THE BELEN BRIDGE SITE AND THE LATE ELMENDORF PHASE OF CENTRAL NEW MEXICO

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the New Mexico State Highway and Transportation Department,
whose support we wish to acknowledge.

ADMINISTRATIVE SUMMARY

In 1986 and 1987, the Museum of New Mexico conducted archaeological excavations at the Belen Bridge site, LA 53662, east of Belen, Valencia County, New Mexico. The work was done at the request of the New Mexico State Highway and Transportation Department as part of Project SP-GRS-1306(200), a bridge construction and road realignment project.

The field project consisted of two major excavation phases. The excavations uncovered 8 pithouses and 82 extramural hearths, pits, and postholes dating to the A.D. 1200s, or the Late Elmendorf phase. These features represent several different seasonal occupations, in which only one to three structures were used at any one time. Although a wide variety of wild plant and animal food remains were recovered, the site was used primarily for farming and therefore represents a notable departure from the kinds of sites and occupations previously described for the Late Elmendorf phase. The presence of many vessels of St. Johns Polychrome raises serious questions about archaeologists' notions of exotic trade items and how they relate to late prehistoric social and political systems in the Southwest.

Submitted in fulfillment of the terms of Joint Powers Agreement F00474 between the New Mexico State Highway and Transportation Department and the Museum of New Mexico.

NMSHTD Project SP-GRS-1306(200)
MNM Project 41.386 (Belen Bridge)

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INTRODUCTION

At the request of William Taylor of the New Mexico State Highway and Transportation Department (NMSHTD), the Museum of New Mexico conducted excavations at the Belen Bridge site, LA 53662, in the late spring and early summer of 1986 and again in the fall of 1987. The site lay across the river from Belen, Valencia County, New Mexico (Fig. 1). The project was occasioned by the proposed improvements to the bridge over the Rio Grande and the approaches to it. The site is located along NM 385 (the Manzano Expressway) just [redacted] It became apparent that the U.S. Army Corps of Engineers should be involved because of the Section 404 permit requirements for the bridge improvements. The potential problems raised by this discovery were resolved by Jan Biella, Corps archaeologist.

The Belen Bridge site was first exposed as a small sherd and lithic artifact scatter during the construction of a highway bar ditch and water-control berm along the north side of the Manzano Expressway. Excavations revealed 8 pithouses and 82 extramural hearths, pits, and postholes. The current evidence suggests multiple, probably seasonal, occupations over the span of a century. The pottery assemblages indicate a late Late Elmendorf-phase affiliation and dates the occupations to the A.D. 1200s.

The project survey, by Steven A. Koczan of the NMSHTD, was followed by testing and evaluation in the late spring of 1986, and the first excavation immediately followed (Wiseman 1987). It was apparent that the site extended south, under the Manzano Expressway. The removal of the blacktop required a monitoring phase in the fall of 1987, followed immediately by the second excavation phase. Seven days were required for the testing, 46 days for the first excavation, and 19 days for the second excavation. Two days during the first excavation phase were lost to rainy weather.

The project was completed by the Office of Archaeological Studies (formerly the Research Section of the Laboratory of Anthropology), Museum of New Mexico. Regge N. Wiseman supervised the project, and Daisy Levine (testing phase) and Ann Noble were project assistants. The crew for the first excavation phase consisted of Randy Anderson, Barbara Fox, Richard Ortega, and Marc Thompson (night watchman). Jon Frizell and Steven R. Hoagland also worked for a short period. Volunteers included Casey Davis, Carmie Lynne Toulouse, Robert H. Weber, and Darlene Goodman. In the fall of 1987, Steve Hoagland and Ann Noble monitored the removal of the blacktop. The crew of the second excavation phase included Peter Bullock, Stephen Lent, Susan Moga, James L. Moore, Ann Noble, Rod North, Adisa Willmer, and Dorothy Zamora. David A. Phillips, Jr., served as the principal investigator. Eligio Aragon of Alley Cat Backhoe handled the backhoe expertly during the first excavation phase, and the highway contractor, Twin Mountain Rock Company, provided a roadgrader and operator during the second excavation phase.

Modern Climate

The present-day climate of the project area is summarized in Figure 2 (data from Gabin and Lesperance 1977). The average January temperature is 1.4 degrees C (34.5 F.), and the average July temperature is 25.8 degrees C (78.5 degrees F). The average annual precipitation is 190 mm (7.5 in). The average frost free-season, to judge by data for Albuquerque and Socorro, is 197 to 203 days, beginning in early to mid May and ending in early to mid October (Tuan et al. 1973). The date of the first fall frost is more predictable than the date of the last spring frost. The Belen area receives 70 to 80 percent of the normal possible annual sunshine.

Past Climate

A dendroclimatic profile of the Belen area from A.D. 900 to 1350 shows a series of shifts between cool-moist periods and warm-dry periods (Fig. 3). The data, taken from Dean and Robinson (1977), are presented in terms of standard deviations from the mean for A.D. 680-1972. Regarding the significance of the standard deviation values, the authors state: "Variation that exceeds two standard deviation units in either direction is considered to be significant in the sense that such departures are sufficiently rare to have had potential adaptive consequences for plant, animal, and human populations" (1977:8).

Given the low elevation, warm climate, and low modern precipitation in the Belen region, a climatic regime of mean or higher (cooler/ moister) would be necessary for successful dry farming. These periods, marked by the broken heavy line along the mean line (0.00) in Figure 3, are: ca. A.D. 1100-1130, 1160-1180, 1190-1210, 1230-1250, 1265-1270, 1295-1325, and 1330-1340.

In view of the deleterious effects that warm/dry periods and any previous cultivation would have on soil moisture content, it is important to keep in mind the duration, frequency, and staggering of the warm/dry periods: ca. A.D. 1130-1160, 1180-1190, 1210-1230, 1250-1265, 1270-1295, and 1340-1350 (Fig. 3).

Regarding the staggering of the warm/dry periods, it should be noted that the century from the mid-1000s to the mid-1100s was noted for relatively long, cool/moist periods. It was followed by a long warm/dry period, which lasted from 1130 to 1160 (Fig. 3). The next period, 1160 to 1250, had three moderately long cool/moist periods staggered by two shorter warm/dry periods. From 1250 to 1295, the climate was warmer/drier than previously; it seems unlikely that the brief, slightly cool/moist period of 1265-1270 would have provided much soil moisture recharge in areas outside the Rio Grande Valley proper.

Topography

The Belen Bridge site is on the east side of the Rio Grande. It sits on the first terrace, 200 m from the terrace edge. At this point, the almost flat terrain slopes gently to the west from the foot of the second terrace, 600 m east of the site. A minor drainage, which heads at the edge of the second terrace, passes immediately north of the site. Elevations range from 1,463 m (4,800 ft) at the Rio Grande to 1,471 m (4,825 ft) at the site to 1,494 m (4,900 ft) at the top edge of the second terrace. The Manzano Mountains, 21 km (13 mi) to the east, reach an elevation of 3,078 m (10,098 ft).

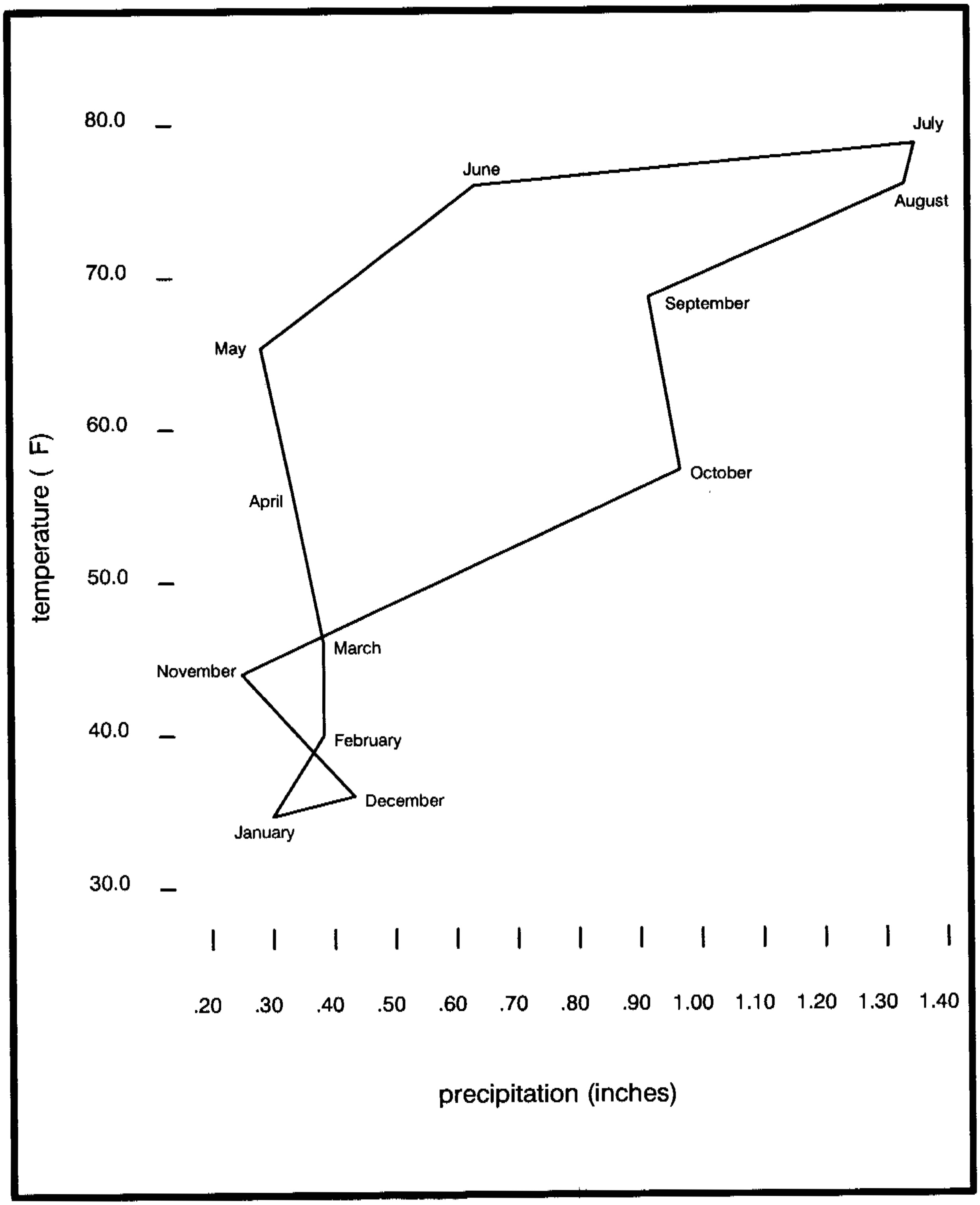


Figure 2. Modern climate of project area.

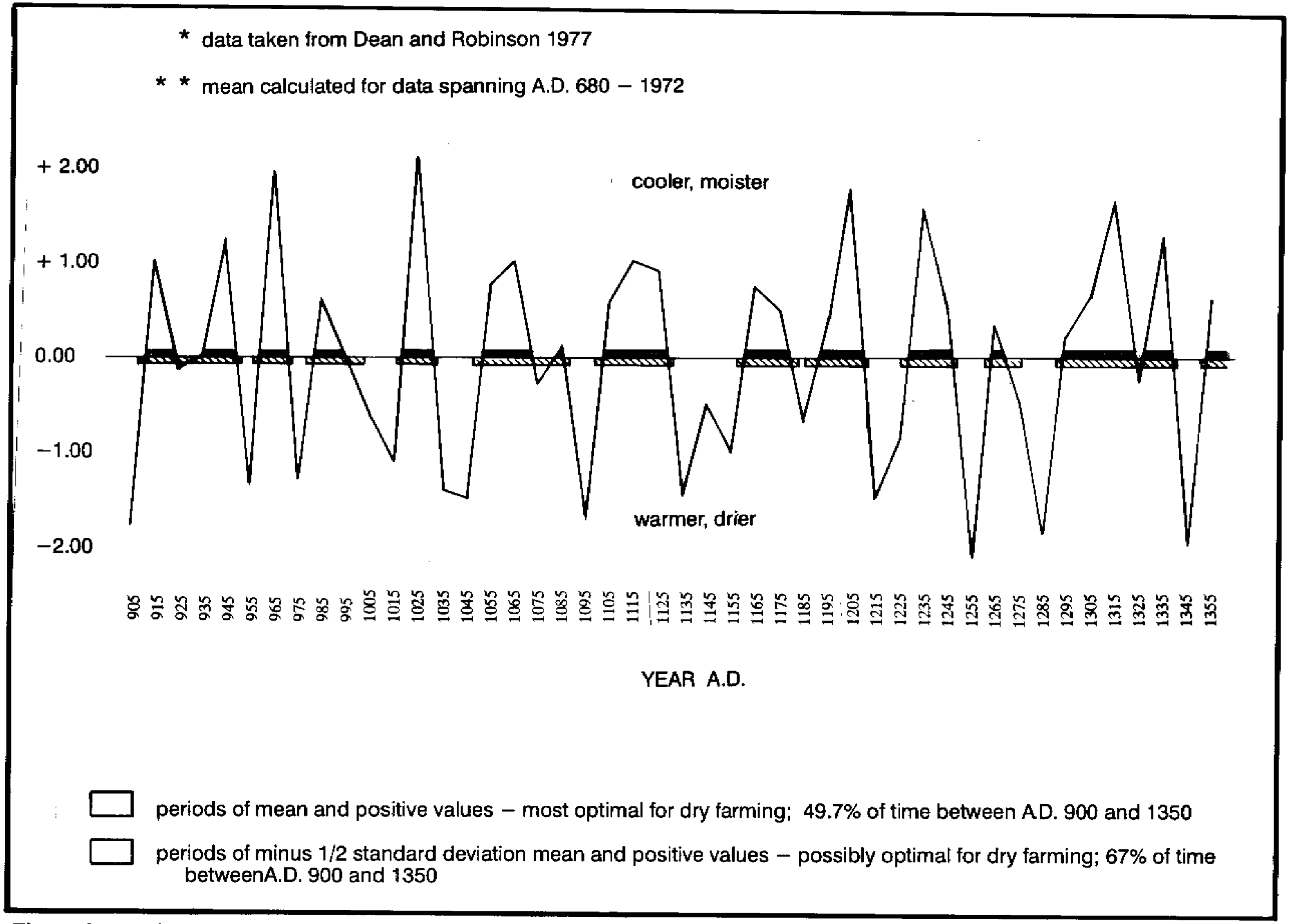


Figure 3. Dendroclimatic profile, Belen area, A.D. 900-1350.

Geology and Soils

The local surface geology is Quaternary in age (Dane and Bachman 1965). The Rio Grande floodplain, west of the site, consists of alluvial soils. The site rests on undivided deposits of the upper part of the Santa Fe group. Pediment, terrace, and other deposits of gravel, sand, and caliche comprise the second terrace.

The soils of the first terrace belong to the coarse-loamy, mixed, thermic Pajarito series (Pease 1975). In the site area, the soil is Pajarito Loamy Fine Sand, a well-drained mixed alluvium on slopes of 0 to 5 percent. The surface layer is 33 cm (13 in) of light brown loamy fine sand underlain by a 18 cm (7 in) subsoil of light brown fine sandy loam. The substratum of light brown fine sandy loam and loam, which reaches an effective rooting depth of 150 cm (60 in), has a few to common threads or soft masses of lime. Permeability of these soils is moderately rapid, runoff is slow, and available water capacity is 18-21 cm (7-8.5 in). The arable potential of these soils is fairly good, though moisture availability during dry years would be poor because of the sand component. Associated soils include Wink, Caliza, and Bluepoint series.

Hydrology

The Rio Grande is a major perennial water course having seasonally variable flow. Although today it is largely controlled by a series of dams, and much of the water is taken off for irrigation agriculture during the growing season, it was once famous for its devastating, almost yearly floods (Sargeant 1987).

The small drainage that passes immediately north of the Belen Bridge site carries water only during heavy local rains and dries up soon thereafter. However, its bed is quite sandy, and its water-retaining capability would be fairly good, particularly in wetter than average years. Its watershed lies on the western margin of the second terrace and measures approximately 1 sq km.

Flora

Brown and Lowe (1980) categorize the vegetation of the Belen region as Semidesert Grassland of the Grassland formation. According to Kuechler (1964), the immediate site area was probably characterized by the saltbush-greasewood association of the Shrub component of Western Shrub and Grassland. Species present in the area today include galleta, black grama, mesa dropseed, sand dropseed, Indian ricegrass, sand sage, and broom snakeweed (Pease 1975). The Rio Grande Valley floodplain supports a variety of riparian species and is suitable habitat for migratory waterfowl.

Fauna

Numerous species of mammals are known in the Belen area (Findley et al. 1975). Species that would have been economically important to the prehistoric inhabitants include: desert cottontail, jackrabbit, spotted ground squirrel, black-tailed prairie dog, and Gunnison's prairie dog. Antelope, another animal of importance to prehistoric peoples, probably was also present in the grasslands east and west of the river valley.

The Belen-Socorro section of the Rio Grande lies along the Rio Grande Sub-Flyway and provides sanctuary for migratory birds (Ligon 1961:310). From 1940 to 1957, 264 species were recorded, 87 of which are nesting species. On one day late in December 1953, 60,736 individuals representing 76 species were counted. Economic species of potential importance to the site inhabitants that were sighted on that day include: Canada goose, snow goose, mallard, gadwall, pintail, green-winged teal, shoveler, common merganser, and Gambel's quail.

Numerous species of fish have been recorded for the Rio Grande (Koster 1957). Those of potential use to the site inhabitants include smallmouth buffalofish, river carpsucker, Rio Grande chub, flathead chub, blue catfish, flathead catfish, American eel, and warmouth bass.

CULTURAL SETTING

Previous Research

Archaeological research in the Belen region has been minimal. Surveys and several small salvage excavations have been conducted from time to time. Numerous sites were recorded by H. P. Mera and other staff members of the Laboratory of Anthropology during the 1930s (Mera 1935, 1940). In 1947 Edwin N. Ferdon and Erik K. Reed (1950) visited a Pueblo II-III pithouse site at Belen but were able to do little more than identify the ceramics and make observations on a partly exposed structure. Pipeline salvage excavations during the early 1950s exposed two small Pueblo III pueblos along the Rio Puerco west of Los Lunas (Fenenga 1956 and Fenenga and Cummings 1956).

In the mid-1950s, the Anthropology Club of the University of New Mexico excavated four Basketmaker III-early Pueblo III pithouses at a site 4.5 km (3 mi) north of Isleta (Vivian and Clendenon 1965). Starting in the mid-1950s, the University of New Mexico held its field school at the important Pueblo IV site of Pottery Mound on the Rio Puerco some 16 km (10 mi) northwest of Belen (Hibben 1955). In 1968, students from the University of New Mexico's Department of Anthropology responded to a call to Rio Grande Estates (now Rio Communities) to view a site disturbed by construction (Switzer 1968). One day's excavation revealed several adobe-walled rooms of a Pueblo III pueblo, but nothing more could be accomplished at that time.

During the 1970s and 1980s, archaeological activity increased dramatically because of federal laws and regulations regarding construction and land management. Surveys and limited excavations were conducted on water-control structures, pipelines, highway construction, and subdivision development. Some of the more significant projects to date include the sample surveys along Rio Puerco and Rio Salado, west and southwest of Belen (Wimberly and Eidenbach 1980) and the excavation of Sevilleta Shelter, several kilometers south of Belen (Winter 1980). It was not until the publication of the Rio Abajo survey report, however, that a culture history was established for the region (Marshall and Walt 1984).

In summary, archaeological work in the Belen region has invariably been sporadic and limited in scope. Though a start has been made in defining the basic culture history and chronology, our data for all periods are minimal. Much work will have to be done to verify and expand upon the cultural scheme devised by Marshall and Walt (1984). Once this has been accomplished, serious inroads can be made on the questions of subsistence adaptation, social and economic development, external relations, and culture process and change.

Culture History

Marshall and Walt (1984) define several prehistoric and historic periods and phases for the Rio Abajo. While the Belen area is not, strictly speaking, within the Rio Abajo, it is sufficiently close (about 16 km, or 10 miles) that the broad cultural outline should be applicable. The Belen Bridge site is a ceramic-period occupation belonging to the Late Elmendorf phase. Only a brief mention will be made of the other periods and phases except for data and observations pertinent to its interpretation. The reader is referred to Marshall and Walt (1984) for a more detailed treatment.

Ceramic-period developments leading up to the Late Elmendorf phase begin with the Basketmaker III manifestation called the San Marcial phase (A.D. 300-800). San Marcial sites are small and composed of pithouses for habitation and surface structures for storage. The sites are situated along the Rio Grande and represent the first agriculturally linked, essentially sedentary existence in the region. Ceramic manufacture included several Mogollon utility types and San Marcial Black-on-white. Anasazi wares such as Lino Gray are a minor component of the assemblage.

During the Tajo phase (A.D. 800-950 or 1000), settlement content, size, and pattern change little. More sites are found, and the settlements extend further north along the river. The ceramic complex is dominated by Pitoche brown ware, with small amounts of Mimbres Black-on-white and Elmendorf Black-on-white. Early Tajo assemblages include small amounts of Red Mesa-style black-on-white, and later ones have Gallup and Puerco-Escavada-style black-on-whites. Lino and Kana-a gray wares are the utility types, and corrugated types are absent.

The Early Elmendorf phase (A.D. 950 or 1000-1100) is distinguished by the first real increase in site size and a tendency towards aggregation. Pithouses are still present, but an increase in site size is attributable mainly to increased surface room counts. Pitoche brown ware continues to dominate the assemblage, and Elmendorf Black-on-white becomes the major painted ware.

The Late Elmendorf phase (A.D. 1100-1300) is characterized by continued coalescence of the population and a tendency for placement of large sites in defensible positions. Small sites remain in locations similar to those of previous phases. Though occasional pithouses are present, pueblo-style architecture clearly dominates. Pottery continues to be dominated by Pitoche brown ware and Elmendorf Black-on-white. However, a number of intrusives are found, notably Chupadero Black-on-white, Socorro Black-on-white, Los Lunas Smudged, and several of the White Mountain red wares, especially St. Johns Polychrome.

The Ancestral Piro (A.D. 1300-1540) and Colonial Piro (A.D. 1540-1680) phases are marked by the coalescence of previous trends in settlement characteristics, the inception of glaze pottery production, the coming of the Spaniards, and abandonment of the region when most of the population moved south with the Spaniards ousted during the Pueblo Revolt. Following the Reconquest of 1692, the Rio Abajo was resettled by people of Spanish decent, the original Indian populations having remained in the El Paso del Norte region.

PROJECT OBJECTIVES

The testing and evaluation phase and subsequent excavation phases of the Belen Bridge project evolved as emergency activities. Consequently, a formal research design was not developed until the laboratory phase. The dearth of information on the prehistory of the Belen region leaves the field of research questions wide open; we must start with the most basic ones: culture content and dating. As a result of field observations during excavation and preliminary examination of the artifacts, several research objectives were identified:

1. To describe the architecture and material culture in sufficient detail to constitute an accurate record for comparative purposes.

2. To delineate the intrasite spatial organization with respect to the structures and extramural features and their functional and temporal relationships. Cursory examination of the site map shows differential placement of the structures, the large pits, and the smaller pits and firepits.

3. To reconstruct the subsistence base through the analysis and synthesis of floral and faunal data recovered by screening and selective soil sampling.

4. To analyze and assess the data for site function and duration. Structure types, variability, frequency, and interrelationships; and artifact types, variability, frequency, and distribution with respect to the structures and site features will be vital in these analyses.

5. To use as many techniques as possible to establish confident dating for the occupation(s), including absolute techniques (radiocarbon, archaeomagnetic) and relative techniques (ceramic cross-dating, sherd/vessel matching and correlation, stratigraphy, variable trash deposition).

6. To assess the Belen Bridge findings with respect to the expectations outlined by Marshall and Walt (1984) for the Late Elmendorf phase of the Rio Abajo province.

7. To compare the Belen Bridge findings with all pertinent manifestations outside the Rio Abajo where useful functional and temporal relationships can be identified. Synchronic and diachronic perspectives will be investigated. The comparisons will focus on architecture, subsistence, and ceramics. Because of the potential breadth of such studies, they will be abbreviated here with the major objective of establishing perspective.

8. To follow up any major problems discovered during the excavation or subsequent analyses. One such problem is the relative abundance of what are presumed to be Grants and Jemez obsidians. The impression gained in the field is that the Grants type is more abundant, even though it must have been imported. Jemez obsidian, a superior glass for knapping, reached Belen and beyond by water transport down the Rio Grande. While these materials are fairly distinctive to the unaided eye, it is necessary to test a number of pieces chemically to confirm their identity.

A second problem, potentially related to the first, is the high frequency of St. Johns Polychrome recovered from all of the major proveniences at Belen Bridge. While Marshall and Walt (1984) use the presence of this type in defining the Late Elmendorf phase, their comments indicate that its frequency at Belen Bridge is unusually high, raising the possibility that the occupants had special access to this "status" pottery. One possible explanation involves the Pueblo IV site of Pottery Mound. Located several kilometers northwest of Belen, Pottery Mound is known to have been a focal point on a major east-west trade route 50 to 100 years after the abandonment of the Belen Bridge site (Hibben 1955). However, virtually nothing is known about how and why that trade route came into existence. The Belen Bridge data give us the opportunity to look at conditions leading up to the development of Pottery Mound and the trade system.

THE SITE AND EXCAVATIONS

As first recorded, the Belen Bridge site was a scatter of sherds and lithic artifacts exposed in the bottom of the Manzano Expressway bar ditch. The surface of the bar ditch at the time of the project was 50 cm lower than the nearby undisturbed surface and the surface of the expressway. Because of flooding from the nearby drainage, the bar ditch had been widened to create a berm along the north side, thereby exposing more of the site. Phase 2 excavations under the expressway showed the site to extend southward up to, and perhaps under, the blacktop of the Baca dealership driveway and parking area. This blacktop, although within in the new right-of-way, was not removed. Work was confined to proposed new construction areas, so we were unable to determine whether or not archaeological remains exist under the dealership driveway.

Except for a small, thin scatter of lithic artifacts and a few sherds on the surface between the berm and the drainage, there were absolutely no other indications of the site. The sandy soil and mesquitegrass cover on the gentle westward slope simply blended in with the surrounding terrain and vegetation. Normally, architectural remains are expected on the terrace edge overlooking the valley, but LA 53662 was 200 m east of the terrace edge, bordering the east side of the Rio Grande Valley.

During testing and evaluation, limited surface collections were made according to a grid, and eight backhoe trenches and two hand-excavated strip trenches were dug to determine the nature and extent of that portion of the site lying north of the Manzano Expressway. These activities exposed portions of three pithouses (Features 10, 14, and 20), an extramural pit (Feature 16), and an extramural hearth (Feature 4).

During the two excavation phases, selective surface stripping and test pitting were used to discover site features (Figs. 4 and 5). The initial surface stripping of the site consisted of successive shallow passes with heavy equipment. Once stains were encountered, use of the machinery ceased. Stripping depth varied from 15 to 25 cm. To even out the excavation surface and discover and better-define features, most of the areas stripped by machine were then stripped again by hand to depths of 5 to 10 cm. None of the fill removed by machinery was screened. The fill removed by hand was turned over and spread out to look for artifacts, but it was not screened. Artifacts were sacked by general provenience according to recognized features (e.g., area between Features 10 and 14).

In the central part of the site, defined as the area of the bar ditch, all stripping was done by hand to control carefully for any features that might lie immediately below the surface layer. Stripping depth varied according to the contours of the bar ditch and, along the south edge, the thickness of the road bed material. Minimum and maximum stripping depths were 5 and 40 cm, respectively. Artifact provenience control was maintained through the original grid, and all fill, except road bed material, was passed through one-quarter inch screen.

Soil composition and compaction differed between the northern and central/southern parts of the site. In the northern zone, the subsoil was loosely consolidated sand with lower clay content. The cultural features in this zone readily collapsed upon extended exposure to the elements following excavation. The composition and general lack of consolidation probably stems from the proximity of the arroyo to the north edge of the site. In the central (and southern) zone, the clay content of the subsoil was higher and dried to a cementlike hardness. The change from one subsoil type to the other was abrupt, linear, and parallel to the arroyo. These subsoils are probably important for understanding the presence or absence of adobe linings on some of the cultural features described below.

Architectural and extramural features such as hearths and pits were indicated in all but one instance by a decided concentration of charcoal-stained, trashy fill. These trash deposits were almost invariably restricted to the uppermost 20 or 30 cm of the fill of these features, indicating remnants of a once widespread blanket of refuse covering this part of the site. Evidence of this refuse blanket was missing in virtually every part of the site, probably because of water and wind erosion of the deposits subsequent to abandonment. An extramural manifestation of the refuse blanket in the form of a 1 by 2 m deposit was encountered east of Pithouse 2 during stripping.

The excavation of individual features varied with circumstances in arbitrary units, natural/cultural units, or both. Hand tools were used to loosen the fill. All fill was passed through one-quarter inch screen. Flotation and pollen samples were taken as deemed appropriate. Recording was done on standard Museum of New Mexico forms, and mapping was performed with the plane table and alidade. Once analysis was completed, the collections were sent to the Archaeological Repository of the Museum of New Mexico.

