a domed roof. However, it is possible that this was an open structure comprised of only walls. The walls of Structure 1 were probably brush, a common material in structures of this size and shape historically. There is no indication of adobe or jacal. The postholes present within the structure suggest that material used for the walls was fastened to an earlier constructed structural framework. The form and size of the structure suggests it was a warm-weather structure, based on Hard's (1983) analysis of Jornada Mogollon structures. However, the presence of a central hearth suggests it was used during the fall, when it would have been necessary to heat the structure.

The postholes left from the walls form an irregular oval and suggest that brush was fastened to a framework constructed earlier. It is also possible that whole leafy branches were simply stuck into the ground. Possibly, the tips of the branches were tied together to form a domed roof, although the structure may have been composed of just walls. It is also possible that the posts supported a covering composed of animal hides. A possible entrance in the southeastern portion of the structure may be indicated by a gap in the circle of postholes.

Floor 1 is a shallow circular basin with walls that slope upward to the original ground surface. Only a single floor is present within the structure. The floor does not have a prepared surface. A slight degree of smudging is present on the floor surface. Since the degree of smudging on a floor is considered an indicator of extent of use, the little bit of smudging on the floor surface suggests that this structure was used for only a single season prior to abandonment. There is no evidence

of remodeling connected with the floor.

Although artifacts were present within the fill of Structure 1, there were no artifacts on the floor surface. This suggests that the structure was cleared out prior to abandonment. This may indicate a planned abandonment of the structure, perhaps at the end of a seasonal visit.

The exact temporal position of Structure 1 within the construction sequence at LA 116503 is not known due to the small size of the intact portion of the site within the project area. However, Structure 1 probably was constructed during the occupation of LA 116503.

A shallow floor was dug out, and a surface structure of posts or branches was constructed over it. The walls of the structure were probably covered with brush or animal hides. The top of the structure most likely had a domed roof with an opening for smoke. An interior hearth was dug into the floor, although it is not known if it was used for heat or cooking.

A number of expedient extramural hearths were constructed and briefly used away from the structure. These may have been used for food processing of some sort, possibly at the same time the structure was occupied. Each hearth was used for a brief or single period.

At the end of the seasonal occupation of LA 116503, Structure 1 was abandoned. At abandonment, the belongs and site furniture was removed, the posts were pulled, and the structure was dismantled. The interior hearth and postholes filled with eolian material. How long it took for this deposition took place is problematic, given the relatively shallow depth of this material. This deposit could be the result of a single storm or an accumulation of a whole season. After this material was deposited, the remaining depression was used as a discard area for trash and processed bone. This trash deposit may have also come from another area of the then still-occupied site.

Conclusion

LA 116503 is a Jornada Mogollon habitation site on the banks of Red Lake Tank. When it was occupied, the playa of Red Lake Tank was a permanent water source. The site may have been utilized seasonally as a staging area for hunting and the gathering of wild foodstuffs. The presence of freshwater mussel shell indicates that the gathering of available foodstuffs extended at least as far as the Pecos River (the closest source of freshwater mussels). The large quantities of processed bison bone indicate that hunting was pursued in the area, and the game was brought back to the village for processing. A habitation base camp suggests that families were occupying the site.

Gathering activities also took place, a suggestion supported by the presence of ground stone artifacts. Ground stone is indicative of plant processing, although insects are also known to have been processed in a similar manner (Sutton 1988). The presence of permanent water adjacent to the site makes a large range of additional gathering activities possible, including the possibility that cultivated crops of maize were been planted in the immediate area. However, because of the small portion of the site excavated, it is impossible to do more than speculate on most of these issues.

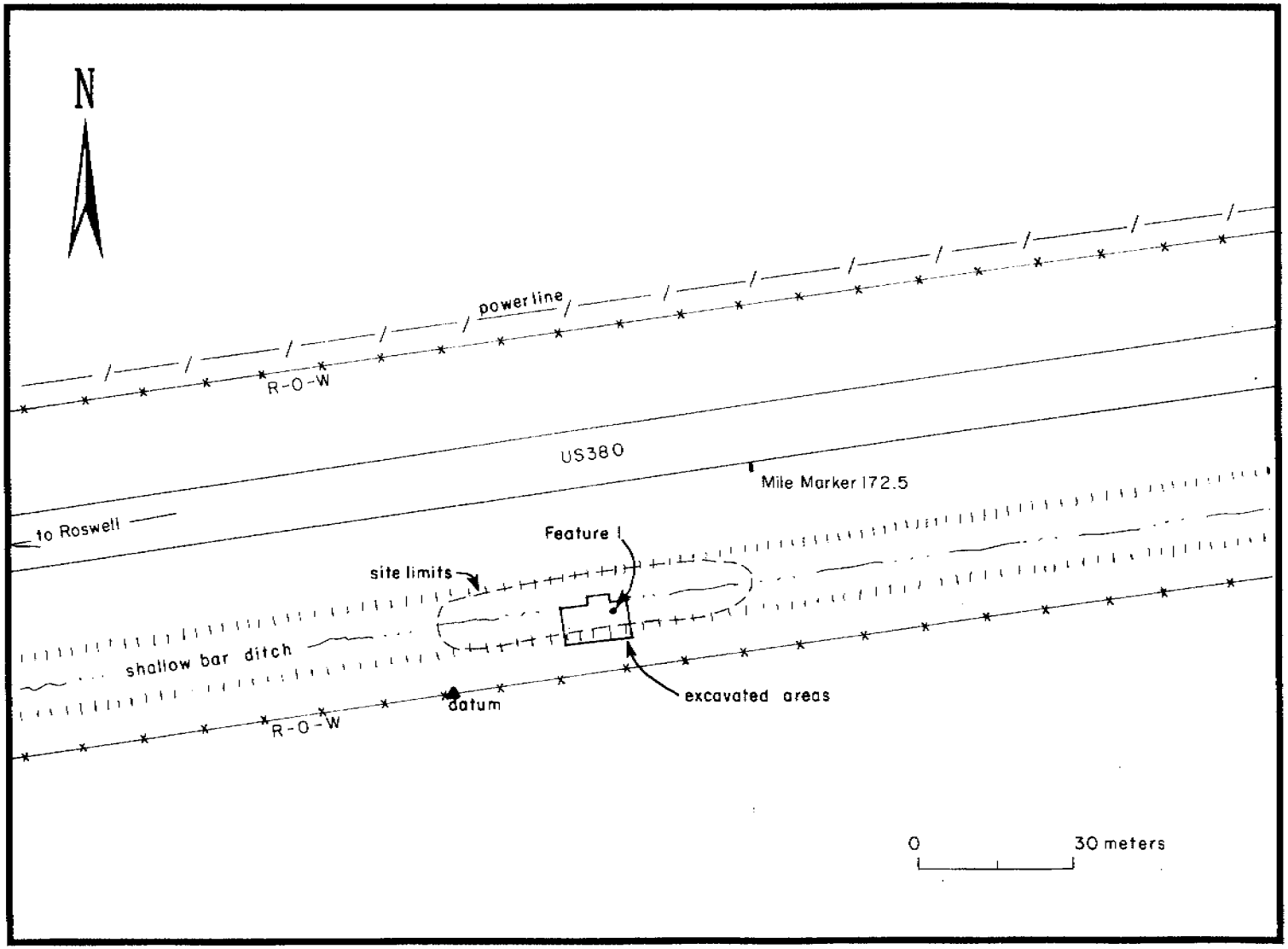

Figure 7. LA 116504 site map.

LA 116504

LA 116504 is east of Red Lake Tank on a west-facing slope of a low ridge overlooking the tank (Fig. 7). The site covers an area of 12 m by 60 m on the south side of U.S. 380. However, most of this is an extremely thin ceramic and lithic artifact scatter. The main site area is a small hearth with an associated concentrated ceramic and lithic artifact scatter. This portion of the site measures 8 by 4 m, an area of 32 square meters. Surface artifacts within the main concentration totaled 6 ceramics and 27 lithic artifacts, an artifact density of 1.0 artifacts per square meter. All of the artifact concentration is within the existing right of way.

Feature 1 (Hearth)

Feature 1 is a small hearth in an area of a previously recorded sherd and lithic artifact scatter. It measures .32 by .36 m, covers 1.15 sq m, and is .10 m deep. No other indications of the feature were present prior to excavation. Beginning in the area of the highest surface artifact concentration, 53 sq m were surface-stripped to a depth of 10 cm, exposing a large stone slab that covered the top of Feature 1. This slab was a metate fragment, turned upside down.

The fill of Feature 1 was limited to a single stratum of material, Stratum 1, a dark gray, ashy soil filled with flecks of charcoal.

Of simple construction, Feature 1 was constructed by digging a small pit in the ground. There is no evidence that the walls were finished or prepared in any way. The small size of the feature and the single layer of deposition within it suggest that it was utilized for only a short period of time. Preservation of the contents was enhanced by the presence of the metate fragment covering the top of the hearth. LA 116504 is a short-term use area, probably connected with the gathering of wild seeds. The site is assigned to the Jornada Mogollon culture, based on the ceramics present. No associated surface or additional features were found at LA 116504.

LA 116505

LA 116505 is south of U.S. 380 on the top and east-facing slope of a low ridge (Fig. 8). The site measures 60 by 90 m, but most of this is an extremely thin surface artifact scatter. Two small surface artifact concentrations are present within the existing right-of-way, each of which was originally believed to represent a separate cultural component. One concentration measures 3 by 10 m, an area of 30 sq m. Surface artifacts in this area totaled 10 lithic artifacts, an artifact density of 0.33 per sq m. The second surface artifact concentration measured 5 by 6 m, an area of 30 sq m. Surface artifacts in this area also totaled 10 lithic artifacts, an artifact density of 0.33 artifacts per square meter.

All of the cultural material in the right-of-way at LA 116505 was found to be redeposited material from outside of the project area. The main surface artifact concentration is south of the existing right-of-way, completely outside of the project area. No features were found at the site.

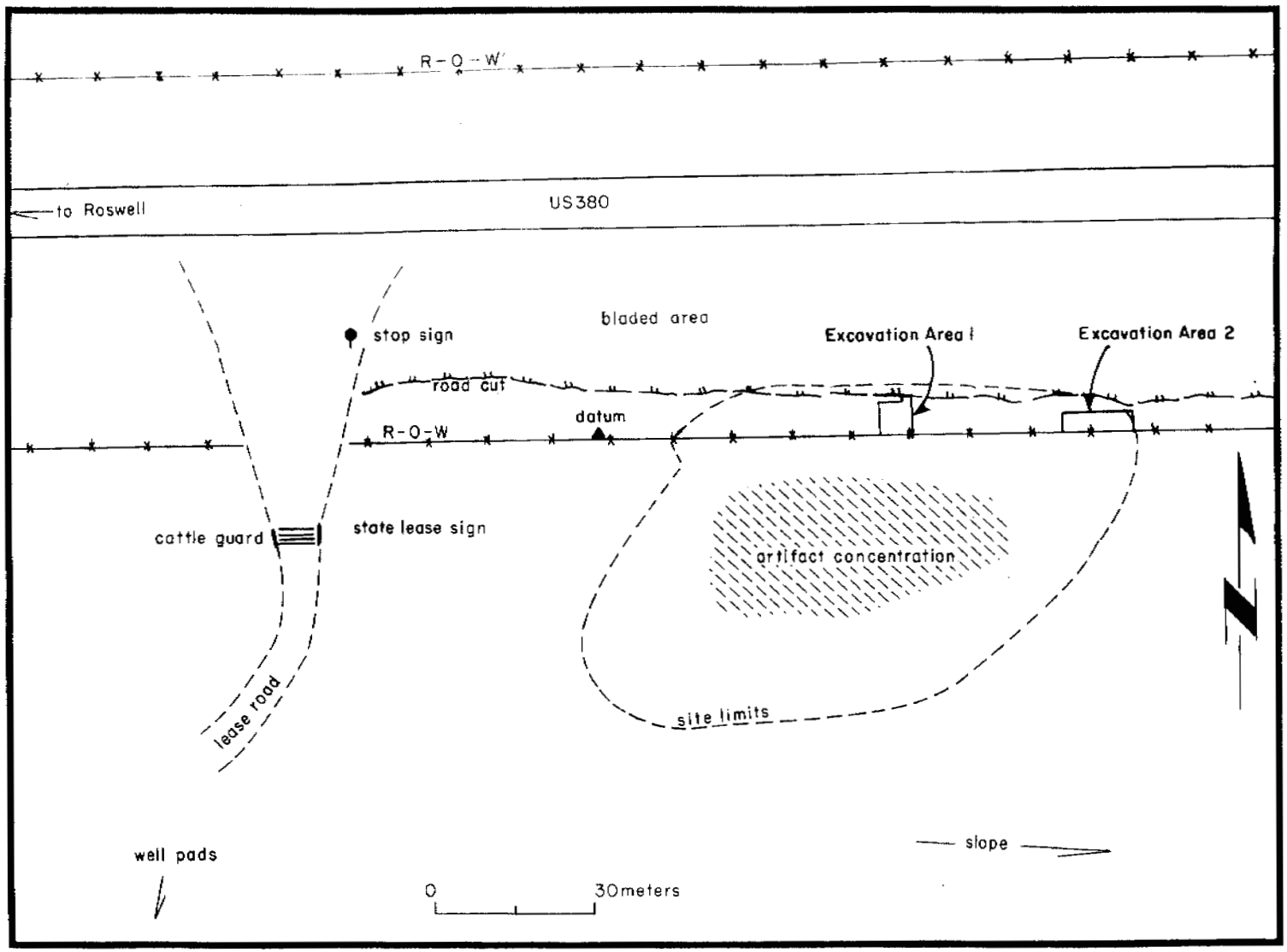

Figure 8. LA 116505 site map.

SITE DATING

Dating three of the four Red Lake Tank sites (LA 116502–LA 116504) was based on the success of the radiocarbon dating. Other dating methods have not proved successful. It has also been possible to determine a relative date for the site within the Jornada Mogollon based on the ceramic assemblage. This combination of C-14 and ceramic dating helps correct for the shortcomings of both dating techniques. Radiocarbon dates are often older than the sites dated because of the added age of the wood itself, while ceramic sequences tend to "float" in time unless anchored to more absolute dates.

Dendrochronology can give a precise date based on the tree rings from specific species of wood, recovered from an archaeological contexts. The lack of wood fragments at all four of the Red Lake Tank sites made the application of dendrochronology as a dating technique impossible.

Archaeomagnetic dating is based on the presence of iron in the soil. Released by heat, these particles line up on magnetic north and remained fixed once they cool down. By measuring the angle present and comparing it to the route of the wandering north pole, a precise date can technically be obtained for any area of burned earth (such as a hearth). Although a number of thermal features such as hearths and roasting pits were present at three of the Red Lake Tank sites (LA 116502–LA 116504), none of the features exhibited the degree of intense heating (or oxidation) necessary for archaeomagnetic dating to be effective. For this reason, no archaeomagnetic samples were collected from any of these sites.

Precise dating of archaeological structures or features can also be achieved with radiocarbon dates. This dating technique is based on measurements of the amounts of specific types of radioactive carbon isotopes within organic material. Samples of burnt wood were collected at three of the sites excavated (LA 116502–LA 116504) and subjected to radiocarbon dating by Beta Analytic, Inc.

Radiocarbon (C-14) dates were determined for three sites. The calibrated two-sigma date range for LA 116502 is A.D. 695-975. The calibrated two-sigma date range for LA 116503, the later of the two Eastern Jornada Mogollon sites, is A.D. 1035-1245. The earlier Eastern Jornada Mogollon site (LA 116504) has a calibrated two-sigma date range of A.D. 980-1175. However, the actual age of the wood has to be considered when using radiocarbon dating. Typically, an old wood problem will result in a date that is 50 to 100 years earlier than the feature being dated.

Relative dates for LA 116502-LA 116505 can also be obtained by the presence of diagnostic artifacts. Relative dates for the two Jornada Mogollon sites (LA 116503 and LA 116504) were obtained by comparing their ceramic assemblages to those from other Jornada Mogollon sites. This allows gross age differences to be determined within the Jornada Mogollon. The ceramic assemblages from LA 1116503 and LA 116504, when compared to those from other sites, can be used to help assign these sites to a specific culture and reveal their relative dates within that culture.

Comparison of the ceramic assemblages from LA 116503 and LA 116504 reveals age differences. LA 116504 is the older of the two sites based on its ceramic assemblage (see Wilson, this volume). Jornada Brown wares dominate the assemblage. In contrast, LA 116503 has a ceramic assemblage dominated by Chupadero Black-on-white and containing Three Rivers Red-on-terracotta. These age differences reflect and parallel the differences in the calibrated radiocarbon

dates.

Relative dates can also be obtained for sites by dating additional diagnostic artifacts such as projectile point types. LA 115603 is the only one of the Red Lake Tank sites where projectile points were found within the project area. Of the seven projectile points recovered at LA 116503, six were Harrell-type points common to Eastern Jornada sites, and one was a Late Archaic corner-notched point. A number of fragmentary Archaic projectile points were found at LA 116505 outside of the project area. No diagnostic artifacts were recovered at LA 116502 or LA 116504.

CERAMIC ANALYSIS

C. Dean Wilson

A total of 191 sherds collected during the data recovery phase of the Red Lake Tank project were analyzed--155 sherds from LA 116503 and 16 sherds from LA 116504 (Table 1). This analysis involved the recording of data allowing for the determination of the possible time of occupation of these sites as well as the examination of various ceramic trends, including patterns of vessel production, exchange, and use. In order to compare trends noted during the present study to those documented in other studies, analysis strategies and categories similar to those previously defined in other studies in the general area were used (Hill 1996a, 1996b; Jelinek 1967; Kelley 1984; Mera 1943; Runyon and Hedrick 1987; Wiseman in prep. a and b).

Descriptive Attributes

The recording of ceramic attribute categories reflecting resource use, manufacturing technology, and vessel form allows for the examination of various patterns. Ceramic attributes recorded during this study include temper type, pigment, surface manipulation, slip, and vessel form.

Temper Categories

Temper categories were identified by examining freshly broken sherd surfaces through a binocular microscope. More detailed characterizations of temper from seven sherds assigned to various temper categories were submitted for petrographic analysis (see Hill, this volume).

All of the brown ware and red ware sherds were tempered with some form of crushed igneous rock. Temper categories identified during the present study are similar to those described at other sites along the Middle Pecos as well as those in the Sierra Blanca region to the west (Hill 1996a, 1996b; Jelinek 1967; Kelley 1984; Mera 1943; Runyon and Hedrick 1987; Wiseman in prep. b).

The most common tempering group is represented by a leucocratic igneous rock containing light feldspar and quartz fragments that may represent the use of crushed granites or monzanites. This group is identified by the dominance of milky white to light gray grains, probably representing feldspar along with some quartz. Dark fragments representing hornblende may be present in extremely low amounts. Fragments size appears to be relatively small, and grain size tends to be smaller than in similar temper noted for El Paso Brown from sites in the El Paso area. Petrographic analysis conducted on three sherds assigned to this category indicates two sherds contain monzanite, possibly from natural inclusions in the clay, and another was described as alpite granite (Hill, this volume).

Another temper group was distinguished by numerous very small and profuse clear to dark fragments, referred to here as crystalline igneous rock. Larger grains are sometimes present and usually roundish and crystalline in structure. These fragments appear to be crystalline or sugary in appearance. This group may represent the use of Capitan alpites. Petrographic analysis indicates a granite alpite (Hill, this volume).