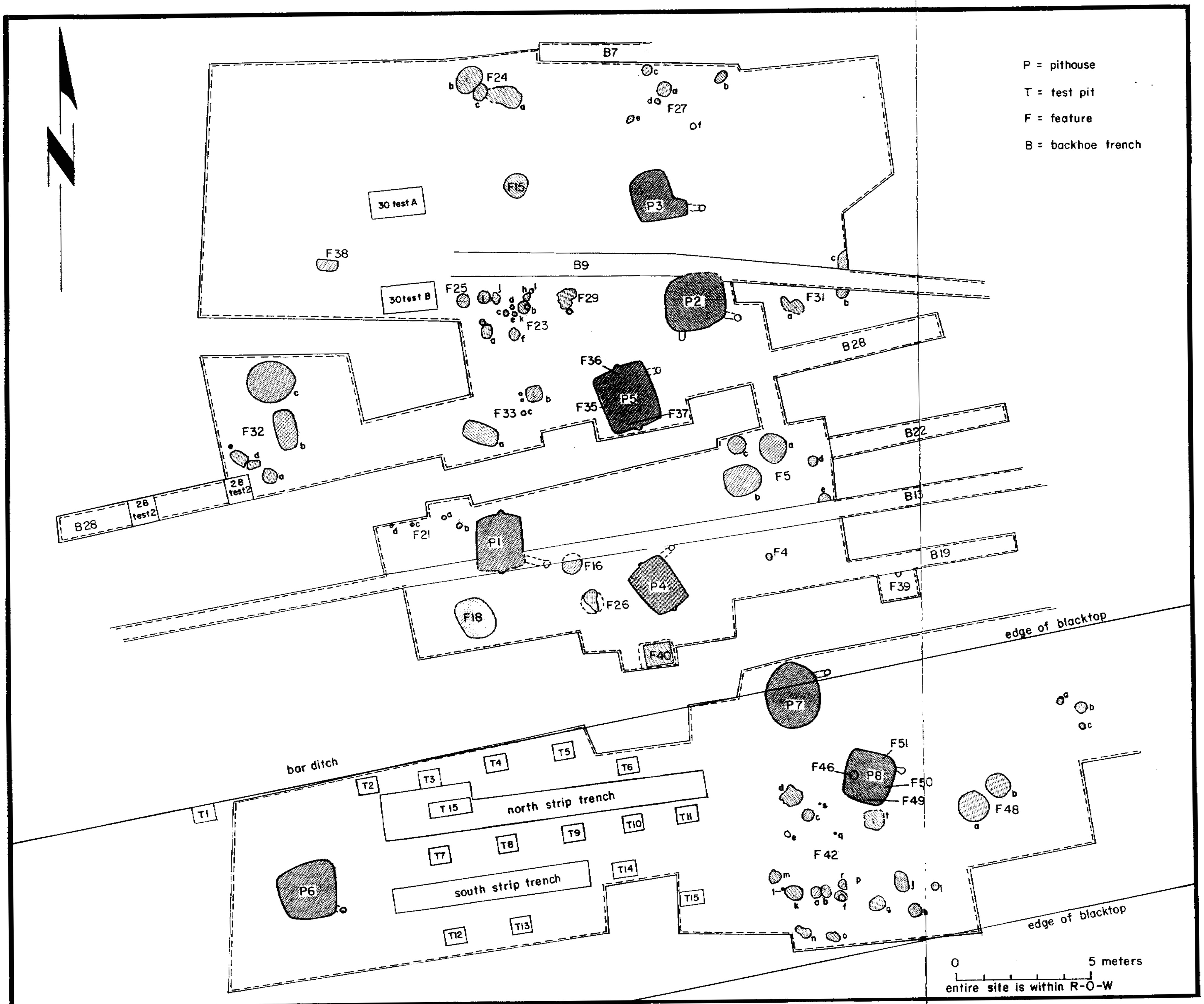


Figure 4. Site map, LA 53662.

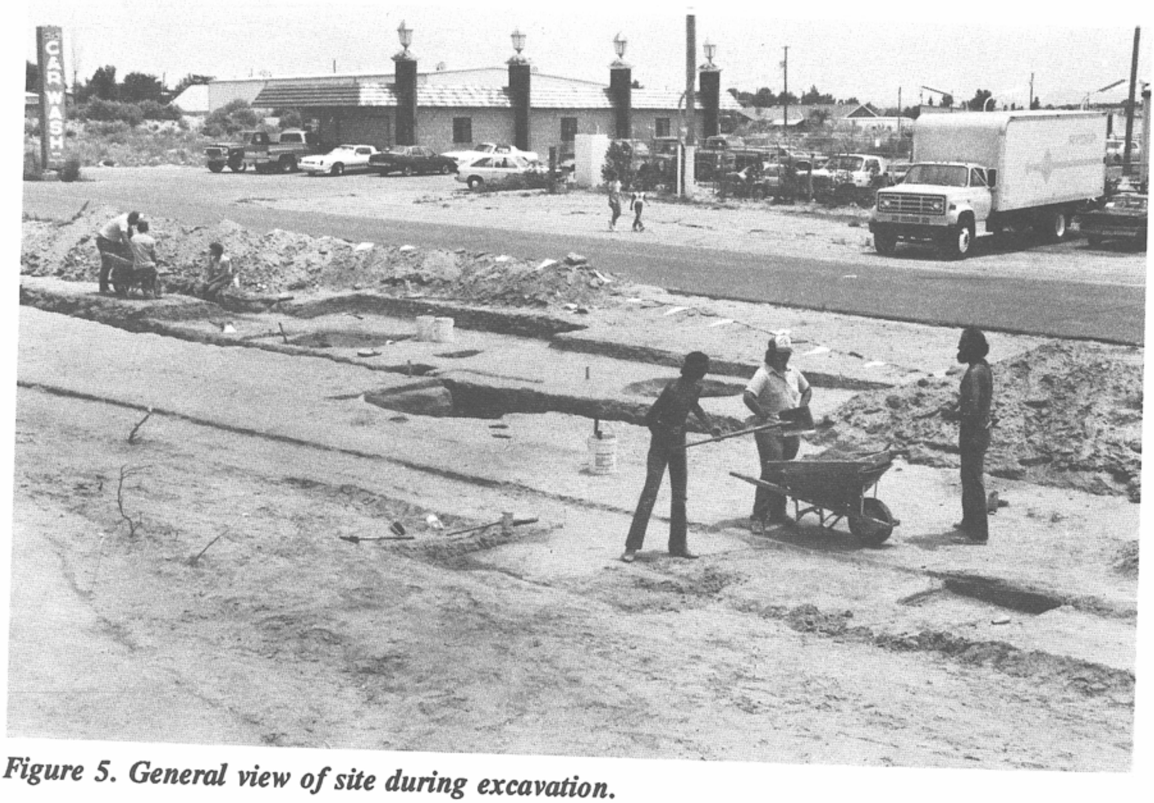


Figure 5. General view of site during excavation.

Pithouses

Eight small pithouses were excavated at the Belen Bridge site. Floor plans vary: rectangular (N=3), square with rounded corners (N=3) and sides, oval (N=1), and boot-shaped (N=1). Sizes range from 1.42 by 1.82 m to 2.10 by 2.46 m. The floors and walls of most of the structures were plastered with adobe.

The basic complement of floor features in each pithouse consisted of a hearth (usually placed in a corner or against a wall), a ventilator that exited eastward through a wall from a corner or the end of the structure, and a set of roof-support postholes. Only Pithouse 3 lacked roof-support postholes. Pithouse 2 had two hearths and two ventilators that probably were not used simultaneously. No deflectors were present, though some structures had pairs of small-diameter holes in the proper position for such.

Other floor features varied from structure to structure. These included ash pits, ladder holes (?), and small storage pits. In Pithouse 5, a truncated adobe cone was imbedded in the floor.

The pithouses had two-post (N=5) and four-post (N=3) roof-support systems. Pithouse 5 originally had a four-post system that was later remodeled to a two-post system. Pithouse 3 lacked interior postholes.

The fills of the pithouses varied in the presence or absence of observable stratigraphy, the amount of heavily charcoal-stained fill and its vertical distribution, and the amount of trash (broken artifacts and manufacture debris).

Only Pithouse 4 had heavily charcoal-stained, stratified fill from floor to surface. The north half of the fill in this structure was excavated in arbitrary levels, and the south half was excavated according to the stratigraphy. Care was exercised to segregate rodent-disturbed fill from undisturbed fill.

The fills of Pithouses 1, 3, and 7 were also stratified. Each had one or more strata of trash (heavy charcoal stain with numerous artifacts) and one or more light-colored strata bearing only small numbers of artifacts. Pithouse 1 had two trash strata, a thin (10-20 cm) horizontal one just above the floor and a thicker horizontal one at the top of the fill. Pithouse 3 had one thick horizontal trash stratum at the top of the fill. Pithouse 7 had three rather thin strata of trash. The uppermost stratum was horizontal and located at the top of the fill. The other two were situated in the lower half of the fill and had a downward dip from south to north.

The fill of Pithouse 2 was stratified but lacked dark trash units. The fill consisted of two nearly equal units, an upper coarse-textured one and a lower fine-grained one. Artifacts were fairly common in the upper unit.

Pithouses 5, 6, and 8 lacked trash and stratigraphy altogether. Human burials were found in Pithouses 5 and 8.

Pithouse 1 (Feature 14, Figs. 6 and 7)

Shape and Size. Pithouse 1 was rectangular with squared corners and a ventilator extending eastward from the southeast corner. The dimensions were about 2.00 m north-south and 1.65 m east-west; the south wall had been destroyed by backhoe trenching, precluding accurate measurement of the north-south dimension. The pit had been dug at least 1.15 m into native soil, and the floor was 1.25 m below the modern surface (bottom of the expressway bar ditch).

Construction. The original pit was dug to an unknown depth below the aboriginal ground

Figure 6. Pithouse 1.

surface. The initial size of the pit was approximately 2.20 by 2.00 m, and the corners were rounded. After a pit of the desired size and shape was created, the floor was prepared, followed by the construction of the walls. Thus, the floor went under the walls rather than curving up to meet them. Postabandonment rodent intrusions severely damaged most of the wall/floor junctures, thereby exposing the construction sequence. The highest remaining wall was 1.25 m above the floor.

Walls. The walls were made by packing 20 to 35 cm of sandy adobe against the original pit sides, as described above. The nearly vertical wall surfaces were then smoothed to a slightly undulating but essentially flat finish. The three remaining walls were straight and met in sharply defined corners. The approximate position of the south wall could be estimated from the position of the south roof-support posthole and wall groove. The only wall features were grooves for the main roof support posts (see below).

Floor. The floor was the leveled, trampled, or smoothed bottom of the original pit. It may or may not have been plastered with a few millimeters of sandy adobe.

Two holes for roof-support posts were found one each in the centers of the north and south walls. The posts were set in holes and grooves in the walls. The north hole measured 17 by 22 by 30 cm, and its wall groove was 14 cm wide and 15 cm deep (into the wall). The south hole measured 18 by 20 by 27 cm, and its partially destroyed wall groove was 15 cm wide by 5 cm deep. Neither the holes or the grooves were plastered. Judging by the depth of the groove and placement of the north posthole, it is possible that the post was entirely recessed within the wall and plastered over to conceal it. However, rodents had burrowed into the holes and the grooves, destroying parts of these features, disturbing the

Figure 8. Pithouse 2.

with well-rounded corners and two ventilators, one extending eastward from the southeast corner and the other extending southward from the southwest corner. The dimensions of the structure were about 2.00 m north-south, 2.10 m east-west. Most of the north wall had been destroyed by the backhoe, precluding accurate measurement of north-south dimension. The depth to floor from modern surface was 1.30 m, and the highest remaining wall was 90 cm.

Walls. At the time of excavation the walls were in bad condition, evidently as the result of erosion after abandonment. It was unclear whether adobe wall material had been placed against the faces of the original pit as in Feature 14. In plan view, all four walls were slightly bowed outward.

An unplastered niche was dug into the south wall at floor level near the southeast corner. The opening was 30 by 19 cm, and the inside dimensions were 41 by 23 by 25 cm.

Floor. The floor was mainly the original pit bottom, compacted through use. The central area had what appeared to be a thin (1 to 3 mm) adobe plaster on it, probably to fill in a depression developed through constant traffic. The floor, essentially flat and level, curved up slightly to meet the walls.

The roof was supported by four posts set into unplastered holes in the corners. The holes measured as follows: northeast, 15 by 14 by 14+ cm; southeast, 14 by 11 by 26 cm; southwest, 13 by 14 by 18 cm; northwest, 14 by 12 by 20 cm.

Hearth 1, a deep D-shaped basin next to the south wall measured 39 by 33 by 23 cm and had a thin (3 to 5 mm) adobe plaster. It was well-burned but contained almost no charcoal or ash at the time of excavation.

Hearth 2, a deep, unplastered oval basin was next to the west wall. It measured 38 by 33 by

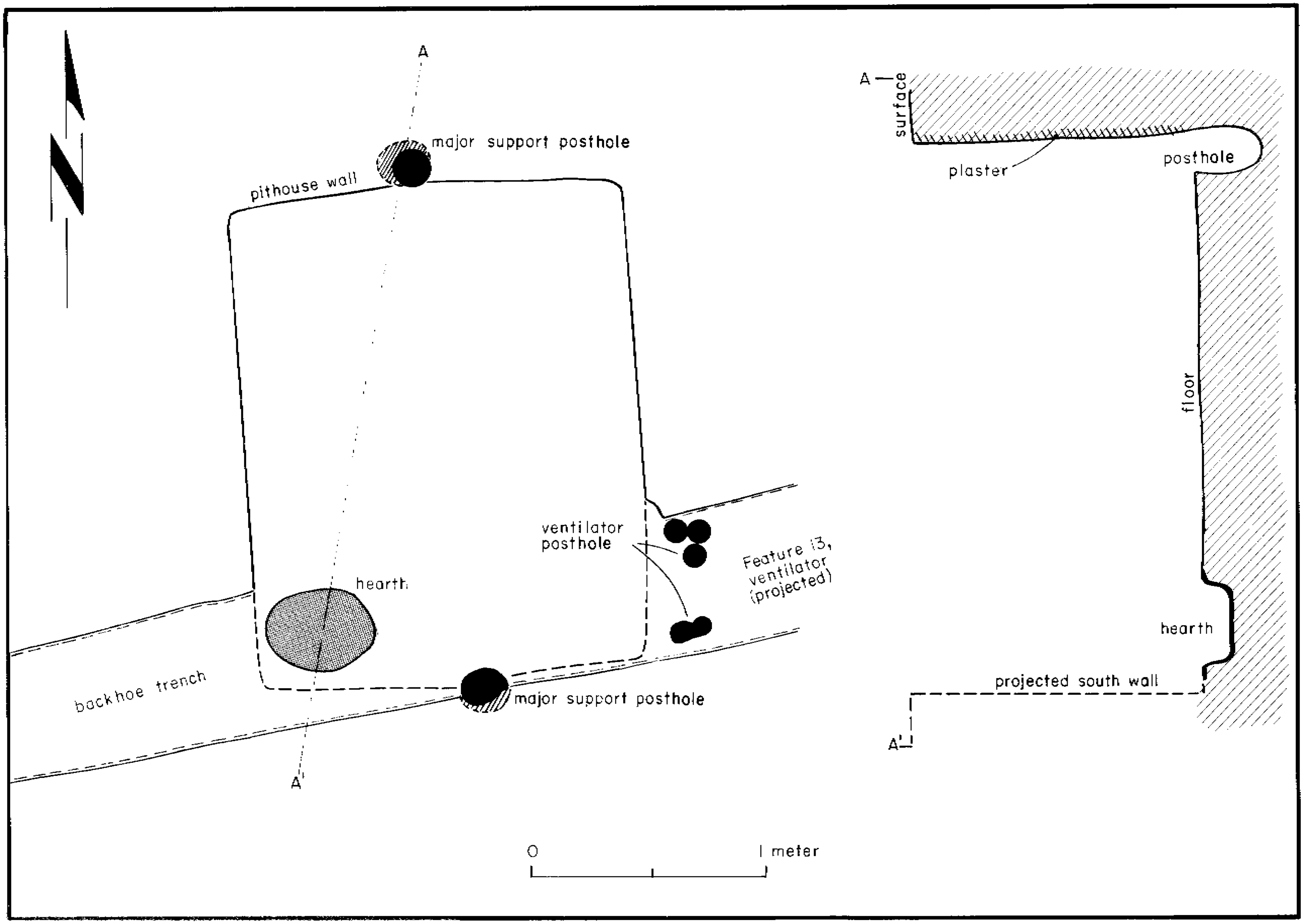


Figure 7. Plan and profile of Pithouse 1.

fills, and partly obscuring the evidence.

An oval hearth with its nearly flat bottom, slightly outsloping sides, and low coping was placed in the southwest corner of the structure. It was well plastered and retained ridging left by unobliterated finger marks. Its dimensions were 44 by 35 by 12 cm. Its sides and bottom were well burned, and the fill was charcoal-stained. The nearby wall was reddened by the flames.

Ventilator. The ventilator entered the structure at floor level in the southeast corner. Though it was mostly destroyed by backhoe trenching, remnants of small post sockets in the caliche marked its entry, and the faint suggestion of the south edge of the shaft was noted in the appropriate location of the south face of the backhoe trench. The two groups of small posts were spaced 30 cm apart, indicating the maximum vent opening size. The three postholes in the northern group and the two posts in the southern group were all about the same size, 9-10 cm in diameter and 7-9 cm deep.

Roof. The only evidence of a roof was the two main support posts and several reed-impressed chunks of adobe. Presumably, a single viga spanned the length of the structure, and side walls sloped downward to the margins of the structure, giving the roof a gabled shape. However, a search of the outside perimeter of the structure failed to locate post abutments.

Structure Fill. The fill was moderately well stratified into four units, designated Strata 1 through 4 from top to bottom. In general, the texture became coarser and the compaction decreased uniformly from top to bottom.

Stratum 1 was a compacted tan clayey silty sand that may have derived totally from the bar ditch construction and subsequent filling through natural processes. It contained small amounts of cultural materials and was difficult to excavate. Thickness varied from 10 to 30 cm.

Stratum 2 was a variably charcoal-stained clayey silty sand containing occasional small pebbles, cultural materials, and small flecks of charcoal. Its texture was fairly fine, but an absence of significant compaction made it easy to excavate. Thickness varied from 20 to 40 cm.

Stratum 3 was a tan clayey silty sand with a very light charcoal stain, adobe chunks that got larger and more numerous with depth, and some cultural materials. Small charcoal fragments were fairly common, and the fill was very easy to excavate. Thickness varied from 50 to 80 cm.

Stratum 4, essentially the floor fill of the structure, differed little from Stratum 3 except that its uppermost 5 cm was an ash and charcoal lens covering most of the central part of the structure. The trends of Stratum 3 continued in Stratum 4, such that the largest and most numerous adobe chunks were present in the latter. Thickness varied from 10-15 cm.

An assessment of the integrity of the fill is based on the sherds of eight vessels. The sherds of Vessels 17 and 50, including one with actual sherd fits, link the stripping, overburden, and Strata 1 and 2 proveniences. The sherds of Vessel 13 indicate contemporaneity of all three subunits of Stratum 3, and the sherds of Vessels 20 and 29 indicate that Strata 3 and 4 were interrelated. Combined, these five vessels suggest a basic division of the structure fill into upper (surface to bottom of Stratum 2) and lower (Stratum 3 to floor) depositional units. However, the sherds of Vessels 26, 31, and 62 link the upper fill with the middle and lower parts of Stratum 3, indicating mixing. This was expected because of the severe rodent destruction of the bases of the walls. While the primary division of the deposits into upper and lower temporal units may be valid, any interpretations and correlations must be tempered with the knowledge that postdepositional disturbance of the fill took place.

Pithouse 2 (Feature 10, Figs. 8 and 9)

Shape and Size. Pithouse 2 was roughly square,

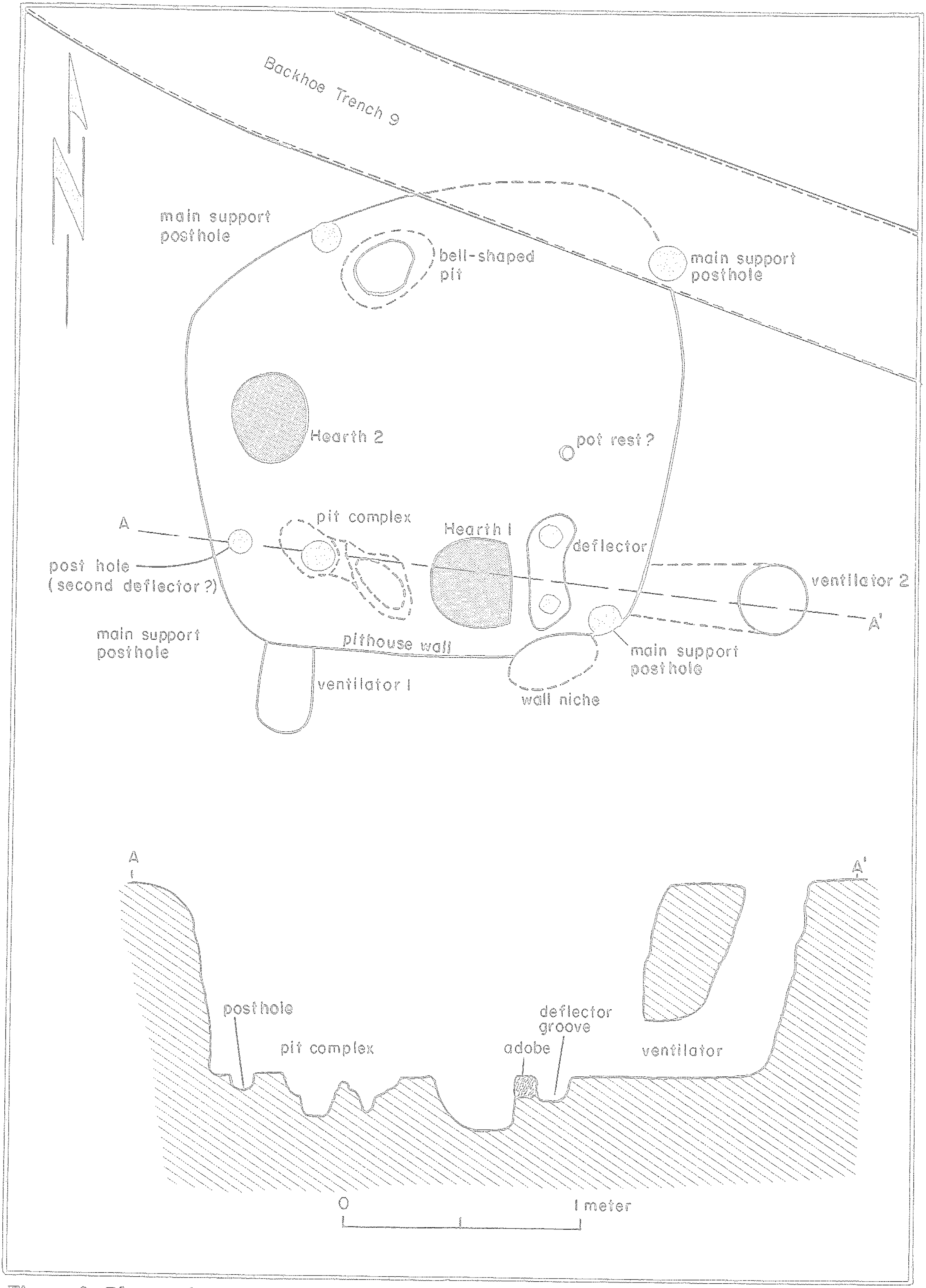


Figure 9. Plan and profile of Pithouse 2.

15 cm and was plastered over with 2 cm of brown sandy adobe. It had been little used, but the fill was moderately charcoal-laden at the time of excavation.

Deflector 1 (Hearth 1) had two vertical posts set in either end of a shallow groove. The unplastered groove measured 50 by 16 by 11 cm, the north hole was 11 by 10 by 23 cm, and the south hole was 8 by 10 by 15 cm.

A small posthole near the southwest corner and 20 cm west of the southwest roof-support post may have been part of a deflector for Hearth 2. The east support presumably was the southwest roof-support post. The deflector post was 10 by 10 by 7 cm.

A small, unplastered, bell-shaped pit along the north wall near the northwest corner measured 25 by 23 cm at the mouth and 40 by 28 cm at the bottom. It was 38 cm deep.

A small, shallow depression (8 by 9 by 2 cm) in the floor 25 cm north of the north post of Deflector 1 probably served to support round-bottomed pottery vessels.

A group of irregular pits around the base of the southwest roof-support post had been filled with nearly sterile, chunky adobe (?) and plastered over with 1 cm of brown sandy adobe. The group of pits, which measured 65 by 30 by 40 cm, appeared to be a series of construction errors made during the placement of the southwest roof-support post.

Ventilator 1. This ventilator belonged to Hearth 1 and entered the structure in the southeast corner at floor level. No internal shoring materials or plaster were noted. The dimensions were as follows: inside opening, 22 by 25 cm; tunnel length, 63 cm; shaft length (vertical), 86 cm; outside opening, 31 by 29 cm. A small (11 by 7 by 7 cm) drainage catchment depression was just inside the inside opening.

Ventilator 2. This ventilator belonged to Hearth 2 and entered the structure in the southwest corner at floor level. The entire vertical shaft opened into the structure, suggesting that a divider of perishable materials may have been installed to allow proper functioning of the ventilator. However, no evidence for such materials was noted. The dimensions were as follows: width at bottom, 20 cm; width at top, 34 cm; length at bottom (into wall), 28 cm; length at top (into wall), 38 cm.

Roof. The roof, supported on four posts set near the corners of the structure, was probably flat with sloping side walls. Aside from the postholes, the only other evidence of the roof were several pieces of reed-impressed adobe, part of the covering for the structural elements. The latter presumably included vigas, latillas, reeds, and adobe. The entry was probably via a hatchway through the roof, though no direct evidence of this was found.

Structure Fill. The fill of clayey silty sand contained chunks of roofing adobe, limited quantities of cultural materials (sherds, lithics, etc.) and small charcoal fragments. The fill was lightly charcoal-stained throughout but lacked obvious evidence of internal stratigraphy. The texture was generally chunky and easy to excavate.

The integrity of the fill is indicated by the sherds of Vessels 4, 7, and 51, which link the stripping, middle fill, and floor fill proveniences. Sherds from two of the vessels include matches. A high degree of rodent disturbance and/or relative contemporaneity of the various levels (i.e., rapid filling) may explain this "noise." Considering that the middle and lower portions of the fill yielded relatively few artifacts and lacked evidence of trash accumulation (charcoal-staining, stratification, etc.), rodent disturbance is the more likely explanation.

Pithouse 3 (Feature 17, Figs. 10 and 11)

Shape and Size. Pithouse 3, a boot-shaped room, had well-rounded corners and a ventilator

Figure 10. Pithouse 3.

extending eastward from the toe. The dimensions were as follows: main room, 1.82 m north-south by 1.42 m east-west; eastward extension, 0.6 m north-south by 0.46 m east-west. The depth of the floor below aboriginal surface was at least 1.24 m; depth below modern surface was 1.54 m.

Walls. The sides of the original pit were packed with 4 to 5 cm of clayey silty sand to make them vertical and then were plastered with up to 5 mm of sandy adobe. The walls in plan view were straight or bowed slightly outward.

A small niche or wall recess was located in the south wall of the eastward room extension and next to the ventilator opening. It measured 33 by 30 by 12 cm and was unplastered.

Floor. The bottom of the original pit was plastered overall with up to 5 mm of sandy adobe. A second partial plastering of 1 to 3 mm thickness was done in the northern part of the main room.

A well-made hearth in the southwest corner of the main room was nearly circular and measured 50 by 48 by 16 cm. Its clay coping was 15 cm wide and 5 cm high. The hearth was filled with ashy, charcoal-stained soil.

Two small postholes and their associated wall grooves were at the east end of the eastward room extension and on either side of the ventilator opening. The north hole measured 10 by 10 by 11 cm and its wall groove 10 cm across by 6 cm deep (into wall). The south hole was 13 by 17 by 10 cm and its wall groove 16 cm across and 7 cm deep. The two grooves diverged from one another from bottom to top. The two poles may have been part of a ladder or a perishable deflector. The holes were not plastered, but the grooves were well-smoothed, plastered, or both.

Ventilator. The ventilator entered the east end

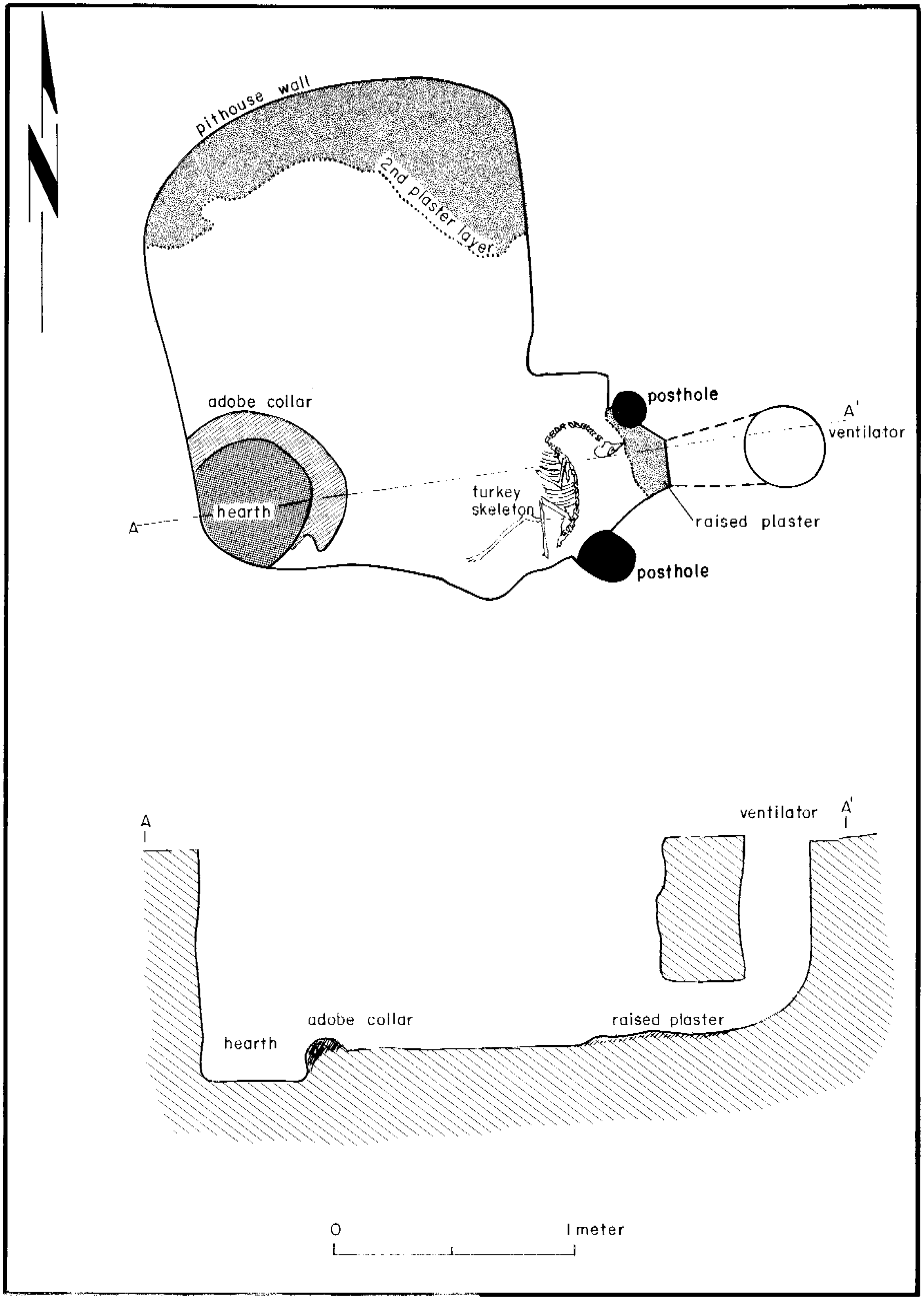


Figure 11. Plan and profile of Pithouse 3.

of the eastward room extension at floor level. The dimensions were as follows: inside opening, 25 by 27 cm; tunnel, 50 cm long; shaft, 72 cm long (vertically); outside opening, 32 cm. There was no finishing work (shoring, plastering, etc.) except for a small adobe ridge (3 to 4 cm high) just inside the interior opening, presumably to stop water from seeping onto the floor from the ventilator.