The other temper group is characterized by the dominance of gray feldspar fragments, presumably from synenites from somewhere in the Sierra Blanca area (Wiseman in prep. a). Feldspar fragments tend to be similar in appearance, angular, and sparsely scattered. These fragments are large compared to other temper fragments and are often readily visible even without the aid of a binocular microscope. These feldspar fragments tend to be opaque and gray to off-white in color. Smaller grains of other minerals are rare if present.

The other rock category identified was limited to Corona Corrugated sherds and is characterized as a mica schist. This temper is recognized by the presence of small to large gray small fragments with mica. Fragments tend to be long and platy. Mica occurs inside and outside of fragments.

Temper occurring in the Chupadero Black-on-white sherds examined was fairly similar, consisting of combinations of dark sherd and rock particles. Sherd and rock particles tend to be small and dark, and they can be difficult to distinguish, particularly in vitrified pastes. The sherd fragments are recognized by their dull appearances and range from dark gray to brown. Rock particles are very fine and may be white to light gray but are often dark gray to black. Petrographic analysis of two sherds assigned to this category indicated the use of fine sand and dark crushed potsherd temper. A single white ware sherd contained light colored dull white fragments, apparently crushed potsherds, and was characterized as a white sherd.

Surface Manipulation

Surface manipulations, reflecting the presence and type of surface textures and polishing, were recorded for both interior and exterior sherd surfaces. *Plain unpolished* refers to surfaces where coil junctures have been completely smoothed, but surfaces were not polished. Polished surfaces are those which have been intentionally polished after smoothing. Polishing implies intentional smoothing with a polishing stone to produce a compact and lustrous surface. *Slightly polished* indicates a plain and slightly compacted or polished surface. *Heavily polished* indicates a lustrous compact surface resulting from intensive polishing. *Unpolished striated* denotes the presence of a series of long shallow parallel grooves resulting from brushing with a fibrous tool on an unpolished surface. *Indented corrugated* refers to the presence of fine exterior coils with regular indentations on the exterior surface.

Slip

Slips represent intentional applications of a distinct clay, pigment, or organic deposit over an entire vessel surface. Such applications may be used to achieve black, white, or red surface colors, not obtainable using paste clays or firing methods normally employed. Surfaces without a distinct slip were classified as *unslipped*. Surfaces over which a high iron slip clay was applied to create a red ware were assigned to a *red slipped* category. Those to which a low iron slip was applied as represented in some white wares were classified as having *white slipped* surfaces.

Paste Profile

The color combinations of a sherd cross section reflects clay iron content and the firing conditions to which a vessel was exposed. Reddish or buff profiles indicate oxidizing atmospheres during the final stages of firing. Black or dark gray profiles result from reduction atmospheres. White or light gray colors may indicate neutral or low oxidation atmospheres. Color categories

recorded for sherd cross sections included *dark gray to black throughout*, *brown or reddish throughout*, *red or brown inside, back outside*, and *red and gray streaks*.

Wall Thickness

Because the overall wall thickness of brown wares in other regions of the Jornada Mogollon have changed through time (Whalen 1994), thickness of sherds was recorded. Wall thickness was recorded to 0.1 cm for all sherds analyzed. This measurement was made on an area of the sherd that appeared to be typical of the overall thickness.

Refired Color

Clips from selected sherds were fired in controlled oxidation conditions at a temperature of 950 degree C. in order to standardize ceramic pastes. This provided for common comparisons of pastes based on the influence of mineral impurities (particularly iron) on paste color, and may used to identify pottery that could have derived from the same source clays (Shepard 1965). The color of each samples was recorded using a Munsell Soil Chart.

Vessel Form

Sherd-based vessel form categories reflect the shape and portion of the vessel from which a sherd was derived. Categories identified were based on rim shape or the presence and location of polish and painted decorations. While it is often easy to identify the basic form (bowl versus jar) of body sherds from many southwestern regions by the presence and location of polishing, such distinctions are not as easy for Jornada brown ware types. For example, Jornada Brown Ware bowl and jar sherds can be polished or smoothed on either side. Therefore, body sherds exhibiting equal amounts of polishing on both sides were simply assigned to an *indeterminate body polished on both sides* category. Sherds with heavier polish or painted decoration on interior surface were classified as *bowl body*. Those exhibiting a more polished or painted decoration on the exterior surface were assigned to a *jar body* category. *Cooking/storage jar neck* sherds were identified by the presence of distinct curves associated with the neck area. *Cooking/storage jar rim* sherds also exhibit the distinct curves of a necked jar. *Bowl rim* refers to sherds exhibiting inward rim curvature characteristic of bowls. *Seed jar rim* refers to sherds derived from spherical vessels that do not exhibit distinct necks, but have rounded openings near the top.

Ceramic Types

Ceramic types represent groupings that relay information about distribution of characteristics with temporal, spatial, and functional significance. Sherds assigned to various types could be lumped into four basic groups, including Jornada Brown Ware, Three Rivers Red Ware, Chupadero Black-on-white, and Corona Corrugated. In some cases, types or categories within these groups were further separated on the basis of technological and stylistic treatments.

Jornada Brown Wares

Plain brown ware types represent the most common pottery at sites investigated during the Red Lake Tank project: 91 sherds, or 58.7 percent of the pottery from LA 116503, and all 16 sherds from LA 116504. Similar plain brown ware vessels may have been produced in the Jornada region

possibly as early as A.D. 200 and were common until the abandonment of the middle Pecos region by Jornada Mogollon groups. Brown ware ceramics from various areas of the Jornada region have long been divided into types based on combinations of attributes thought to be spatially significant. The recognition of various brown ware types are based on postulated areal differences in surface color, polish, and temper noted for the plain brown ware from different areas of the Jornada Mogollon region (Jelinek 1967; Jennings 1940; Lehmer 1948; Whalen 1995; Wiseman 1996). Recent studies indicate considerable overlap in the attributes associated with brown ware pottery common in different areas of the Jornada Mogollon region (Hill, personal communication; Whalen 1995). These examinations indicate strong similarities in both pastes and manipulations of brown ware pottery found in both the riverine and mountainous areas of the Jornada Mogollon. Even petrographic analysis involving detailed characterizations of pastes and temper from distinct areas of the Jornada Mogollon could often not distinguish pottery from distinct regional groups. Therefore, many recent studies have simply lumped plain brown ware sherds previously assigned to types such as El Paso Brown, Jornada Brown, or South Pecos Brown into a single plain brown ware category and have attempted to document variation in pottery from different areas through the distribution of various paste and technological attributes (Hill 1996a,1996b; Whalen 1995).

Other studies indicate that subdivisions within Jornada Brown Ware may be useful, although factors contributing to the differentiation of these brown wares may be more complicated than often assumed (Wiseman 1996). For example, Wiseman (1996, in prep. a) uses modified versions of brown ware types described by Jelinek (1967). In this typology, Jornada Brown, also recently referred to as Sierra Blanca variety (Wiseman in prep. a), is described as generally having well-polished surfaces that obscure temper grains. Temper fragments are often fine, consisting of a profusion of small equally sized grains. Jornada brown vessel wares are usually thick (6 to 8 mm). Jornada sherds from Red Lake Tank were somewhat thinner, averaging about 5.4 mm.

Another category is South Pecos Brown. This type is generally well smoothed, and polishing may be strong to absent. Temper is represented by sparse large gray feldspar fragments, perhaps syenites from the Sierra Blanca area, that frequently show through the surface. This temper results in blocky to tabular paste cross sections. The protruding temper cracks are surrounded by very small radial cracks and surface clays that have contracted or shrunken toward the body clay.

El Paso Brown is mainly distinguished from Jornada Brown by the profusion of large fragments including rounded quartz fragments, representing granite temper, which may protrude through the surface. El Paso Brown sherds also tend to be soft and have less evidence of polish or luster and more scraping marks on interior surfaces. Pastes tend to be dark or brown with a dark core.

Problems in the use of the recognition of these brown ware varieties stem from various mixes in attributes used to define different plain brown ware types. For example, some sherds may contain a temper class commonly used to define one variety along with a surface manipulation frequently used to define another (Wiseman 1996). Still, the use of such categories may allow for the monitoring of variability in assemblages that may be of spatial or temporal significance and are not as cumbersome as the monitoring of a combination of attribute categories.

During the present study, different classification strategies were employed in the identification of brown wares during various phases of the analysis. During the initial examination, all brown ware sherds were placed into categories of a single "Jornada" plain brown ware group (see Table 1). Three basic categories were recognized. Sherds exhibiting plain polished surfaces were

assigned to either a *plain brown body* or *plain brown rim* category. A single very thin sherd similar to those derived from El Paso Polychrome was placed into a third brown ware category.

Next, an attempt was made to place these sherds into previously defined regional brown ware types. A subsample of the sherds initially classified as plain brown ware were first separated by Reggie Wiseman. Based on information regarding such divisions and my examination of sherds to which Wiseman assigned to various types, I assigned the remaining brown ware sherds to similar categories (Table 2). Given the associated traits of these sherds, the great majority were classified as Jornada Brown, with a small number of sherds placed in the South Pecos and El Paso Brown group. While I feel that definite overlap is represented and that some of the sherds assigned to different plain brown wares could have been produced in the same regions and even by the same potters, the recording of these categories does provide information about the nature of brown ware variation at Red Lake Tank sites. For example, although some overlap is represented, the dominance of sherds assigned to Jornada Brown indicates differences in the overall characteristics of the pottery from other regions, such as El Paso, as well as differences in nearby pueblo sites such as Bloom Mound and the Henderson site, where El Paso Polychrome is described as the dominant type (Kelley 1984; Wiseman in prep. b). Additional information relating to plain brown ware pottery recovered during the present project is indicated by distributions of attributes recorded (Tables 3-11). The dominance of dark high-iron paste, small igneous temper, well-polished surfaces, and wide vessel walls is consistent with an assemblage dominated by Jornada Brown. Distributions of various attributes noted in plain brown wares are discussed in more detail below.

Three Rivers Red Ware

Sherds exhibiting applications of bright red clay or red pigments over pastes similar to those described for brown wares were assigned to types of Three Rivers Ware (Wimberly and Rogers 1976). The initial use of red slip is thought to have been inspired by San Francisco Red, a type produced at the onset of pottery production in the Mogollon Highlands (Haury 1936). Pottery from LA 116503 placed into this group includes 16 sherds, 10.4 percent of the total sherds. Temper and pastes of Three River Red Ware types were similar to that noted on Plain Brown Wares, although surfaces tended to be more polished, and bowls are the dominant vessel form. Three Rivers Red Ware sherds were assigned to one of two types based on the presence of a slipped surface versus painted decorations. While other studies have sometimes assigned some red wares to types of Three Rivers Red Ware and other red ware groups, given the similarity of pastes and slips noted in types exhibiting red-slipped or painted decorations, all red-slipped sherds were assigned to a single category.

Sherds with a bright red slip covering at least one surface were assigned to *plain slipped* or Three Rivers Red. Sherds assigned to this type exhibit thin to moderately thick slips. All the red ware sherds examined essentially represent a slipped version of Jornada brown ware, and very distinct intrusive red ware types such as Playas Red were not represented. Unslipped areas are often visible in examples with thin slips, resulting in distinct red streaks and contrasts. Forms are mainly represented by bowls, with slipped interiors. While both the slipped and unslipped surfaces were polished, polishing on the slipped surface is usually more refined.

Other sherds exhibited red painted decoration over an orange to light brown unslipped surface. This paint is described as an iron pigment and is red to maroon. It exhibits a similar appearance as the slip clay noted in previously described red wares. Characteristics of these sherds were

identical to those in pottery previously classified as Three Rivers Red-on-terracotta (Kelley 1984; Mera 1943; Mera and Stallings 1931). Figure 9 (top row) illustrates painted decorations on one of the Three Rivers Red-on-terracotta sherds. The paste is similar to that noted in Jornada Brown sherds, although it tends to be harder. Temper is described as less variable than in Jornada Brown, represented by evenly spaced white quartz fragments (Kelley 1984). Surfaces tend to be very smoothed and polished. Primary designs consist of a series of two to five narrow lines 2 to 4 mm thick applied directly below the rim. These lines usually occur in rectilinear patterns, although curvilinear and scroll-shaped patterns are sometimes represented. Secondary designs are sometimes incorporated into these lines and include small solid triangles. This type is generally represented by bowl forms.

Chupadero Black-on-white

All the white ware sherds identified during the present study exhibit traits typical of Chupadero Black-on-white, described in sites covering a wide area of the Jornada Mogollon (Kelley 1984; Levine 1992; Mera 1931; Hayes et al. 1981; Vivian 1964; Wiseman 1986). Sherds from Chupadero Black-on-white vessels represent the second most common ceramic group at LA 116503, including 45 sherds, 39 percent of all sherds. Chupadero Black-on-white was first manufactured sometime between A.D. 1050 and 1100 and continued to be produced to about A.D. 1550. It is often the dominant and sometimes only white ware type at sites in the Jornada region (Mera 1931).

Chupadero Black-on-white sherds usually have dense light gray to white pastes, reflecting the use of a low-iron clay firing to buff colors and a low-oxidizing or neutral atmosphere. Chupadero sherds from LA 116503 consistently fired to similar buff colors in an oxidizing atmosphere, in contrast to the red colors of sherds representing all other ceramic types identified during the present study. Temper is often dark and includes fine sherd and rock fragments. The decorated surfaces of Chupadero Black-on-white are often unpolished with striated or scored treatments resulting from scraping. A total of 24 sherds (or 53.3 percent) of Chupadero Black-on-white from LA 116503 exhibited unpolished interiors with distinct striations characteristic of this type. Surfaces are sometimes covered with a white slip, which is often streaky, although unslipped Chupadero Black-on-white sherds are fairly common. While Jelinek (1967) divided Chupadero Black-on-white sherds into several types thought to be temporally sensitive, primarily based on the presence of slips, surface color, and temper type, these distinctions do not appear to be warranted. Four of the Chupadero Black-on-white sherds from LA 116503 exhibit a white slip over a gray paste, while the remaining sherds are unslipped.

Painted designs of Chupadero Black-on-white vessels often consist of combinations of hatchured and solid motifs. Designs were executed in a series of panels in which the basic design was repeated every one or two sections. At least four and as many as eight panels may be represented. Of the 45 sherds from LA 116503 derived from Chupadero Black-on-white vessels, 27 (60 percent) are painted, and 18 (40 percent) are unpainted. Of the painted sherds, 19 (70.4 percent of all painted sherds) exhibit solid decorations only, 4 (14.8 percent) are hatchured, 3 (11.1 percent) exhibit solid and hatchured decorations, and 1 (3.7 percent) has indeterminate designs.

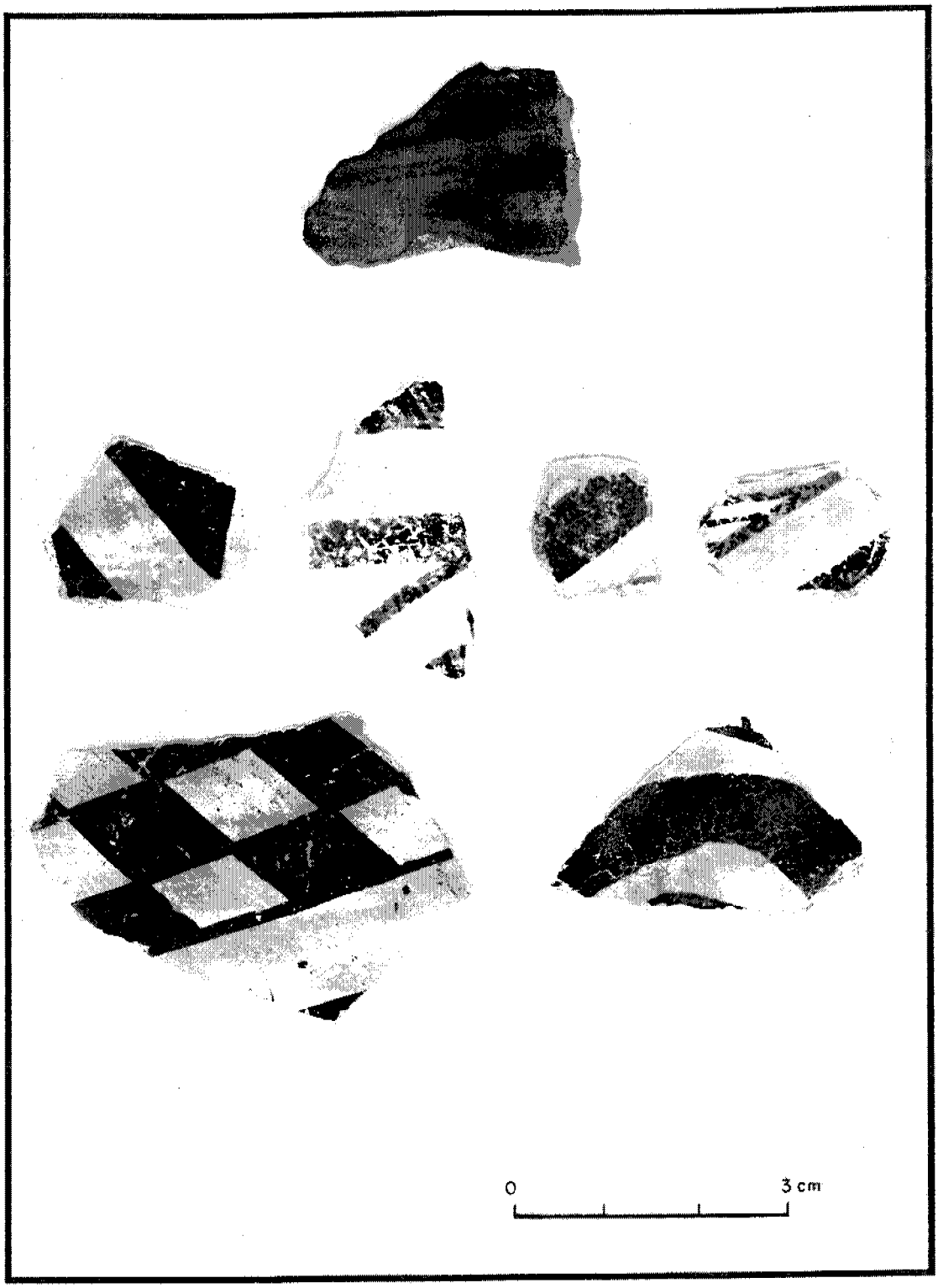

Figure 9. Sherds from LA 116503: Three Rivers Red-on-terracotta (top); Chupadero black-on-white (middle and bottom).

Examples of Chupadero Black-on-white sherds from LA 116503 are illustrated in Figure 9.

Corona Corrugated

A total of 3 sherds (1.9 percent of all sherds) from LA 116503 exhibited the distinct combination of traits indicative of Corona Corrugated (Hayes et al. 1981). This represents the last type belonging to the Pitoche series, as defined by Mera (1935). Pastes tend to be crumbly and to be tan to dark gray in color. Surfaces are usually dark gray or black but are sometimes tan or brown. The schist temper noted during the present study was also common in Corona Corrugated sherds from Gran Quivira (Hayes et al. 1981). Corona Corrugated is almost exclusively represented by jars. Exterior surfaces usually exhibit indented corrugations, although plain corrugated surfaces sometimes occur. Interior surfaces are usually somewhat polished.

Ceramic Trends

Distributions of various ceramic types and attribute categories are first used to determine the potential time of occupation of LA 116503 and LA 116504. Next, ceramic distributions are used to examine various issues, including patterns of vessel production, exchange, and use.

Dating of Sites

Distributions of various types and attributes provide clues concerning the time of occupation of LA 116503 and LA 116504, but these interpretation are limited by the small size of the sherd samples. Interpretations based on combinations of certain types may also assume a relatively short occupation, which may not always be the case.

It is very difficult to assign any precise dating span to LA 116504, given that the pottery from this site consists of 16 sherds from two or three vessels. The absence of later types could possibly indicate that this site dates to before the introduction of decorated types such as Chupadero Black-on-white and Three Rivers Black-on-white, or it could simply reflect the effect of the very small sample size. A C-14 date from this site ranged from A.D. 980 to 1175, casting some doubt on a pre-eleventh-century date.

The occurrence of a range of pottery types from a number of vessels allows for the assignment of a relatively precise date to LA 116503, despite the relatively small sample size. In addition to the 155 sherds recovered during the excavation of LA 116503, information was recorded during infield analysis of 14 sherds outside the right-of-way. Types identified during this analysis include plain brown ware, Red Slipped Red, and Chupadero Black-on-white.

While plain brown ware and slipped red sherds dominate the assemblage of sherds recovered during the excavation of LA 116503, these types were produced over a very long period. More specific dating information is provided by the presence of three types associated with a later occupation, including Chupadero Black-on-white (A.D. 1050-1100 to 1545), Three Rivers Red-on-terracotta (A.D. 1150 to 1300), and Corona Corrugated (A.D. 1225 to 1460). Roughly similar combinations of pottery types have been noted at a number of other sites in the Roswell area (Sebastian and Larralde 1989). Another argument for a late occupation is the absence of Mimbres Classic Black-on-white, which co-occurs at sites dating to the twelfth century. The absence of Lincoln Black-on-white and glaze-painted types could also indicate an ending date somewhere before A.D. 1300, although their absence could also simply reflect the small sample size. Thus,

a best-guess ceramic date for this site would be sometime between A.D. 1200 and 1300, within the McKenzie period of the Middle Pecos sequence (Jelinek 1967). A single C-14 date from this site ranged from A.D. 1035 to 1245, in relative agreement with the ceramic dating. Distributions from this site contrast with data from Bloom Mound and the Henderson site, which appear to date sometime between A.D. 1250 and 1400 (Wiseman in prep. b) and may be slightly older than the better-known pueblos in the Roswell area.

Production and Exchange

An important issue is whether pottery examined during the present study could have been produced locally, or at least at nearby sites in the Middle Pecos region. Jelinek (1967) suggests that several of the pottery types he described may have been made along the middle Pecos. Others have noted that the nearest major sources of the temper types common in pottery occurring in the Middle Pecos are in the Sierra Blanca, Capitan, and Sacramento Mountains, in an area that has been referred to as the Lincoln County porphyry belt. This area includes much of the mountainous areas in Lincoln, northern Otero, and western Chaves counties (Allan and Ford 1991; Hill 1996a, 1996b). As part of the present study, clays and sands along the Pecos River and sporadic igneous dike outcrops in the Roswell area were collected. These collections did not yield rocks or clays with inclusions similar to temper noted in Jornada Brown Ware types, and the majority of the clays from sources along the Pecos River were distinct from ceramic pastes noted in Jornada Brown Ware types. Examinations of temper from sherds recovered during the Red Lake Tank project support the use of monzanites and alpite granite from the Sierra Blanca area (see Hill, this volume). Both surface and paste characteristics of pottery from Red Lake Tank resulted in the assignment of the majority of plain brown ware sherds to Jornada Brown. Kelley (1984) notes that the Sierra Blanca region may have been a manufacturing center of Jornada Brown, including that found in the Middle Pecos region. The range of characteristics of brown wares from LA 116503, however, may be different from that noted at two of the best known late sites in the Jornada region, such as the Henderson site and Bloom Mound. Characteristics of the pottery from these sites resulted in the assignment of the great majority of them to El Paso Polychrome (Kelley 1984; Wiseman in prep. b). El Paso Polychrome is common in late assemblages in the El Paso region, 125 miles to the southwest of Roswell, although it is possible that such pottery may have been produced at sources closer to the Pecos Valley (Kelley 1984). The presence of this pottery has sometimes been interpreted as indicating that Bloom Mound and the Henderson sites were important centers in a exchange system that was ultimately linked to the El Paso region. In contrast, the low frequency or absence of El Paso Polychrome at LA 116503 and sites in the Pecos Valley indicates that not everybody in the Middle Pecos participated in this system, but may have interacted more strongly with groups to the west, in the Sierra Blanca region. It is also possible that the differences at LA 116503 reflect different factors, indicating an occupation just prior to the development of interaction systems with groups in the El Paso area.

The presence and characteristics of other types recorded at LA 116503 indicate close ties with the Sierra Blanca region and mountainous areas to the west. Characteristics of the paste and temper noted in Three Rivers Red Ware types were very similar to those occurring in the Sierra Blanca region. Chupadero appears to have been produced in the Gran Quivira country in central New Mexico and the Jicarilla and Capitan Mountains in southeastern New Mexico (Wiseman in prep. a). It appears to represent a trade ware in many areas, where it occurs in significant frequencies (Hayes et al. 1981; Hill 1996a, 1996b; Kelley 1984). The only pottery recovered that clearly originated somewhere other than the Sierra Blanca region is the three schist-tempered Corona Corrugated sherds. Corona Corrugated sherds with schist temper dominate assemblages in the

Gran Quivira area (Hayes et al. 1981).

Vessel Function

Distributions of forms and decorations may provide information concerning the activities associated with vessels from which the sherds derived. In many areas of the Southwest, combinations of sherd shape and location of polishing or painted decorations provide clues concerning associated vessel forms. For example, in most southwestern traditions, sherds derived from jar body sherds can be identified by the presence of decorations or polishing on the exterior surface only, while bowls are recognized by decoration or polishing on the interior. Unfortunately, this does not appear to be as useful for Jornada Mogollon assemblages. Thus, the relatively high percent of undecorated sherds that were polished on both sides were placed into an indeterminate form category, because they could have been derived from bowls or jars.

It is also important to note that sherds exhibiting similar shapes but belonging to different pottery groups and exhibiting similar shapes could have been used in very different activities. A characteristic of pottery assemblages in Southeastern New Mexico is the specialization of vessel forms belonging to different ceramic groups (Wiseman in prep. a). Some of the main differences between ceramics assigned to different groups relate to hardness, durability, and porosity and would have influenced their function and uses. Therefore, distributions of various vessel form attributes are described separately for sherds belonging to each of the four ceramic groups identified.

Information concerning vessel form indicates that the sherds recovered from sites investigated during the Red Lake Tank project did derive from vessels representing a wide range of forms (Tables 5 and 6). While many of the sherds were from plain brown ware types that could not be assigned to a precise category, those that could are represented by roughly equal frequencies of bowl and jar sherds. Rim forms include both cooking/storage jars and seed jars. The majority of red ware sherds are derived from bowl forms, although jar forms were identified. The majority of sherds from Chupadero Black-white-vessels are derived from jars, although bowl forms are represented. The widespread distribution may relate to its apparent superiority to brown ware jars in a number of activities. Chupadero pastes tend to be hard and not porous, particularly when compared to other types commonly occurring in the Jornada Mogollon country. These vessels would have been particularly well suited for activities involving transportation of goods, food serving, and storing liquids. All of the Corona Corrugated sherds are from jars. Corona Corrugated tends to be less porous and better fired than Mogollon Brown wares and would have been superior for storing liquids and cooking.

PETROGRAPHIC ANALYSIS OF SEVEN SHERDS FROM RED LAKE TANK

David V. Hill

Seven sherds were examined from the Red Lake Tank area. Two Jornada Brown Ware sherds were examined from LA 116504. Four Jornada Brown Ware sherds and two sherds of Chupadero Black-on-white were analyzed from LA 116503.

The ceramics were analyzed by the author using a Nikon Optiphot-2 petrographic microscope. The sizes of natural inclusions and tempering agents were described in terms of the Wentworth Scale, a standard method for characterizing particle sizes in sedimentology. These sizes were derived from measuring a series of grains using a graduated reticle built into one of the microscope's optics. The percentages of inclusions in the ceramics were estimated using comparative charts (Matthew et al. 1991; Terry and Chilingar 1955).

Sample 1

The paste of this sherd is a medium brown color and is slightly birefringent. The paste contains a granite aplite. The rock fragments present consist of about equal proportions of quartz, plagioclase, and orthoclase. A few black opaque areas that could be weathered biotite are present in a few of the rock fragments. Isolated grains of quartz, plagioclase, and orthoclase are present in the paste as well. The inclusions make up about 25 percent of the paste and range from fine to coarse in size. The degree of weathering of the feldspars to sericite and clay minerals combined with the continuous size distribution of the inclusions is suggestive of the use of clay that already contained the rock fragments and mineral grains.

Sample 2

The paste of this sherd is a light brown color and is slightly birefringent. Sparse fine sands and brown biotite, much of which has altered to hematite, are naturally present in the ceramic paste. The vessel was tempered using a monzonite or quartz monzonite porphyry. Quartz is present in trace amounts in a few of the larger rock fragments but accounts for only about 3 percent of the minerals present. The texture of the monzonite is subhedral granular. Finer grained monzonite fragments contain sparse magnetite with hematitic rims. A few of the larger monzonite fragments contain green hornblende. The feldspars display alteration to clay minerals and sericite. The monzonite fragments and isolated grains of orthoclase, plagioclase, and quartz account for about 15 percent of the paste and range in size from medium to very coarse in size. A single rounded grain of trachyite is also present.

Sample 3

The paste of this sherd is a dark brown color and almost opaque. It contains about 30 percent isolated mineral grains and rock fragments. These inclusions range in size from very fine to coarse. A subhedral monzonite makes up the rock fragments present in the paste. The feldspars have weathered partially to clay minerals and sericite. The degree of alteration of the feldspars combined with the continuous size distribution of the isolated mineral grains and rock fragments is indicative of the use of clays that naturally contained the monzonite. Quartz is occasionally present in a few of the rock fragments, but overall it is uncommon in the sample. Some brown hornblende and weathered brown biotite is also present in some of the rock fragments.

Sample 4

The paste of this sherd is a light gray color. The past contains about 25 percent very fine to fine sand. While most of the sand grain represent quartz, a few highly altered feldspars are also present. In addition, about 10 percent of the paste also contains fine to medium-sized dark gray to brown potsherd temper.

Sample 5

The paste of this sherd is a reddish brown. The paste contains 20 percent inclusions that appear to have been derived from a subhedral monzonite. Based on the alteration of the feldspars to clay minerals and sericite and the continuous particle size distribution form fine to coarse, it is likely that the vessel was made using clay that contained the monzonite as natural inclusions. Some quartz is present in a few of the rock fragments and as isolated grains, but it is much less common in the paste than orthoclase or plagioclase. Sparse brown biotite is also present in the paste and in a few of the rock fragments.

Sample 6

The paste of this sherd is a medium brown color. The paste contains 35 percent inclusions that range in size from very fine to coarse. Based on the degree of weathering of the feldspars and the distribution of particle sizes, it is likely that the inclusions are a natural constituent of the source clay. The rock fragments in the paste indicate that the present rock was a porphyritic aplite granite. Quartz, plagioclase, and orthoclase are present in about equal amounts.

Sample 7

The paste of this sherd is a light gray color and is virtually identical to Sample 4 in terms of the size and amount of fine sandy dark brown to black sherd temper. Two medium-sized fragments of augite are present in this sherd. Augite was not present in the paste of Sample 4. The presence or absence of augite is not likely the result of variation in the sampling imposed by the analysis.

Discussion

Samples 2, 3, and 5 contain monzonites, most likely natural inclusions in the source clay. Quartz poor granites are a part of the Capitan pluton. Clays containing such materials would have been available along the eastern margin of the Capitan Mountains (Allan and Ford 1991).

Samples 1 and 6 contain aplite granite. Aplite granite has been reported in Jornada Brown Ware ceramics from the Sierra Blanca area (Warren 1992).

Samples 4 and 7 represent sherds of Chupadero Black-on-white. Both of the sherds have very similar paste characteristics. They both contain isolated mineral grains, predominately quartz and weathered feldspar, along with fine to medium-sized crushed potsherds. Previous petrographic analysis of three Chupadero Black-on-white sherds from the Carlsbad area also contained fine sands and dark colored sherd temper (Hill 1997).

LITHIC ARTIFACT ANALYSIS

Lithic artifact analysis was accomplished with two basic goals in mind: to provide a descriptive summary of the lithic artifacts from each of the four sites, and to provide information that could be used to address the general research problems outlined in the data recovery plan for the four sites.

Prehistoric Puebloan sites (both Jornada Mogollon and Anasazi) tend to have less lithic artifacts for their size than earlier prehistoric sites. This fact is reflected in the assemblages from these sites. Two of the sites are Jornada Mogollon, and another is possibly Late Archaic (the fourth site is redeposited material). There are 8 lithic artifacts from LA 116502, 811 from LA 116503, 137 from LA 116504, and 20 from LA 116505.

The descriptive lithic artifact analysis attempted to identify patterns in prehistoric artifact production and use. Interpretation of the two Jornada Mogollon sites (LA 116504 and LA 116504) is based on the assumption that Puebloan lithic assemblages reflect the need to satisfy two needs: the production of flakes that can be utilized without further modification as expedient tools, and material that can be further modified into formal specialized tools.

This is in contrast to the interpretation of LA 116502, which follows a biface-based technology common to Archaic sites. Here the goal is the production of specific tools, with explicit distinctions made between tools and waste, and modified tools are common. However, the small size of the LA 116502 artifact assemblage makes any interpretation of that site conjectural.

It has been argued that expedient tools, flakes utilized with little or no modification, are the result of material abundance on residential sites (Post 1993). However, they may also represent a convenient, flake-based, domestic lithic technology (Abbott et al. 1996).

The existence of formal tools such as projectile points, drills, etc. within an assemblage implies design directed toward specific tasks or activities. Early stages of formal tool manufacture and expedient flake production produce flakes that are indistinguishable from each other. The waste flakes produced in the later stages of formal tool production, however, are distinctive biface thinning flakes.

Distinctive resharpening, or rejuvenation, flakes are a common by-product of tool maintenance and reuse. Their presence is an indication of these specific activities occurring on a site.

The presence of nonlocal, or exotic, materials can be used to postulate spheres of social and economic interaction. Conversely, an absence of nonlocal lithic material may reflect the isolation of a population or community.

The research design developed for these sites focused on the identification of site activities, as a manner of inferring site function. These lithic artifact assemblages can indicate a range of activities that may have taken place at these sites. Different activities can be inferred through the presence of different artifact types and their frequencies. Since LA 116503 contains a residential structure, a wider range of actives can be expected than at a hunting camp, or short-term procurement area such as LA 116502 and LA 116504.

Analytic Methods

The guidelines and format of the Office of Archaeological Studies *Standardized Lithic Artifact Analysis: Attributes and Variable Code List* (OAS 1994a) were followed in the analysis of lithic artifacts from the Red Lake Tank sites. Definitions used in lithic analysis are also included in this volume. The following attributes were included in analysis.

Material Type

Codes for material types are for general material groups unless the material is unquestionably from a recognized source. For example, although a wide range of chert occurs on these sites, all were classified as "chert." If a specimen was of a specifically named chert (such as Washington Pass chert), it was coded by the specific name.

Morphology (Artifact Type)

This is the characterization of artifacts by form.

Portion

Portion represents that part of the artifact present. Flakes and tools can be whole or fragmentary. Angular debris and cores are whole by definition.

Dorsal Cortex

Cortex is estimated to the nearest 10 percent increment. For flakes this is the cortex on the dorsal surface. Cortex on the platform was not included. For other morphological types, the percentage of cortex on all surfaces is estimated and added together.

Flake Platform

Flake platform is recorded for whole and proximal flakes. Some lateral flakes also have their platforms recorded, if the platform is still present. Either the morphology of the impact area prior to flake removal or extreme modifications of the impact area caused by the actual flake removal is coded.

Size

Artifact size is recorded in millimeters.

Edge Number

Artifacts can have one or more utilized edges. Each utilized edge on an artifact is given an edge number. Consecutive numbers are used for artifacts with more than one utilized edge. Each edge was analyzed separately for function and wear patterns.

Function

Function describes and characterizes artifact form.

Wear Patterns

Artifact modification caused by human use is coded as wear.

Analytic Results

The lithic artifact assemblages for the Red Lake Tank sites vary in size. This reflects both cultural affiliation and site type and demonstrates how these sites vary.

Material Selection

The range of lithic materials used for tools is remarkably similar for the four sites that were excavated. The artifact assemblages are dominated by local materials, with small amounts of nonlocal materials also present at two sites (LA 116503 and LA 116504).

LA 116502. Although the lithic artifact assemblage from LA 116502 is extremely small (8), they are comprised of three materials: metamorphic sandstone, chert, and quartzitic sandstone. Chert is the most common material present at this site (62.5 percent). Metamorphic sandstone is the second most common (25.0 percent). Quartzitic sandstone makes up the remaining 12.5 percent. All of these materials are available locally.

LA 116503. The largest lithic artifact assemblage was recovered from LA 116503 at 811 (Table 12). The majority of the material used is chert (61.8 percent), followed by quartzitic sandstone (21.8 percent), silicified wood (8.3 percent), and siltstone (4.8 percent). Other materials occur in smaller amounts. These include metamorphic sandstone (0.7 percent), Alibates dolomite (1.8 percent), rhyolite (0.2 percent), obsidian (0.3 percent), and basalt (0.1 percent).

Of these materials, only two are nonlocal. Alibates dolomite is found in the area of the Canadian River Valley in the Texas Panhandle, roughly 400 km (250 miles) north of the Red Lake Tank sites. Visually, the obsidian recovered from LA 116503 resembles Jemez obsidian from the Jemez mountains northeast of Santa Fe. Both Jemez and Polvedera obsidian are known from sites in the Pecos Valley (Shackley 1995). The other material, including silicified wood, are present in the Pleistocene gravel deposits along the Pecos River.

LA 116504. Material use at LA 116504 would be expected to follow the pattern of LA 116503 (Table 13), since both are Eastern Jornada Mogollon sites. However, quartzitic sandstone is the most common material in the LA 116504 lithic artifact assemblage, comprising 38.7 percent. This is followed by chert, which makes up 34.3 percent of the assemblage. Silicified wood (12.4 percent) and siltstone (10.2 percent) are also present, as are metamorphic sandstone (0.7 percent), obsidian (2.2 percent), limestone (0.7 percent), and Alibates dolomite (0.7 percent).

All of the materials in this assemblage are locally available except for Alibates dolomite, found in the northern Texas panhandle, and obsidian, possibly from the Jemez Mountains of north central New Mexico.

LA 116505. The lithic artifacts recovered at LA 116505 are redeposited from outside of the project area. The number of collected artifacts is small, and the materials represented are local. Chert comprises 60 percent of the assemblage, silicified wood makes up 15 percent. Metamorphic sandstone and siltstone each are present at 10 percent. Quartzitic sandstone is also present at 5 percent of the assemblage.