Roof. The only evidence of the roof were two to three dozen small pieces of adobe bearing reed and wood impressions, burned remnants of which remained in one of the chunks. The method of supporting the roof is unknown. Entry was probably down a ladder placed in the east end of the eastward room extension.

Structure Fill. The uppermost 25 cm of fill, starting 20 cm below the modern, undisturbed surface, consisted of densely packed adobe chunks, some with stick and reed impressions, in a soft, sandy matrix. The fill from there to the floor was essentially the same, though adobe chunks were fewer in number. Cultural materials and small pieces of charcoal, while present, were not particularly abundant, but they were spread throughout the fill of the main room and the eastward extension. The ventilator shaft, by comparison, contained trashy fill. Other than the obvious concentration of adobe in the upper fill, there was no stratification as such. An articulated turkey skeleton lay on the floor of the eastward room extension.

The integrity of the fill can be assessed by using the sherds of four vessels. The sherds of Vessels 1 and 2 indicate that the strip zone, upper fill, and middle fill are essentially equivalent, perhaps largely because the main part of the fill was excavated in arbitrary levels. Little stratigraphy was noted in the faces of the test pit. The sherds of Vessels 47 and 48, through actual fits, link the floor fill and the floor contact proveniences. Thus, two meaningful fill units can be postulated: a lower one, which includes the floor and the 10 cm of fill above it, and an upper one, comprising all the rest of the fill up to the surface.

The skeleton of a mouse, apparently a burrow death, and the articulated turkey skeleton were found on the floor in the southeastern part of the structure. The presence of a mouse and slight displacement of a couple of the turkey bones indicate that at least some rodent burrowing has disturbed the deposits. However, the disturbance appears to have been minimal.

Pithouse 4 (Feature 20, Figs. 12 and 13)

Shape and Size. Pithouse 4, a rectangular structure, had fairly well-rounded corners and a ventilator extending eastward from the northeast corner. The dimensions were 1.92 m north-south by 1.60 m east-west. The structure had been dug at least 1 m into native soil. The floor was 1.23 m below present surface.

Walls. The walls were almost vertical and varied from straight to slightly bowed outward in plan view. The surfaces were well-smoothed and perhaps plastered with 2 to 3 mm of sandy adobe. The only wall features were a ventilator opening and a hearth recess (see below).

Floor. The floor was a thin adobe (?) plaster over native soil.

Two postholes and associated wall grooves for the main roof supports were located in the centers of the north and south walls. The north hole was 25 by 18 by 36 cm, and its groove was 20 cm wide and 22 cm deep (into the wall). The south hole was 28 by 21 by 45 cm, and its groove was 20 cm wide by 22 cm deep. Neither the postholes nor the grooves were plastered, though rodent damage could have destroyed evidence of finished surfaces. The north post was almost completely recessed into the wall and could easily have been hidden by a coat of plaster.

The hearth, in the northwest corner, was a well-made, plastered basin with a well-defined coping. The bottom of the hearth rested at floor level, indicating that the hearth had been made by placing the coping in the corner and then

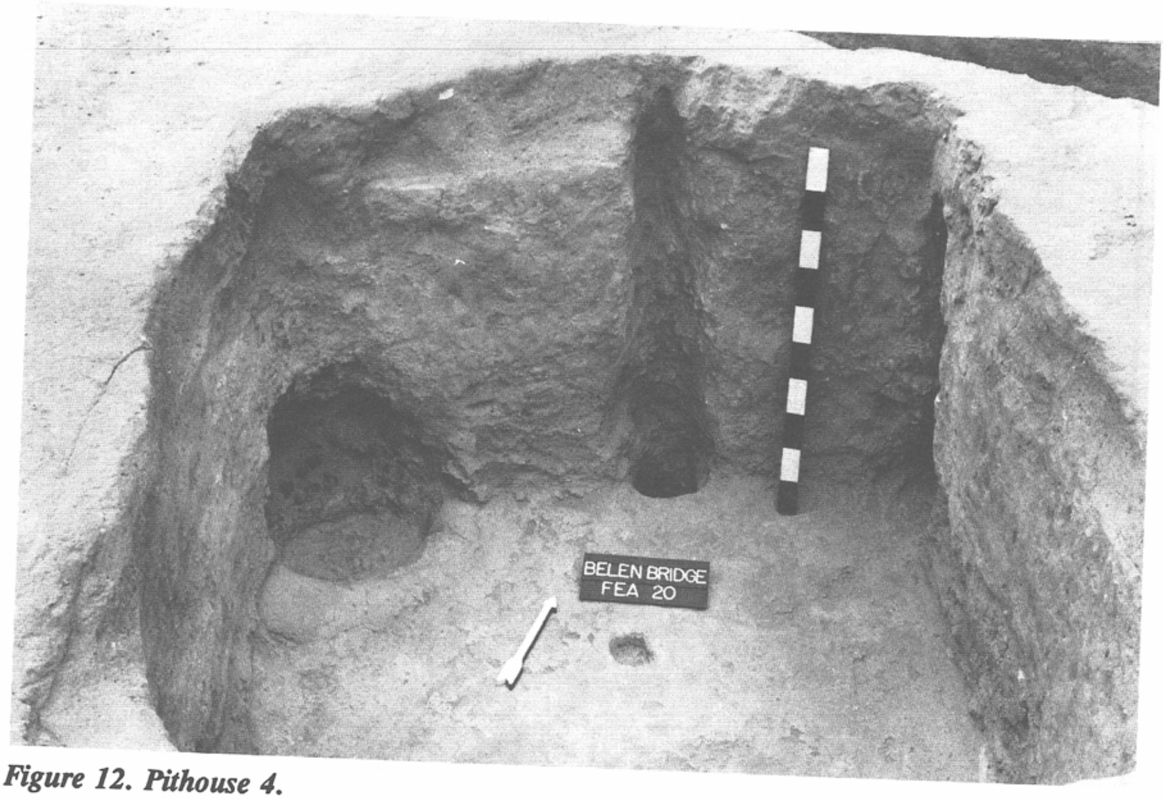


Figure 12. Pithouse 4.

plastering the bottom and sides to create a basin. The adobe coping was 12 to 16 cm wide and 8 to 10 cm high. The interior dimensions were 45 by 32 by 14 cm. The hearth had been so intensely used that the surface crumbled during cleaning. The fill was laden with charcoal stain, but the pieces of charcoal were small. The wall in the corner above the hearth was also intensely burned. The processes of continual heating, disintegration, and cleaning resulted in a cavity in the corner that was 60 cm wide, 36 cm high, and 12 cm deep (into the wall). At the time of excavation, the surface of the recess showed only slight sooting, and a number of pieces of burned wall surface were in the fill nearby.

What may have been a footing hole for a small auxiliary roof-support post (9 by 10 cm) was noted in the north central part of the floor. Depth was not recorded.

Ventilator. The ventilator shaft was destroyed by one of the backhoe trenches, and its opening into the structure interior evidently slumped prior to filling or was damaged by rodent intrusion. At the time of excavation, all that remained of the ventilator was the collapsed interior opening and tunnel. The original opening on the interior was about 23 by 26 cm, as suggested by remnant curvatures along the sides. Tunnel length was at least 40 cm, perhaps more. It entered the structure at floor level.

Roof. The gabled roof was supported by two main supports placed at either end of the structure. An auxiliary post set in the north-central part of the structure evidently lent additional support to the main beam, though it could also have been part of a deflector for the hearth. Numerous pieces of stick and reed impressed adobe in the fill indicate that the outermost two layers of roof were composed of these materials. Other construction details are lacking. Entry was through a hatchway in the roof, though its position could not be

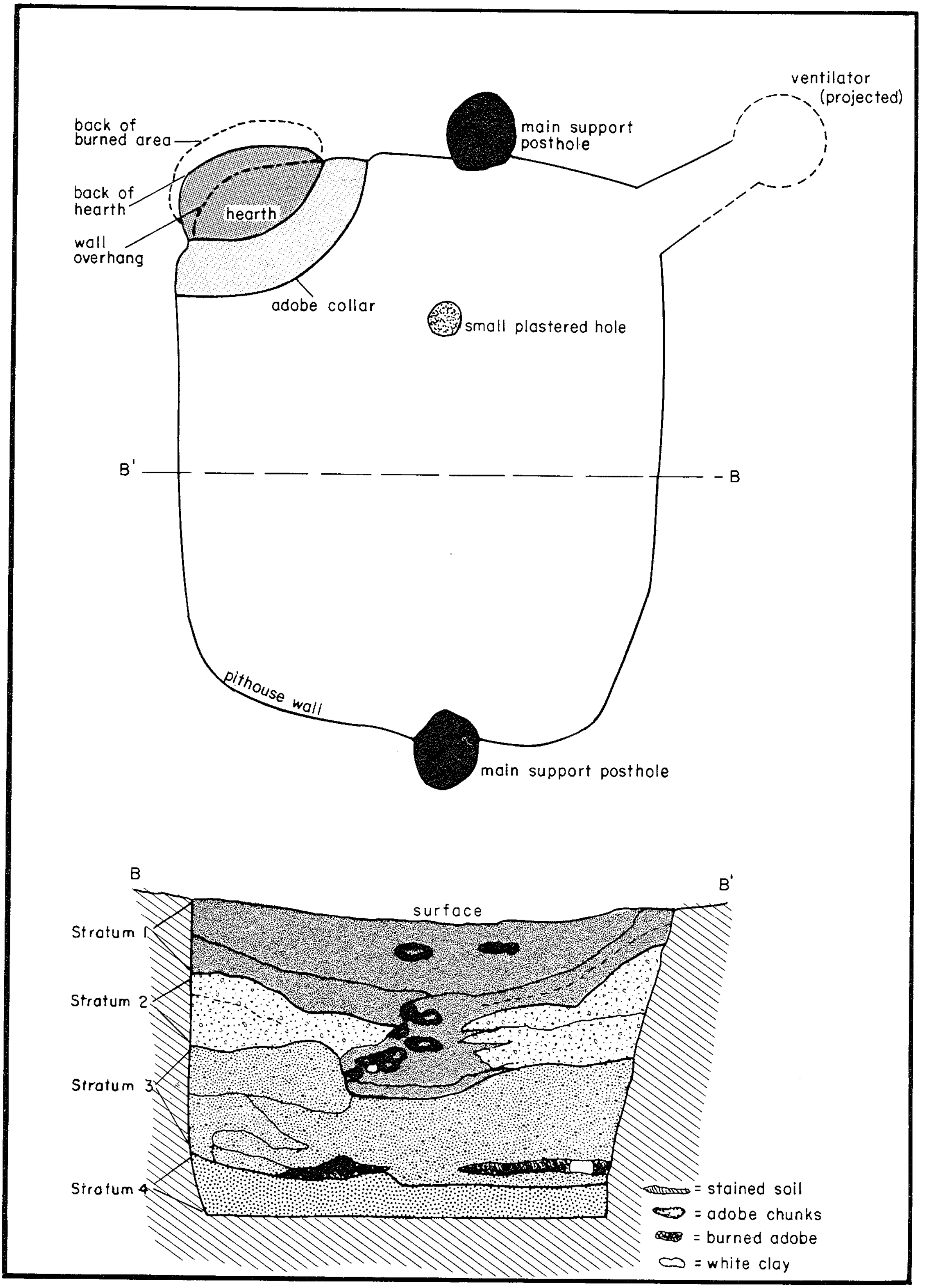


Figure 13. Plan and fill profile of Pithouse 4.

determined during excavation.

Structure Fill. The fill of this structure was well stratified and contained the most trash of any feature encountered at the site (Fig. 13). The refuse extended from the highest point of the remaining structure to the floor. Also evident was moderately severe rodent intrusions, especially in the central part of the structure and along the wall-floor juncture. The north half of the fill was excavated in arbitrary levels, and the south half was excavated according to the major stratigraphy, though microstratigraphy was present throughout. Extreme care was taken to segregate collections from the disturbed and undisturbed portions of the fill.

Stratum 1 was heavily charcoal-stained clayey sand containing a large number of sherds and bone, a few broken cobbles, a number of small chunks of charcoal, and a number of adobe chunks, some of which were burned. Thickness varied between 24 and 34 cm.

Stratum 2 was like Stratum 1 except it contained more sand and less charcoal stain (was lighter in color). Cultural materials were nearly as common as in Stratum 1. The thickness of Stratum 2 varied from 10 to 40 cm.

Stratum 3 was slightly darker clayey silty sand and contained large numbers of sherds, bones, lithic debitage, and artifact fragments (more than Strata 1 and 2) but fewer chunks of adobe and cobbles (had a finer texture). A thin, heavy charcoal lens marked the bottom of the stratum. Overall stratum thickness varied between 30 and 47 cm.

Stratum 4 contained numerous adobe chunks from the roof. Many were burned, and several had stick and reed impressions. The stratum was moderately charcoal stained and contained some cultural material. Stratum thickness varied from 15 to 20 cm.

Integrity of the fill can be assessed by the sherds of Vessels 3 and 10. Sherds from one suggest the linkage of Strata 2 and 3, while sherds from the other link Strata 3 and 4. Although rodent intrusion was noted in the center of the room fill, in the area of the ventilator, and along the bases of the walls, we believe that careful excavation successfully segregated disturbed from nondisturbed collections and that the indications for short-term filling of the structure are valid.

Pithouse 5 (Feature 34, Figs. 14 and 15)

Shape and Size. Pithouse 5 was rectangular with sharply defined corners and a ventilator extending east from near the northeast corner. The dimensions were 2.46 m north-south by 2.10 m east-west. The depth of floor below aboriginal surface was at least 79 cm, and the depth below modern surface was 1.20 m.

Walls. Wall preparation consisted of smoothing or perhaps plastering the original pit sides with 2 to 3 cm of sandy adobe. Wall openings other than the ventilator and roof-support wall grooves were absent (see below).

Floor. The floor had been well-smoothed or thinly plastered with sandy adobe. This structure had the most floor features, though at the time of abandonment, only the hearth, ash pit, and main roof-support postholes were open. All the rest had been plastered over.

Two sets of postholes and wall grooves were found in the centers of the north and south walls. The north hole was 11 by 13 by 35 cm, and its wall groove was 16 cm wide and 8 cm deep (into the wall). The south hole was pear-shaped and measured 8 to 13 by 12 by 10 cm, and its groove was 14 cm wide and 15 cm deep. None of these features showed evidence of plastering, and all had suffered from rodent intrusions. A low adobe coping (5 to 8 cm wide, 5 to 7 cm high) surrounded the south posthole, evidently to assist in keeping the bottom of the post in place.

Vertical posts had been set in each of the corners of the floor, though they had been pulled

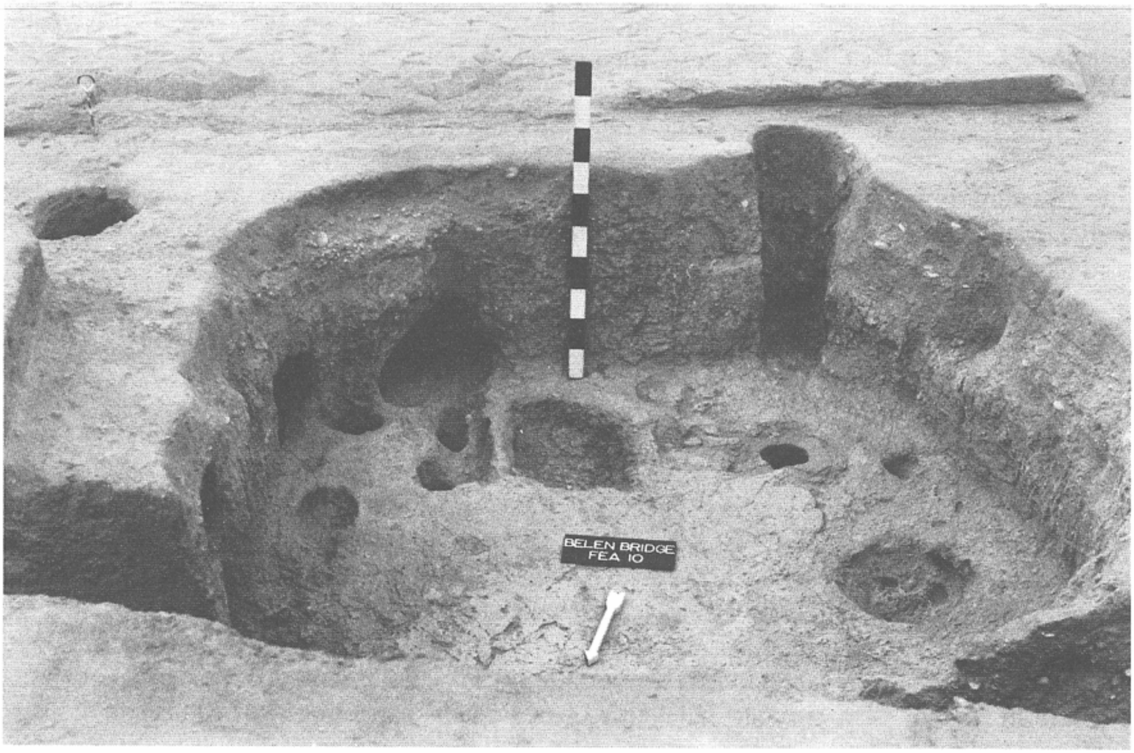


Figure 14. Pithouse 5.

and the holes plastered over prior to the abandonment of the structure. None of the holes were plastered or otherwise finished. The dimensions were as follows: northeast, 13 by 12 by 18 cm; southeast, 14 by 15 by 20 cm; southwest, 10 by 11 by 20 cm; northwest, 10 by 12 by 34 cm. The corners above the posts were slightly grooved, but unlike wall grooves described thus far, these grooves were finished in the same manner as the walls.

A posthole immediately west of the northeast corner post and along the north wall may have held a secondary roof-support post. It was 12 in diameter, 21 cm deep, and unplastered.

In the northwest corner, a circular, plastered basin hearth had a horseshoe-shaped coping and a roughly shaped sandstone slab placed vertically against the back side of the basin. The inside dimensions were 34 by 40 by 20 (depth) cm. The coping was 11 to 15 cm wide and 2 to 4 cm high. The slab was 23 by 15 by 3 (thick) cm. The fill was charcoal-stained clayey silty sand with moderate amounts of charcoal flecks and small fragments.

An ash pit immediately east of the hearth and along the north wall had inward-sloping upper sides and a deep basin bottom. This unplastered pit had an orifice diameter of 27 cm and depth of 19 cm. The fill was charcoal-stained clayey silty sand with a few small adobe chunks and pieces of charcoal.

A truncated, cone-shaped piece of adobe had been sunk into the floor, its top flush with the floor surface. The sides and top were purposefully shaped, but the bottom was slightly irregular. It was slightly burned red on the top and one side, and it rested on a thin (2-3 mm) layer of ash. Its purpose is unknown, but it may have been used to plug a hole. Its diameter was 15 cm at the bottom and 13 cm at the top, and its height was 10 cm.

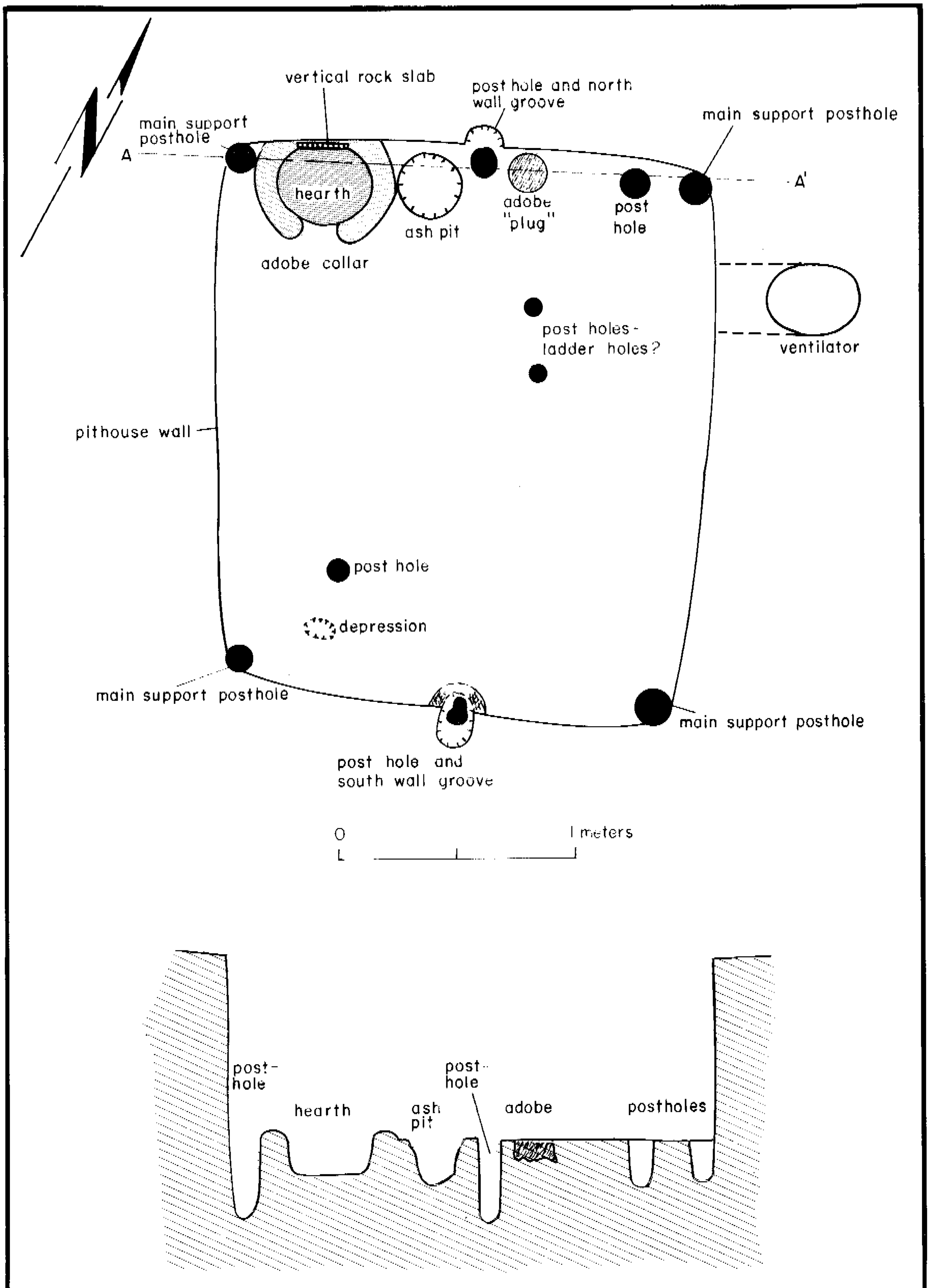


Figure 15. Plan and profile of Pithouse 5.

A pair of small postholes or pole holes in the north-central part of the room had been plastered over with a pinkish-buff clay prior to the abandonment of the structure. Their size, placement, and relationship to one another suggest they held the bottom of a two-pole ladder. The dimensions were as follows: north hole, 7 by 7 by 10 cm; south hole, 7 by 8 by 10 cm. Neither hole was plastered.

A small posthole near the southwest corner was paired with a shallow depression. The depression appears to have been caused by repeated scraping, perhaps caused by the bottom end of an unsecured ladder pole. Together, the posthole and depression may mark the location of a two-pole ladder. However, the posthole or pole hole had been plastered over prior to the abandonment of the structure. The dimensions were as follows: pole hole, 9 by 10 by 26 cm; depression, 9 by 13 by 1 cm. The hole was not plastered.

Ventilator. The ventilator entered the structure at floor level through the east wall near the northeast corner. The feature had no internal supports and was not plastered. The dimensions were as follows: interior opening, 29 by 27 cm; tunnel length, 26 cm; shaft length, 84 cm; exterior opening, 29 by 39 cm.

Roof. The structure may have had two different roofs. Both probably used the two main support posts in the centers of the north and south walls. The earlier roof was probably flat or nearly flat because it also incorporated posts set in each corner. Entry was through a hatchway in the roof. The second roof apparently used only the two main supports and therefore probably had a pitched roof. Entry was also through the a roof hatch. However, there is no way to determine which ladder location was used with which roof because both ladder locations were plastered over before the final abandonment of the structure. Aside from the floor features and an occasional piece of wood-impressed adobe noted in the fill, no other evidence of the roof construction was observed.

Structure Fill. The fill of this structure was essentially devoid of cultural materials and charcoal staining. In fact, the fill was so subtle that the presence of the structure was nearly overlooked. Three human burials (Burials 1-3; Features 35-37) were in the fill above the floor.

No partial vessels were present in the fill, making an assessment of integrity impossible. The presence of the three burials in such a small structure would have resulted in significant disturbance to a major portion of the fill. However, since none of the burials penetrated any closer to the floor than about 20 cm, it seems likely that the floor contact and floor fill artifacts were meaningfully associated.

Pithouse 6 (Feature 43, Figs. 16 and 17)

Shape and Size. Pithouse 6 was square with rounded corners and slightly rounded sides, and a ventilator extended east from the southeast corner. The dimensions were 2.12 m north-south by 2.06 m east-west. The original pit was dug at least 90 cm into native soil. The floor was 1.35 m below modern surface.

Walls. The walls were finished by smoothing the original pit surfaces. No wall features other than the opening to the ventilator were noted.

Floor. The bottom of the original pit was leveled and smoothed for a floor. Somewhat later, a 1 to 2 cm layer of adobe was spread over the west-central and northwestern areas to fill in low spots. Both the older surface and the newer one were blackened through use.

The roof was supported by four vertical posts, one set near each corner. The dimensions were as follows: northwest, 20 by 25 by 22 cm; northeast, 19 by 20 by 17 cm; southeast, 16 by 20 by 13 cm; southwest, 19 by 17 by 37 cm (floor opening 20 by 25 cm). None of the holes were plastered or otherwise finished except for the northwest one, which had been filled in to a level 25 cm below floor and layered with several dozen small pebbles

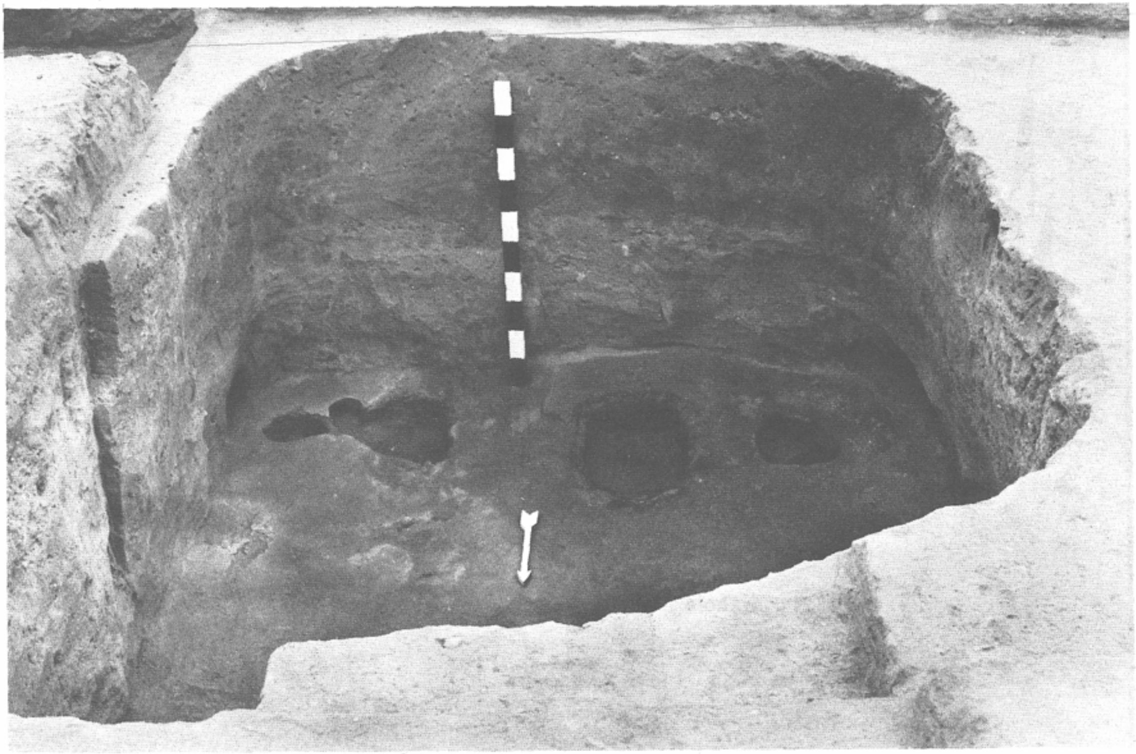


Figure 16. Pithouse 6.

to make a foundation for the post. The northeast and northwest postholes were plastered over.

A deep oval basin hearth in the southwest quadrant of the structure measured 40 by 34 by 16 cm and was moderately well burned. It is unclear whether it had been plastered.

A deep basin in the southeast corner was 28 by 27 by 18 cm and presumably served as a receptacle for ash and charcoal cleaned from the hearth. However, its fill of moderately charcoal-stained soil contained decidedly less charcoal than the fill of the hearth.

A large, deep floor pit in the north-central part of the structure measured 49 by 58 by 62 cm. The bottom half was plastered with a 1 cm layer of the same material into which it had been dug. The upper half, which penetrated a lens of sand and gravel, lacked plaster, probably because of bad adhesion and/or rodent disturbance. The fill was almost devoid of cultural material, and the pit was plastered over prior to abandonment of the structure.

Ventilator. The ventilator entered the structure at floor level in the south- east corner. No evidence for internal supports or plastering were noted. The interior opening at the time of excavation was closed by a roughly hexagonal slab, presumably to keep out drifting sand. The dimensions were interior opening, 17 by 18 cm; tunnel length, 53 cm; shaft length, 93 cm; exterior opening, 19 by 18 cm.

Roof. Other than the postholes and numerous small pieces of adobe in the floor fill, no direct evidence of the roof or its construction details was found. Entry was probably by ladder through a roof hatch, but no landing area or ladder holes were identified in the floor.

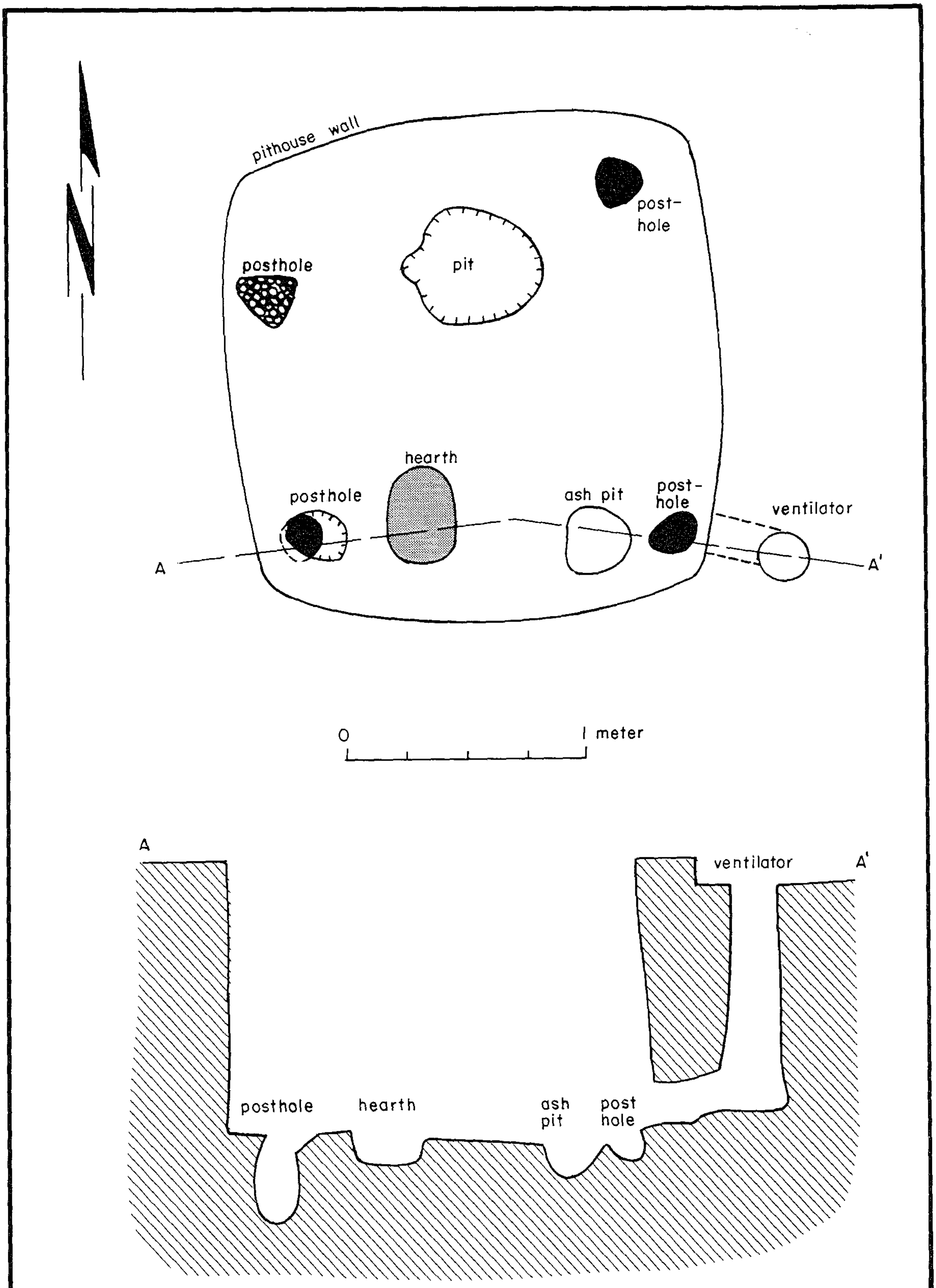


Figure 17. Plan and profile of Pithouse 6.

Structure Fill. The fill was almost devoid of cultural materials. Subtle charcoal stains occurred in discontinuous lenses throughout the fill. Sherds, lithic debris, and animal bone were rare, and small pieces of adobe from the roof were fairly common, especially in the lower fill. Occasional, unmodified river cobbles had to have been brought into the site by the inhabitants.

No partial vessels were present with which to assess the integrity of the fill. Many of the sherds found in the middle and upper fill were within or near rodent disturbances, rendering their associations suspect. Whether the rodents got to the lower fill was not clear.

Pithouse 7 (Feature 45, Figs. 18 and 19)

Shape and Size. Pithouse 7, an oval structure, had a ventilator entering the northeast quadrant from the east. The dimensions of the room were 2.37 m north-south by 1.90 m east-west. The floor had been excavated at least 90 cm into native soil and at the time of excavation was 1.40 m below modern surface.

Walls. The walls slanted gently outward from the base and were plastered with 1 to 2 mm of adobe. The surfaces were sooted with hearth smoke.

A large niche penetrated the southeast quadrant of the wall at floor level. The sides, bottom, and top were fairly well smoothed but not plastered. The internal dimensions of the niche were 55 by 29 by 33 cm. The opening was 30 by 30 cm, and the bottom of the niche was 3 cm below floor level.

Floor. The bottom of the original pit was roughly leveled by adding red clay to the low spots. Then, 2 to 4 cm of sandy adobe was spread over the entire floor area. By the time of abandonment, the surface of the floor was darkened from use.

The roof had been supported by two posts set in the north-central and south-central sectors of the room. The north post had been set in a hole measuring 42 by 26 cm at the top and 22 by 22 cm at the midpoint; its total depth was 67 cm. The south post was too short; it had to be set on the floor and braced in a shallow, unplastered groove in the south wall. The groove was 14 cm wide and at least 6 cm deep (into the wall).

The rather elaborate basin hearth (32 by 33 by 13 cm) was excavated into native soil, surrounded with a coping of adobe (6-14 cm wide, 8 cm high), and provided with a sloped fire wall (40-60 cm wide, 30 cm high). Basin and the fire wall were well burned (reddened) and sooted. A small hole in the bottom of the hearth may have been the result of repeated cleaning.

A small posthole (8 by 9 by 11 cm) in the floor northwest of the ventilator opening may have supported a deflector, or it could have been the socket for a ladder. A careful search for a companion hole failed to find one.

Ventilator. The ventilator entered the structure at floor level in the northeast quadrant. No evidence of internal supports or plastering were noted. The dimensions were as follows: interior opening, 21 by 41 cm; tunnel length, 50 cm; shaft length, 90 cm; exterior opening, 20 by 17 cm.

Roof. Other than the posthole, wall groove, and a few pieces of adobe found in the floor fill, no direct evidence of the roof or the details of its construction were noted. Entry presumably was through a hatch in the roof.

Structure Fill. The fill was well stratified with alternating lenses of trash and sterile clayey sand (Fig. 20). The strata dipped from the southeast corner towards the north and west, indicating primary filling from the southeast (i.e., from the direction of Pithouse 8, Feature 47).

Stratum 1 was heavily charcoal-stained soil with numerous unmodified river cobbles, sherds, lithic debris, bone, and occasional pieces of adobe. The texture was heterogeneous, and the stratum as

Figure 18. Pithouse 7.

a whole was essentially identical to the capping strata of Pithouses 1, 2, 3, and 4.

Stratum 2 was tan clayey sand like the native soil of the site. Few sherds, lithic debitage, or other cultural materials were present. The texture was fine and homogeneous.

Stratum 3 was a lightly charcoal-stained lens with moderate quantities of sherds and other cultural debris. The texture was fine and homogeneous.

Stratum 4 was clean flood-deposited (?) sand, coarse sand, and fine gravel. Cultural materials were few.

Stratum 5 was clayey sand, like Stratum 2.

Stratum 6 was a lightly charcoal-stained, clayey sand lens containing small amounts of cultural materials. The texture was fine and homogeneous.

Stratum 7 was a light-colored clayey sand containing numerous pieces of presumed roofing adobe and small amounts of cultural debris. The texture was coarse and heterogeneous.

Fill integrity assessment is facilitated by the sherds of Vessels 58 and 62, which link the main upper and lower units. Evidence of rodent disturbance was minimal. The stratigraphy was clearcut and lacked the blurring indicative of rodent intrusion. The linkage of the major units by the sherds could mean one or two things: the sherds were located along the contact between upper and lower fill and arbitrarily segregated during collection, or the associations with each stratum are valid and indicate relatively short-term filling of the structure. At the present time, the latter possibility seems most likely, though excavation error cannot be entirely ruled out.

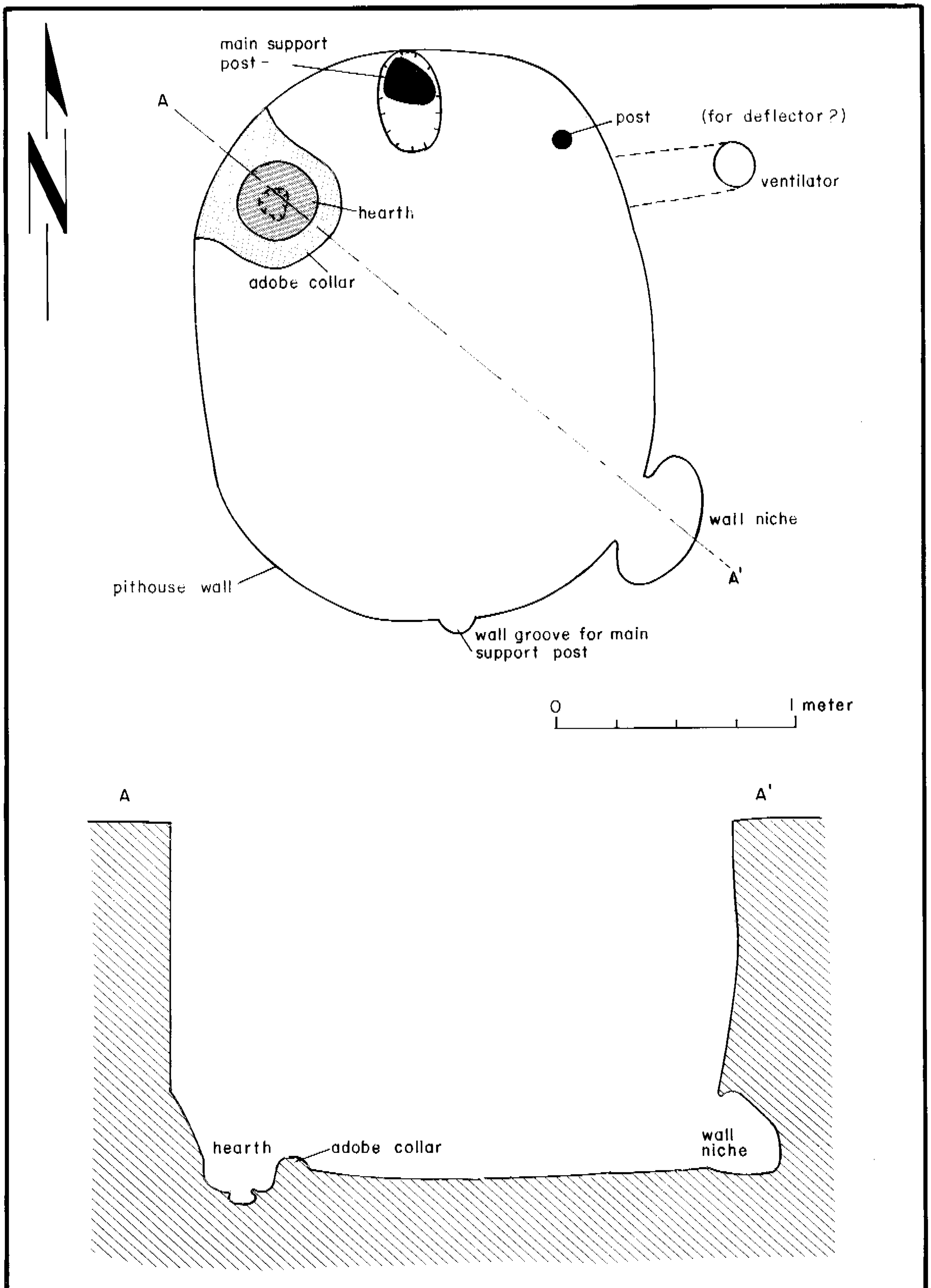


Figure 19. Plan and profile of Pithouse 7.

midpoint. The depth of the pit below floor surface was 20 cm. It was not plastered.

Ventilator. Most of this feature had collapsed before filling of the structure. Although its original size could not be determined, the interior opening was 22 cm, and the tunnel length was 46 cm. No indications of internal supports were noted.

Roof. Aside from the two main roof-support posts and a few pieces of reed-impressed adobe, direct evidence of roofing details was lacking.

Structure Fill. The fill lacked charcoal-staining and contained very few cultural items. However, Burials 4-6 (Features 49-51) were found in the fill.

As with Pithouse 5, the paucity of material culture and the absence of partial vessels in the fill of this structure precludes an assessment of fill integrity. The fact that three bodies were present in such a small structure virtually guarantees that most of the fill was disturbed during their burial. However, since the burial pits did not reach the floor, the floor and floor fill (0-15 or 20 cm above the floor) associations are probably good.

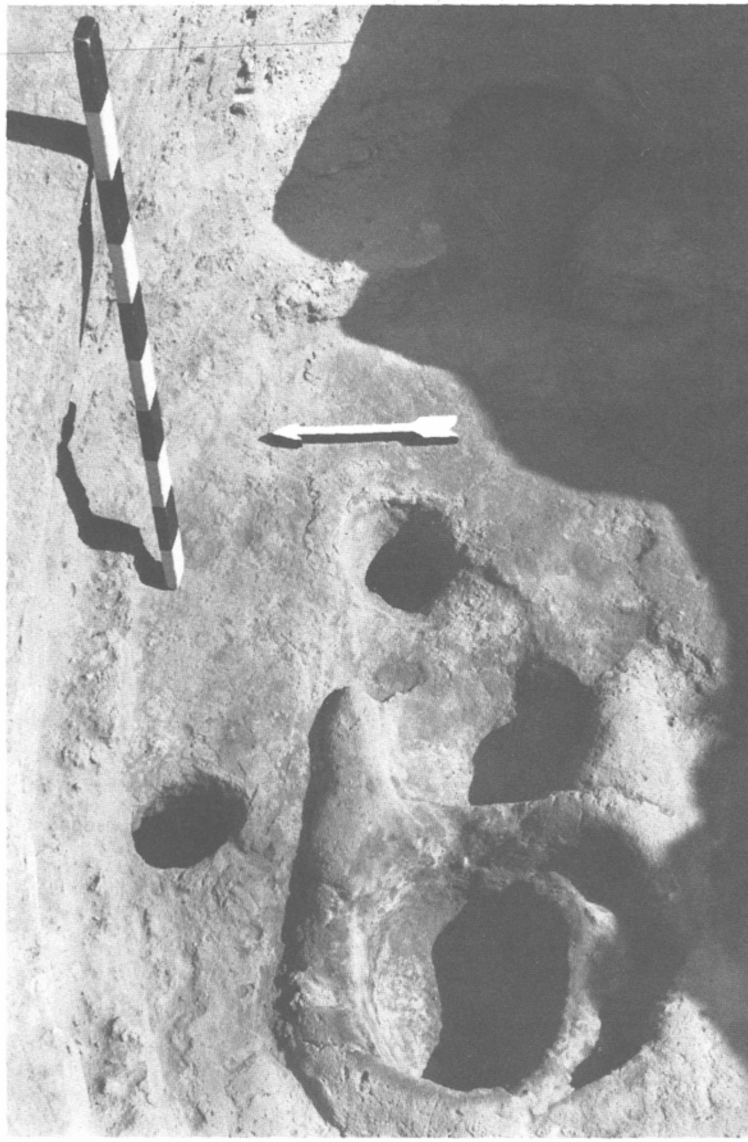


Figure 21. Pithouse 8.

Ceremonial Structures or Kivas

No ceremonial structures or kivas were identified at the Belen Bridge site. Archaeologists frequently use unusual architectural features to identify potential kivas. Although nearly every structure had a unique feature at the Belen Bridge site, no floor features were identified as potential sipapus. Consequently, we have no basis on which to identify a kiva at LA 53662 and assume that none existed.

The Question of Surface Structures

The presence of two hearths with associated pairs of small postholes (Features 23b and 33b; see "Extramural Features"), the formality of their

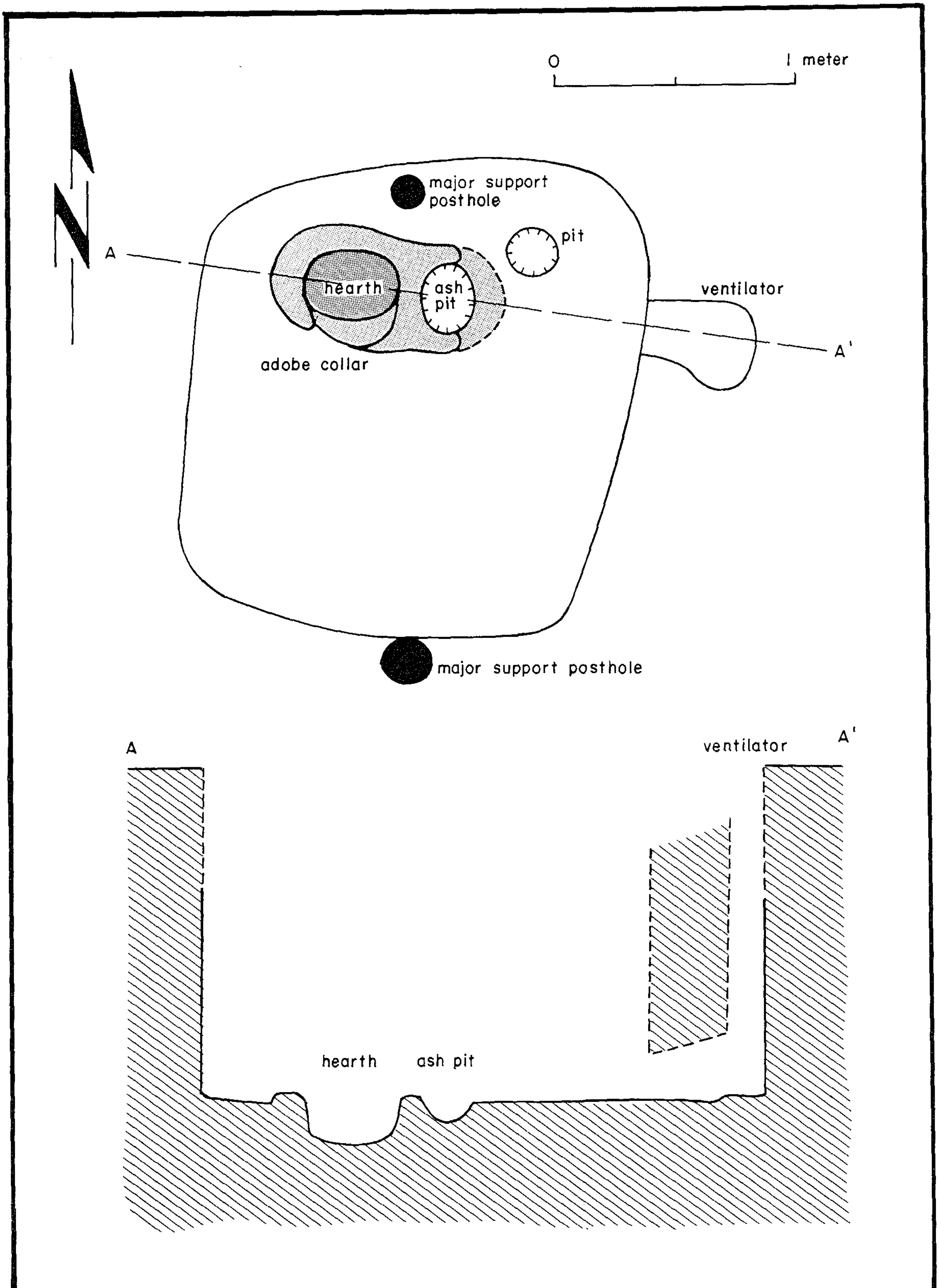


Figure 22. Plan and profile of Pithouse 8.

construction, and a possible adobe floor or use-surface raise the possibility that surface structures were present at the site. The pairs of holes are reminiscent of the deflector posts found in pithouses and kivas elsewhere in the Anasazi Southwest (but not in the Belen Bridge pithouses). Those associated with Feature 23b (Features 23d-23e) contained ash and had burning around sections of their rims, indicating nonpost functions. However, the hearth and holes were well made, and with another small pit, Feature 23c, their arrangement seemed formal--traits that frequently typify features found inside but not outside of structures. Those associated with Feature 33b were not burned and could have supported a deflector. Like well-made, formally arranged features, hearths with deflectors are normally found inside structures.

The presence of Features 23b-23e and 33b, then, suggests that surface structures once existed in this location. What might have been a fragmentary adobe floor was noted during excavation in the area immediately south of Feature 23 and north of Feature 33. However, positive identification of the feature as a floor and its relationship to Feature 23b could not be established. The possible floor could also have been use-compacted native soil. It is in this area that the natural substrate change noted earlier was first observed. Also, the bar ditch truncated the south side of the surface, making it impossible to determine its relationship to Feature 33b.

The only other feature potentially associated with surface structures is the set of four posthole-like pits (Feature 22) west of Pithouse 2. However, unlike any of the other presumed postholes at the site, whether interior or exterior, these pits/postholes were carefully made with smoothed, shaped sides and flat, even bottoms. The difference is sufficiently striking that, during excavation, we believed that they may have had special functions rather than the more mundane one of supporting posts. The fills were sand, almost without cultural materials.

In conclusion, we cannot state with certainty whether surface structures were present at the Belen Bridge site. It is clear, though, that they may have been present and that future excavators will have to use extreme caution when searching extramural areas at similar sites.

EXTRAMURAL FEATURES

Outdoor hearths, pits, and postholes/sockets occurred in clusters in several areas of the site (Figs. 4, 23-39). Frequently, examples of all these were present in the same cluster. In most instances, these clusters appeared to be truly extramural (unroofed) work areas, for few postholes or other evidence was found to suggest the presence of shades, wind barriers, or other ephemeral structures. Three clusters (Features 23/33, 27, and 42) did have what appeared to be postholes or post sockets, which may have supported vertical posts and brush shades.

Hearths

Thirty-six hearths, including the two discussed in the previous chapter ("The Question of Surface Structures"), occurred in seven clusters (Fig. 4; Table 1). They varied in shape, size, and construction details. Nine (Features 42a-42c, 42e, 42g, 42h, 42j, 42k, 44a) were either wholly or partially lined with sandstone slab fragments and/or small river cobbles (Figs. 23-24). All of these hearths were located at the south end of the site. One hearth (Feature 23a) was a simple basin lined with adobe made from native soil (Fig. 25); this was the only extramural hearth to produce an archaeomagnetic sample. The remaining 26 hearths (Features 4, 5d, 5e, 23b, 23f, 25, 27a-27c, 29a-29d, 31a, 31b, 32a, 32d, 32e, 33b, 39, 42f, 42i, 42r, 44b, 44c, 46) were simple, unlined basins dug into native soil, or, in the case of Feature 46, in the fill of Pithouse 8 (Figs. 26-34). In two instances, hearths were partly superimposed on earlier ones (Features 29a-29d, 31a). Features 29a-29d may have been four separate hearths or a single hearth enlarged several times. Feature 42f had originally been larger, but its size was reduced by partial plugging with adobe.

None of the hearths showed intense burning, and the fills varied from lightly to moderately charcoal stained. Some reddening did occur on the rims of five of the hearths and associated features (Features 23a-23e), but in all instances the reddening was localized (southwest sides) and not particularly intense.

Pits

Twenty pits of various sizes and shapes were excavated in whole or in part. There were two general shapes (roughly circular and racetrack oval), two general depths (shallow and deep), and a range of sizes (Fig. 4; Table 2). One very odd pit, Feature 42d, was actually a complex pentagonal arrangement of five smaller pits inside one large one. Shape, depth, and size were not co-occurring attributes.

Shallow Pits (Features 5a-5c, 15, 24b, 24c, 31c, 32b, 32c, 33a, 38, 42d, 42n, 42o, 42t, 48a, 48b)

The 17 round to oval pits were relatively shallow regardless of whether they were within the area of the bar ditch or elsewhere in the site. It is possible, of course, that one or more shallow pits were lost during the construction of the bar ditch and berm. All of the pits were excavated to depths not exceeding 80 cm, and most were 50 cm or less. With one exception, the sides were left more or less vertical and the bottoms slightly dished. Only three of the pits, including Features 24b, 24c (Fig. 35), and 32b, had 1 cm thick plasters of sandy brown adobe. The plastering appears to be an attempt to shore the sides against collapse of the loosely packed sand into which the pits had been dug. Feature 42d, mentioned above, was so complex that the reader is referred to Figures 23-24 for details.

The functions of most of the shallow pits can only be guessed. Feature 32b was lightly burned (?), but heavy rains destroyed it before a detailed examination could be made. Its bottom fill,

Table 1. Extramural hearth data

Feature	Dimensions (cm)
Unlined	
4	25 x 25 x 3
5d	36 x 35 x 13
5e	30+ x 47+ x 9
23b, upper	43 x 48 x 18
23b, lower	25 x 24 x 13
23f	52 x 40 x 10
25	45 x 50 x 5
27a	58 x 58 x 20
27b	38 x 58 x 14
27c	42 x 43 x 13
29a	ca. 36 x 50 x 12
29b	ca. 31 x 36 x 15
29c	ca. 46 x 46 x 10
29d	ca. 23 x 23 x 8
31a, east	45+ x 40+ x 16
31a, west	43+ x 34+ x 16
31b	36+ x 50 x 9
32a	60 x 59 x 7
32d	34 x 41 x 4-13
32e	60 x 50 x 15
33b	59 x 62 x 15
39	18+ x 25 x 12
42f, upper	24 x 33 x 4
42f, lower	38 x 46 x ?
42i	29 x 28 x 10
42r	39 x 37 x 6
44b	42 x 43 x 7
44c	25 x 25 x 6
46	30 x 35 x 10

Lined, completely or partially, with rocks	
42a	45 x 42 x 6
42b	51 x 39 x 10
42c	49 x 47 x 10
42e	20+ x 18 x 5+
42g	56 x 59 x 21
42h	49 x 50 x 10
42j	75 x 56 x 14
42k	52 x 59 x 8
44a	26 x 24 x 6
Lined with adobe	
23a	48 x 45 x 14

Table 2. Extramural pit data

Feature	Dimensions (cm)
Shallow Pits	
5a	112 x 105 x 31
5b	110 x 135 x 15
5c	65 x 69 x 16
15	90 x 90 x 20
24b	80 x 110 x 40
24c	60 x 60 x 30
31c	70+ x 41 x 31
32b	155 x 79 x 17
32c	186 x 175 x 15
33a	129 x 75[a] x 33[a]
38	40+ x 85 x 30
42d	78 x 91 x 39
42n	61 x 35[a] x 21[a]
42o	58 x 38 x 8[a]
42t	70+ x 47 x 20+
48a	114 x 110 x 39
48b	92 x 90 x 54
Deep Pits	
16	86[a] x 86[a] x 83[a]
18	154 x 135 x 123[a]
26	87 x 60 x 107

[a] average

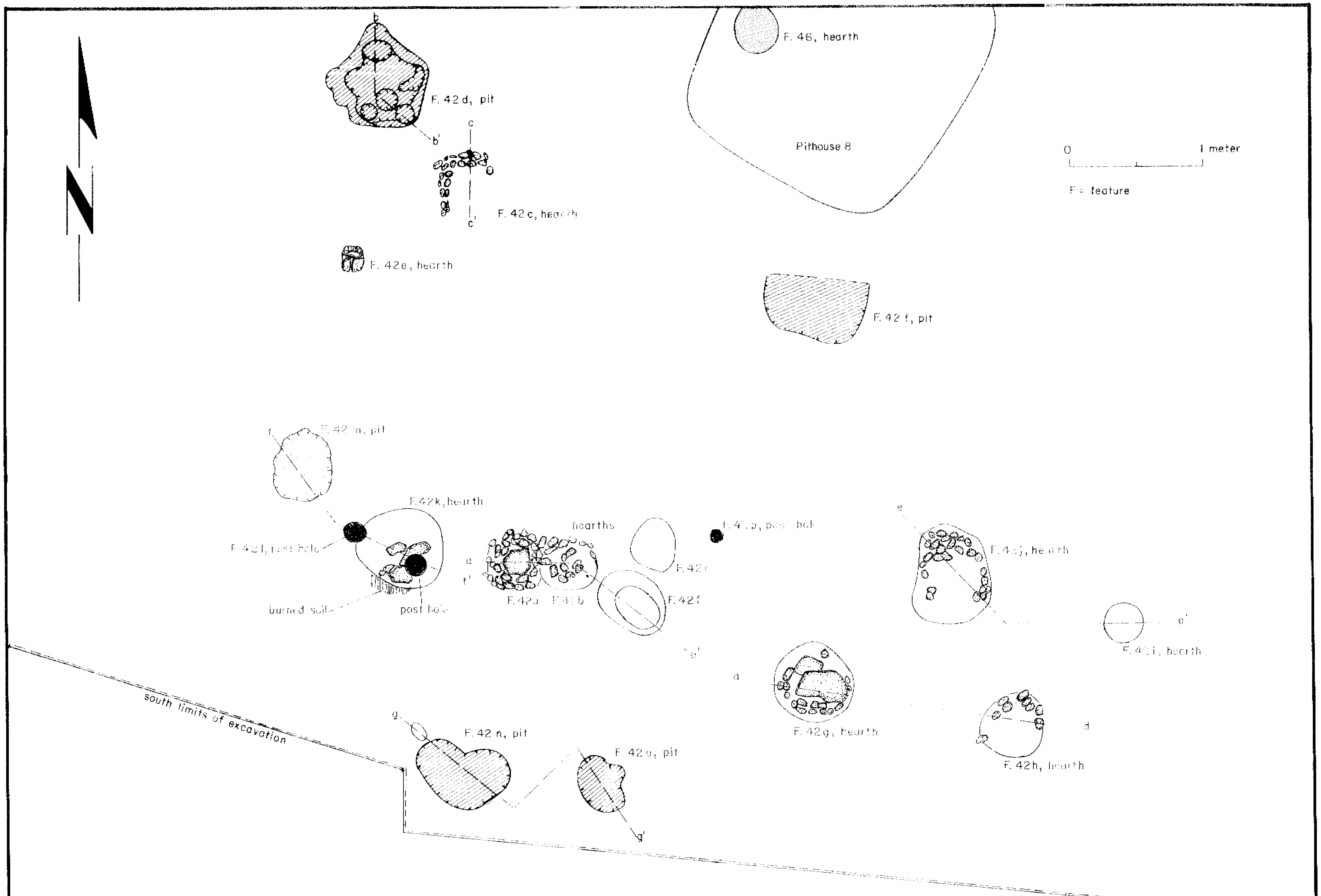


Figure 23. Plan of Feature 42.