Material Cortex

Material use serves as an indication of human decision-making processes with regard to the suitability of materials (Young and Bonnichsen 1985:128). The presence within a site area of tested material, or of substantial numbers of core flakes exhibiting dorsal cortex, can thus be presumed to illustrate the manner in which this material suitability is determined.

LA 116502. The small assemblage lacks tested material and a large number of core flakes exhibiting dorsal cortex. Of the lithic artifact total, fully 50 percent lack any dorsal cortex. This suggests that any selection of material occurred at a different location, prior to its use at LA 116502.

LA 116503. The large number of chert flakes exhibiting dorsal cortex indicates that the reduction of chert took place at this site (Table 14). Although some evidence for the flaking of other materials is present at LA 116503, this is limited to the small-scale flaking of siltstone, quartzitic sandstone, and silicified wood. Of the lithic artifact total, 70.9 lack any dorsal cortex. This suggests that lithic material suitability testing was conducted, except in the case of chert, at another unknown location prior to its use at LA 116503.

LA 116504. A pattern of material reduction similar to that exhibited at LA 116503 is present in the LA 116504 assemblage (Table 15). Chert is present as flakes exhibiting varying amounts of dorsal cortex, suggesting that this material was being utilized for the manufacturing of tools. Of the lithic artifact total, 66.6 percent lack any dorsal cortex. This suggests that this lithic material suitability testing was conducted, except in the case of chert, at another unknown location prior to its use at LA 116504.

LA 116505. The lithic artifact assemblage from LA 116505 shows evidence of chert reduction. This is not too surprising, since the assemblage is redeposited material from what may be a possible chert quarry site outside of the project area.

Artifact Morphology

LA 116502. Core flakes make up the major portion of this small assemblage (87.5 percent). The sole exception at this site is a single biface.

LA 116503. Core flakes make up the largest category of artifacts at LA 116503, 89.9 percent of the total assemblage (Table 12). The second largest category is comprised of biface thinning flakes, only 3.7 percent of the assemblage. All of the additional morphological categories are limited to 1.5 percent or less.

The high percentage of core flakes can represent core reduction or the manufacturing of flakes

for use as expedient tools. Core flakes are present in all material types occurring at LA 116503. This range of occurrence suggests that the creation of core flakes for use as expedient tools was taking place. This form of convenient disposable lithic technology is characteristic of Puebloan sites (Akins and Bullock 1992; Neusius 1988). Only among chert artifacts in this assemblage is there the range of cortex occurrence that might indicate core reduction.

LA 116504. Core flakes make up 93.4 percent of the total assemblage (Table 13). As at LA 116503, biface thinning flakes are the second most common artifact type (3.6 percent). Other morphological categories are limited to single occurrences.

As with LA 116503, the high percentage of core flakes can represent core reduction or the manufacturing of flakes for use as expedient tools. Core flakes are present in virtually all material types occurring at LA 116504, suggesting that the creation of core flakes for use as expedient tools was taking place. This form of convenient disposable lithic technology is characteristic of Puebloan sites (Akins and Bullock 1992; Neusius 1988). Only among chert artifacts in this assemblage is there the range of cortex occurrence that might indicate core reduction.

LA 116505. Core flakes make up the largest category of artifacts at LA 116505, 90.0 percent. Only two artifacts out of 20 are not core flakes.

Flake Portion

Numbers of distal and proximal flake portions within an assemblage can be an indication of core reduction or tramping by livestock. An extremely high percentage of distal fragments suggests breakage took place during core reduction. Numbers of distal and proximal fragments that are roughly equal are believed to represent breakage caused by livestock (Moore 1996), as are high percentages of proximal fragments.

LA 116502. The flake assemblage is primarily composed of whole flakes, and a single distal fragment also present.

LA 116503. The flake assemblage contains roughly twice as many proximal portions to distal portions among core flakes (Table 16), suggesting trampling by livestock. This conclusion is supported by the relatively higher numbers of proximal portions present among biface thinning flakes and hammerstone flakes.

LA 116504. The flake assemblage also shows evidence of trampling by livestock. Proximal portions of core flakes versus distal portions are present in a ratio of 5 to 1 (Table 17).

LA 116505. Redeposited material has twice as many proximal portions as distal portions of core flakes. This suggests that LA 116505 was trampled by livestock.

Flake Platform Type

Flake platforms are the remnants of the core or tool from which the flake was struck. Platform types provide information on the level of core reduction technology pursued at a particular site. Cortical platforms are those that contain cortex material, thus representing early-stage reduction. Single facet platforms can occur at any stage of reduction. Multiple-facet platforms represent late-stage core or biface reduction (Moore 1994).

LA 116502. Cortical platforms make up the largest category (71.4 percent). Absent and crushed platforms each represent 14.3 percent of the assemblage. No single-faceted platforms were present at LA 116502.

LA 116503. Platform types are shown in Table 18. Single-facet platforms are by far the largest category present (60.5 percent). Cortical faceted flakes comprise 21.2 percent of the total. Flakes where the platform was absent totaled 9.7 percent of the assemblage. Multiple-faceted platforms were present on 4.2 percent of the assemblage. Artifacts with collapsed platforms comprised 3.5 percent. Crushed platforms made up the remaining 0.9 percent.

LA 116504. Six platform types occur in the assemblage (Table 19). The most common form is single-faceted (60.7 percent). Cortical platforms are the second most common (22.2 percent). Absent and crushed platforms each make up 5.9 percent of the assemblage. Multiple-faceted platforms are present at 2.9 percent, and collapsed platforms at 2.2 percent.

LA 116505. Of the 18 redeposited flakes recovered at LA 116505, cortical platforms make up 66.6 percent of the assemblage total. Single-faceted platforms comprise 27.7 percent of the total. Flakes where the platform is absent make up the remaining 5.5 percent of the total.

Tools

LA 116502. Only two of the eight artifacts collected show evidence of utilization. Both of these artifacts are formal tools. One is a side scraper, the other is an end scraper. No utilized debitage was present at LA 116502.

LA 116503. The lithic artifact assemblage totals 811. Of this total, 23.8 percent (193) are tools (Table 20.). Utilized debitage used as expedient tools make up the largest single category of this total (38.9 percent).

Formal tools make up the majority of tools recovered at LA 116503. The large number of formal tools is surprisingly dominated by gravers (N=72). These are made of seven materials and make up 37.3 percent of the total tool assemblage. Other formal tools include end scrapers and side scrapers (8.8 percent), knives (4.7 percent), projectile points (3.6 percent), and spokeshaves (3.1 percent). The assemblage also contains two denticulates and two hammerstones, as well as a single drill and a single chopper.

Seven projectile points were recovered at LA 116503. These were assigned to temporal categories. Six of the projectile points are Puebloan side-notched points of the "Harrell" type. These are commonly associated with Puebloan sites in eastern New Mexico. The seventh projectile point is the midsection of a Late Archaic corner-notched point.

LA 116504. The tool assemblage differs considerably from that at LA 116503, although the assemblage is quite a bit smaller (Table 21). At LA 116504, utilized debitage comprises 68.5 percent, making up a majority of all tools by a wide margin.

Included in this assemblage is a small number of formal tools. Three knives are present, comprising 15.8 percent of the assemblage. The other formal tools include one spokeshave, one side scraper, and one end scraper.

LA 116505. Three of the redeposited lithic artifacts from LA 116505 show evidence of utilization. Utilized debitage makes up 100 percent of the utilized assemblage. No formal tools were recovered at LA 116505, although both Archaic and Late Archaic projectile points were present on the intact portion of the site outside of the project area.

Material Texture

While material selection may depend on local availability, studies have shown different material textural preferences for prehistoric Puebloan and Archaic groups (Elyea and Eschman 1985:246).

While utilized debitage occurs in the widest variety of materials, the tendency is for projectile points and bifaces to be made of finer-textured material than most of the other artifacts. This suggests that formal tools are made of material that will enhance their specialized functions (Bleed 1985). An ability to have a sharp edge is valued in materials such as obsidian and chert for projectile points and bifaces. Materials such as metamorphic sandstone, quartzitic sandstone, and chert are utilized where durability is valued, as in scrappers and choppers. A greater variety of materials are acceptable as utilized debitage, where the main value of the artifacts may be availability and convenience.

LA 116502. All of the tools in the assemblage are scrapers made of local chert. This suggests a concerted effort toward sharp edges.

LA 116503. Utilized debitage is present in virtually all materials. Formal tools are constructed primarily from finer-grained materials, including chert, silicified wood, and a fine-grained quartzitic sandstone. As we have seen, gravers dominate the formal tool assemblage. While a majority of these tools are made from finer-grained materials, they occur in all material categories. The need for large numbers of gravers caused by the specialized nature of the site may have resulted in some relaxation of material standards.

In contrast, all but one of the projectile points at LA 116503 are made of chert (one is a fine-grained quartzitic sandstone).

LA 116504. Utilized debitage includes most material categories. However, the material selection for formal tools is toward edge durability, and most tools are made of quartzitic sandstone or metamorphic sandstone.

LA 116505. The utilized debitage occurs in the more common materials within the assemblage, chert and quartzitic sandstone.

Discussion

The presence of bifaces and their percentage within an assemblage has been used by Kelly (1988:721-723) to differentiate between types of sites. Biface production should take place at residential sites, indicated by the presence of large numbers of bifaces and biface thinning flakes. In contrast, logistical camps and resource procurement areas should have few biface thinning flakes but large percentages of resharpening flakes and biface fragments.

The frequency of biface thinning flakes is low in these assemblages, as we would expect for logistic or resource-procurement sites. This pattern is best seen in the assemblage from LA 116504. The large percent of formal tools and the relatively small percentage of expedient tools at LA 116503 are atypical of a Puebloan site, suggesting a specialized range of activities (Akins and Bullock 1992).

LA 116502, with its tool assemblage restricted to formal tools, is typical of an Archaic short-term use area. However, the small number of artifacts makes any interpretation of this site suspect. The site could also just be an Eastern Jornada Mogollon short-term use area lacking ceramics.

Gross interpretations can be made of possible activities represented by a sites' tool kit of utilized artifacts (Perry and Christenson 1987). Bidirectional wear is traditionally considered an indication of cutting and slicing, while unidirectional wear is thought to indicate scraping. Experiments conducted by Brose (1975), and Vaughan (1985), show that wear patterns are unreliable indicators of use (Moore 1996). However, it should be possible to determine, however roughly, the types of activities pursued at this site (Christenson 1987:77).

Projectile points exhibiting wear indicate that hunting took place at LA 116503. Point bases suggest the rehafting of arrows. The presence of the choppers, bifaces, and scrapers suggests that animal butchering and leather processing also was carried out at this site. The presence of hammerstones may be related to the striking of flakes to use as expedient tools, although they could have also been used to sharpen (pit) the surfaces of ground stone tools. Denticulates and spokeshaves are specialized tools usually associated with wood working.

The specialized tool of note in this assemblage is the graver, present in this assemblage in remarkably large numbers. A total of 72 gravers are present in this assemblage. Gravers are used to split wood and bone. They are used to score and cut a groove down the side of a bone or piece of wood. Once the cut is deep enough, the material is split in two. Wood may have been worked at LA 116503, since rehafting may have taken place, and other specialized tools associated with wood working (denticulates and spokeshaves) are present. However, the large numbers of split bison bone occurring on the site indicates that the splitting of bone was probably the main focus of graver use. This combination of split bison bone and large number of gravers suggests LA 116503 functioned as a specialized site for the processing of bison.

There is less focus toward a specific task apparent in the assemblage from LA 116504. Here, although there is a spokeshave present, the formal tools are knives and scrapers. These tools are usually associated with animal butchering and hide processing.

Many of the expedient flake tools utilized in these assemblages could have also functioned in a similar manner as the formal tools. They may, however, represent different unknown activities, such as the processing of vegetal foodstuffs. These expedient tools could be the result of unplanned actions, the repairing of clothing or equipment.

Projectile points were present at two of the four Red Lake Tank sites (LA 116503 and LA 116505). Seven projectile points were found at LA 116503 during excavation (Fig. 10). Six of these are Harrell points (Figs. 10b-10f), a projectile point type associated with the Early Formative Jornada Mogollon period (Carmichael 1986). The seventh projectile point is the midsection of a Late Archaic corner-notched point.

Six projectile points are tied into the occupation of LA 116503. Two of these points were present within the trash fill of Structure 1. Two were recovered from the fill of Feature 1, an extramural hearth. The other three were found in the vicinity of the extramural features. All six of these points had been broken during the period the site was occupied. Two were subsequently reworked.

Four of the Harrell projectile points are bases, broken at the notches. This is a commonly occurring break in hunting activities. The presence of bases is considered indicative of rehafting at a site. This type of point fragment is prevalent in areas where point replacement takes place.

The other three Harrell points are distal fragments. This is the type of point fragment likely to be recovered from an animal killed by an arrow. Each of these fragments had been dealt with in a different manner.

Two fragments were reworked into smaller usable projectile points. One point was reworked with the addition of a new pair of side notches, into a smaller version of a Harrell point. The second reworked distal portion was given a finished concave base. The third distal projectile point fragment was discarded, its small size making it too small to rework.

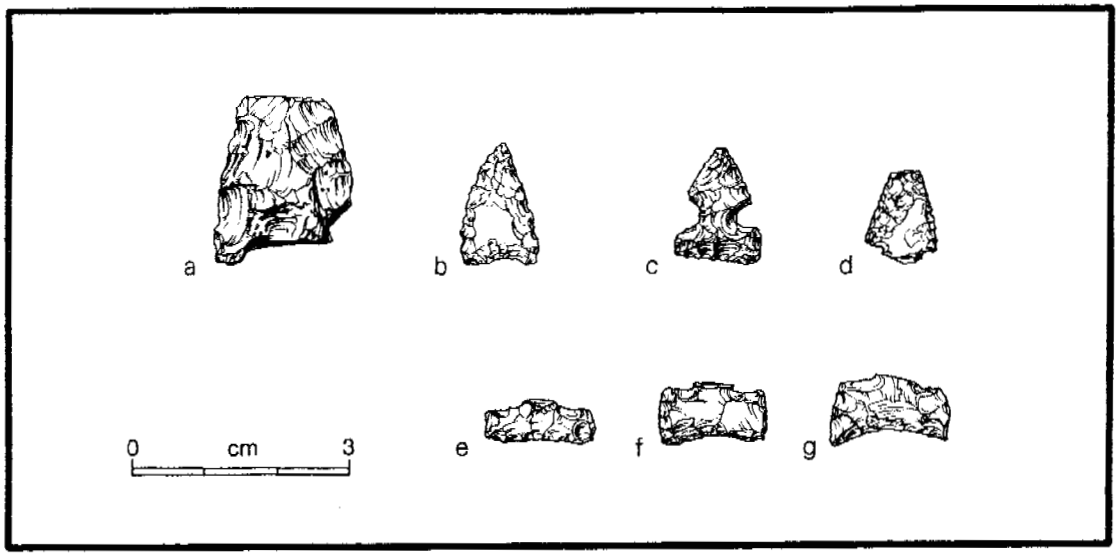

Figure 10. Projectile points from LA 116503: (a) Archaic; (b-g) Harrell.

The midsection of a Late Archaic point was also recovered within the project area. While this artifact could represent a curated older item, it also suggests that an earlier Late Archaic component may be present at LA 116503. Additional Late Archaic projectile points were found, but not collected, outside of the project area, supporting the concept of an earlier component at the site. This would not be surprising with a permanent water source at Red Lake Tank.

A number of projectile points were found at LA 115605. However, all were outside of the project area and were not collected. All but one of these projectile points were fragmentary, making identification problematic. The one whole point found at LA 116505 is identified as a Late Archaic style Ensor projectile point.

No projectile points were recovered from LA 116502 or LA 116504.

Analysis of the lithic artifacts from LA 116503 shows that an expedient core-flake technology was utilized by the sites' inhabitants. This served to supplement the specialized tool use that was taking place. Any initial core reduction is limited to locally occurring materials. Little tool manufacturing was carried out, as indicated by the small number of biface thinning flakes. There is no evidence that the biface-reduction technology related to the manufacture of the large number of specialized tools utilized at LA 116503 took place at this locale.

Assemblages from excavated Puebloan sites tend to reflect an expedient lithic technology, in which flakes were produced as short-term, disposable tools. Formal tools, other than projectile points, are rare (Larralde 1994). LA 116504 reflects this type of assemblage. Bifacial reduction is generally associated with Archaic and Basketmaker II or other early Puebloan sites (Lent 1991; Moore 1994) and seems to have been replaced as part of the general cultural shift to a sedentary agricultural lifestyle. This shift seems to have taken place at a later period among the Jornada Mogollon, especially the Eastern Jornada Mogollon, than among groups such as the Mogollon and Anasazi.

This assemblage suggests that LA 116503 and LA 116504 had populations with a long-established lithic tradition based on expedient core reduction and flake tool use. Bifacial reduction seems to have been maintained exclusively for the extensive production of formal specialized tools.

Nonlocal material is sparse at LA 116503 and LA 116504 and is limited in both cases to Alibates dolomite and obsidian. The presence of this nonlocal material indicates at least a degree of long-distance procurement, suggesting that these sites functioned as part of a larger exchange and communications system.

No nonlocal material was present at LA 116502 or LA 116505.

GROUND STONE ARTIFACT ANALYSIS

Ground stone artifacts were found at two of the four Red Lake Tank sites. Five ground stone artifacts were found at LA 116503, and two were recovered at LA 116504.

Attributes chosen for analysis reflected the desire to achieve the greatest return of useful information within the available time frame. The guidelines and format followed the Office of Archaeological Studies' *Standardized Ground Stone Artifact Analysis* (OAS 1994b).

LA 116503

Five ground stone artifacts were recovered at LA 116503. Four of the five pieces of ground stone are manos (two whole manos and two mano fragments). The fifth ground stone artifact is an end fragment of a basin metate. These artifacts were recovered from three proveniences across the site.

Manos

All four of the manos collected from LA 116503 are made of a fine-grained sandstone. One mano was recovered from the fill of Structure 1. Found within Stratum 1, this is a center fragment of a one-handed mano. Only one side has been used for grinding. The remaining portion exhibits the characteristics of a heat spall, indicating that the stone was subjected to intense heat, probably from a fire. The utilized side has a flat grinding surface that only slightly extends up the remaining end, indicating that the mano was used with a shallow basin metate (Schlanger 1991). The grinding exhibits resharpening and pitting to the use surface to revive the artifact's grinding capability.

A whole one-handed mano was recovered from the fill of Feature 3, an extramural hearth. The stone was at least partially shaped by pecking prior to its use for grinding. Both of the two sides have been used for grinding. Both of the grinding surfaces extend only slightly up the ends, indicating that the mano was used with a basin metate. Despite the resharpening, the grinding sides are heavily worn.

A small edge fragment of a mano was recovered from the area between extramural Features 1 (hearth) and Feature 4 (hearth). Because this is an edge fragment from the middle of the mano, it is impossible to determine the type of mano represented. This fragment is a heat spall, the result of intense heating of the stone. The mano was at least partially shaped by flaking prior to its utilization and is heavily ground on one side.

A whole one-handed mano was recovered 8 m west of Structure 1, away from the main site area. This mano is heavily ground on both sides and was shaped by flaking prior to use. It shows no evidence of later modification, such as pecking. Both of the grinding surfaces only slightly extend up the ends, indicating that this mano was used with a very shallow basin metate.