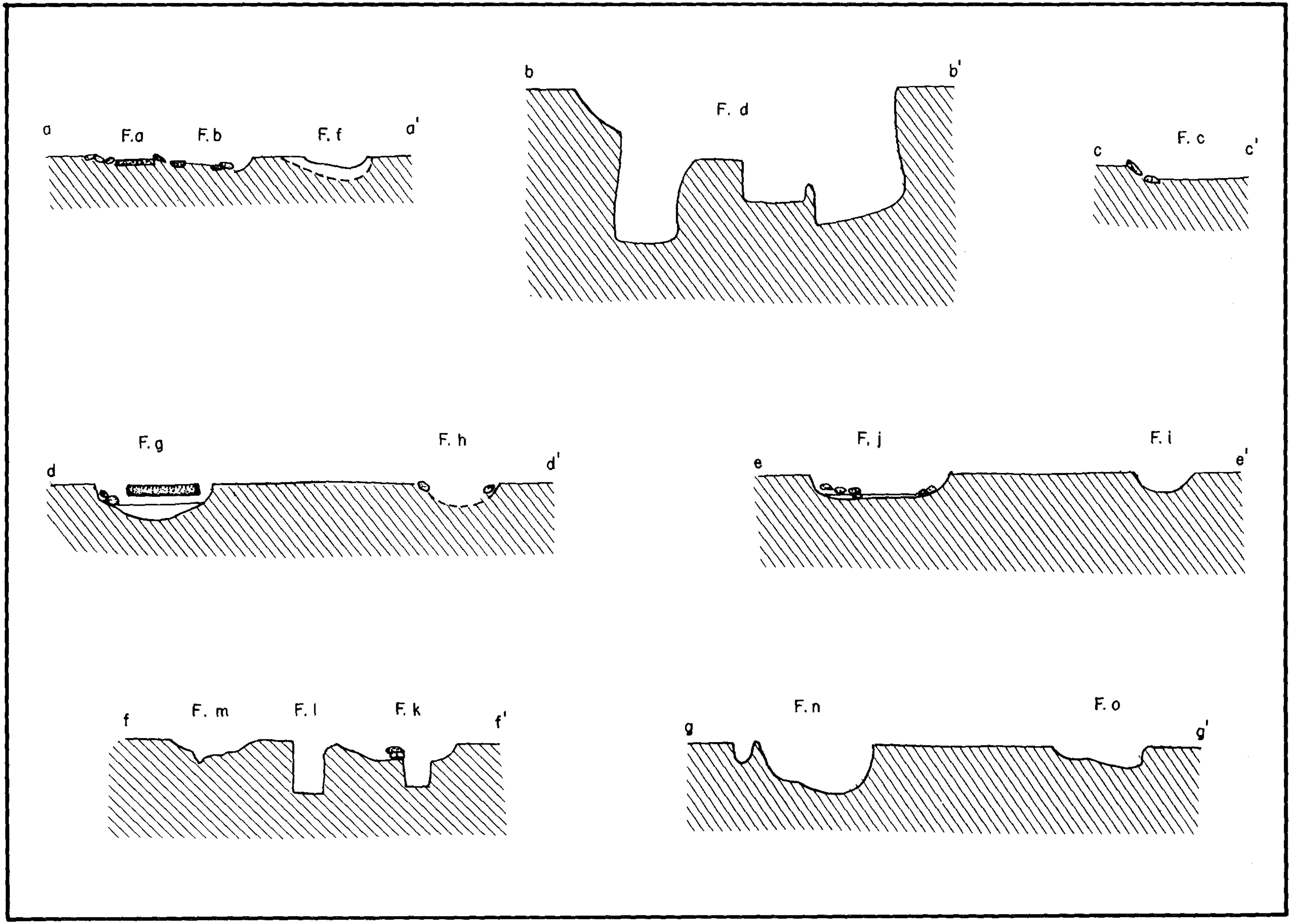


Figure 24. Profiles of Feature 42.

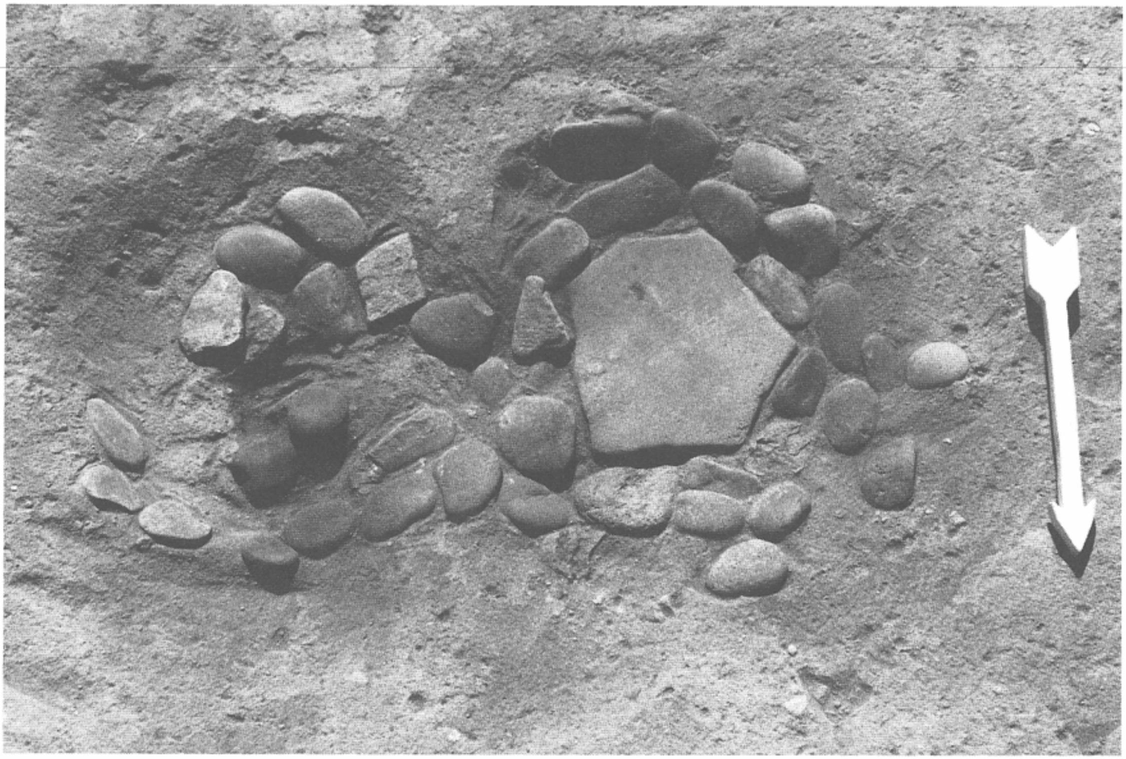


Figure 25. Features 23a and 23b, rock-lined extramural hearths.

however, was only lightly charcoal-stained and did not evince the intensity of burning one might expect if the stain resulted from an in-place fire. The complex pit, Feature 42d, is truly enigmatic, and its function is unknown.

The fills of the rest of the pits, except Features 48a-48b, were essentially the same--lightly to moderately charcoal-stained soil with some trash at the top and nearly devoid of stain and cultural materials in the bulk of the fill. Features 48a and 48b (Fig. 36) had very trashy upper fills but otherwise nearly sterile lower fills. These pits were presumably used for storage, but none contained direct evidence of this.

Deep Pits (Features 16, 18, 26)

Features 16, 18 (Fig. 37), and 26 (see Fig. 28) were all in the central part of the site. They were dug into native soil to depths varying between 1.35 and 1.75 m below the present surface. Two of the pits (Features 16 and 26) were bell-shaped and lacked a plaster lining; one had a circular orifice, and the other a key-shaped one. Feature 18 (also referred to in this report as Pit 18) had a wide mouth, and the lowermost portions of the sides and bottom had up to 1 cm of sandy brown plaster.

The fills of the two bell-shaped pits were nearly devoid of cultural materials except at the mouths. These were filled with the heavily charcoal-stained trash common to the uppermost levels of Pithouses 1, 2, 3, and 7 and all fill of Pithouse 4. By way of contrast, the fill of Feature 18 contained significant quantities of cultural materials, small pieces of charcoal, and charcoal staining.

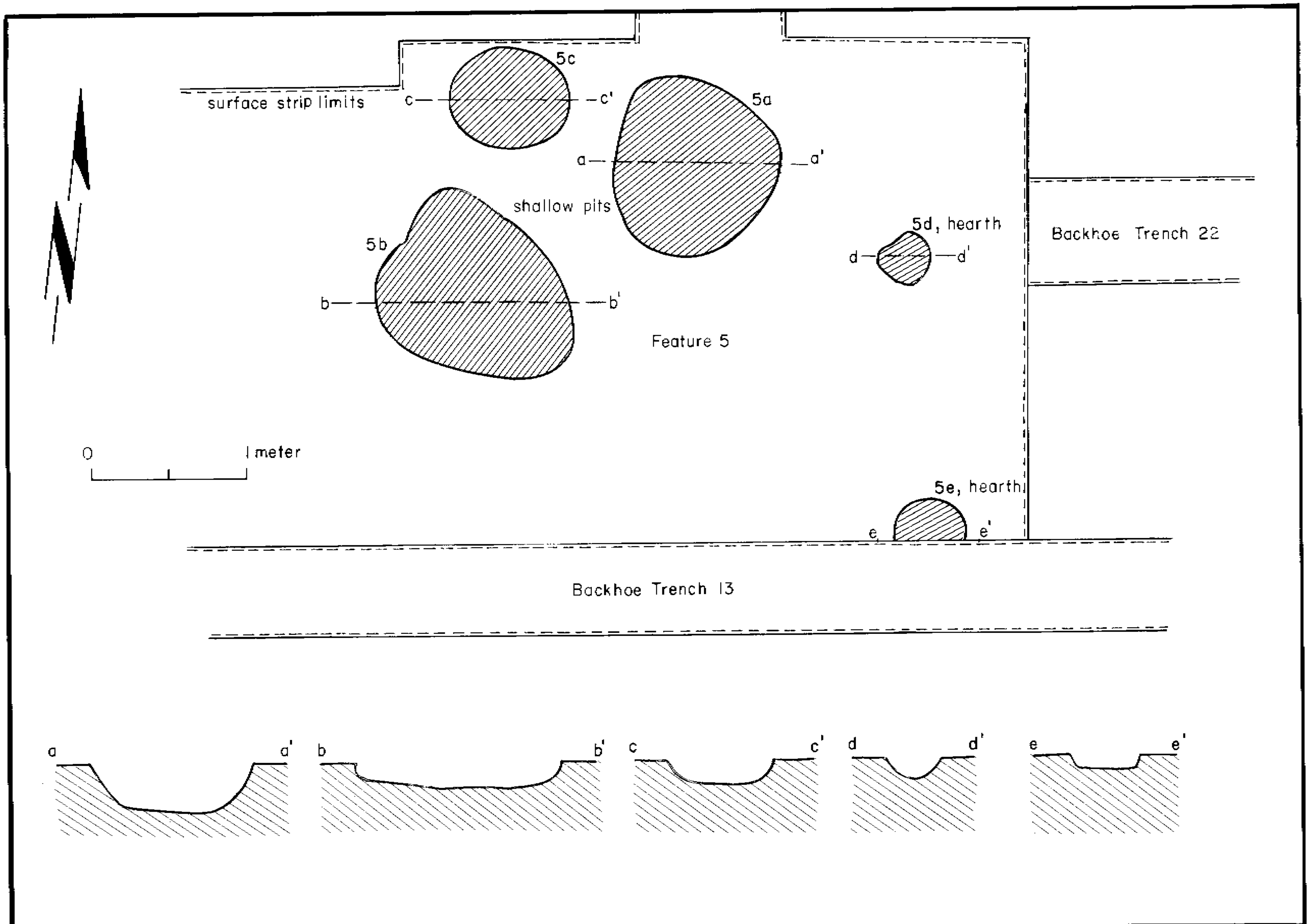


Figure 26. Plan and profiles of Feature 5.

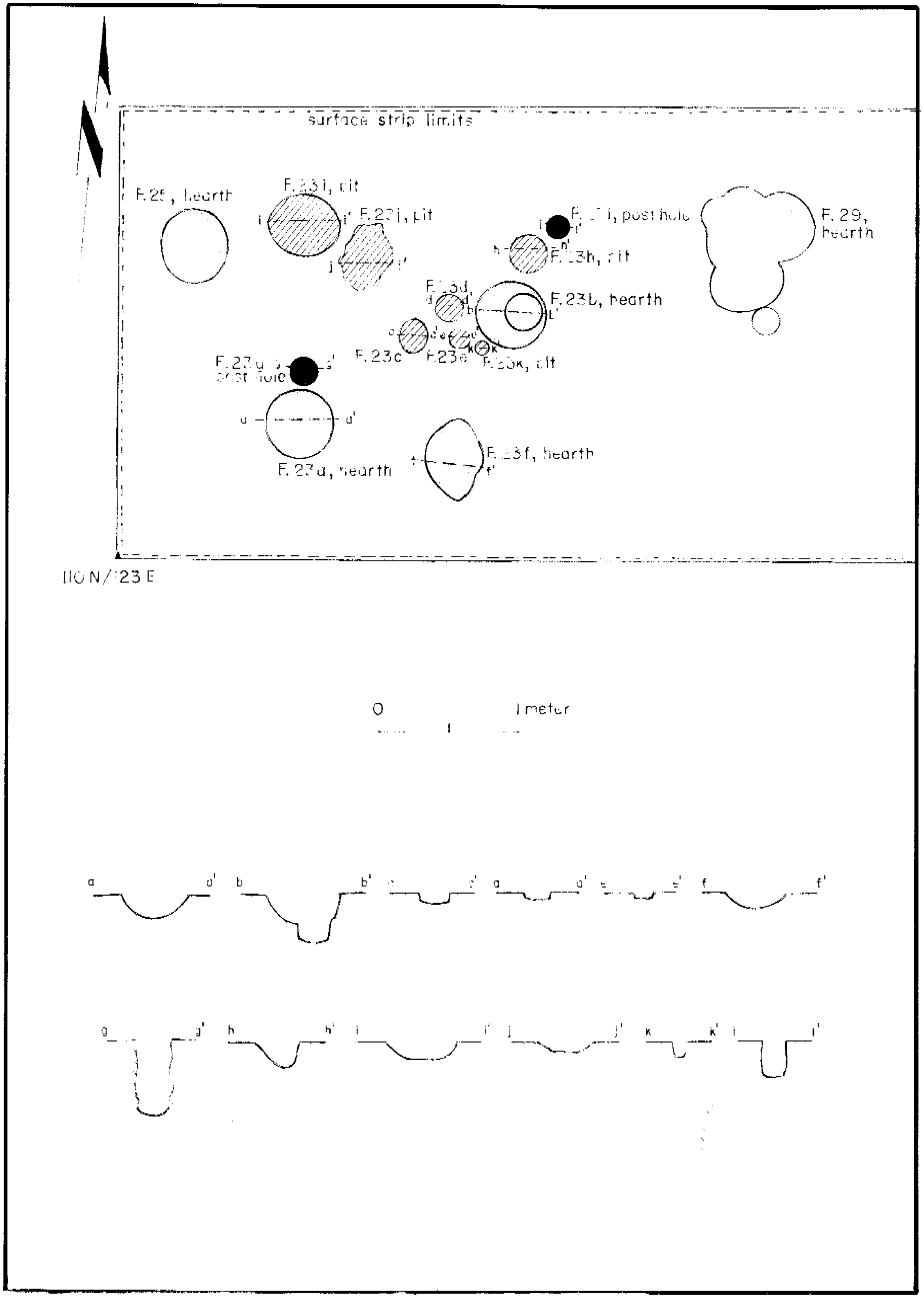


Figure 27. Plan and profiles of Features 23, 25, and 29.

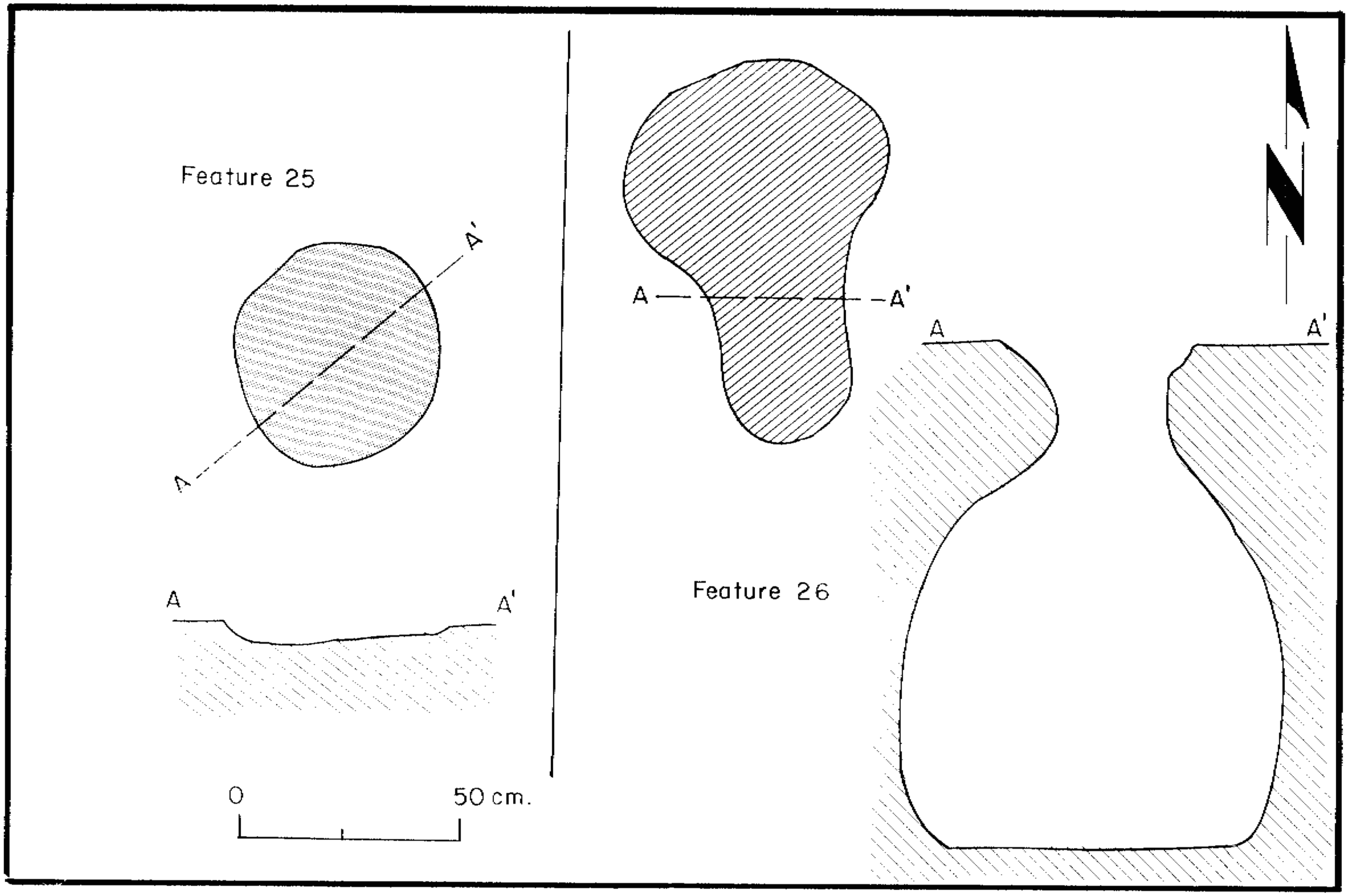


Figure 28. Plans and profiles of Features 25 and 26.

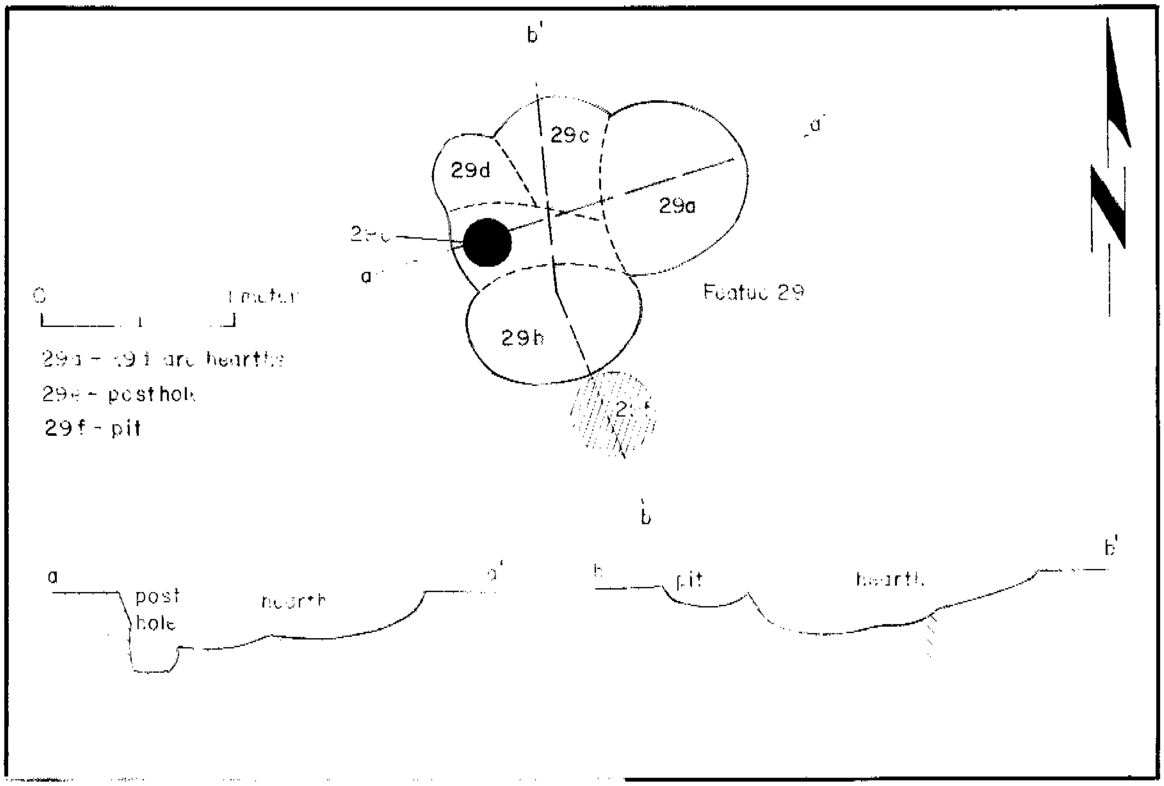


Figure 29. Plan and profiles of Feature 29.

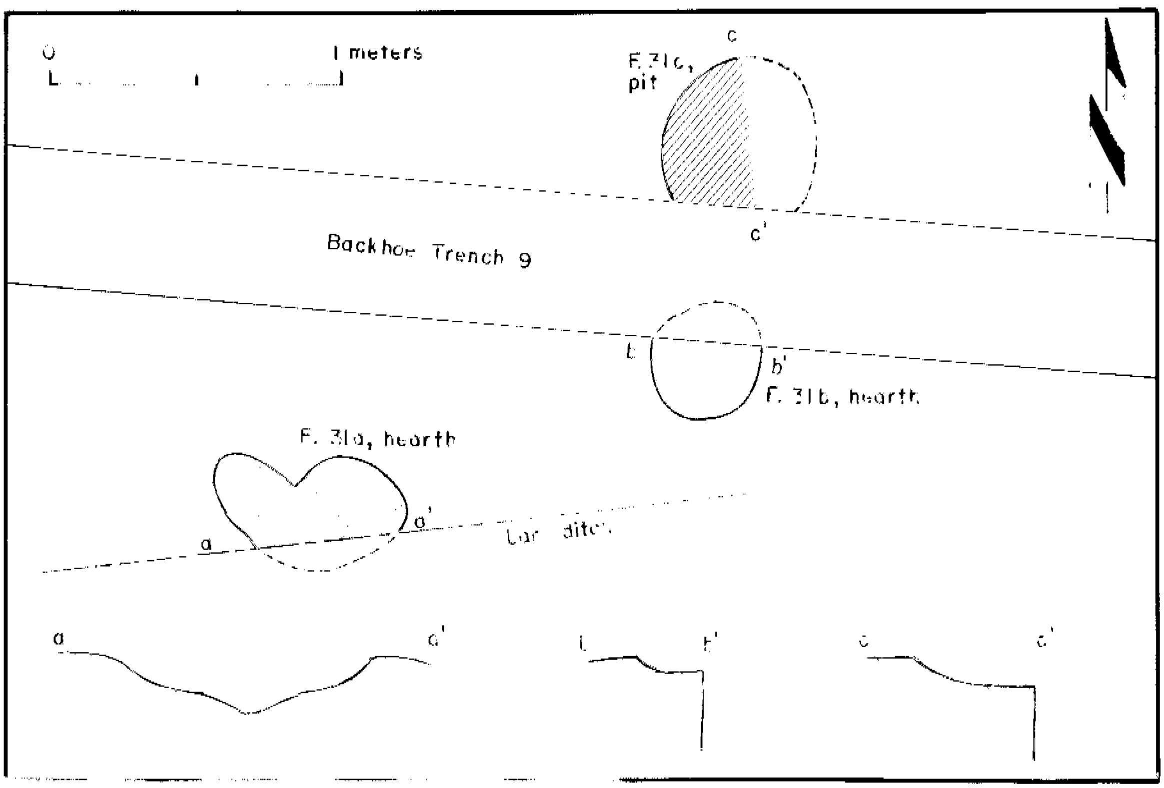


Figure 30. Plan and profiles of Feature 31.

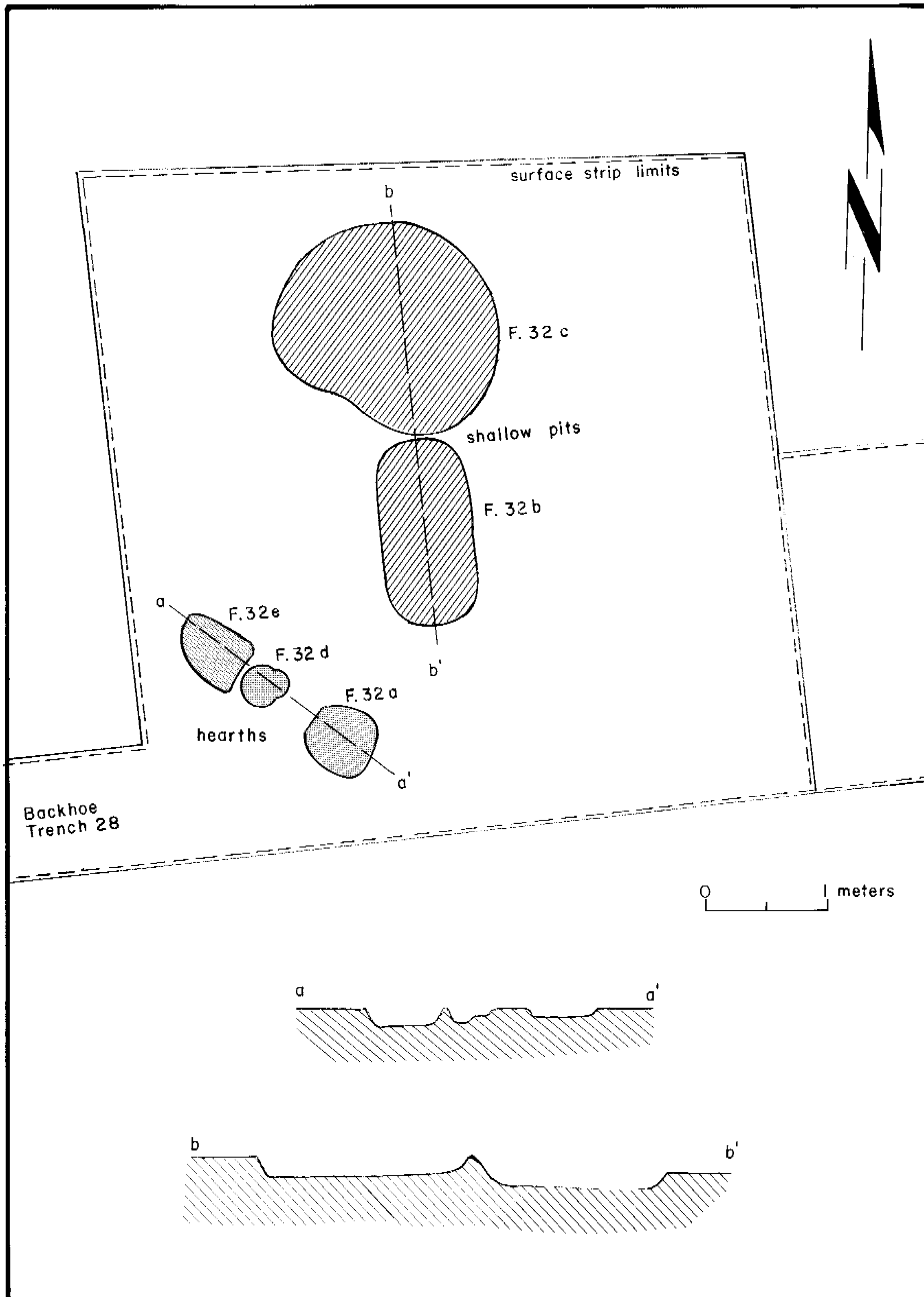


Figure 31. Plan and profiles of Feature 32.

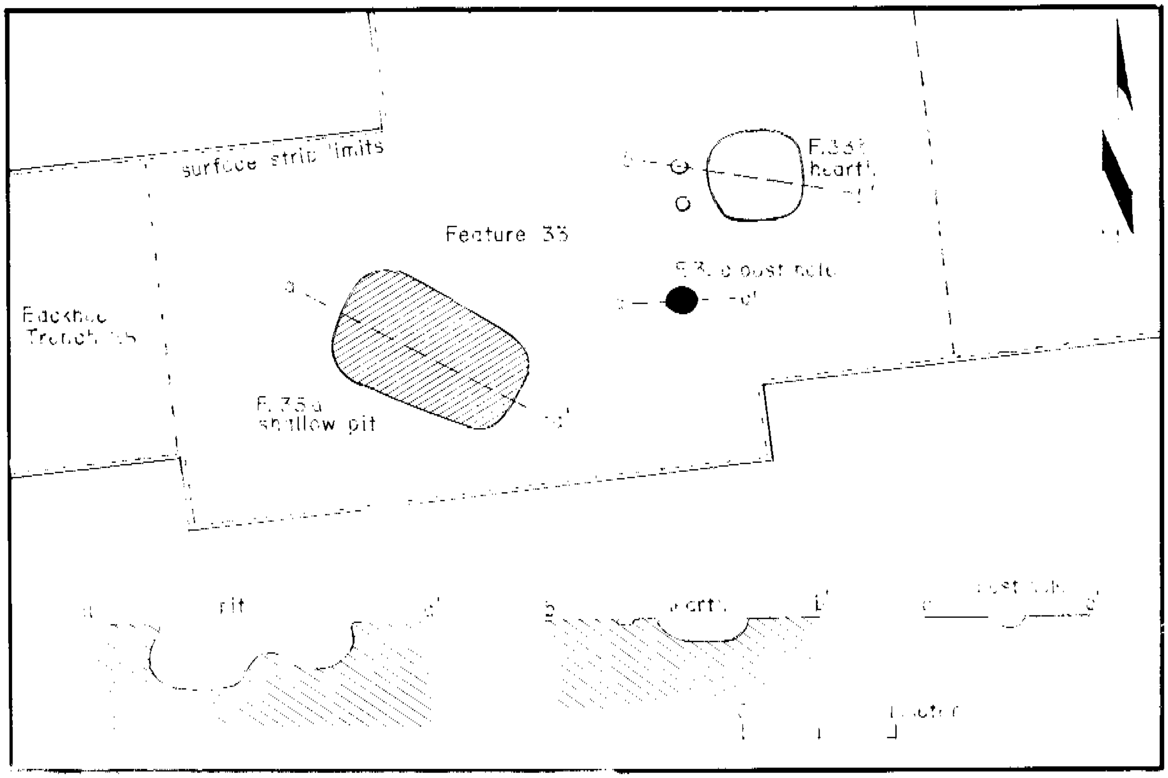


Figure 32. Plan and profiles of Feature 33.

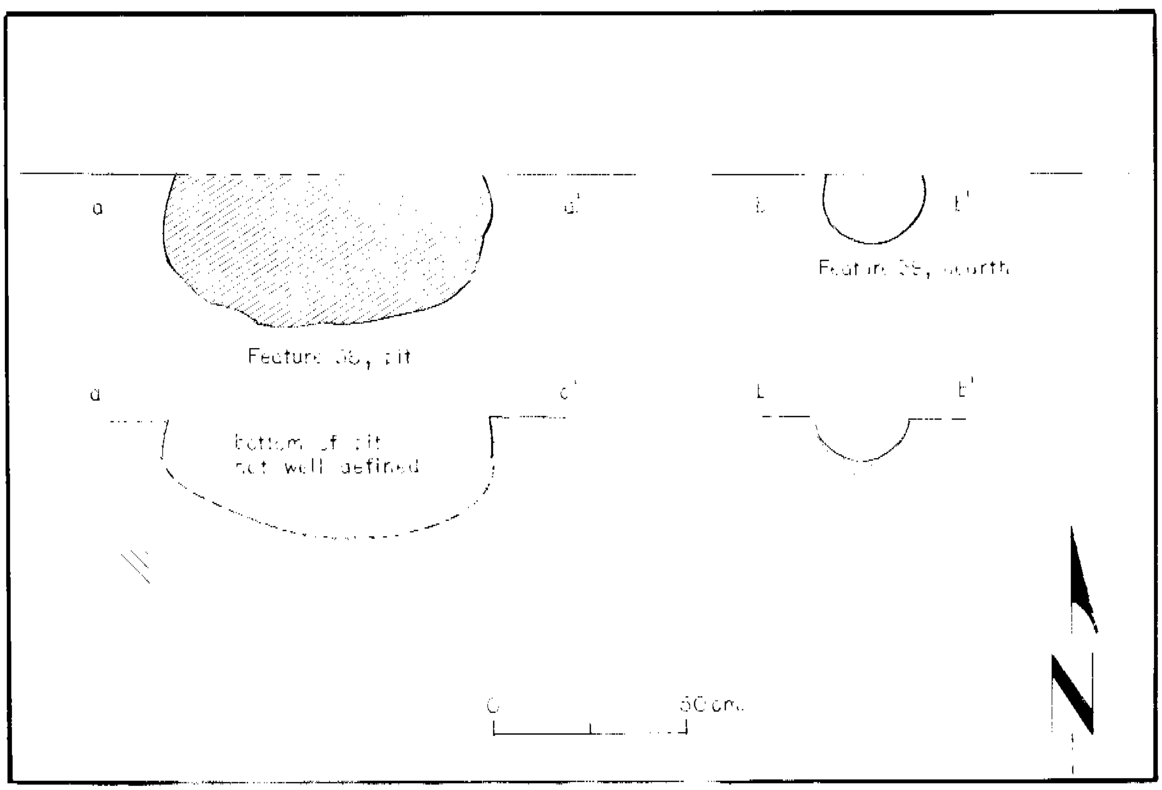


Figure 33. Plans and profiles of Features 38 and 39.

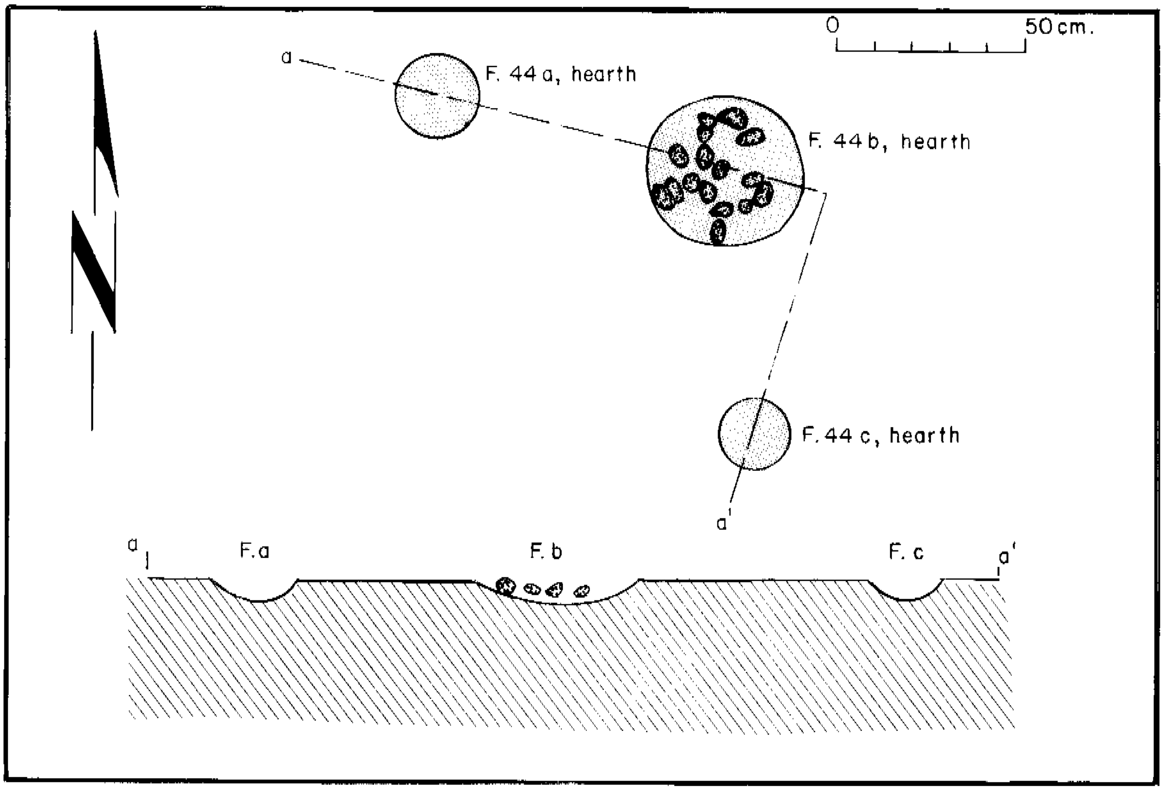


Figure 34. Plan and profile of Feature 44.

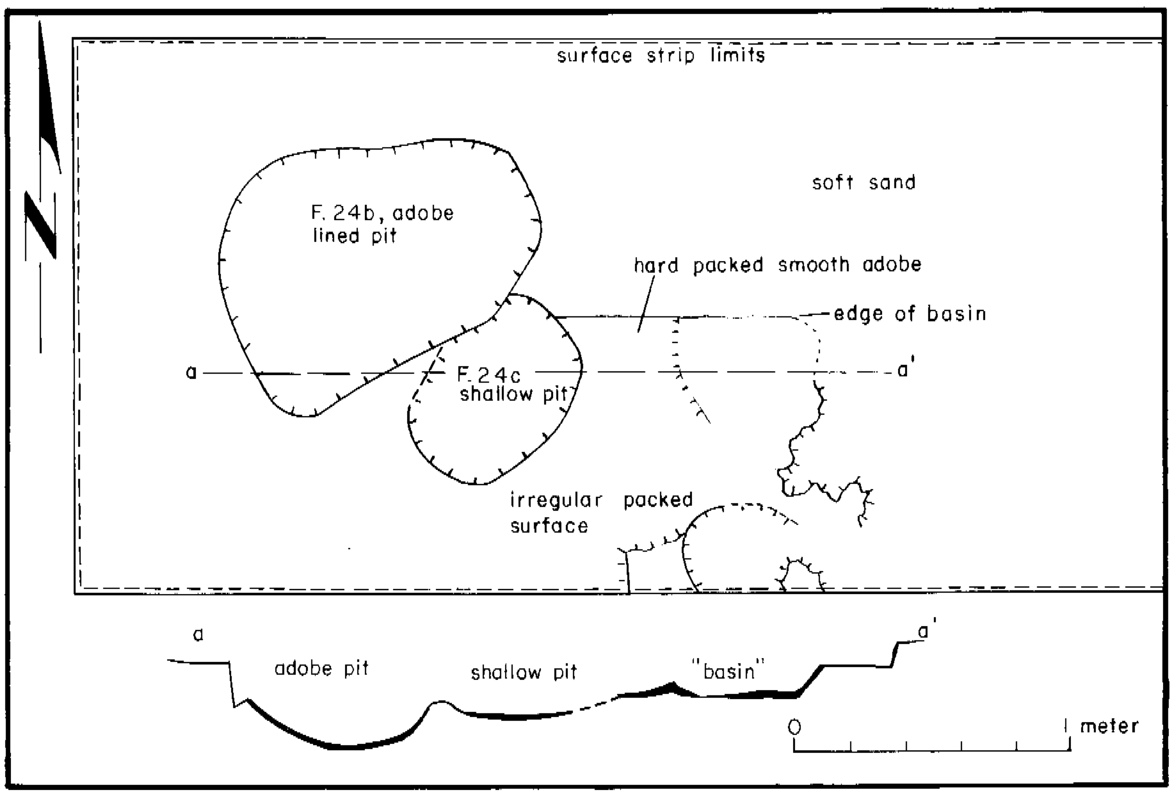


Figure 35. Plan and profile of Feature 24.

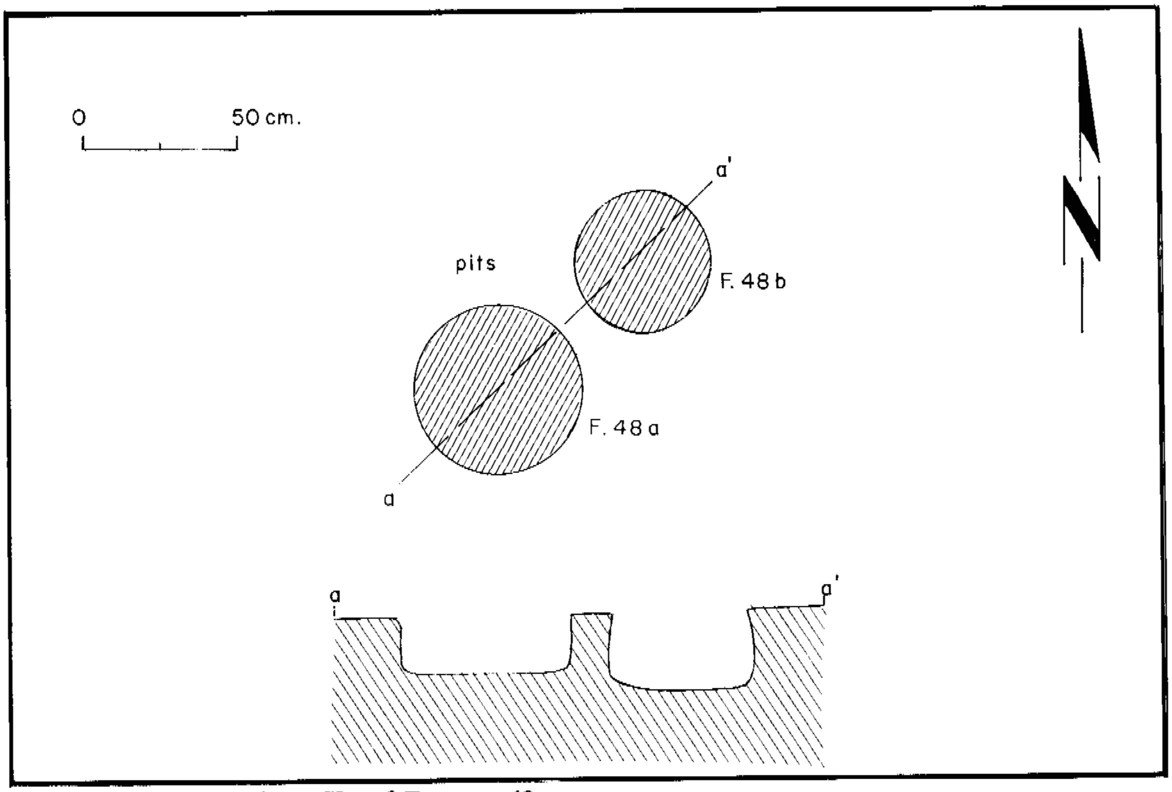


Figure 36. Plan and profile of Feature 48.

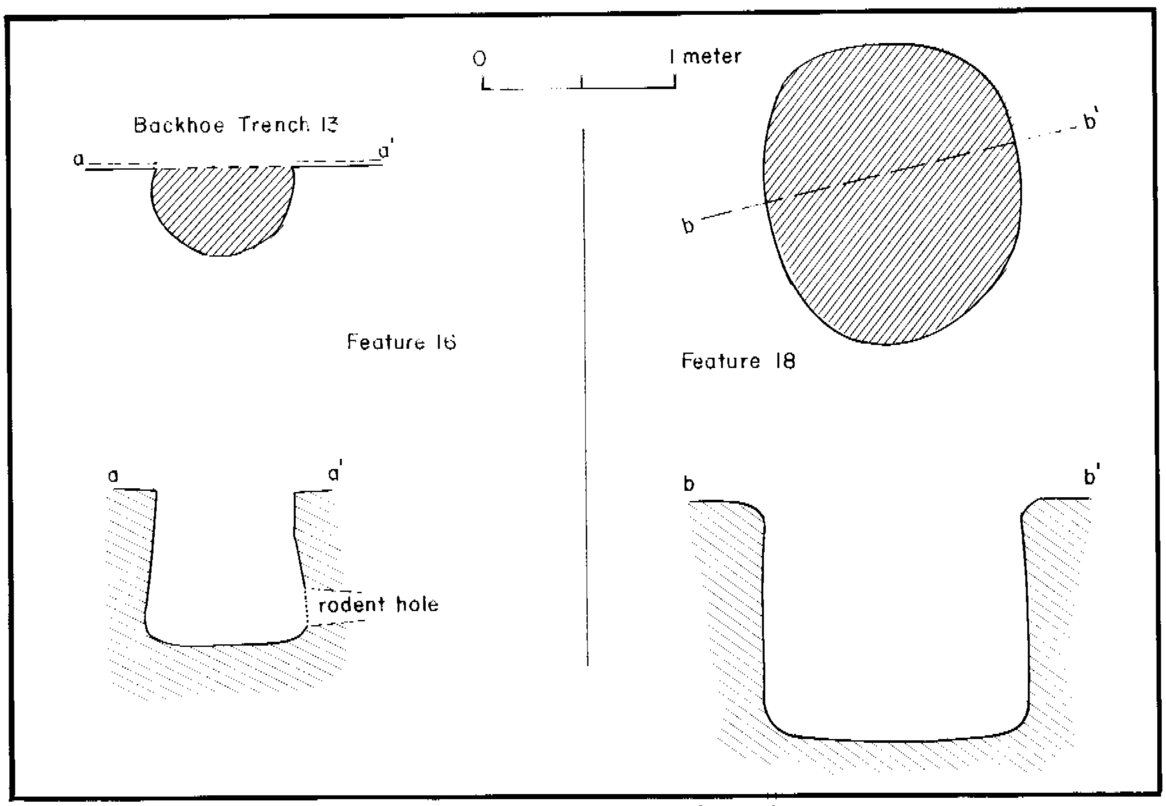


Figure 37. Plans and profiles of Features 16 and 18, deep pits.

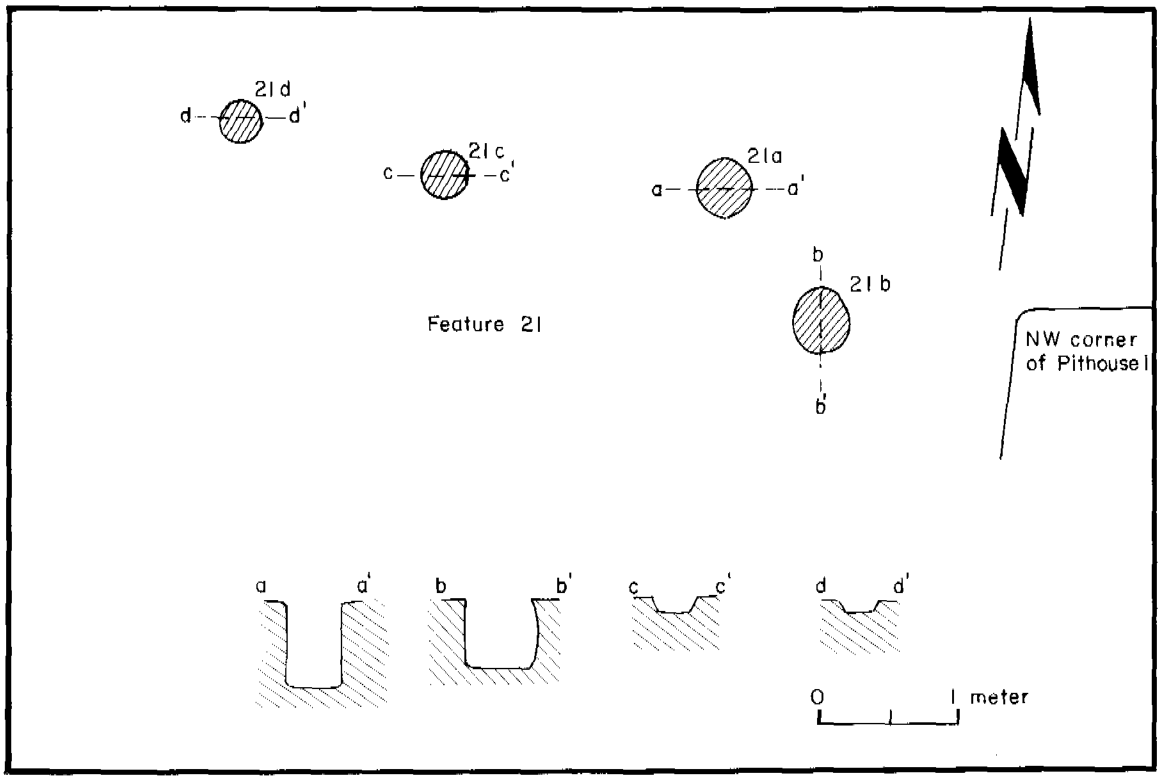


Figure 38. Plan and profiles of Feature 21.

Probable Postholes and Post Sockets

The difference between a "hole" and a "socket" is the depth of the depression. Postholes are deep enough to hold heavy posts upright, and post sockets are so shallow that some form of brace may have been necessary to help support the post. By these criteria, eight possible postholes and seven possible post sockets were excavated (Table 3).

Three postholes (Features 23g, 231, 29e) and two sockets (Features 23k, 33c) are associated with the hearth complexes of Features 23 and 33 and may be the remnants of a single large ramada. A poor alignment of four holes (Features 21a-21d; Fig. 38) west of Pithouse 2 could be part of a structure, though their careful workmanship suggests other possibilities as well. And finally, one posthole (Feature 42l) and five sockets among the Feature 42 group (42p, 42q, 42s, and those associated with 42k and 42n) probably belonged to one or possibly more ramada-like structures. The fills of these holes and sockets varied from clean sand to trashy, the latter almost certainly being part of the refuse layer that covered this part of the site.

Trash-Filled Low Areas and Miscellaneous Depressions/Features

Fifteen features (Features 23c-23e, 23h-23j, 24a, 27d-27f [Fig. 39], 29f, 40, 41, 42d, 42m) of various shapes, sizes, and depths may have had some purpose but lack traits normally identified with hearths, storage pits, borrow pits, postholes, and post sockets (Fig. 4). Five (Features 23i, 23j, 27e, 41, 42m) may have been nothing more than trash-filled low places. Feature 24a had the irregular sides and bottom normally thought to indicate a construction materials borrow pit, possibly the source of materials used to line nearby pits 24b and 24c. Evidently it was later filled with trash. Others (Features 27d, 27f, 29f) may have been pot rests, later inadvertently filled with refuse. Three (Features 23c-23e) appear to have been functionally associated with Feature 23b, a hearth. The functions of Feature 23h--a circular, conical-bottomed pit--and Feature 42d are conjectural. Feature 40 was not investigated in sufficient detail to speculate on its function.

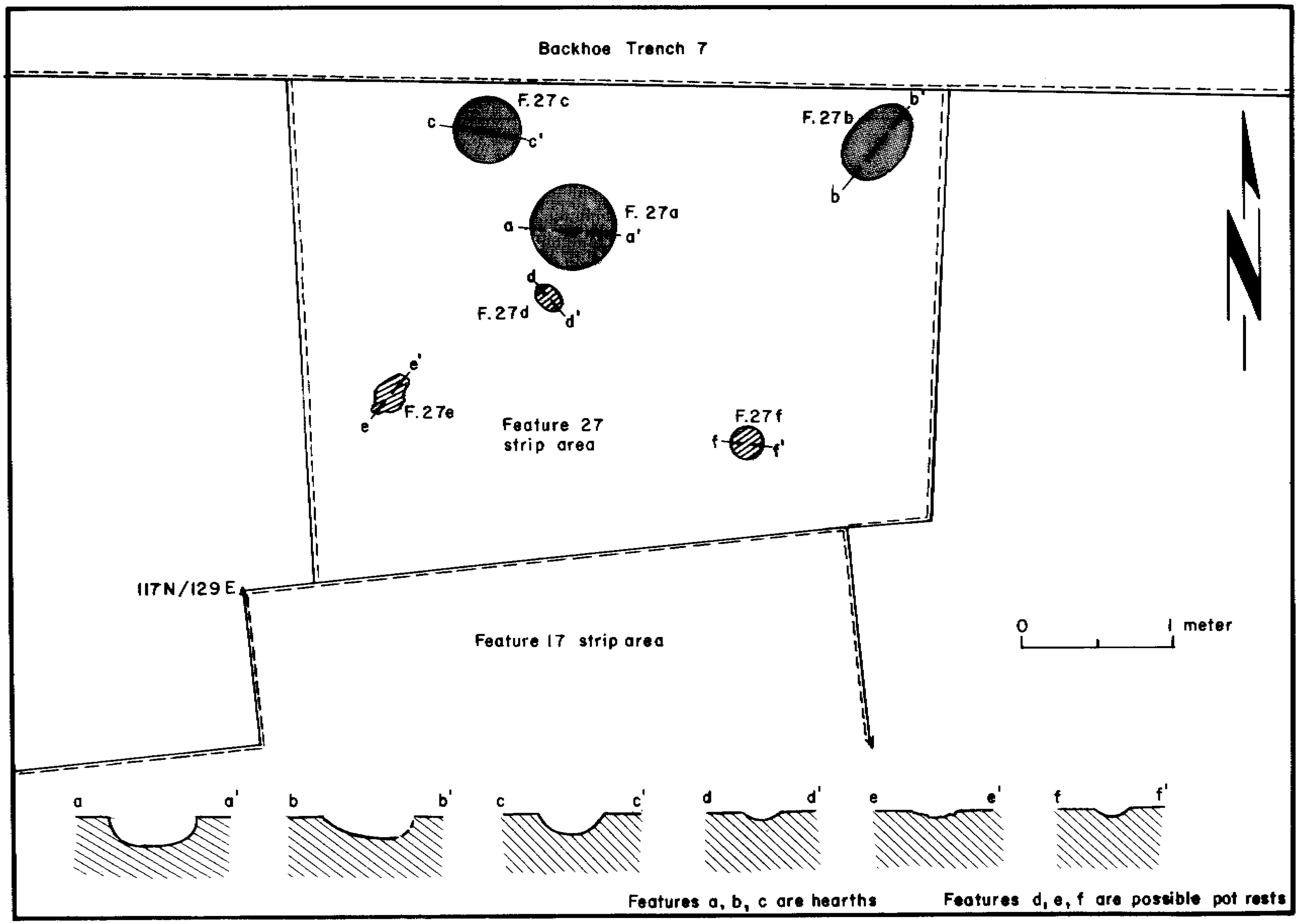


Figure 39. Plan and profiles of Feature 27.

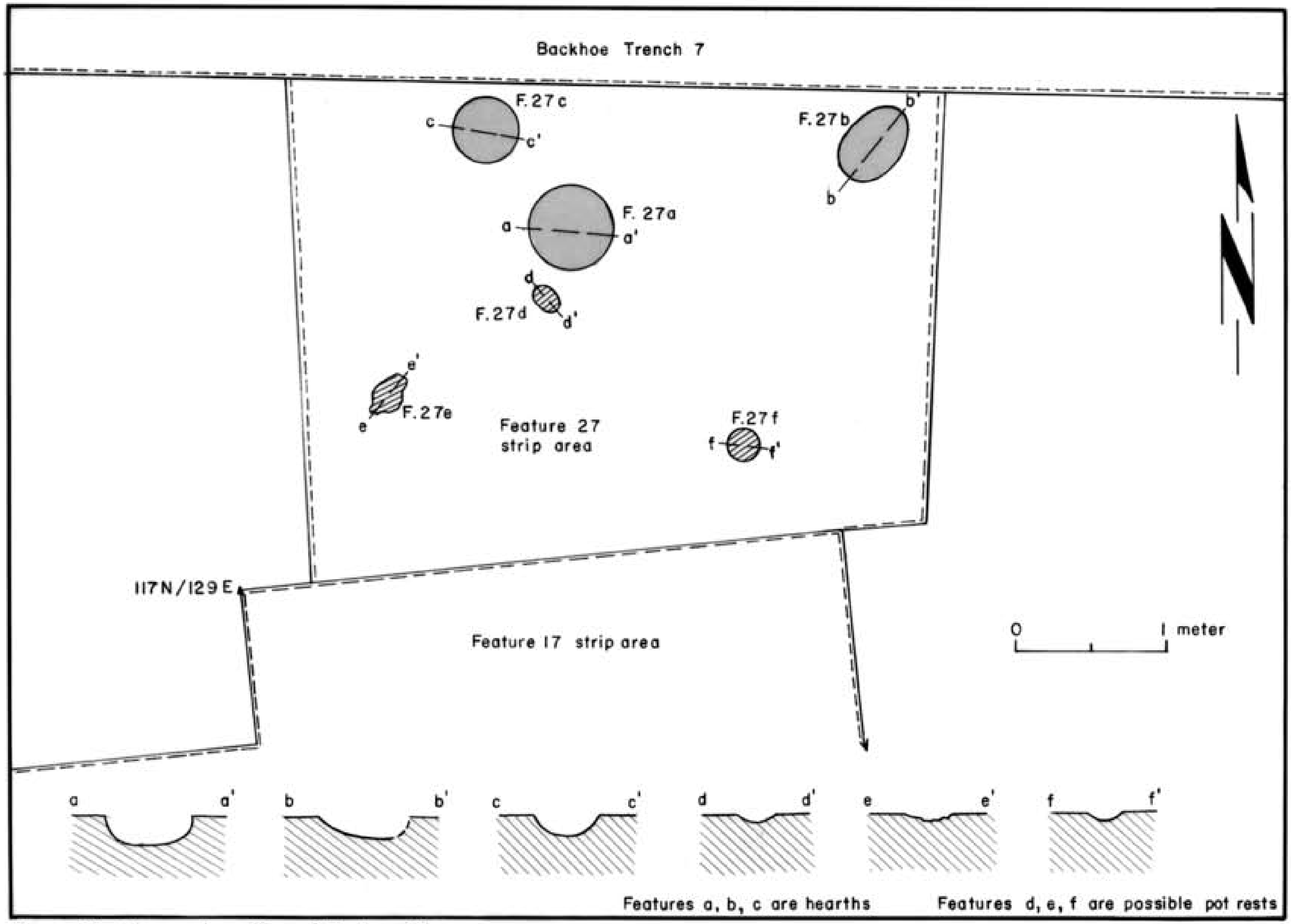


Figure 39. Plan and profiles of Feature 27.

Table 3. Extramural posthole and post socket data

Feature	Dimensions (cm)
Postholes	
21a[1]	22 x 21 x 32
21b[1]	26 x 23 x 26
21c[1]	17 x 17 x 6
21d[1]	15 x 14 x 4
23g	21 x 22 x 50
23l	17 x 16 x 25
29e	12 x 12 x 23
42l	16 x 16 x 26
Post Sockets	
23k	9 x 9 x 11
33c	17 x 20 x 9
42p	10 x 9 x 5
42q	10 x 11 x 16
42s	10 x 11 x 15
associated with 42k	13 x 14 x 13
associated with 42n	12 x 10 x 10

[1] May not be structural; see text.

Given the relatively small quantities of trash, the artifact inventory from the Belen Bridge site is remarkably varied, but each type is represented by only a few artifacts. Artifacts associated with food acquisition, preparation, consumption, and storage (projectile points, manos and metates, pottery) dominate the assemblage. Also found were floor/wall plaster smoothing stones, a cloudblower, jewelry, fossils, pithouse equipment (ventilator blocking slab), general purpose tools (abraders, awls, chopper, hammerstones, knives, a polishing stone, and flake tools for cutting and scraping), and chipped stone and jewelry manufacturing debris. Clearly, a full range of items and activities necessary for the maintenance and conduct of daily life is represented.