Metate

LA 115603. A single metate fragment was recovered. Found in the Stratum 1 fill of Structure 1, this is an edge fragment of a very shallow basin metate. This metate fragment is also

a heat spall, the result of intense burning. It shows no evidence of shaping or of later pecking.

LA 116504

Two ground stone artifacts were recovered at LA 116504. One artifact is a possible polishing stone. The second ground stone artifact is a small basin metate. These artifacts were recovered from two proveniences across the site.

Polishing Stone

A small piece of ground stone was found 3 m from the single feature at LA 116504. This is a very fine sandstone slab measuring 2.8 by 2.5 cm and 0.9 cm thick. Roughly triangular, both sides and two of the three edges show evidence of grinding. Both sides are heavily ground on flat planes. There is convex grinding on two of the three edges. If made from a finer material than sandstone, this would appear to be an unfinished pendent. Finely abrasive stones of this type were commonly used in the polishing or finishing of leather (White 1962).

Metate

The basin metate found at LA 116504 is made from an angular slab of fine-grained sandstone. It was found turned upside down over the top of the single feature found at the site (Feature 1, hearth). It shows evidence of shaping by a small amount of flaking prior to use. The grinding surface is only slightly concave, but it is heavily ground. The grinding surface has also been rejuvenated, or resharpened, by pecking.

Discussion

Although small, the ground stone assemblages from LA 116503 and LA 116504 provide important information on the degree of plant use and the related activities pursued at both Jornada Mogollon sites. The presence of ground stone artifacts with LA 116503 (a habitation site), as well as at LA 116504 (a short-term use area), show that the processing of plant material had taken place at both sites.

One-handed manos and basin metates are the major elements of a grinding technology oriented toward the efficient processing of wild seed (Bartlett 1933; Lancaster 1986), although as specialized tools they are also used in the processing of insects (Sutton 1988). These artifacts are portable but are usually found in archaeological contexts that show they were outside of structures or in sheltered areas (Schlanger 1991). The occurrence of ground stone at LA 116503 seems to be such a case. Although both mano and metate fragments are present within Structure 1, they are from the later trash deposit fill of the structure, not the floor surface.

Basin metates are often found on sites that have no evidence of structures, indicating that their place of use was not always associated with habitation areas. The metate found at LA 116504 is evidence that seed processing occurred at the site. The short-term nature of site use therefore could have focused on seed collection and processing. The processing of insects for food is less likely to take place at the area of collection than at a camp site (Sutton 1988). The presence of a hearth with the metate at LA 116504 thus makes the processing of insects, as well as seeds, a possibility.

Manos and metates had to be resharpened frequently. Bartlett (1933) suggested this had to be done every five days when the tools were in constant use. The resharpening was done by pecking the grinding surface with a hammerstone or core to rejuvenate the grinding surface. This resharpening was responsible for most of the wear on these ground stone tools. Manos had to be resharpened more frequently and replaced more frequently than metates (Wright 1990).

The mano and metate fragments from LA 53678 are all heat spalls. Common forms of breakage, heat spalls occur when stone is subjected to intense heat. Differentiation in heating causes breaks to occur in the stone (Shelley 1983). When these artifacts are broken, they may be discarded immediately, stored for future use, or utilized in some other manner (Schlanger 1991). Stone artifacts are commonly reused on prehistoric sites, quite often in hearth or roasting pits. This is particularly true in area such as Red Lake Tank, where native stone is rare in large pieces.

None of the ground stone artifacts from LA 53678 show any indication of secondary wear, indicating that they were not used later for another purpose, such as the grinding of clays or paints, or for the shaping of beads. There is nothing to suggest that the one artifact that may have served as a polishing stone ever had an earlier use.

Schlanger (1991) has found that there is a correlation between the locations of mano and metate fragments and length of site occupation. Broken mano and metate fragments only occur in fill and trash deposits when the site occupations or structures last longer than the use-life of these tools. The broken artifacts are usually first delegated to a floor surface. Through time these artifacts accumulate and are then "transformed" into trash and removed from the structure to designated trash locations (midden areas, fill, sheet trash, etc.).

In the case of LA 116503, ground stone artifacts made the transition to trash status. Although artifacts are present in the structure, they are broken fragments included as part of the structure's fill.

This is in contrast to the ground stone at LA 116504. In this case, the metate fragment found at the site was curated by being placed over the top of the hearth. This is an action analogous to secondary use, making the use-life of the ground stone artifact longer than the length of the site's occupation. Not only does this fit Schlanger's model (1991), but it is a further indication that LA 116504 was a short-term use area.

Basin metates and one-handed manos, designed for the efficient grinding of wild seed (Bartlett 1933; Wright 1990), continue as a presence on Puebloan sites after agricultural intensification as specialized tools (Phagan 1986; Shelley 1983), despite the developed dependence on maize. Although these tools were often utilized in the processing of insects into meal (Sutton 1988), their main use remained the processing of wild seed. This continued use was particularly developed in areas of marginal agriculture, such as the Jornada Mogollon. The presence of one-handed manos and basin metates at the Jornada Mogollon sites of LA 116503 and LA 116504 shows that this seed-gathering secondary subsistence system took place at these sites.

MACROBOTANICAL MATERIALS FROM RED LAKE TANK (LA 116502, LA 116503, AND LA 116504)

Pamela J. McBride

Flotation samples were examined from five thermal features from LA 116502, LA 116503, and LA 116504. C-14 dates indicate LA 116502 dates to approximately ca. A.D. 900, LA 116503 to ca. A.D. 1200, and LA 116504 to ca. A.D. 1100. The only structure recorded at the three sites from the current project was a small (2.5 m diameter) surface structure at LA 116503. Four extramural features were also excavated at the site. LA 116502 and LA 116504 were structureless sites, consisting of single features.

A vegetation survey was conducted at the Red Lake Tank sites in July 1997. The area is principally a shrub-grassland, with sizable grass expanses. LA 116503 is just west of Red Lake Tank (artifact scatter extends north of LA 116503, outside of the right-of-way, to within 2 m of the present playa edge). This sizable playa was filled by a spring located toward its north edge and was filled year round with standing water until a few decades ago. Mesquite is the dominate shrub at the sites, and yucca, prickly pear cactus, condalia, and snakeweed are other important shrubby species. Dropseed bristlegrass, beardgrass, and three-awl grass were the predominate species identified on the sites. Herbaceous species included sunflower, doveweed, western peppergrass, devil's claw, and coyote gourd (Table 22.). Many of these species have economic uses, either as food, medicine, fuel, or construction material. Riparian taxa such as bulrush, willow, or cattail may have been available to the occupants of LA 116503 from nearby Red Lake Tank.

Methods

The seven soil samples (from five features) 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). Each sample was immersed in a bucket of water, and a 30-40 second interval was allowed for settling out of heavy particles. Samples ranged in size from 1.65 to 4.7 liters. 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 retrieved material had dried. Each sample was sorted using a series of geological screens (4.0, 2.0, 1.0, and 0.5 mm mesh) and then reviewed under a binocular microscope at 7-45x. The fine material caught in the pan after passing through the geological screens was also examined but subsampled in three out of the seven samples.

From each flotation sample, a sample of 20 pieces of charcoal was identified (10 from the 4 mm screen and 10 from the 2 mm screen). If less than 20 pieces were present, all charcoal from the two screens was identified. Each piece was snapped to expose a fresh transverse section and identified at 45x. When less than 20 pieces of charcoal were present, all charcoal was identified. Charcoal samples identified prior to submission for radiocarbon dating were examined in the same fashion, but all pieces were identified when possible. Low-power, incident-light identification of wood specimens does not allow species- or even genus-level precision but can provide reliable information useful in distinguishing broad patterns of utilization of a major resource class.

Results

Nonwood plant remains were absent from the flotation sample taken from LA 116502. Charred goosefoot was identified from LA 116503 and LA 116504. A charred purslane seed was recovered from the west half of the hearth at LA 116504, and a charred cheno-am seed was recovered from the east half of the hearth at LA 116503 (Table 23). The adaptive advantage that weedy annuals have of proliferating in the disturbed ground around habitation sites, agricultural fields, and middens makes them a readily available resource and their seeds have been recovered from a wide variety of prehistoric assemblages. Documented economic uses of weedy annuals like goosefoot and pigweed seeds abound in the ethnographic literature. Castetter (1935) describes the use of these as a ground meal, either eaten as gruel or combined with other food such as corn meal and made into cakes. Harrington (1967) cites the same uses and says the seeds can be parched and eaten partially raw, although he finds the seeds too small to chew easily. The fleshy leaves of purslane were boiled and eaten in much the same manner as those of goosefoot and pigweed.

Charcoal identified from flotation and C-14 samples was predominately mesquite (Tables 24 and 25). Wood identified from LA 116502 was the only exception, where the only taxon identified was saltbush/greasewood. Saltbush/greasewood was recovered from all C-14 samples, but only from LA 116502 flotation samples. Possible condalia was recovered from LA 116503 and LA 116504.

Discussion

Taxa recovered in low quantities like the three from Red Lake Tank are difficult to interpret. Low abundance may be a reflection of poor preservation, a small sample number, or preparation methods rather than the actual degree of plant utilization. Previous studies in the area include Fox Place, Dunnahoo Hills, Sunset, Garnsey Spring Campsite, and Bob Crosby Draw (Table 26). Plant remains are notoriously sparse from small special-use sites in the Roswell area. Sites are shallow and often in dunal environments, where degradation of carbonized floral material is high from the grinding action of shifting sands. Most sites also lack structures, further contributing to the probability of poor preservation conditions. Roswell area sites lack plant remains, or remains are limited to small numbers of weedy annuals and the rare cactus seed. Floral remains are more abundant only in larger sites with structures, such as the Fox Place (to the west in the Rio Hondo Valley), where 12 taxa were recovered, including maize cobs. The Sunset site (also to the west next to Rio Hondo) consists of shelters and caves that date primarily to the ceramic period. The protection afforded by the shelters and caves resulted in the recovery of 16 plant taxa. This pattern partly reflects site-type difference in the conditions that allow for the deposition and preservation of more fragile remains, and partly a distinctly greater emphasis on the agricultural basis for sustaining a concentrated human population.

Charcoal was present in four of the six projects compared in Table 27. The diverse wood assemblages from Fox Place and Sunset reflect the procurement of wood from the varied habitats afforded by topographic heterogeneity and the presence of an active stream. These assemblages are in sharp contrast to those from Red Lake Tank. Wood taxa from Garnsey Spring Campsite are also more diverse than the wood taxa from Red Lake Tank. This may be a reflection of sample size differences, or, more likely, woods like New Mexico olive and juniper were collected as driftwood from the Pecos River, less than a mile from Garnsey Spring Campsite.

Summary

Cultural plant materials at Red Lake Tank sites consist of eight charred goosefoot seeds, one cheno-am seed, one charred purslane seed, and charcoal from the five thermal features that were sampled for floral remains. This paucity of informative plant remains may be a reflection of the normally poor preservation of perishables at shallow sites in the Roswell area or simply an artifact of small sample size. Fuel use at Red Lake Tank sites was wholly nonconiferous, and mesquite and saltbush/greasewood dominate the assemblage. Small amounts of condalia were also identified.

Regardless of age, goosefoot is the most widespread economic annual from the Roswell area sites. Sites with structures like Fox Place or shelters like Sunset generally have better preservation than the smaller shallow sites like Red Lake Tank. Wood assemblages reflect regional difference in habitats from which site inhabitants could procure resources. To date, all evidence for farming derives from larger aggregated pueblos and sites that may have been associated with larger settlements.

POLLEN ANALYSIS OF THREE GROUND STONE ARTIFACTS FROM LA 116503 AND LA 116504, CHAVES COUNTY, NEW MEXICO

Richard G. Holloway

Three pollen wash samples were sent for pollen extraction and analysis to Quaternary Services. These pollen washes were taken from ground stone artifacts recovered from LA 116503 and LA 116504, Chaves County, New Mexico. I have not personally visited the project area.

Methods and Materials

Chemical extraction of pollen samples was conducted at the Palynology Laboratory at Texas A&M University, using a procedure designed for semiarid southwestern sediments. The method, detailed below, specifically avoids use of such reagents as nitric acid and bleach, which have been demonstrated experimentally to be destructive to pollen grains (Holloway 1981).

From each pollen wash sample submitted, the dried residue of the wash was used in its entirety. The area washed was measured by personnel of the Office of Archaeological Studies at the Museum of New Mexico (Table 28). Prior to chemical extraction, three tablets of concentrated *Lycopodium* spores (batch #307862, Department of Quaternary Geology, Lund, Sweden; 13,500 ± 500 marker grains per tablet) were added to each sample. 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 release the *Lycopodium* spores from their matrix. After neutralizing the acid with distilled water, the samples were allowed to settle for 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 five seconds. The suspended fine fraction was decanted through 150μ 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 with concentrated hydrofluoric acid (HF) overnight to remove silicates. After completely neutralizing the acid with distilled water, the samples were treated with a solution of darvan and sonicated in a Delta D-9 Sonicator for 30 seconds. The darvan solution was removed by repeated washing 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.

The samples were dehydrated in glacial acetic acid in preparation for acetolysis. Acetolysis solution (acetic anhydride: concentrated sulfuric acid in 9:1 ratio), following Erdtman (1960), was added to each sample. Centrifuge tubes containing the solution were heated in a boiling water bath for approximately eight minutes and then cooled for an additional eight 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, monitored during periodic examination of the residue, did not remove fossil palynomorphs.

Heavy-density separation ensued, using zinc bromide ($ZnBr_2$), with a specific gravity of 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. The residues were rinsed in a 1 percent solution of potassium hydroxide (KOH) for less than one minute, which was effective in removing the majority of the unwanted alkaline soluble humates.

The material was rinsed in Ethanol (ETOH) stained with safranin-O, rinsed twice with ETOH, and transferred to 1-dram vials with tertiary butyl alcohol (TBA). The samples were mixed with a small quantity of glycerine and allowed to stand overnight for evaporation of the TBA. The storage vials were capped and returned to MNM Inc. at the completion of the project.

A drop of the polliniferous residue was mounted on a microscope slide for examination under an 18 x 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. If warranted, full counts were conducted by counting to a minimum of 200 fossil grains. 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.

Total pollen concentration values were computed for all taxa. In addition, the percentage of indeterminate pollen was also computed. 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:

$$\mathbf{PC} = \frac{\mathbf{K}*\Sigma_p}{\Sigma_L*\mathbf{S}}$$

Where: PC = pollen concentration
K = *Lycopodium* spores added
Σ_p = fossil pollen counted
Σ_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" is 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.

Since all three samples were pollen wash samples, the pollen concentration values were calculated using a modification of the above formula. This modification involved the substitution of the area washed (in cm^2) for the sediment weight (S) variable in the denominator from the above equation because the sample was in liquid form. The resulting concentration value is thus expressed as estimated grains per cm^2. The use of pollen concentration values from these particular samples is preferred, as explained above, to accentuate the variability between pollen wash samples. The use of the area washed also provides a mechanism for comparing calculated pollen concentration values between artifacts.

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 rockshelter, 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/gm 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 (ca. 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 that 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 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 grains with spine length greater than or equal to 2.5μ, while the low spine group have spines less than 2.5μ long (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, 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 the 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 of the presence of flowers at the sampling locale (Bohrer 1981). This enables the analyst to infer a human presence.

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 in 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/g. 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 and Discussion

Table 28 contains the raw counts and calculated pollen concentration values from these samples. The amount of pollen was extremely low. Only 4 to 7 grains were encountered during the actual counts, while the number of marker grains counted was very high.

LA 116503

FS 185 was a pollen wash of a ground stone artifact, and the area washed measured 108 cm^2. The pollen concentration value was very low, only 5.68 grains/cm^2. *Pinus* (4 grains/cm^2 and *Ephedra* (1 grain/cm^2) pollen were the only taxa present.

FS 200 was also from a ground stone artifact, and the area washed measured 83.375 cm^2. This

artifact contained a slightly higher pollen concentration value of 19.69 grains/cm^2. *Pinus* (10 grains/cm^2), cheno-am (7 grains/cm^2), and low spine Asteraceae (3 grains/cm^2) pollen were the only taxa present.

LA 116504

FS 60 was taken from this ground stone artifact, and the area washed was estimated at 82.65 cm^2. *Pinus* (16 grains/cm^2), cheno-am (16 grains/cm^2), and high spine Asteraceae (5 grains/cm^2) were the only taxa present.

The paucity of pollen types from these artifacts is not really unexpected. *Pinus* dominated the assemblages, but the small amount of pollen suggests that this taxon was deposited via long-distance transport. It is likely that *Pinus* was absent from the local vegetational community. Pines produce enormous quantities of pollen grains specifically adapted for wind pollination. Thus it is not surprising to recover small amounts of this taxon from areas far removed from a pine source.

All of the other pollen types present are present in equally low quantities and likewise probably indicate long-distance transport. No economic pollen types were present from these samples. While cheno-am pollen sometimes suggests an economic usage, the extremely low pollen concentration values suggest a local, noneconomic source.

Conclusions

The lack of pollen data prevents interpretation of the function of these artifacts. The only pollen types present were those of members of the local flora, and these were in very small amounts. The number of taxa present was very small, and the concentration values, equally small. No possible function of these artifacts could be inferred from the palynological data.

FAUNAL REMAINS

Nancy J. Akins

A total of 771 pieces of animal bone were recovered at LA 116503, and 9 pieces were collected at LA 116504. The vast majority are fragmentary bones from large mammals. The fragmentary nature of most of this bone makes its identification problematic. Most of the bone appears to be from large mammals, possibly bison, based on the thickness of the bone, but some of the fragments could also be from deer or antelope. The fragmentary nature of the bone is primarily the result of poor preservation caused by the shallowness of the cultural deposits at both sites. Extensive processing of the bone may have also contributed to the condition of these faunal remains.

Analytic Methods

A modified version of the OAS faunal recording format was used to record the fauna. Variables recorded include the field specimen (FS) number, lot number, number of pieces of bone with that identification, an indication that an identification was uncertain, the taxon, whether the element was part of an articulation, the body part represented, body part side, body part completeness, portion of the skeletal element represented, the age of the animal, criteria for aging, environmental alteration and degree, animal alteration and location, burning degree and location, rounding, processing type and location, and whether the element is a tool, ornament, or manufacturing debris. Articulations, burning, rounding, and manufacture do not occur in this small sample and are not discussed.

Taxonomic identifications were made as specific as possible using the OAS comparative collection. Because this collection lacks some species and does not cover the variability found in many of those present, identification to the species level is often not possible. When an element (piece of bone) could not be identified to species or even family, a range of indeterminate categories was used to identify the size of the animal involved and note whether it was mammal, bird, or indeterminate. Each bone was counted only once, even if it was broken into a number of pieces during excavation or laboratory processing.

Taxa

The taxa found, common name or indication of the size of the animal, and number of elements at LA 116503 and LA 116504 are given in Table 29. The fragmentary nature of both assemblages makes it impossible to determine the minimum number of individuals (MNI), although it is possible that this bone represents no more than a single individual of each species represented.