During the planning and production of a tool or artifact, the maker had in mind either a specific tool for a specific function or a more generalized tool for multiple functions. This is not to say that many or most special-use tools did not, during their use-lives, serve more than one function. Most probably did. However, it is important to distinguish the originally intended functions of the artifacts, which helped determine what form the tools would take. Skill requirements, amount of labor investment, and fragility of the finished product are important aspects of the distinctions being made here.

A good example of a special tool is the projectile point. For aerodynamic, functional, and perhaps other reasons, their characteristics (size, shape, weight, and hafting elements) had to meet certain specifications. This undoubtedly did not preclude the occasional use of a hafted arrowpoint for limited cutting or scraping as long as these chores did not risk breakage. This type of secondary use of a special tool differs from secondary uses imposed after breakage and discard. Using the projectile point example, a broken point could be used in an impromptu fashion, much like a utilized flake. Importantly, such use probably cannot be distinguished from secondary use characteristics engendered while the artifact was hafted and still a functioning projectile tip.

General-purpose tools are those made with the intention of serving two or more but not necessarily related functions, for example, the awl and the hammerstone. The awl might be used for hide working and basket weaving, and the hammerstone could be used for chipped lithic and ground stone artifact manufacturing as well as maintenance of the grinding surfaces of manos and metates during their use-lives.

The artifacts will be discussed according the following functional categories: hunting; plant-food processing; construction tools; general purpose tools; ornamental, ceremonial, or recreational artifacts; and miscellaneous artifacts. The better-represented categories are discussed first, and the lesser ones last. The miscellaneous category includes unfamiliar items and those too fragmentary to be assigned elsewhere.

Hunt-Related Artifacts (Projectile Points)

The six projectile points include two Archaic-style examples (Figs. 40a and 40b) and four arrowpoints (Figs. 40c-40f; Table 4). One of the Archaic-style points is stemmed with an indented base and steeply retouched (reworked?) blade edges (Fig. 40a). The other has the silhouette of a squat, San Jose type (Fig. 40b). Both specimens are complete.

Three arrowpoints are side-notched, and one is unnotched (Figs. 40c-40f). Of the side-notched points, one has a straight base, another has a slightly indented base, and the base is missing on the third. Two are complete and one is fragmentary. The very small, unnotched projectile point is also fragmentary; the tip and one corner are missing.

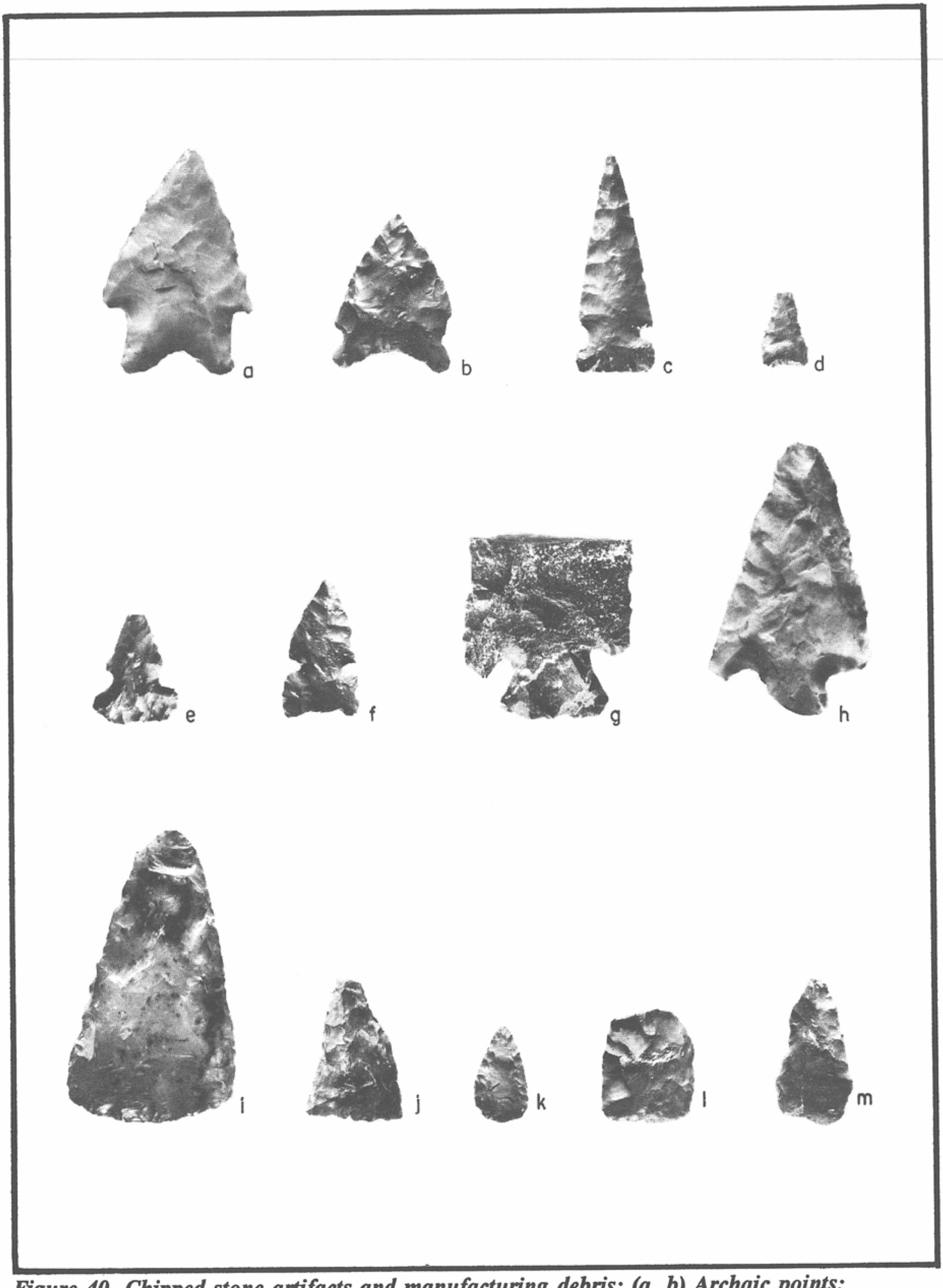


Figure 40. Chipped stone artifacts and manufacturing debris: (a, b) Archaic points; (c-f) arrowpoints; (g, h) knives; (j-m) projectile point preforms.

Table 4. Projectile point data

Type and Provenience	Length (cm)	Width (cm)	Thickness (cm)	Weight (g)	Material	Remarks
Archaic-like						
Disturbed fill	3.8	2.5	0.6	4.6	light gray chert	stemmed; indented base; blade reworked; complete
Disturbed fill	2.6	2.0	0.4	1.4	opaque obsidian	squat, San Jose-like; complete
Ceramic Period						
Pithouse 2, Stratum 3	3.6	0.8	0.5	1.4	opaque obsidian	side notches; straight base; complete
Feature 16, lower fill	1.3+	0.8+	0.2	0.1+	opaque obsidian	very small and unnotched; incomplete
Feature 24 stripping	1.8+	1.4+	0.3	0.6+	hazy black obsidian	side notches; straight base; incomplete
Pithouse 5, lower fill	2.3	1.3	0.3	0.6	opaque obsidian	side notches; slightly indented base; reworked (?); complete

+ measurement of broken point

Table 5. Dimensions of metate fragments

	Length (cm)	Width (cm)	Thickness (cm)	Weight (g)
Mean	8.06	8.18	6.34	462.1
SD	3.38	1.40	2.77	174.94
Range	3.6-14.4	5.7-10.8	3.0-11.5	133-714

Table 6. Dimensions of mano fragments (does not include complete mano)

	Length (cm)	Width (cm)	Thickness (cm)	Weight (g)
Mean	8.78	8.83	2.85	292.4
SD	2.89	2.41	0.80	190.07
Range	4.8-15.8	6.0-12.3	2.1-4.6	88-571

Three small bifacial fragments appear to have been parts of finished artifacts. Their thicknesses suggest that they may be projectile point fragments. One (of dark red chert with white streaks) seems to represent an Archaic style, and another (of white chalcedonic chert) may be from a corner-notched style point. The third was made from dark gray obsidian. All three are from nonspecific proveniences such as stripping areas.

Plant-Food-Processing Artifacts

A salient aspect of the manos and metates from Belen Bridge is that all are small fragments. The two largest manos, for instance, are only half complete. The small size of most, especially the metate fragments, suggests that there was a deliberate attempt to break them. One column-shaped metate fragment has a thickness of 11.5 cm, yet the remaining grinding surface on the fragment measures 6.3 by 6.7 cm. Minimal work was expended in forming most of the metate and mano specimens. Usually, the creation of the grinding surface and the reduction of odd angles of the stones are the only evidence of modification. Also, most specimens show very little use-wear.

In addition to the manos and metates described below, 10 very small fragments may be from manos. Eight are of sandstone, and two are of basalt. One small sandstone fragment may be from a metate, and another sandstone fragment has two grinding surfaces, one for use as a metate and the other as a mano.

Metates

The ten metate fragments represent nine specimens and three types: basin, trough, and slab (Table 5). They are made of basalt (44 percent), a crumbly white sandstone (33 percent), and a poorly to well-cemented tan sandstone (22 percent). They were distributed as follows: Pithouse 1 fill, 1; Pithouse 2 fill, 2; Pithouse 4 fill, 3; Pithouse 5 fill, 2; Pit 18 fill, 1; miscellaneous, 1.

Basin metates are represented by three definite and one probable examples. One appears to be of the distinctly Archaic form with a small oval basin in a larger stone. One was used to grind yellow pigment, and another also was used as a mano. Two are partially burned.

Trough metates are represented by three fragments, two of which belong to the same artifact. Of all the metates, these show the most use, though neither was particularly thick to start with. One is nearly worn through the bottom. The other was sufficiently long-lived that a second mano was used with it, as evidenced by a second, narrower trough within the first. The single fragment and one of the two that fit together are partly burned.

One definite and one probable slab metate were found. The definite example is partially burned.

The thick, column-shaped metate fragment mentioned above is too small to determine its type.

Manos

The 13 complete and fragmentary manos represent two types: one-hand and two-hand (Fig. 41; Table 6). They are made of crumbly to well-cemented tan sandstone (46 percent), basalt (38 percent), off-white sandstone (8 percent), and dirty sandstone (8 percent). One is complete, two are half manos, and the rest are small fragments. They were distributed as follows, including the complete mano: Pithouse 1 fill, 2; Pithouse 2 fill, 2; Pithouse 3 fill, 1; Pithouse 4 fill, 4; Pithouse 5 fill, 1; Pithouse 8 fill, 1; Pit 18 fill, 1; miscellaneous, 1.

Two-hand manos appear to be the more common, though the fragmentary nature of most specimens makes this determination difficult. Two are definitely two-hand manos, and another nine are probable. All but one have single grinding

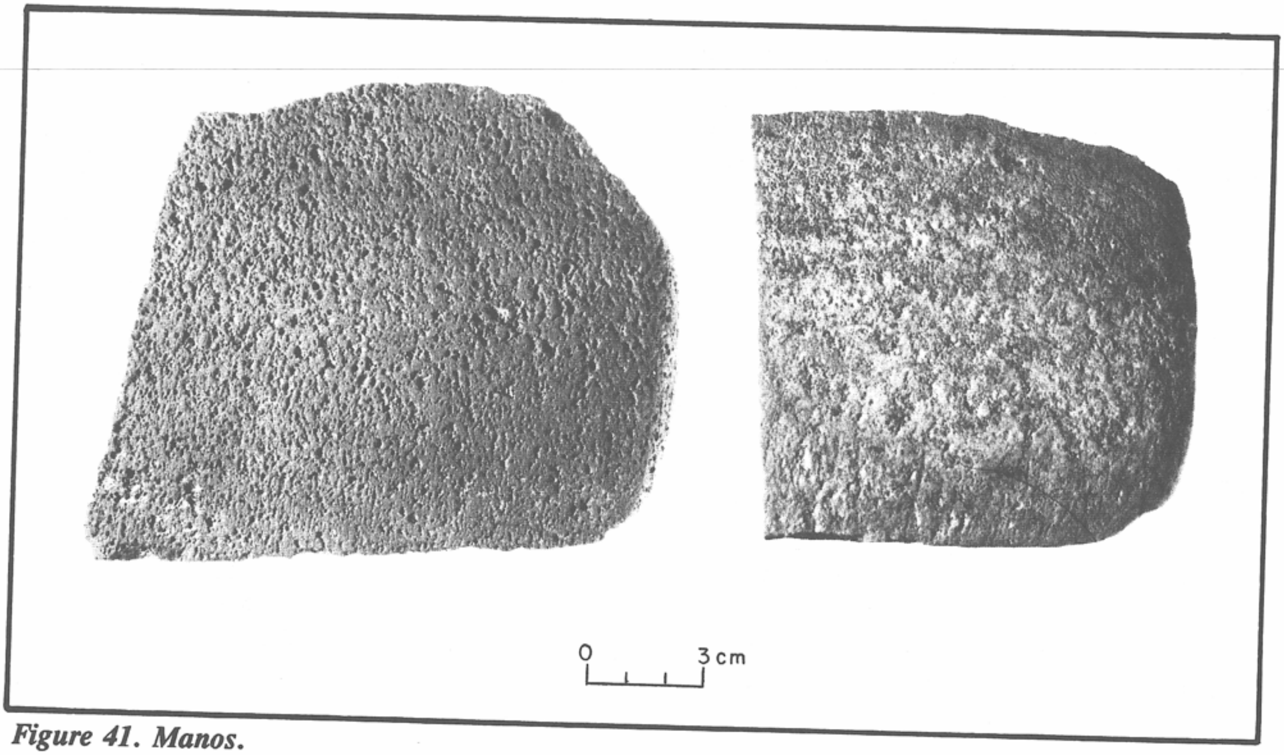


Figure 41. Manos.

surfaces, and of these, all but one are flat to slightly convex. The grinding surface of the other is double-faceted, and the mano as a whole has a diamond-shaped transverse cross section. Its up-curved end indicates use on a trough metate. One mano has two grinding surfaces, one well developed, and the other poorly developed. One fragment is partly burned.

There are two one-hand manos. One, of crumbly sandstone, is complete and has two fairly well-developed grinding surfaces. Its edges have been shaped by pecking and grinding. It measures 12.6 by 8.9 by 4.1 cm and weighs 891 g. The other is basalt and has two parallel grinding surfaces, but the artifact is so poorly developed that it is impossible to determine whether it is complete or fragmentary.

Construction Tools

One complete and one fragmentary river cobble each have polishing wear on one face. They may have been used to smooth the wall and floor surfaces of the structures. The complete specimen measures 7.6 by 5.2 by 5.0 cm and comes from the lower fill of Pithouse 6. The fragment measures 9.3+ by 5.3+ by 2.6+ cm and comes from the medial fill of extramural Pit 26.

General Purpose Tools

Several tools were probably made with the intention of serving more than one function. It will be noted that utilized flakes are included in this section even though they are not formed tools (in the sense that they lack intentional shaping). However, there is a growing body of evidence that a major aspect of ceramic-period core reduction was directed towards obtaining flakes with sharp edges which could be used as needed for cutting and scraping activities. As a group they were used for a variety of purposes and therefore can be characterized as general purpose tools.

Abraders

Five pieces of poorly consolidated sandstone and two naturally rounded pieces of pumice have well-flattened surfaces and rounded edges indicative of heavy use (Fig. 42; Table 7). The coarseness of the grain would make these pieces useful for sanding and abrading activities, though there is no clue as to what material or materials were worked. The pumice specimens came from the floor fill of Pithouse 3 and the middle fill of Pithouse 4. The sandstone specimens came from the upper middle and floor fill of Pithouse 2 and the middle fill of Pithouse 4.

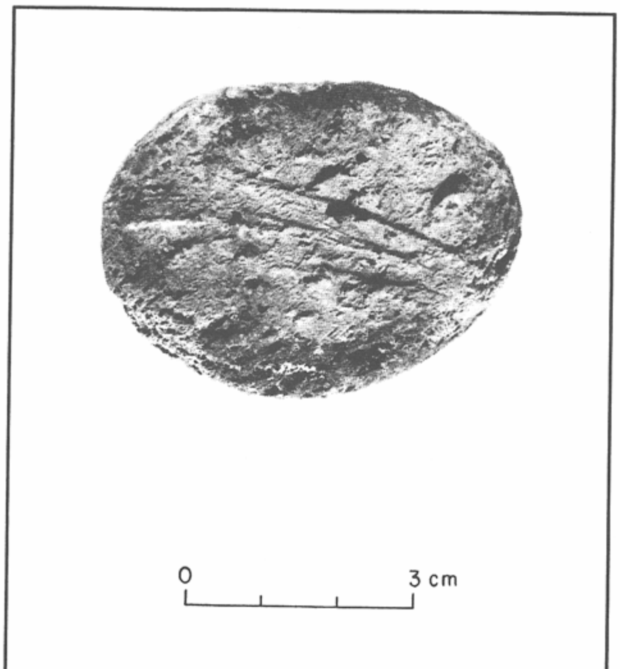


Figure 42. Pumice abrader.

Awls

Three awls display minimal modification of the bone splinters and elements from which they were made. One, from Pithouse 3, Level 3 fill, was made from a large mammal long bone splinter and measures 15.3+ by 1.0 by 0.5 cm. Another, from Pithouse 4 north fill, was made from a split radius with the distal head left partially intact and measures 10.5 by 0.9 by 0.7 cm (Fig. 43).

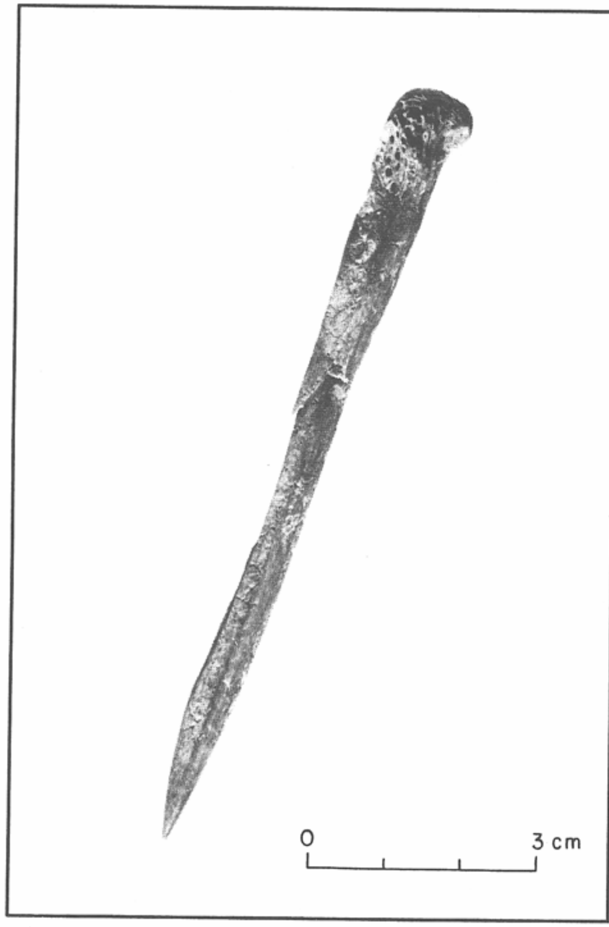


Figure 43. Awl.

The third, from the uppermost 6 cm of fill in Pit 48a, was made from a splinter of a mammal long bone and measures 7.7 by 5 by 0.45 cm. All are in a very poor state of preservation.

A fourth, very small awl is from the lower fill of Pithouse 7. The small bone sliver has been

Table 7. Dimensions of abraders by material type

	Length (cm)	Width (cm)	Thickness (cm)
Sandstone			
Mean	10.6	8.2	4.0
Range	7.9-13.5	4.1-10.3	3.3-4.6
Pumice			
Mean	6.5	4.1	2.9
Range	5.6-7.4	3.8-4.3	2.8-3.0

Table 8. Dimensions of hammerstones

	Length (cm)	Width (cm)	Thickness (cm)	Weight (g)
Mean	8.1	6.6	5.1	351.1
SD	1.2	0.8	1.2	137.6
Range	5.9-11.5	5.3-7.9	2.2-7.2	131-654

Table 9. Dimensions of complete cutting tools

	Length (cm)	Width (cm)	Thickness (cm)
Mean	3.5	2.2	0.9
SD	1.0	0.6	0.4
Range	2.3-5.0	1.4-3.9	0.2-2.1

Table 10. Distribution of all cutting tools

Provenience	Knives	Heavy Cutting Tools	Knife/Shavers	Knife/Scrapers
Pithouse 1 fill	2		2	
Pithouse 2 fill				1
Pithouse 4 fill	4	2	1	
Pithouse 7 fill			3	
Pit 18 fill	1		1	
Miscellaneous			1	

shaped around all edges, and the tip is ground to a point. It measures 2.5 by 0.5 by 0.1 cm.

Six small fragments, two of which fit together, are also probably parts of awls. In general, all are poorly preserved.

Chopper

A small cobble has had several flakes bifacially removed from the larger end to produce a straight, sharp ridge which could then be used for chopping. The edge, which displays heavy battering, has an angle of 80-90 degrees and a length of 6 cm. The chopper measures 10.2 by 8.2 by 4.4 cm and comes from the lower fill of Pithouse 7.

Hammerstones

Thirty-four cobbles display battering and scarring indicative of pounding (Table 8). Shape and condition vary: unmodified cobbles with limited battering on one end; partially modified cobbles possessing several flake scars having battered ridges and points; and greatly modified pieces from which virtually all traces of the original cobble surface have been removed. Many ridges and points on the latter examples are greatly dulled from use. Materials include quartzite (67 percent), chert (15 percent), rhyolites and basalts (9 percent), red granite (6 percent), and silicified wood (3 percent).

An examination of hammerstone distribution by weight in 50 g increments shows four modes (Fig. 44). They were distributed as follows: Pithouse 1 fill, 3; Pithouse 2 fill, 1; Pithouse 4 fill, 14; Pithouse 6 fill, 2; Pithouse 7 fill, 3; Pit 15 fill, 1; Pit 18 fill, 7; Pit 26 fill, 2; miscellaneous, 1. The mode encompassing the range 331-480 g includes 17 hammerstones, or 50 percent of the specimens.

Knives

Fragments of three large bifaces, two of them corner-notched and the third unnotched, may be from hafted knives (see Fig. 40). One corner-notched specimen from Pithouse 4 stripping is missing half of the blade, measures 3.1+ by 2.8 by 0.6+ cm, and is made from dark red chert (jasper) with white streaks (Fig. 40g). The corner-notched specimen from Pithouse 4 floor fill is badly broken, measures 4.6+ by 2.6+ by 0.6 cm, and is made from light gray chert with red and olive-green mottling (Fig. 40h). The unnotched specimen from Pit 18, Level 2, is roughly triangular, may have been heat-treated, measures 5.0 by 2.8 by 0.7 cm, and was made from light gray chalcedony with black and reddish-brown inclusions (Fig. 40i).

The suggested function of these items is based solely on morphology because the presence or absence of use-wear and the interpretation of use-wear is not necessarily definitive.

Polishing Stone

An unmodified cobble has one face with a heavy polishing sheen. The cobble measures 7.6 by 5.2 by 5.0 cm, and the area bearing the polishing sheen measures 3.0 by 3.5 cm. The materials on which this artifact were used are unknown, but it appears to be too small for effective use on house plaster or animal hides and is probably too large for use in pottery manufacture.

Flake Tools (by Karen L. Wening)

Belen Bridge informal tools (N=59) form only 2 percent of the assemblage and are almost all unmodified debitage with light, one-time use. Generalizations are difficult to make based on the small size of the tool assemblage. Mean tool sizes are larger than mean debitage size, indicating a preference for larger debitage flakes for tools.

Tools were monitored for edge contour and angle, location and type of edge damage, retouch modification, and tool condition. Eleven tool types and four functional categories (cutting tools, scraping tools, drills, and notched tool) were devised.

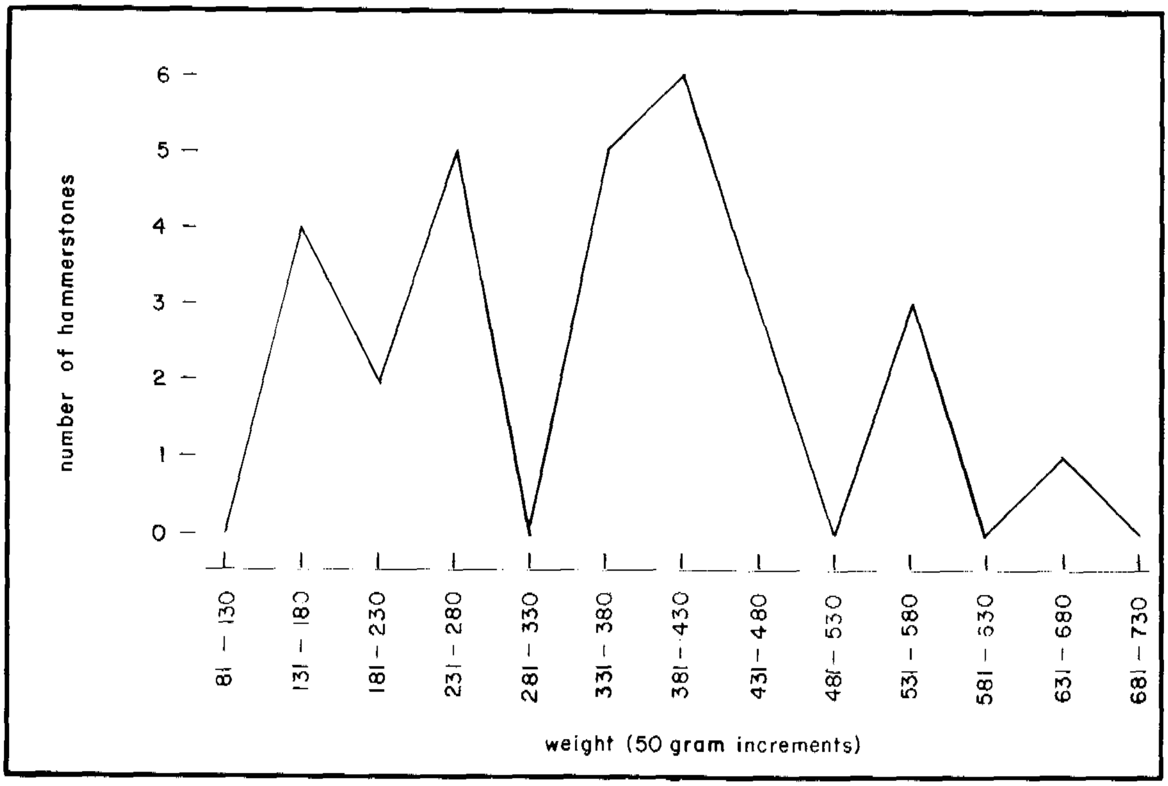


Figure 44. Hammerstone distribution by weight.

Cutting Tools. The 14 cutting tools include knives (7), knives/shavers (8), heavy cutting tools (2), and knives/scrapers (1) (Tables 9 and 10). Knives exhibit an edge angle measuring between 15 and 40 degrees and exhibit bidirectional wear. Knives/shavers possess two used edges, one of which has been used as a knife, and one of which has been used as a shaver. The term "shaver" is used for edges exhibiting acute-edged angles with unidirectional wear. Since the edge is too acute for use as a scraper, yet exhibits wear typical of scraping, it may have been used in a shaving motion as in whittling. Extremely acute edge angles, such as those measuring between 26 and 35 degrees, may be best for cutting (Wilmsen 1968:156) or tasks associated with longitudinal motion (Siegel 1985:93). Although edge angle is used in functional determination of tools at LA 53662, location and type of use-wear is considered equally, if not more, important.

Once edge angle observations are used to "narrow down the probable use of the tool," use-wear should then be used for more specific functional assignments (Siegel 1985:93). For example, knife edges are acute and exhibit bidirectional wear resulting from longitudinal motion, which occurs along nearly the entire length of thin, lateral flake edges. Knives/shavers exhibit steeper edge angles (20 to 55 degrees) and unidirectional wear, usually restricted to a distal portion of a lateral flake edge. Knife/shavers are larger and thicker than knives, but edge damage and morphology suggest a shaving type of use rather than a scraping one. The heavy cutting tools exhibit bidirectionally scarred and crushed edges with angles of 35 and 65 degrees. The single knife/scraper is a small Jemez obsidian flake with one unidirectionally worn, 45 degree edge and one bidirectionally worn, 15 degree edge.

Scraping tools. The 32 scraping tools range in size from small chert, chalcedony, and obsidian flakes to large basalt flakes, and all but two exhibit steep edge angles with unidirectional wear (40 to 80 degrees). Two tools with edge angles of 30 and 35 degrees display ventral abrasion and unidirectional edge scarring indicative of scraping use despite the sharp edge angles. The distribution of scraping tools was as follows: Pithouse 1 fill, 4; Pithouse 2 fill, 2; Pithouse 4 fill, 3; Pithouse 5 fill, 1; Pithouse 7 fill, 7; Pithouse 8 fill, 1; Pit 16 fill, 1; Pit 18 fill, 7; Pit 24 fill, 1; Pit 26 fill, 1; Pit 48b fill, 2; miscellaneous, 2. Dimensions of the 25 complete scrapers are listed in Table 11.

Drills. The three drills are small but complete (23 by 13 by 9 mm, 20 by 6 by 4 mm, and 21 by 18 by 6 mm. Two are chalcedony, the other of black local obsidian. Two drills are unidirectionally retouched along one edge and exhibit end rounding. The obsidian drill is heavily rounded with unidirectional striations occurring on the flattened part of the bit, indicating a nonrotary motion for the tool, at least during the last stage of use. The chalcedony drills retain pointed bits which are rounded and slightly polished over the entire tip of the drill. Two drills come from the lower fill of Pit 18, and the third from Pit 48b fill.

Notched Tool. One brown chalcedony flake is unidirectionally retouched along a lateral edge to form a small concavity which exhibits unidirectional wear (23 by 13 by 7 mm). It was found on the surface.

Ventilator-Opening Blocking Slab

A crumbly sandstone slab has a pentagonal shape, one well-smoothed surface, and one partly smoothed surface. The edges, aside from being broken, are not otherwise modified. The smoother surface is partially burned towards one end. The artifact was found blocking the inside opening of the ventilator in Pithouse 6, but its angular shape only loosely fit the oval opening. Thus, its final placement apparently was impromptu, probably to prevent sand from drifting into the structure during the absence of the owners. It measures 19.9 by 14.3 by 3.3 cm.