LA 116503

The vast majority of the bones recovered from LA 116503 could not be identified to the kind of animal (746 pieces, or 96.8 percent). As shown in Table 29, because of its fragmentary nature, this bone could only be separated by size of animal represented, not species. The largest category

of bone is large mammal. Representing deer or larger, bone in this category numbers 548, or 71.1 percent. The second largest category is very large mammal (elk or larger), numbering 105 pieces, or 13.6 percent of the assemblage. The category of large artiodactyla (large bison or elk) contains 61 pieces of bone, or 7.9 percent of the assemblage. Most of the bone in these categories is most likely bison, but the fragmentary nature of the pieces makes a definite conclusion impossible. The remaining unidentifiable bone (30 pieces, or 3.9 percent) is from small mammals or birds.

A total of four taxa were identified in the LA 116503 faunal assemblage. The largest category of identified bone (19 pieces, or 2.5 percent) is bison (*Bison bison*). Mule deer (cf. *Odocoileus hemionus*) is represented by three pieces of bone (0.4 percent). One piece of shell (0.1 percent of the assemblage) is identified as western box turtle (*Terrapene ornata*). There are also two pieces of mussel shell (species unidentified) in the assemblage.

The bone recovered from LA 116503 is broken down by major provenience in Table 30. The occurrence of bone at LA 116503 is in two distinct locations. Scattered bone forms an element of the sheet trash present in the area of Structure 1 and the associated extramural features. However, the largest quantity of bone at LA 116503 is in the trash fill of Structure 1. These fragments form part of the trash deposited in Structure 1 after its abandonment, and during its later period of use as an expedient dumping area.

The largest variety of taxa (11) was recorded from the surface stripping of the site. This material probably represents sheet trash across the site area, particularly in the general area of Structure 1 and extramural features. Although most of these taxa are unidentified (144 pieces, or 96 percent), bison (3 pieces, or 2.0 percent), turtle (1 piece, or 0.7 percent), and mussel (2 pieces, or 1.3 percent) are also present. The environmental alterations, pitting and etching, of this bone indicate that none of it is of recent origin.

The rest of the faunal assemblage is from the fill of Structure 1 and three of the four extramural hearths (Features 1, 4, and 5) excavated at LA 116503. The second largest number of taxa (9) are in the fill of Structure 1. Although both bison and deer are identified in this provenience, the majority of the bone is not identifiable (572 pieces, or 96.8 percent). Twelve pieces of this nonidentifiable bone is clearly from small or medium-sized mammals. The rest of the unidentified bone is from large to very large mammals.

Unidentified large mammal bones dominate the assemblages from the other three proveniences. Twenty-one of the 22 pieces of bone recovered from Feature 1 were classified as medium-large mammal. The one other piece of bone is an unknown small mammal or bird. In Feature 4, 3 of the 4 bones recovered are large mammal bones (75 percent). The other bone is from a small mammal. In Feature 5, one bone (25 percent) is from a medium to large mammal, and the rest (3 pieces, or 75 percent) are large mammal.

LA 116504

All of the bone (9 pieces) recovered from LA 116504 is from unidentified taxa. The largest categories are large mammal (4 pieces, or 44.4 percent), and large land bird (prairie chicken size) (2 pieces, or 22.2 percent). The bone from LA 116504 is also in extremely poor condition. As at LA 116503, the large mammal is probably bison. The environmental alterations, pitting and

etching, of the bone indicate that none of it is of recent origin.

All of the bone from LA 116504 was recovered in the surface stripping of the site. This suggests that it was present as sheet trash across the site area.

Discussion

The poor state of the recovered bone from LA 116503 and LA 116504 effectively obscures most of the expected evidence of its cultural modification. Environmental alteration of the faunal remains is heavy. Most of the bone recovered is etched, pitted, or both, while only a single piece from either of the two sites is sun-bleached. This indicates that virtually none of the bone was left exposed to the elements for any appreciable length of time.

A majority of the recovered bone is present in fragments of less than 25 percent of the total bone. Although at least some of this is due to processing, the poor condition of the bone makes the extent of the processing hard to determine. Impact fractures and spiral breaks are present in small numbers, principally on the best-preserved bone fragments. This indicates that at least some processing took place at both sites. It also suggests that more processing may have occurred than is visible in the recovered faunal record. Very little burning is evident on the bone from either site, although this may be another skewed result caused by poor preservation.

Unlike evidence of processing and modification, the age of the animals represented in the faunal assemblages from these two sites can be determined despite the poor preservation of the collected bone. The vast majority of the recovered bone from LA 116503 (766 pieces, or 99.4 percent) is from mature animals. All of the bone recovered from LA 116504 (9 pieces, or 100 percent) is from mature animals. A similar age patterning at the nearby Garnsey Kill site allowed Speth (1983) to determine the seasonality of hunting at that locale. Speth found that a preponderance of mature animals represented spring hunting. The same conclusion could be drawn from this material.

CONCLUSIONS

Data recovery efforts at the four Red Lake Tank sites (LA 116502–LA 116505) focused on the cultural affiliations represented by each site and the resulting differences in site structure, subsistence, and resource procurement. Radiocarbon samples are used, in combination with lithic artifact and ceramic data, to aid in the determination of cultural affiliation at the site level. The range of site activities, their relationship to site function, are based on artifact, pollen, and macrobotanical analyses. Subsistence and resource procurement patterns in the Red Lake Tank area are examined by inferences derived from the assembled data sets.

Although the precise dating of the Red Lake Tank sites was not one of the primary goals of the research design (Bullock 1997), it was hoped that precise dates would aid in the assessment of site use-life, population movements, settlement patterns, and community organization.

LA 116502

Cultural Affiliation

The cultural affiliation of LA 116502 is problematic. Although a feature is present, the artifact assemblage is too small (8 artifacts) to allow cultural determination without the presence of diagnostic artifacts. Superficially, the artifact assemblage could be assigned to the Archaic period. However, the site may be transitional Late Archaic or early Eastern Jornada Mogollon, based on the radiocarbon sample from Feature 1 (hearth). This yielded a date range of A.D. 695-975. If the old wood problem is taken into account, LA 116502 is more likely to be a single-episode Eastern Jornada Mogollon use area, or at least date to that time period.

LA 116502 was originally believed to be a multicomponent site. Upon excavation, this proved not to be the case. This is a short-term use area, with a single component.

Site Structure

The small size of the artifact assemblage, coupled with the presence of a single roasting pit, indicates that LA 116502 is a short-term use area. Marcobotanical data from the contents of the roasting pit is limited, with charred plant remains completely absent from the feature. Although this could be a result of poor preservation, it could also suggest that the feature was not used in association with plant materials. The artifact assemblage indicates that while a single episode of stone knapping took place at LA 116502, very little in the way of additional activities occurred.

While we know that a small amount of lithic flaking took place at LA 116502 and that a very small hearth was constructed and used, there is nothing to indicate why these individuals were in this location. This suggests that LA 116502 may be a short-term camp site, used for a single night.

The small size of the lithic artifact assemblage makes an interpretation questionable. However, the presence of two scrapers suggests that some limited activities, possible connected with butchering or leather work, may have taken place at this locale.

Resource Procurement

Short-term use-areas are usually associated with resource procurement. They can be connected with hunting, the gathering of wild plant material, the collection of raw materials, and even the gathering of pigments and clays (Adams 1978). These sites vary in size and tend to transcend both time and cultural affiliation (Ellis 1988; Leslie 1979: Oakes 1985).

From the small artifact assemblage recovered from LA 116502, no specific activities are suggested except for a single episode of roasting, possibly of a single meal. Identification of the wood charcoal recovered from the hearth shows it to all be saltbush/greasewood. Thus the vegetation of this area, away from the Red Lake Tank playa, was similar to what is present in the area today.

LA 116503

Cultural Affiliation

LA 116503 has been assigned to the Eastern Jornada Mogollon by the presence of diagnostic ceramics and projectile points. While there is evidence of an earlier Late Archaic presence at the site, use of the project area is limited to the Eastern Jornada Mogollon occupation.

The Eastern Jornada Mogollon occupation of LA 116503 is also confirmed by the sole radiocarbon date (C-14) from the site. The radiocarbon sample collected from LA 116503 (Extramural Feature 2, hearth) yielded a possible date range of A.D. 1035-1245. This is well within the range of the Eastern Jornada Mogollon period. If the old wood problem is considered, the site then actually becomes somewhat later. The old wood problem becomes a factor when the wood is older than its period of use, making the site appear older than it actually is.

Based on the ceramic assemblage, Wilson (this volume) dates the site to the mid to late A.D. 1200s, and definitely before A.D. 1300. The recovered ceramic artifacts exhibit the expected range of ceramic types present within the assemblage for the period. This combination of data enables LA 116503 to be assigned to the Late Maljimar phase or early Ochoa phase (Sebastian 1989). This period (dating to the middle-to-late A.D. 1200s) corresponds to the Mckenzie phase in Jelinek's Middle Pecos sequence (see Wilson, this volume).

The Eastern Jornada Mogollon occupation of the site is the main component within the project area and includes all of the excavated features. The structure excavated at LA 116503 fits Hard's (1983) model of Jornada Mogollon summer structures, despite evidence that the Eastern Jornada Mogollon cultural sequence for this portion of the state differs from the Jornada Mogollon in the Rio Grande Valley (Leslie 1979; Levine 1997; Moore 1996; Wiseman 1993). This suggests that some aspects of Jornada Mogollon culture may remained constant, despite regional adaption to different general environments.

A majority of the projectile points recovered from LA 116503 are Harrell-type points, arrow

points associated with the Eastern Jornada Mogollon. This is a second form of relative dating that allows us to assign this site to the Jornada Mogollon.

One Late Archaic projectile point was also recovered at LA 116503. While this one point may be a curated specimen, the presence of several additional Late Archaic projectile points outside of the project area suggests that an earlier Late Archaic component is present at LA 116503. Artifact occurrences at the site are concentrated north of the project area, suggesting that this earlier component may be present in this area of the site.

Site Structure

Site structure can be determined for a site based on the range and types of activities that may have been conducted within a specific locale. On-site activities can be deduced from the locations and functions of site features. Descriptive information on features, combined with analysis of the associated artifacts and other cultural material, can assist in determining feature type.

Pollen samples were collected from the surfaces of several of the ground stone tools. In addition, macrobotanical samples were collected from a number of features. These studies focused on the identification of plant remains and their significance with regard to economic and subsistence practices. This form of analysis is not limited to plants utilized for food. Activities such as the weaving of baskets and matting, or the making of twine may be indicated by the results of this type of analyses.

Results from the macrobotanical analysis were limited. Cultural plants were limited to chenopam and goosefoot. Cultivars were not present within any of the samples. A number of noncultural plants types that have economic importance were recovered from the samples, but interpretation of their presence is problematic due to their common occurrence in the local landscape. Pollen analysis results were also disappointing. No evidence of cultivars or economically useful wild plants was found (see Holloway, this volume).

LA 116503 is on the southwestern edge of Red Lake Tank playa, suggesting that the site location is the direct result of the presence at Red Lake Tank of a permanent water source. The presence of sheet trash and a trash-filled structure shows that the site experienced long-term, repeated use, which indicates LA 116503 is a seasonal habitation site.

The revelation that LA 116503 was a seasonal habitation site changed the thrust of subsequent investigations, but not its overall focus on determining the features present at the site and the activities that they represent.

As a seasonal habitation site, evidence of a greater number of activities should be present at LA 116503 than at the other Red Lake Tank sites, which were used for short periods of time. This is not to suggest that all activities represented had an equal degree of focus to the population. Through use of the archaeological record at LA 116503, two activities stand out in importance: the hunting and processing of bison, and the processing of wild plant seed.

Site activities can be investigated through analysis of the artifacts present. Evidence of the hunting and processing of bison, at least to a limited degree, is present in the faunal remains at

LA116503. The hunting of bison by the site's population can be extrapolated by the presence of bison bone. Although the recovered faunal remains from LA 116503 contain a variety of animal species, bison bone forms the largest identified percentage of the site's faunal record. Admittedly, identified bison bone comprises only 2.5 percent of the total faunal assemblage, but if probable bison bone is included, the percentage climbs to 95.1 percent. The large number of processing-related tools, particularly gravers (used to split bone), indicates that at the very least secondary processing may have taken place at the site.

Additional data related to bison processing includes the large occurrence of cutting and scraping tools within the lithic artifact assemblage. Combined with the large numbers of gravers, this suggests a skinning and butchering tool kit. While it is possible that any processing may have involved other materials such as plant products, the faunal evidence indicates that bison could have been a major focus of activity at this locale.

The second major activity pursued at LA 116503 was the processing of seed. While not nearly as intensely pursued as bison processing, this is indicated by the presence of one-handed manos and basin metates. Both of these types of artifacts have been shown to relate to the processing of wild seeds (Lancaster 1984).

Although wild grass seed is usually considered the main item gathered in this area, acorns and mesquite beans are also possibilities. Because Red Lake Tank was a permanent water source during the occupation of LA 116503, other plant seeds or fruits could also have been available. The opportunistic collecting and processing of insects, which historically utilized basin metates (Sutton 1988), also cannot be ruled out. The occurrence of ground stone artifacts in trash deposits is indicative of repeated site use, as are the trash deposits themselves.

Lithic artifacts are another method of identifying activities that may have been pursued at LA 116503. Specific forms of flakes are produced by different lithic material reduction strategies. Core flakes are produced on Jornada Mogollon sites as expedient and disposable tools. Biface flakes are produced during biface reduction, commonly in the production of specialized formal tools. Formal tools are produced for specific functions, although their use may not be limited to a single action. Lithic tools wear during use. Although attempts to show that forms of wear are task specific have proved inconclusive (Brose 1975; Moore 1996), general interpretations of the range of activities represented by the lithic assemblage are possible.

Bifacial reduction, usually restricted on Jornada Mogollon sites to the making of formal tools, has an extremely limited presence at LA 116503, given the large numbers of formal tools present within the artifact assemblage. Greater production of formal tools would be indicated by a larger than expected number of biface flakes within the lithic artifact assemblage. This is not the case at LA 116503, where there is little evidence that tool production was taking place at the site. Of a total of 193 tools, 76 are expedient tools (utilized flakes), and 117 are formal tools.

We would expect a larger number of expedient tools on a Puebloan site, of whatever cultural affiliation. This unusually heavy emphasis on formal tools suggests a corresponding emphasis on specialized hunting-based activities, including hunting and game butchering. While gravers are known to be used for wood as well as bone, the large number of gravers associated with bison bone at LA 116503 suggests that they were used in processing bison bone. Gravers are used to cut

a groove in a bone, allowing it to be split to obtain the marrow and as part of the utilization process of the bone itself.

The condition of the projectile points recovered from LA 1106503 is also characteristic of hunting. The recovered point bases indicate that the rehafting of arrows took place at the site. The distal point fragments, while not from the same points, are evidence of hunting success. Two of the points have been reworked. In both cases broken distal ends have been resharpened. Attempts at reusing point fragments by reworking them suggests that point resources were limited at LA 116503, possibly through a lack of suitable material for points or a lack of time in which to make them.

The low utilization rate of core and biface flakes as expedient tools at LA 116503 indicates the pursuit of specialized activities rather than the broad-based subsistence patterns commonly associated with Puebloan sites. Cutting and scraping are represented in the lithic artifact assemblage. Animal processing is likely, based on the existence of scrapers and knives. This includes the processing of bone (as indicated by the gravers) and the possible processing of leather.

Limited knapping of lithic materials took place at LA 116503, at least in the portion of the site that was excavated. What stone knapping did occur was most likely connected with the maintenance, not the production of tools. Tool production was probably centered at a different locale, possibly the winter village location. If tool production did occur at LA 116503, it was not within the project limits.

The processing of available plant material based on the site location near an area of permanent water (including the use of reeds, willow, etc.) may have also taken place. No evidence of any riparian plant species was found in the collected macrobotanical samples. Macrobotanical data from Features 2 (hearth) showed the presence of cheno-ams and goosefoot. The samples collected from Features 4 and 5 (both hearths) contained only noncultural species (see McBride, this volume).

No maize or grass pollen was present on the grinding surfaces of either the one-handed manos found across the site or the grinding surface of the basin metate found on Floor 1 of the surface structure (see Holloway, this volume).

Faunal remains represent another avenue for studying possible activities at LA 116503. The presence of faunal remains, especially in light of the high utilization of lithic artifacts, could indicate types and forms of faunal consumption. The faunal remains recovered from LA 116503 are overwhelmingly bison. There is evidence of processing on some of the better-preserved bone. One likely possibility is that these bones were returned to the site whole and then processed at that location. The lack of bone from other species, while possibly a result of poor preservation, could be a further indication of site specialization associated with the hunting of bison. The other species in the assemblage, such as deer and possible rabbit, may represent opportunistic kills.

Bison bone was also recovered from the sheet trash deposits outside of Structure 1, but in lower frequencies than within the structural fill. Low bone frequencies in sheet trash deposits can result from both natural and cultural factors. Sheet trash deposits are subject to erosional and deteriorational forces, and trampling and scavenging by wild animals and cattle. At LA 116503

this suggests that if the artifacts recovered in surface stripping represent sheet trash, it was a sparse deposit. Other definite midden areas at LA 116503 may have been removed by the construction of U.S. 380 or are present outside of the project area.

Freshwater mussel shell is also present in the area of the structure and extramural features. Its presence is limited to the sheet trash in this portion of the site. Freshwater mussels are a common food source in the area. The Pecos River as the closest place they could have occurred historically (Wiseman 1985). Their presence at LA 116503 indicates that wild foods were gathered at least as far away from the site as the Pecos River (12 km).

The features and artifacts at LA 116503 are evidence of an Eastern Jornada Mogollon seasonal habitation site, dating to the Maljimar phase. Analysis of the artifact assemblages and structural features indicate that subsistence was probably based on hunting and the gathering of wild plants. Additional activities involved in the maintenance of a community can probably be assumed to have taken place at LA 116503. These include the needed construction and repairing of clothing and equipment.

It is possible that LA 116503 was occupied as a seasonal habitation connected with the exploitation of bison herds in the general site area. The trash filled structure indicates that LA 116503 was occupied at least twice for some period of time. However, it is possible that the structure's trash fill came from another area of the still-occupied site. The consistency of the artifact assemblages from both the general site and the fill of the structure, coupled with the lack of bleaching on the recovered bone, suggests that multiple uses of the site took place within a relatively short period of time. This conclusion is supported by the small amount of eolian deposition within the structure after abandonment and before the remaining structural depression was filled with trash.

Resource Procurement

There has been a tendency to model Eastern Jornada Mogollon subsistence on hunter-gather use of the region. The Mescalero Apaches in particular had a form of subsistence analogous to that postulated for the Jornada Mogollon (Gallager 1979; Wiseman 1996). This hunter-gather analogy becomes problematic given the variety of ceramic era sites in the region.

While there is little doubt that hunting and gathering played an important part in Eastern Jornada Mogollon subsistence, it is possible that the importance of these activities has been overstated. Conversely, the tendency has been to downplay the importance of agriculture when dealing with the ceramic cultural period in this area of New Mexico (Sebastian 1989). This has resulted in the commonly held belief that the Eastern Jornada Mogollon were a nonagricultural sedentary people (Corley 1965; Leslie 1979; Stuart and Gauthier 1981; and Tainter 1979).

An alternative theory, supported by Sebastian (1989), suggests that these sites actually represent more than one culture. In this model, a sedentary culture and a hunter-gather culture have become lumped together due to trade-based cross-cultural ties, resulting in a variety of site forms containing various types of ceramics.

While these theories may make sense at the site level, when applied on a regional scale their

limited conceptual views of cultural adaptation seem simplistic and naive. Subsistence is rarely an either/or proposition. Rather it is the utilization of a range of resources, differing only in the direction of its emphasis.

If we consider the Eastern Jornada Mogollon as a sedentary Puebloan people whose form of subsistence was modified to compensate for living on the edge of the plains, a better comparison would be with other sedentary groups living in similar circumstances (Jelinek 1967). Thus, a better analogy for the Eastern Jornada Mogollon may be groups such as the Mandan, Hidatsa, and Pawnee on the eastern edge of the Northern Plains. These sedentary groups utilized a mixed economy, having an agricultural-based subsistence that was supplemented with specialized food procurement in the form of regular seasonal bison hunting forays onto the plains (Willey 1966).

The artifact assemblage at LA 116503 could reflect just such a form of specialized food procurement. While the site is identifiable as Eastern Jornada Mogollon, the combination of elements within the artifact assemblage suggests a subsistence strategy with an emphasis on specialized hunting and gathering rather than the typically considered agriculturally dominated subsistence base.

The practice of bison hunting as part of Eastern Jornada Mogollon subsistence is well known (Jelinek 1967; Speth 1983; Wiseman 1996), but it is usually associated with the later phases of the culture. Jelinek (1967) found evidence of intensive bison hunting occurring in his Late Mckenzie phase (A.D. 1250-1350). The bison bone at the Garnsey Spring site has a similar date range (Parry 1979). Wiseman (1985) has a date of A.D. 1300 for Rocky Arroyo, where bison bone was present, while the Garnsey Kill site has been dated by Speth (1983) to A.D. 1450-1500.

In contrast, Leslie (1979) recognizes this bison hunting specialization as part of the Maljamar phase (A.D. 1150-1300). A similar earlier date was assigned to the Townsend site bone bed, north of Roswell, by Maxwell (1986). LA 116503 may fit in between these two suggested periods, indirectly supporting the earlier pattern of bison hunting proposed by Leslie and Maxwell.

Support for a later period of bison utilization has been provided by a regional overview of sites in eastern New Mexico and Texas with recorded bison bone (Dillehay 1974). Reviewing the existing literature in 1974, Dillehay found distinct periods when bison bones did not occur in site assemblages. He surmised that bison were absent from the region during these periods. One period when bison were absent extended from A.D. 500 to 1200. This was reportedly followed by a reoccurrence of bison in the region after A.D. 1200 (Dillehay 1974).

While the research by scholars such as Jelinek and Dillehay provide reference points for work in the region, it is only to be expected that the increased data from additional excavated sites would allow the reevaluation and refinement of their theories. Shifts of 25 or 50 years in the occurrence of bison or the dating of cultural periods are easily possible. It is also conceivable that in some areas, such as the Pecos Valley, remnant bison populations were never completely absent (just reduced in number).

Many of the Eastern Jornada Mogollon sites associated with bison hunting are kill sites, places where the bison were driven into stream beds and killed (Maxwell 1986; Speth 1983). Except for basic butchering, little evidence of processing is present at these sites. Processed bison bone is

more evident at habitation sites (Jelinek 1967, Wiseman 1985, 1996), such as LA 116503.

Although Pueblos traditionally sent hunting parties out onto the plains for bison, the duration of these hunting parties was usually limited (White 1962). The seasonal hunting of bison that may be represented at LA 116503 follows a pattern more commonly associated historically with the mixed economy of sedentary groups living on the eastern edge of the Northern Plains, such as the Pawnee (Ludwickson 1975), Hidatsa (Matthews 1877), and Mandan (Will and Spinden 1906).

For the Pawnee, Mandan, and Hidatsa, the hunting of bison involved a seasonal movement of virtually the entire population onto the plains, leaving the elderly and infirm to care for the permanent village and already planted crops (Ludwickson 1975; Matthews 1877; Will and Spinden 1906). This movement onto the plains usually took place in the spring. A similar seasonal population shift at the community level has been suggested for the Jornada Mogollon based on site structural data (Whalen 1979). A summer village was established near the hunting grounds, and the main focus of activity was the hunting and processing of bison meat in large quantities for winter consumption (Ludwickson 1975; Matthews 1877; Will and Spinden 1906).

Historically bison were divided into six bundles after the hunt, before being transported back to the village. Composed of the four limbs with two additional meat and hide bundles, this division created bundles that each weighed 75-100 km. This effectively limited the length of oxidation that occurred until the meat could be processed. The entire axial skeleton, from the skull to the caudal vertebrae, was not removed with the hide and was usually left behind. Various parts of the head brought back to the village included the tongue, brains, and horns (Dallman 1983). Most of the meat not consumed immediately was cut into thin strips and dried for consumption during the winter months (Will and Spinden 1906).

Processed bone at Eastern Jornada Mogollon sites such as LA 116503 could represent a similar strategy in the transportation of bison meat to the site. At habitation sites such as LA 116503, bison lower limb bones are found in quantities that far exceed the presence of other skeletal elements (Jelinek 1967; Wiseman 1996). These also tend to be the skeletal elements represented in low numbers at bison kill sites (Speth 1983). A similar pattern seems present at LA 116503, but this could be more apparent than real, given the poor condition of the bone.

In the Northern Plains, a population shift back to the permanent village usually took place in the late summer (Willey 1966). This return was timed to coincide with the harvesting of crops (Ludwickson 1975; Will and Spinden 1906). The cultivated crops required less attention during the growing season (Will and Spinden 1906; White 1962) than has commonly been assumed (Hogan and Gerow 1994). A similar seasonal movement of a population away from its fields of cultivated crops would explain the common lack of agricultural evidence at Eastern Jornada Mogollon sites (Leslie 1979; Whalen 1979).

There is no evidence that maize was cultivated at LA 116503; however, it is a possibility, given the site's position near a permanent water source (Carmichael 1986; Hard 1983; Leslie 1979). However, the lack of trough metates argues against the processing of maize at the site, suggesting that any maize consumed at the site was already present in a processed form and had probably been brought to the locale (Lancaster 1984). Groups on the Northern Plains historically transported maize, both whole kernel and ground meal, to supplement their summer diets

(Ludwickson 1975; Matthews 1877; Will and Spinden 1906). This could have also been the habit in this area.

Another view is that LA 116503 was a seasonal camp, primarily connected with nonbison resource procurement. In this scenario, the bison bone at LA 116503 represents the opportunistic killing of a single animal. However, this interpretation does not explain the specialized nature of the tool assemblage, with its 72 gravers.

While the hunting of bison may have served as one focus of activity at LA 116503, a second focus was the gathering of locally available wild seed. The ground stone artifacts at LA 116503 indicates that this was most likely, but not limited to, grass seed such as Indian ricegrass. Oakes (1985) found similar evidence of the specialized large-scale gathering of a specific wild foodstuff (in this case acorns) in her work at Hackberry Lake.

Rabbits, insects, and other available plants may have further supplemented the diet of the site's population; however, there is no evidence of it. None of the usual evidence of broad-based hunting and gathering that would be present at a permanent habitation site is present at LA 116503. This is especially apparent given the site's location adjacent to the enriched, oasis-type environment of a permanent or semipermanent water source. Mesquite charcoal was identified within at least one of the extramural roasting pits. This suggests that the depletion of some resources, such as wood, at the immediate site adjacent to the playa was taking place and necessitating the gathering of firewood in the drier surrounding countryside.

Jornada Mogollon sites containing both pit structures and small surface room blocks are known for the eastern plains region of New Mexico (Leslie 1979). While these sites are usually considered permanent habitation sites, the possible bilateral focus of subsistence suggested at LA 116503 suggests that this is not always the case. LA 116503 also differs from most of these sites by representing repeated use. The repeated use of a site by Puebloan people familiar with the area suggests seasonal use, as does the short time frame represented by the ceramic assemblage.

Seasonality at LA 116503 is apparent in both the artifacts and the site's structure. The bone recovered from LA 116503 tends to be from mature individuals. Similar evidence has been observed in age distributions of bison at the Garnsey Kill site, where adult male bison dominate the assemblage, indicating that hunting at that locale occurred in the spring (Speth 1983). The presence of a surface structure rather than a deep pit structure also suggests that the site was occupied during the warmer portion of the year such as spring through fall (Hard 1983).

Based on the type of temper and the range of ceramic types, the ceramic assemblage at LA 116503 suggests that the site was occupied by a population with established contacts to the west. While this may simply be an indication of regional trade, given the seasonal nature of the site, this could also indicate a permanent winter residence near the Sacramento Mountains, Sierra Blanca (Kelley 1984), or even near Roswell at a site such as Bloom Mound, the Henderson Site, or Rocky Arroyo (Wiseman 1993).

The excavated portion of LA 116503 formed an extremely small percentage of the total site area, making any interpretation little more than conjecture. However, based on the assembled data sets, and related regional information, this may be an accurate picture of settlement, population

movement, and site function.

Alternatives to the usual manner of dealing with Eastern Jornada Mogollon sites reveal a broader, more complicated range of cultural behavior then is generally assumed for this prehistoric Puebloan culture. Rather than an either/or hunter-gatherer versus sedentary subsistence patterns, intricate combinations of the two are a more realistic approach in dealing with these sites. The result is a wide range of site types tailored to the utilization of specific items or situations. LA116503 could represent just such a response to a specific need.

LA 116504

Cultural Affiliation

The site has been assigned to the Jornada Mogollon based on the presence of diagnostic ceramics. A radiocarbon sample collected from LA 116504 Feature 1 (hearth) yielded a date range of A.D. 980-1175. Taking into consideration the old wood problem, the site is actually younger. Based on the ceramics, LA 116504 could be either earlier than or contemporary with LA 116503.

This site was originally believed to contain a number of cultural components. Excavation proved this not to be the case, and LA 116504 represents a single Eastern Jornada Mogollon component.

Site Structure

LA 116504 is a short-term use area. A number of activities are indicated, based on the artifact assemblage. The number of activities suggests that this site, although short-term, was occupied for a longer period of time than LA 116502.

The presence of ceramics suggests that the individuals at LA 116504 were in the locale long enough to prepare at least one meal and presumably break several pots. The short use-life of the site is confirmed by the presence of the single feature found at LA 116504, a hearth. The simple design and small size of the hearth suggest that it was used for only a short time, also indicating a short use-life for the site.

Several vessels (at least two) are represented by the ceramic assemblage at LA 116504. All of the ceramics recovered at LA 116504 are brown wares. This limits our ability to date them relative to LA 116503, due to their long period of production in the region.

The lithic artifact assemblage from LA 116504 indicates that a number of activities took place at the site. The presence of scrapers and knives suggests the processing of game. This is confirmed by the occurrence of bone. Both a large land bird (such as a prairie chicken) and a large mammal (possibly antelope or deer) are represented by faunal remains. These activities also include a short, or single, incident of tool-related stone chipping.

The processing of plant material is indicated by the presence of a metate at LA 116504. That the metate is a basin metate suggests that this processing was connected with the gathering of locally or seasonally available wild grass seed (Lancaster 1984). The macrobotanical sample from

the Feature 1 (hearth) contains only two cultural species, goosefoot and purslane. This may be the result of poor preservation, always a concern at shallow sites in the Roswell area.

A pollen sample was taken from the metate found covering Feature 1. Unfortunately it gives no information about the plant seed associated with the metate's use.

Resource Procurement

Short-term procurement areas are a common occurrence among the Eastern Jornada Mogollon (Leslie 1979; Oakes 1985). These sites are usually associated with the task-specific gathering of plant foodstuffs (Oakes 1985). This type of site occurs in the general area at a much greater frequency than habitation sites (Leslie 1979; Whalen 1979; Wiseman 1996).

Small short-term resource procurement areas associated with the gathering of wild plants are a common feature in Puebloan culture historically, where wild foodstuffs were utilized to supplement diets despite the cultivation of domesticated crops (Ellis 1988). This is true of wild foodstuffs and plant material collected for other purposes such as grass or reeds for basketry, medicinal plants, and plant material used for dyes or pigments (White 1962).

In most cases the collecting of wild plants took place as a day trip, or at most a trip of several days, from the village (White 1962). The location of LA 116504 on the Eastern Plains suggests that these people were operating out of a base camp in the general area. This would probably be a seasonal camp similar to LA 116503. This is also indicated by the small size of the site compared to the more common large gathering locales (Oakes 1985). The exact location of any settlement related to LA 116504, however, remains unknown.

The focus at LA 116504 on the gathering of wild grass seed puts the site seasonally in the same period of the year as the seasonal habitation sites such as LA 116503. The identification of mesquite charcoal in the single hearth found at this site suggests that the vegetation of the area was similar to that present today. The ceramic assemblage from LA 116504 suggests that although LA 116504 appears older than LA 116503, these two sites could be contemporanious, representing different activities carried out by members of the same group. This suggests that when members of the community (most likely women) were not occupied with their usual duties in camp (like the processing of bison or other game), they pursued other gathering activities.

The lithic artifacts may also be an indication of the gender of the site's inhabitants. Although projectile points that would indicate hunting were originally reported at LA 116504, none were recovered during the excavation. The lithic tools that were recovered are all tools associated with the processing of game. Large game (deer or antelope) and large land birds (possibly prairie chicken) are indicated at LA 116504 by the presence of bone. Typically among the Pueblos, the hunting of large game is a male activity, while the processing of game is associated with women (except in cases were the processing takes place away from the camp or habitation) (White 1962). The combination of lithic tools used in animal processing and ground stone suggests that the inhabitants of LA 116504 were a mixed group of men and women.

The faunal remains recovered from LA 1106504 are another source of information on resource procurement at the site. Faunal remain recovered at LA 116504 were limited to a few fragments

of bone from a large mammal and a large bird. While these could not be identified at the species level due to their poor preservation, they could represent successful hunting in the general site area. The mature nature of these animals could indicate that they were killed in the spring (Speth 1983), as at LA 116503, also a spring occupation.

LA 116504 may have served as a short-term camp site associated with hunting and gathering. As we've seen in the discussion of LA 116503, the processing of wild seed and large game could be actively pursued at the same site. It is therefore logical that bands would travel out from the seasonal village to gather wild seed and hunt, perhaps staying away for up to several days or a week at a time. LA 116504 could represent the short-term procurement area, or camp site, of just such a group.

LA 116505

LA 116505 has been assigned to the Late Archaic period based on the presence of diagnostic projectile points found outside of the project area. This was originally believed to be a multicomponent site. However, the redeposited nature of the artifacts within the project area made the determination of components impossible. The lack of features or deposits has limited the application of more precise dating methods.

Site structure at LA 116505 cannot be determined due to the lack of intact features or cultural deposits within the project area. While it is possible that lithic tool production took place outside of the project area, there is nothing to suggest any activities were pursued within it. The small number of lithic artifacts recovered within the project area are all the result of downslope redeposition from outside of the project area, caused by slope erosion.

All of the lithic artifacts recovered at LA 116505 were redeposited from outside of the project area. The redeposited nature of these artifacts, combined with the small size of the assemblage, severely limits its value for site interpretation.

While it is possible that LA 116505 may be a resource procurement area, no intact portion of LA 116505 exists within the proposed project area. Intact portions of the site may exist to the south, outside of the project area.

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APPENDIX 2: TABLES

Table 1. Distribution of ceramic types from red lake tank sites

Pottery Types	LA 116503		LA 116504	
	#	%	#	%
Jornada Plain Brown Body	88	56.8	15	93.8
Jornada Plain Brown Rim	2	1.3	1	6.3
Thin polished unpainted	1	.6		
Plain slipped red	10	6.5		
Three Rivers Red-on-terracotta	6	3.9		
Chupadero Black-on-white (solid)	27	17.4		
Unpainted white	18	11.6		
Corona Corrugated	3	1.9		
Total	155	100.0	16	100.0

Table 2. Specific types of brown wares from Red Lake Tank sites

Pottery Types	LA 116503		LA 116504	
	#	%	#	%
Jornada Brown	81	89.0	8	50.0
El Paso Brown	2	2.2		
Unpainted El Paso Polychrome	1	1.1		
South Pecos Brown	5	5.5	8	50.0
Jornada/South Pecos Brown	2	2.2		
Total	91	100.0		100.0

Table 3. Temper distributions at LA 116503

Temper	Jornada Brown Ware		Three Rivers Red Ware		Chupadero Black-on-white		Corona Corrugated	
	#	%	#	%	#	%	#	%
Leucocratic	58	63.7	15	93.8				
Small crystalline igneous	25	27.5			1	2.2		
Gray feldspar	8	8.8	1	6.3				
Dark sherd or rock					43	95.6		
Light sherd					1	2.2		
Mica schist							3	100.0
Total	91	100.0	16	100.0	45	100.0	3	100.0

Table 4. Temper distributions at LA 116504

Temper	Jornada Brown Ware	
	#	%
Small Crystalline	8	50%
Gray Feldspar	8	50%
Total	16	100.0

Table 5. Vessel form distributions at LA 116503

Vessel Form	Jornada Brown Ware		Three Rivers Red Ware		Chupadero Black-on-white		Corona Corrugated	
	#	%	#	%	#	%	#	%
Indeterminate body (polished both sides)	35	38.5	3	18.8				
Bowl rim			1	6.3				
Bowl body	29	31.9	9	56.3	7	26.9		
Jar body	22	24.2	1	6.3	19	73.1	4	100.0
Cooking/storage jar rim	1	1.1	2	12.5				
Cooking/storage jar neck	1	1.1						
Seed jar rim	3	3.3						
Total	91	100.0	16	100.0	26	100.0	4	100.0

Table 6. Vessel form distributions at LA 116504

Vessel Form	Jornada Brown Ware	
	#	%
Bowl body	7	43.8
Jar body	2	12.5
Cooking storage jar rim	1	6.3
Cooking storage jar neck	6	37.5
Total	16	100.0

Table 7. Paste cross sections of brown wares from Red Lake Tank sites

Paste Cross Section	LA 116503		LA 116504	
	#	%	#	%
Gray to dark gray throughout with light to brown exterior	66	72.5	14	87.5
Brown or reddish throughout	6	6.6		
Distinct core red or brown inside, black outside	16	17.6		
Red and gray streaks	3	3.3	2	12.5
Total	91	100.0	16	100.0

Table 8. Interior manipulation at LA 116503

Interior Manipulation	Jornada Brown Ware		Three Rivers Red Ware		Chupadero Black-on-white		Corona Corrugated	
	#	%	#	%	#	%	#	%
Plain unpolished	14	15.3			8	17.8		
Plain slightly polished	38	41.8	8	50.0	1	2.2	3	100.0
Plain heavily polished	39	42.9	8	50.0	7	15.6		
Unpolished with striations					24	53.3		
Total	91	100.0	16	100.0	45	100.0	3	100.0

Table 9. Interior manipulation at LA 116504

Manipulation	Jornada Brown Ware	
	#	%
Plain unpolished	10	62.5
Slightly polished	6	37.5
Total	16	100.0

Table 10. Exterior manipulation at LA 116503

Interior Manipulation	Jornada Brown Ware		Three Rivers Red Ware		Chupadero Black-on-white		Corona Corrugated	
	#	%	#	%	#	%	#	%
Plain unpolished	10	11.0	4	25.0	6	12.0		
Plain slightly polished	55	60.4	5	35.0	10	21.0		
Plain heavily polished	25	27.5	7	40,0	29	66.0		
Unpolished with striations								
Indented corrugated							3	100.0
Indeterminate	1	1.1						
Total	91	100.0	16	100.0	45	100.0	3	100.0

Table 11. Exterior manipulation at LA 116504

Manipulation	Jornada Brown Ware	
	#	%
Plain Unpolished	16	100.0

Table 12. Artifact morphology by material type, LA 116503

Artifact	Metamorphic Sandstone		Chert		Alibates Dolomite		Rhyolite		Siltstone	
	N	%	N	%	N	%	N	%	N	%
Core flake	6	100.0	452	90.2	14	93.3	3	100.0	35	89.7
Biface thinning flake			21	4.2	1	6.7			2	5.1
Resharpening flake			6	1.2					1	2.6
Hammerstone flake			5	1.0					1	2.6
Uniface (first stage)			2	0.4						
Biface (first stage)			1	0.2						
Biface (second stage)			7	1.4						
Biface (third stage)			4	0.8						
Multidirectional core			3	0.6						
Total	6	100.0	501	100.0	15	100.0	3	100.0	39	100.0

Table 12 (continued)

Artifact	Quartzitic Sandstone		Obsidian		Silicified Wood		Total	
	N	%	N	%	N	%	N	%
Core flake	164	92.7	3	100.0	52	77.6	729	89.9
Biface thinning flake	2	1.1			4	6.0	30	3.7
Resharpening flake	3	1.7			2	3.0	12	1.5
Hammerstone flake	3	1.7			2	3.0	11	1.4
Uniface (first stage)							2	0.2
Biface (second stage)							1	0.1
Biface (second stage)	1	0.6			4	6.0	12	1.5
Biface (third stage)	1	0.6			2	3.0	7	0.9
Multidirectional core	3	1.7			1	1.5	7	0.9
Total	177	100.0	3	100.0	67	100.0	811	100.0

Table 13. Percent of dorsal cortex by material type, LA 116503

Cortex	Metamorphic Sandstone		Chert		Alibates Dolomite		Rhyolite		Siltstone	
	N	%	N	%	N	%	N	%	N	%
0	5	83.3	330	65.9	14	93.5	3	100.0	26	66.7
10			32	6.4					3	7.7
20			24	4.8					1	2.6
30	1	16.7	25	5.0					3	7.7
40			13	2.6						
50			10	2.0					1	2.6
60			11	2.2						
70			12	2.4	1	6.7				
80			12	2.4					2	5.1
90			10	2.0						
100			22	4.4					3	7.7
Total	6	100.0	501	100.0	15	100.0	3	100.0	39	100.0

Table 13 (continued)

Cortex	Quartzitic Sandstone		Obsidian		Silicified wood		Total	
	N	%	N	%	N	%	N	%
0	147	83.1	2	66.7	48	71.6	575	70.9
10	3	1.7			8	11.9	45	5.6
20	5	2.8			4	6.0	34	4.2
30	7	4.0			1	1.5	37	4.6
40	3	1.7	1	33.3	1	1.5	18	2.2
50							11	1.4
60	2	1.1			1	1.5	14	1.7
70	4	2.3			2	3.0	19	2.3
80	4	2.3					18	2.2
90	1	0.6			2	3.0	13	1.6
100	1	0.6					26	3.2
Total	177	100.0	3	100.0	67	100.0	811	100.0

Table 14. Flake type by flake portion, LA 116503

Flake Type	Whole		Proximal		Medial		Distal		Lateral		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Core flake	550	92.7	88	90.7	19	100.0	49	98.0	23	100.0	729	93.2
Biface thinning flake	23	3.9	6	6.2			1	2.0			30	3.8
Resharpening flake	12	2.0									12	1.5
Hammerstone flake	8	1.3	3	3.1							11	1.4
Total	593	100.0	97	100.0	19	100.0	50	100.0	25	100.0	782	100.0

Table 15. Flake portion by platform type, LA 116503

Flake Type	Absent		Cortical		Single		Multifaceted		Collapsed		Crushed		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Core flake	74	97.4	161	97.0	459	97.0	1	3.2	27	100.0	7	100.0	729	93.2
Biface thinning flake	2	2.6	2	1.2	1	0.2	25	77.4					30	3.8
Resharpening flake			1	0.6	4	0.8	7	19.4					12	1.5
Hammerstone flake			2	1.2	9	1.9							11	1.4
Total	76	100.0	166	100.0	473	100.0	33	100.0	27	100.0	7	100.0	782	100.0

Table 16. Artifact function by material type, LA 116503

	Metamorphic Sandstone		Chert		Alibates Dolomite		Siltstone		Quartzitic Sandstone	
	N	%	N	%	N	%	N	%	N	%
Utilized debitage	1	25.0	40	34.2			4	44.4	23	52.3
Hammerstone			2	1.7						
Chopper									1	2.3
Drill			1	0.9						
Graver	3	75.0	46	39.3	2	100.0	4	44.4	15	34.1
Spokeshave			6	5.1						
Denticulate			1	0.9					1	2.3
Scraper (end)			8	6.8			1	11.1	2	4.5
Scraper (side)			4	3.4						
Knife			5	4.3					1	2.3
Projectile point			4	3.4					1	2.3
Total	4	100.0	117	100.0	2	100.0	9	100.0	44	100.0

Table 16 (continued)

	Silicified Wood		Rhyolite		Total	
	N	%	N	%	N	%
Utilized debitage	8	50.0			76	39.4
Hammerstone					2	1.0
Chopper					1	0.5
Drill					1	0.5
Graver	1	6.3	1	100.0	72	37.3
Spokeshave					6	3.1
Denticulate					2	1.0
Scraper (end)	1	6.3			12	6.2
Scraper (side)	1	6.3			5	2.6
Knife	3	18.8			9	4.7
Projectile point	2	12.5			7	3.6
Total	16	100.0	1	100.0	193	100.0

Table 17. Artifact morphology by material type, LA 116504

	Metamorphic Sandstone		Chert		Alibates Dolomite		Siltstone		Limestone	
	N	%	N	%	N	%	N	%	N	%
Core flake			44	93.6			14	100.0	1	100.0
Biface thinning flake	1	100.0	1	2.1	1	100.0				
Resharpening flake										
Hammerstone flake										
Biface (second stage)			1	2.1						
Multidirectional core			1	2.1						
Total	1	100.0	47	100.0	1	100.0	14	100.0	1	100.0

Table 17 (continued)

	Quartzitic Sandstone		Obsidian		Silicified Wood		Total	
	N	%	N	%	N	%	N	%
Core flake	51	96.2	3	100.0	15	88.2	128	93.4
Biface thinning flake					2	11.8	5	3.6
Resharpening flake	1	1.9					1	0.7
Hammerstone flake	1	1.9					1	0.7
Biface (second stage)							1	0.7
Multidirectional core							1	0.7
Total	53	100.0	3	100.0	17	100.0	137	100.0

Table 18. Percent of dorsal cortex by material type, LA 116504

	Metamorphic Sandstone		Chert		Alibates Dolomite		Siltstone		Limestone	
	N	%	N	%	N	%	N	%	N	%
0			25	53.2	1	100.0	10	71.4	1	100.0
10			6	12.8			1	7.1		
20			1	2.1			1	7.1		
30			6	12.8						
40	1	100.0	2	4.3			1	7.1		
50			1	2.1			1	7.1		
60										
70			2	4.3						
80			2	4.3						
90			2	4.3						
100										
Total	1	100.0	47	100.0	1	100.0	14	100.0	1	100.0

Table 18 (continued)

	Quartzitic Sandstone		Obsidian		Silicified Wood		Total	
	N	%	N	%	N	%	N	%
0	44	83.0	3	100.0	7	41.2	91	66.4
10	3	5.7			2	11.8	12	8.8
20	1	1.9			1	5.9	4	2.9
30	1	1.9			1	5.9	8	5.8
40							4	2.9
50	1	1.9					3	2.2
60	2	3.8					2	1.5
70	1	1.9			3	17.6	6	4.4
80							2	1.5
90					3	17.6	5	3.6
100								
Total	53	100.0	3	100.0	17	100.0	137	100.0

Table 19. Flake type by flake portion, LA 116504

Flake type	Whole		Proximal		Medial		Distal		Lateral		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Core flake	94	94.0	25	96.2	2	100.0	5	100.0	2	100.0	128	94.8
Biface thinning flake	4	4.0	1	3.8							5	3.7
Resharpening flake	1	1.0									1	0.7
Hammerstone flake	1	1.0									1	0.7
Total	100	100.0	26	100.0	2	100.0	5	100.0	2	100.0	135	100.0

Table 20. Flake Portion by Platform Type, LA 116504

	Absent		Cortical		Single		Multifaceted		Collapsed		Crushed		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Core flake	8	100.0	30	100.0	79	96.3			3	100.0	8	100.0	128	94.8
Biface thinning flake					2	2.4	3	75.0					5	3.7
Resharpening flake							1	25.0					1	0.7
Hammerstone flake					1	1.2							1	0.7
Total	8	100.0	30	100.0	82	100.0	4	100.0	3	100.0	8	100.0	135	100.0

Table 21. Artifact function by material type, LA 116504

	Metamorphic Sandstone		Chert		Siltstone		Limestone	
	N	%	N	%	N	%	N	%
Utilized debitage			1	50.0	1	100.0	1	100.0
Spokeshave			1	50.0				
Scraper (end)								
Scraper (side)								
Knife	1	100.0						
Total	1	100.0	2	100.0	1	100.0	1	100.0

Table 21 (continued)

	Quartzitic Sandstone		Obsidian		Silicified Wood		Total	
	N	%	N	%	N	%	N	%
Utilized debitage	4	42.9	2	66.7	4	100.0	13	68.5
Spokeshave							1	5.3
Scraper (end)	1	14.3					1	5.3
Scraper (side)	1	14.3					1	5.3
Knife	1	14.3	1	66.7			3	15.8
Total	7	100.0	1	100.0	4	100.0	19	100.0

Table 22. Red Lake Tank vegetation survey

Latin Name	Common Name	Location
Grasses		
Sporobolus sp.	dropseed	LA 116502
Aristida sp.	three-awl grass	LA 116504
Setaria sp.	bristlegrass	LA 116504
Andropogon sp.	beardgrass	LA 116504
Shrubs		
Yucca elata	soapweed yucca	LA 116504
Condalia ericoides	condalia	LA 116504, LA 116505
Playopuntia sp.	prickly pear	LA 116502
Prospis glanulosa	mesquite	dense at LA 116503, La 116504
Gutierrezia sarothroe	snakeweed	LA 116504
Forbs		
Croton sp.	doveweed	LA 116502, LA 116504
Helianthus sp.	sunflower	LA 116504
Cirsium sp.	thistle	LA 116502, LA 116504
Lepidium montanum	western peppergrass	LA 116502, LA 116503
Cucurbita foetidissima	coyote gourd	LA 116502
Prosboscidea cf. *Parviflora*	devil's claw	LA 116503

Table 23. Flotation sample plant remains, LA 116503 and LA 116504

	LA 116503					LA 116504	
	FS 198, Fea. 1, hearth, E ½	FS 204, Fea. 4, hearth, E ½	FS 210, Fea. 4, hearth, W ½	FS 217, Fea. 5, hearth, upper fill	FS 219, Fea. 5, hearth, lower fill	FS 60, Fea. 1, hearth, E ½	FS 62, Fea. 1, hearth, W ½
Cultural Annuals *Chenopodium* (goosefoot)	2	1					
Cheno-am	1					3	2
Portulaca (purslane)							1
Other Indeterminate							
Noncultural Annuals *Amaranthus* (pigweed)	3	3			1 plant part		
Portulaca (purslane)		1	1			2	
Grasses *Cenbrus* (sandbur)		1 floret	2				
Gramineae (grass family)	1	1				1 floret	
Oryzopsis (Indian ricegrass)						1 lemma	
Other *Euphorbia* (spurge)	21	97	25	1	3		
Solanum (nightshade)			1				
Verbena (vervain)			1		1		

All plant parts are seed unless indicated otherwise.

Table 24. Species composition of flotation wood, LA 116502, LA 116503, and LA 116504

	LA 1165502	LA 116503					LA 116504	
	FS 12, Fea. 1, Roasting Pit	FS 198, Fea. 1, hearth, E ½	FS 204, Fea. 4, hearth, E ½	FS 210, Fea. 4, hearth, W ½	FS 217, Fea. 5, hearth, upper fill	FS 219, Fea. 5, hearth, lower fill	FS 60, Fea. 1, hearth, E ½	FS 62, Fea. 1, hearth, W ½
Atriplex/Sarcobatus (saltbush/greasewood)	4/<0.1 g	N/A	N/A	N/A	N/A	N/A	N/A	N/A
cf. *Condalia* (condalia)					3/0.3 g			
Prosopis (mesquite)	N/A	20/0.8 g	20/0.3 g	17/0.1 g	17/2.0 g	20/1.6 g	10/0.3 g	1/<0.1 g
Undetermined nonconifer	N/A	N/A	N/A	N/A	3/0.3 g	N/A	10/0.3 g	N/A
Total weight	<0.1 g	0.8 g	0.3 g	0.1 g	2.6 g	1.6 g	0.6 g	<0.1 g

Note: Wood is recorded as number of pieces/weight in grams.

Table 25. Species composition of wood for C-14 dating

Taxon	LA 116502, FS 198, Fea. 1, roasting pit	LA 116503, FS 198, Fea. 1, hearth, E ½	LA 116504, FS 62, Fea. 1, hearth, W ½
Atriplex/Sarcobatus saltbush/greasewood	147/6.98 g	14/0.46 g	4/0.16 g
cf. *Condalia* condalia	N/A	3/0.13 g	7/0.82 g
Prosopis mesquite	N/A	180/6.27 g	58/7.41 g
Undetermined nonconifer	N/A	1/0.07 g	3/0.29 g
Unknown	N/A	N/A	1/0.07 g
Total weight	6.98 g	6.93 g	8.75 g
Total taxa	1	2	3

Note: Wood is recorded as number of pieces /weight in grams.

Table 26. Red Lake Tank carbonized flotation remains in the context of other regional examples

Taxon	Fox Place	Red Lake Tank (this study)	Dunnahoo Hills	Sunset, LA 71167	Bob Crosby Draw	Garnsey Spring Campsite
Time Period	A.D. 1200s	A.D. 900, A.D. 1100-1300	A.D. 500-1600	Ceramic Period	Late Archaic, Late Ceramic	Late Archaic, Late Ceramic
Annuals: *Amaranthus*	*			*		
Artemisia	*					
Chenopodium	*	*	*	*	*	
Compositae	*					
Helianthus				*		
Nicotana				*		
Oenothera	*			*		
Polygonum	*					
Portulaca		*	*	*		
Cf. *Sphaeralcea*				*		
Perennials: *Acer negundo*	*					
Echinocereus			*	*		
Juglans				*		
Opuntia				*		
Rhus				*		
Vitis				*		
Yucca	*			*		
Grasses: *Phragmites*	stem					
Sporobolus	*			*		
Gramineae	* stem bases					
Cultivars: *Phaseolus*				*		
Zea mays	*			*		
Total Taxa	12	2	3	16	1	0

* Indicates presence of plant remains.

Sources: Fox Place (Toll 1993); Dunnahoo Hills (Toll 1995); Sunset (Toll 1992); Bob Crosby Draw (McBride 1996); Garnsey Spring Campsite (Popper 1984).

Table 27. Regional wood use

Taxon	Fox Place	Red Lake Tank	Sunset	Garnsey Spring Campsite
Total sample weight in grams	62.19	5.7	93.4	51.38
SHRUBBY WOODS: *Compositae*	*		*	
Condalia		*		
Creosotebush	*		*	
Saltbush/greasewood	*	*	*	*
TREES: Ash	*			
Box elder	*		*	
cf. Buckthorn				*
Cottonwood/willow	*		*	
Hackberry	*			
Juniper			*	*
Mesquite	*	*	*	*
cf. Mormon tea				*
New Mexico olive				*
Oak			*	
Undetermined nonconifer	*		*	
Walnut			*	
Total Taxa	8	3	9	6

* Indicates presence of wood.
Source: Fox Place (Toll 1993); Sunset (Toll 1992); Garnsey Spring Campsite (Popper 1984).

Table 28. Raw pollen counts and concentration values

Site	Provenience	Artifact	*Pinus*	Cheno-am	Asteraceae High spine	Asteraceae Low Spine
Raw Counts						
LA 116503	FS 185, surface strip	mano	3			
LA 116503	FS 200, Floor 1	mano	3	2		1
LA 116504	FS 60, Fea. 1	metate	3	3	1	
Concentration Values						
LA 116503	FS 185	mano	4			
LA 116503	FS 200	mano	10	7		3
LA 116504	FS 60	metate	16	16	5	

Table 28 (continued)

Site	Provenience	*Ephedra*	Sum	Total	Marker	Trans/Total Trans	*Lycopodium* added	Area (cm2)
Raw Counts								
LA 116503	FS 185	1	4	5.68	254	4/24	40500	108.00
LA 116503	FS 200		6	19.69	148	4/24	40500	83.38
LA 116504	FS 60		7	38.11	90	2/24	40500	82.65
Concentration Values								
LA 116503	FS 185	1						
LA 116503	FS 200							
LA 116504	FS 60							

Table 29. Faunal Counts by Site and Taxon

Taxon	Common Name or Body Size	LA 116503		LA 116504	
		N	%	N	%
Unknown small animal	small mammal, bird, or herp	2	.3		
Small mammal or medium to large bird	mammal or bird smaller than turkey	2	.3		
Small mammal	jack rabbit or smaller	3	.4		
Small to medium mammal	jack rabbit to coyote size	5	.6		
Medium to large mammal	coyote to deer size	15	1.9		
Large mammal	deer or larger	548	71.1	4	44.4
Very large mammal	elk or larger	105	13.6	1	11.1
Artiodactyl	size undetermined	1	.1		
Medium artiodactyl	deer, pronghorn, mountain sheep	4	.5	1	11.1
Large artiodactyl	bison or elk	61	7.9	1	11.1
cf. *Odocoileus hemionus*	mule deer	3	.4		
Bison bison	bison	19	2.5		
Galliformes	large land bird, size of pheasant or prairie chicken			2	22.2
Terrapene ornata	western box turtle	1	.1		
Mussel	bivalve	2	.3		
Site Totals		771	100.0	9	100.0

Table 30. Counts by provenience, LA 116503

Taxon	Stripping		Structure 1		Feature 1		Feature 4		Feature 5	
	N	%	N	%	N	%	N	%	N	%
Unknown small	1	.7			1	4.5				
Small mammal/large bird	2	1.3								
Small mammal	2	1.3					1	25.0		
Small-medium mammal	1	.7	4	.7						
Medium-large mammal	4	2.7	8	1.4	2	9.1			1	25.0
Large mammal	87	58.0	438	74.1	17	77.3	3	75.0	3	75.0
Very large mammal	44	29.3	59	10.0	2	9.1				
Artiodactyl			1	.2						
Medium artiodactyl	3	2.0	1	.2						
Large artiodactyl			61	10.3						
Deer			3	.5						
Bison	3	2.0	16	2.7						
Turtle	1	.7								
Mussel	2	1.3								
Totals	150	100.0	591	100.0	22	100.0	4	100.0	4	100.0