Ornamental, Ceremonial, and Recreational Artifacts

A variety of items probably served as ornaments or ceremonial paraphernalia or recreational equipment. (Today, bead necklaces frequently serve for secular adornment and as important accoutrements during ceremonies.)

Beads

The 11 recognizable beads are made from three types of materials and represent three basic forms. Another four fragments, all of shell, are probably parts of ornaments.

Tubular bone beads. The six specimens of tubular bone beads, the most common form, are made from sections of bird long bones (Fig. 45). Lengths range from 16 to 37 cm and diameters from 3 to 11 cm. They were made by cutting the bone shafts into sections and grinding the ends smooth. Proveniences include Pithouse 1, Level 2; Pithouse 3 fill; Pithouse 4 stripping; and Pit 18, Levels 2 and 5.

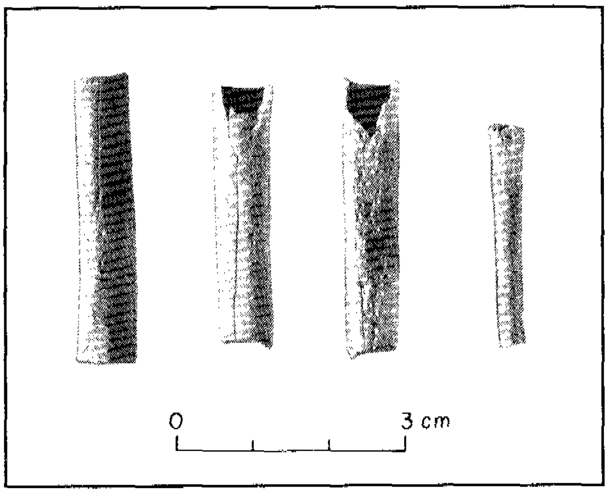


Figure 45. Tubular bone beads.

Discoidal beads. Four beads, two of a white crystalline material (calcite?) and the third of stone but burned too much to allow mineral identification, are approximately round and clearly were intended to be discoidal (Fig. 46). They are 4 to 5 mm in diameter, 2 mm thick, and have bidirectionally drilled holes. Two were recovered

recovered from the floor fill of Pithouse 4, and two came from the fills of the hearth and the ash pit of Pithouse 8.

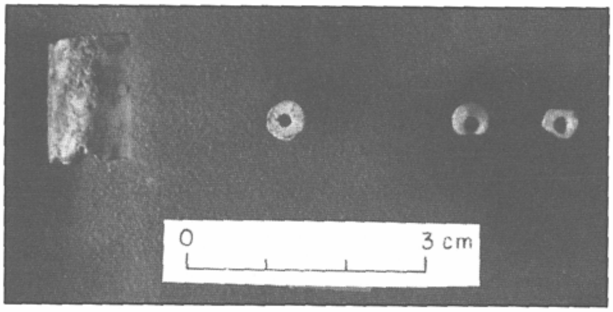


Figure 46. Discoidal beads.

Fetish (?). The third bead type is an unfinished fetish, probably of a mountain lion (Fig. 47). It is long-bodied, has stubby legs carved in low relief, and has a long tail which extends straight out to the back. The partially drilled suspension hole was started through the shoulders, but apparently the piece broke before it could be completed. The material is the same whi crystalline material (calcite?) noted for anoth bead. It measures 1.9+ by 0.6+ by 0.4+ cm and came from the fill of the Pithouse 4 ventilator shaft.

Figure 47. Bead fetish, probably of a mountain lion.

Pendants/Earbobs

A matched set of triangular artifacts was made from the shells of an unidentified, nonfossil bivalve (Fig. 48). They measure 3.7 by 3.4 by 0.1 cm and 3.8 by 3.7 by 0.2 cm and came from the floor fill in the northeast corner of Pithouse 3.

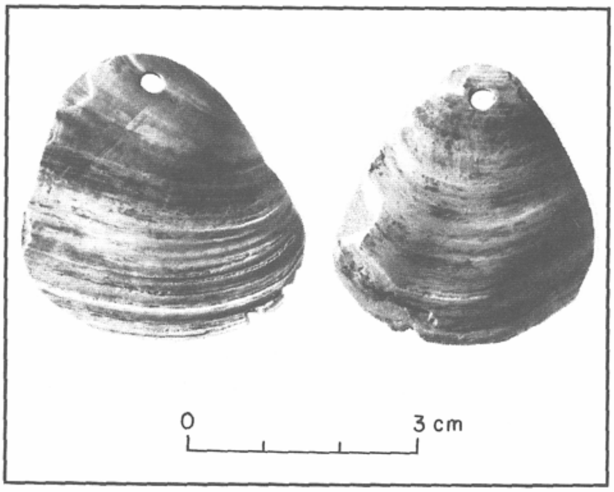


Figure 48. Shell pendants.

Shell Tessera

A small, rectangular piece of shell with rounded corners was probably designed to fit in a mosaic ornament (Fig. 49). Both surfaces were removed down to the mother-of-pearl layer. It measures 1.2 by 1.1 by 0.1 cm and came from Level 1 of Pit 18.

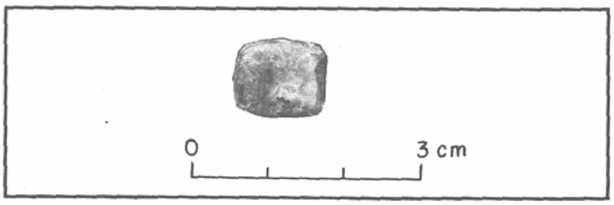


Figure 49. Shell tessera.

Shell Bead/Pendant Blank

A small oval piece of shell has a fairly well-rounded shape. The original shell exterior surface has been partially ground but not removed. It measures 1.7 by 1.4 by 0.15 cm and came from the floor fill of Pithouse 7.

Fossils

Three fossilized bivalves--one brachiopod and two pelecypods--are complete or nearly so (Fig. 50). None shows modification of any sort, and their degree of preservation (amount of detail) varies from good to poor. They had to have been brought into the site by the Indians since these types do not belong to the local geologic deposits. One and perhaps all three are similar to fossils common to the Pennsylvanian period. They range in size from 19 by 20 by 10 cm to 37 by 31 by 20 cm. All three came from stripping and disturbed proveniences.

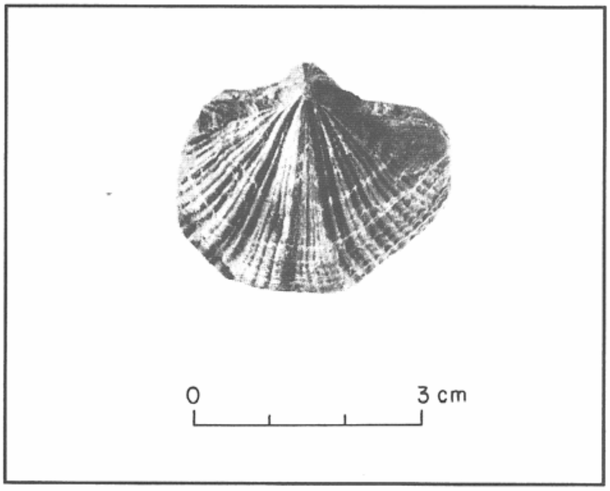


Figure 50. Fossilized bivalve.

Cloudblower

A small fragment of what appears to be a tubular ceramic pipe had charred material clinging to the interior surface of the bowl. Part of the rim and bowl are present. The paste is similar to that of the brown ware utility vessels. The artifact came from stripping at the north end of the site.

Dipper

A miniature dipper was carved from a naturally rounded piece of pumice (Fig. 51). It measures 77 by 42 by 22 cm and came from Pit 5c fill.

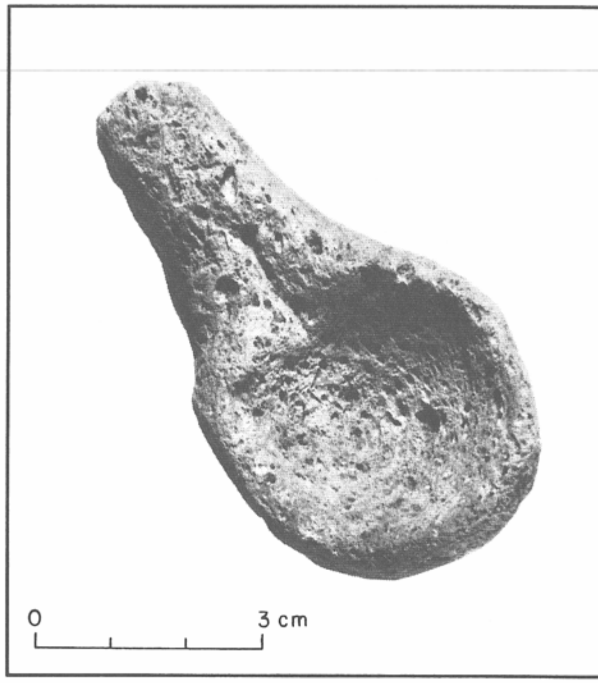


Figure 51. Pumice dipper.

<u>Miscellaneous Artifacts</u>

The form and function of the following items are unknown.

Slab Fragments with One Surface Ground Flat

Eleven small sandstone slab fragments have one side ground down to a flat surface. At least two kinds of sandstone are represented, fine-grained white to off-white and crumbly tan. Three are partly burned, but the burning does not appear to be intentional. They range in size from 5.7 by 3.6 by 2.7 cm to 11.2 by 9.0 by 1.6 cm. They come from Pithouse 1, middle fill; Pithouse 2, middle and floor fills; Pithouse 4, middle fill; Pit 18, middle and lower fill; and Pit 26, upper fill.

Grooved Cobble

A fragment of a flat quartzite cobble has a narrow, shallow groove pecked down one face and across one end. It is reminiscent of the hafting grooves of some axe forms, but this item does not

Table 11. Dimensions of complete scrapers

	Length (cm)	Width (cm)	Thickness (cm)
Mean	4.2	3.1	1.3
SD	1.4	1.2	0.5
Range	2.5-7.2	1.2-6.3	0.6-2.2

appear to be an axe. It measures 60 by 77 by 24 cm and came from miscellaneous disturbed deposits.

Miscellaneous Cobble and Slab Items

Nine sandstone, quartzite, and basalt pieces display various degrees of grinding and/or polishing through unknown uses. Three of the six sandstone slab fragments are partly burned, as is one of the two quartzite cobble fragments. The basalt specimen has a well-developed convex grinding surface on one facet, but it is too small to determine the original size and shape. Sizes range from 4.3 by 4.1 by 2.6 cm to 11.4 by 7.7 by 1.8 cm. Proveniences include Pithouse 1, upper fill; Pithouse 2, middle fill; Pithouse 3, stripping; Pithouse 4, middle and floor fill; Pit 26, upper fill; and Pit 32a, fill.

POTTERY

A total of 8,937 sherds was recovered during the excavations at the Belen Bridge site (see New Mexico Cultural Records Information System, Archeological Records Management Section, for pottery distribution). The bulk of them were presumably locally made and include Corona Corrugated and Elmendorf Black-on-white. The remainder of the sherds include a variety of named and unnamed types, nine of which were probably made in the region and 15 others which were imported from various parts of western and north-central New Mexico or adjacent parts of Arizona and Colorado. From the standpoint of numbers, the most important examples of the latter group are St. Johns Black-on-Red and Polychrome. A number of sherds do not fit an established type, nor do they lend themselves to description as a group. They are tabulated as unidentified sherds and not described.

The analysis focused on sherds from the critical proveniences--the structures and extramural features, their fills, and in some cases, tightly controlled stripping collections in the their immediate vicinity. Thus, 3,019 sherds from noncritical proveniences (mechanical and hand-stripped areas and miscellaneous surface collections throughout the field phase) were not analyzed. Before the analysis of the selected samples began, all of the very small sherds, poorly preserved sherds, the sherds from the unpainted portions of painted vessels, and burned painted sherds, totaling 1,730 pieces, were also removed from further consideration. The objective was to use only those sherds which were large enough to have definitive attributes and to reasonably eliminate guesswork during the analysis. However, all White Mountain Red ware sherds were analyzed, including the very small sherds, to establish the ubiquity of the type at the site. The analyzed sample, then, involved 4,188 sherds, or 46.9 percent of the recovered total.

Two major objectives of the analysis, in addition to the usual temporal and functional considerations, were to make a reasonably accurate count of the numbers of painted and imported vessels represented (locally made utility vessels were excluded) and to identify the sherds belonging to individual vessels. These objectives would allow us to discover the relative popularity of the various types, give us perspective on the actual representation of St. Johns Polychrome and related White Mountain Red ware types, and provide us with data on temporal and occupational relationships among the structures and extramural features. Other benefits of these studies include perspective on the integrity of the deposits and the relative speeds with which they accumulated. The last two aspects have already been discussed in the individual structure descriptions.

Thesherd-matching/vessel-identificationstudy was conducted primarily on the painted wares and to a lesser degree on the nonpainted, nonutility wares (Los Lunas Smudged, etc.). Provenience was marked on individual sherds, which were then separating by type. All of the sherds of each type were spread out on a table. Sherds potentially belonging to the same vessel, as indicated by designs, slip colors, or other criteria, were temporarily grouped. Those that actually fit together were noted and set aside.

The others in the initial groups were observed in detail and compared, especially according to paste characteristics. Comparisons were also made with sherds in other groups to avoid misgrouping. If sufficient similarities were found between or among sherds, they were bagged as a single vessel and assigned a vessel number. In a number of instances, single sherds were so distinctive that they could be assigned a separate vessel number. Sherds lacking sufficient distinctiveness to allow comfortable assignment to one of the identified vessels or to be given their own vessel number were tallied as miscellaneous sherds for the type. All of the identified vessels were listed in the analysis notes, and those with sherds representing two or more proveniences were tracked. These vessels form the basis of the provenience correlation study (see "Data Analysis").

Thus, the number of vessels listed for each type is really a minimum number of vessels, rather than a demonstrably accurate total or maximum number. This approach has resulted in three levels of accuracy, two of which are sufficiently accurate to allow confidence in the tempero-spatial study presented in a later section of this report: (1) those with sherds which actually fit together (although some sherds belonging to such vessels may be of the second type), and (2) those which belong to vessels that are so distinctive that the member sherds are readily recognized. In the latter instance, the character of the vessel designs or slip colors or paste are sufficiently unique that it is deemed highly unlikely that two vessels having those characteristics would be present at this site. This would be especially true of those vessels exchanged into the site, but it also appears to be equally valid for a number of the presumably locally made vessels.

Corona Corrugated

2,110 corrugated sherds
440 "plain" sherds

The bulk of the utility pottery recovered from the Belen Bridge site is similar in all respects to Corona Corrugated, the major prehistoric utility ware in the Gran Quivira district (Hayes et al. 1981:64-65). Many sherds are also similar to the pottery of the Tijeras Canyon sites, which Warren (1980:210-212) characterizes as a Corona Corrugated with a mica schist temper local to the canyon. It is not known whether the Belen Bridge examples actually came from these areas, or were made in the Belen area, or some combination of the two. It is clear that this pottery is not part of the Pitoche series (e.g., Marshall 1980a:184), nor does it belong to the more southerly Mogollon utility wares such as those in the Reserve branch (Rinaldo and Bluhm 1956).

The utility ware is an indented corrugated brown ware with the general Pueblo III characteristics of narrow coils and shallow indentations. The workmanship is poor in that the coils are of variable width, both within the same coil and from one coil to the next. The indentations are of variable depth and not patterned in their placement. The mica content varies from sherd to sherd. Some have a micaceous (sparkly) appearance, some have a surface sheen (profuse, microscopic mica flecks), and others have minor amounts of mica that become apparent under magnification.

Paste and Temper

The clay body has a silty appearance and breaks with an irregular fracture. Some were obviously made from residual clays having high mica content and small quantities of clear quartz; they are essentially self-tempered. Tempering material was not systematically monitored, but it is estimated that at least 70 percent of the Belen Bridge sherds have crushed quartz mica schist and another 25 percent (or less) silvery mica schist. The remaining 5 percent have partial schist and sherd and, in a few instances, what appears to be pumice or similar volcanic material. Rare sherds contain only sherd or only volcanic material. Of course, there is no way of knowing whether these last sherds were locally made, but it should be remembered that several river-deposited pumice pebbles, some faceted (as would be created by grinding off material for use as temper) and others not, were recovered from the site.

Colors are usually light to medium gray-brown, though variations include light red, light orange, light brown, light to medium brownish-gray, and gray. Some are black or partially black from carbonization during use or from incomplete firing, which failed to remove all of the natural organic material from the clay. Paste colors may be monotone, duotone, or polytone (zoned or "sandwiched" in appearance).

Surface Finish

Vessel interiors are generally well-smoothed but not polished. Coil meshing, as seen from the interior, is generally well done, for individual coils and undulations derived from imperfect coil melding are rare.

Vessel exteriors are completely corrugated or, less commonly, the upper body is corrugated and the lower body is plain. The corrugations (actually the unobliterated coils) are most often indented, but examples of unindented clapboarding are occasionally noted. The upper coils on the clapboard and the indented corrugated are usually overlapped onto the coils below, the degree of overlap and protrusion from the vessel surface varying from negligible to as much as 3 mm. Examples of nonoverlapped coils are occasionally found. One of the striking aspects of the coils is the highly variable widths, both within the same coil and from coil to coil. Measured widths vary from 3 to 12 mm, and the majority are in the range of 3-6 mm. The depths, shapes, and organization of the indentations also vary. Some are so shallow that they can be detected only in oblique lighting, but most are obvious. Depths range up to 2 mm. The high points are usually rounded or truncated by smoothing or polishing.

Rare examples of shaped or tooled high points were noted, as was one example of fingernail incising. Indentation placement is normally haphazard, though rare examples are offset in oblique rows of ridges and troughs. The clapboard and the indented corrugated treatments are normally unsmoothed, but various degrees of smoothing and/or polishing are common. Another aspect, one that adds greatly to the overall impression that the surface treatment of the utility pottery is exceedingly sloppy and variable, is the frequent presence of flattened spots that obliterate the indentations and coils. These spots were created by handling the vessels or setting them down while the clay was still wet and pliable.

As mentioned in the description of the paste, all sherds contain mica. The quantities vary greatly from sherd to sherd. Some are obviously micaceous to the unaided eye, and others have a sheen produced by large quantities of microscopic flecks. In still others, mica can be detected with the aid of a microscope. Most of the micaceous specimens, however, are not as eye-catching as the present-day products of Picuris and Taos pueblos.

Vessel Forms

Jars are by far the most common form, but two bowl rims were noted during the analysis. None of the sherds is large enough to reveal many details on actual shapes. However, more or less globular bodies with wide mouths and slightly to moderately outcurved rims are indicated.

Discussion

A number of the sherds classified as local conform in surface treatment (especially coil width) to Pilares Banded and Pilares Fine Banded as described by Dittert (1959:413-415). However, the mica schist temper in these sherds is local (in the sense used here), and the treatment of the coils (widths and irregularity of lower edges) constitutes the lower end of the range of treatment found within the assemblage as a whole. That is, if one looks at the assemblage as a whole, these particular sherds are part of a broad spectrum of treatment, with no obvious modes or cutoff points with which to create separate categories or assign them to different types.

A similar problem was encountered with three sherds that have the surface characteristics of Tesuque Smeared Indented. The indentations on all three form parallelograms, as is common to the type. The temper of one is the subrounded clear quartz common to the earlier utility wares of the Santa Fe region; that of another is quartz mica schist (the "local" material), and the third is probably pumice or similar volcanic material. The last two are probably local products and are tallied under Pueblo III indented corrugated. However, all three have been bagged together under Tesuque Indented for easy retrieval and study.

Elmendorf Black-on-white

167 bowl sherds representing a minimum of 56 vessels
23 jar sherds representing a minimum of 14 vessels
1 sherd of an eccentric form

The primary locally made painted ware recovered at Belen Bridge is the almost mythical type, Elmendorf Black-on-white (Fig. 52). Since the appearance of the name in the literature in the 1970s, it has never been formally described or discussed. The name was first used informally by S. L. Peckham and A. H. Warren in reference to a carbon-paint pottery noticed in the sherd collections from LA 406 and nearby sites. Elmendorf is the name of a railroad siding near LA 406, the type site for Casa Colorado Black-on-white. The carbon-paint pottery evidently was overlooked by H. P. Mera when he was setting up his chronologies, defining pottery types, and preparing his various monographs (e.g., Mera 1935). In fact, it is possible that he was referring to Elmendorf Black-on-white sherds when he described Casa Colorado Black-on-white (1935:29-30), for no mineral-paint, smooth-surfaced, Chupadero-like sherds are currently in the type site collections for LA 406. This assumes that such sherds were not removed from the collections subsequent to the naming of the type and previous to Peckham's and Warren's inspection of the sherds (Stewart Peckham, personal communication).

The Elmendorf Black-on-white from the Belen Bridge site has a typical fine, gray Rio Grande paste, may or may not have a white to cream-colored slip, and has late Pueblo II-early Pueblo III solid and hatched designs executed in carbon paint. It is similar in several respects to Socorro and especially Chupadero Black-on-whites, to which it is obviously related. As Marshall has suggested (1980b:71), the relationship of Elmendorf to these types is similar to that of the carbon-painted Santa Fe Black-on-white to the earlier, mineral-painted Kwahe'e Black-on-white in sites to the north. Contacts between the two regions are amply documented by the presence of trade sherds in the sites of both areas, as evident in Museum of New Mexico site collections.

Paste and Temper

The paste texture is normally the semi-dense, very finely granular "Rio Grande" paste, though dense, semi-blocky examples do occur. The fracture varies from moderately irregular to fairly sharp. The break varies accordingly from soft and crumbly to a distinct snap; most have a soft snap.

A variety of tempering materials was noted. Crushed utility and painted sherd temper is usually dominant, resulting in a peppered appearance in the paste. Crushed rock is also common, though it is not clear whether this constituent derives from the sherd temper, or is a separate additive, or both.

The paste color of most sherds is a homogeneous light to medium gray. Variations include dark gray, light brown, zoned light gray and light brown, and carbon-streaked (dark gray to black core).

Surface Finish

All surfaces, except perhaps the most difficult to reach sectors of jar interiors, are usually well smoothed, but the undecorated surfaces are most often left with slight undulations (i.e., smoothed but not "flat"); a few are rather rough, but none are as rough as the typical Chupadero Black-on-white sherd. Scrape marks are rare, and when they do occur, it is usually on jar interiors. Some vessels were not slipped, but many were coated with a thin white or cream-colored clay which often appears to be faded or washed-out. Occasional sherds have a thick slip which is almost always crazed. The slip is usually restricted to painted zones, though occasional bowl exteriors and jar neck interiors were also slipped. Polishing ranges from none to well-polished. Most sherds are streakily polished.

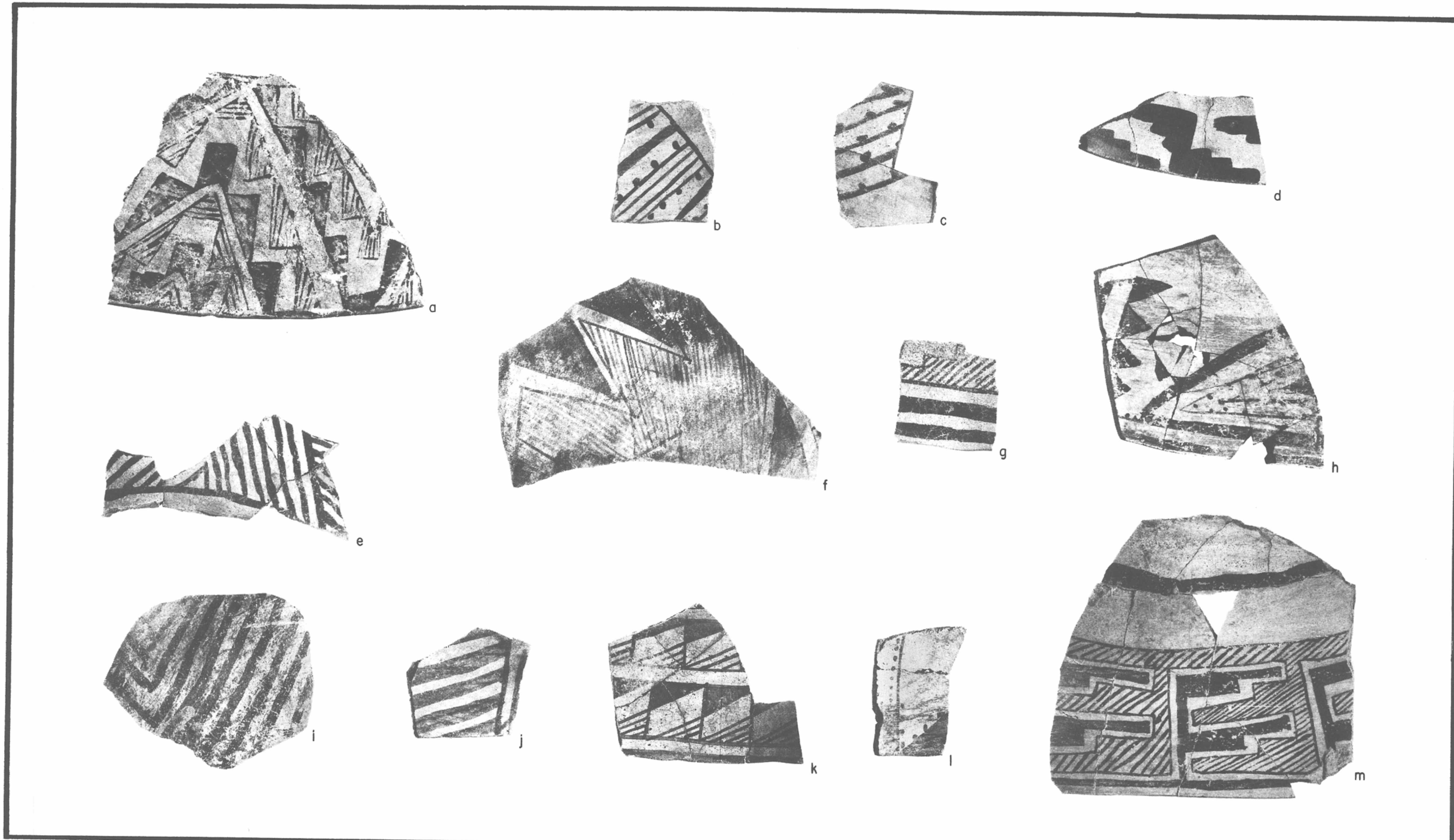


Figure 52. Selected pottery: Elmendorf Black-on-white, showing range in design and finish; and one sherd of Tularosa Black-on-white with carbon paint (lower right).

Designs

The designs are painted in a carbon paint, often gray, thin, and washed-out. Some sherds have a thicker, blacker paint. Most designs are fairly sharp-edged. Fourteen sherds may have a very thin mineral component to the paint.

Design execution varies from fairly precise to sloppy. Most are moderately well done, or about as good the typical Chupadero Black-on-white. Examples with the precision common to Socorro Black-on-white are infrequent.

Design styles include those commonly found on Chupadero, Socorro, Reserve, and Chaco-McElmo black-on-whites. The emphasis in the Belen Bridge specimens is on lines and solids; hatched elements are few. Some designs are distinctly one-of-a-kind, even though they are composed of common elements.

Vessel Forms

Moderately deep and deep bowls and olla-style jars are the known forms. The two measurable bowl orifices are ca. 21 and 26 cm, and the depths are ca. 11 and 12 cm. Rims are simple, direct, slightly tapered to parallel-sided, and rounded to slightly squared (not totally flattened). The sherd material indicates that the general sizes and shapes of the ollas are similar to those of Chupadero ollas.

Comments on Regionally Made Pottery Types

The nine named and unnamed pottery types, all probably manufactured within an arbitrary 80 km (ca. 50 mi) radius of Belen, include Chupadero Black-on-white, Socorro Black-on-white, Los Lunas Smudged, Pitoche Rubbed-Ribbed, four unnamed varieties of brown ware, and a possible Rio Grande copy of Red Mesa Black-on-white. For the most part, the named types conform with established descriptions.

Los Lunas Smudged

An estimated 80 percent or more of the sherds assigned to this type have the fillet of fine bands or combination of fine-banded and corrugated treatment, well-smoothed and polished lower exterior surface, and well-smudged, highly polished interior surface characteristic of the type. However, up to 20 percent of the sherds deviate in one of the three aspects just listed. The fillet may be finely banded, but the actual effect is more like that of the finely banded local Pueblo III indented corrugated sherds (that is, the coils are of uneven width and the lower edges have a ragged, uneven line). In others, the exterior features are typical, but the interior is poorly or spottily smudged. Still others have good fillet treatment and good, polished interior smudges, but the exteriors below the fillet are somewhat rough or streakily polished or both. At least some of these sherds have quartz mica schist temper, so it is possible that they represent a Los Lunas variant made east of the Rio Grande.

Smudged Polished Brown

These plain, smudged, well-polished sherds have the same temper as Los Lunas Smudged. It is likely that they derive from the untextured portions of those vessels.

Unsmudged Polished Brown

These sherds are also like Los Lunas Smudged but lack the interior smudging and exterior corrugations. The temper and well smoothed and polished surfaces are indicative of the Los Lunas tradition.

Thick Brown Ware

The thickness of these brown sherds ranges from 5 to 12 mm, with a mean of 6.9 mm and a mode of 7 mm. The pastes are sandy in appearance. Materials evidently added for tempering include a variety of crushed rocks, including quartz mica schist. The mica content varies from minor to major, but it is usually rather conspicuous, especially under magnification. Other tempers include feldspars of various colors and rare mafics (hornblende?). Some of the tempers are crushed rocks, and others are almost certainly stream sands. Paste colors are variable but usually a shade of medium to dark brown, with or without blackening due to incompletely burned organic material or sooting during use.

The surfaces are fairly well smoothed and usually undulate a little. Some sherds are well polished, but most polishing is streaky. This perfunctory polish is one of the characteristics distinguishing the thick brown wares from the thin ones. Surface colors are the same as paste colors. Flakes of mica are conspicuous on the surfaces, but they are not as plentiful or obvious as those on modern Picuris and Taos vessels.

In general, these sherds and their tempering materials are very similar to the brown ware sherds obtained by the joint COAS-Museum of New Mexico excavation at the Kite site (LA 38448) near Gran Quivira (cf. Wiseman 1986). Quartz mica schist is the major tempering material in Corona Corrugated at Gran Quivira (Warren 1981:71).

Thin Brown Ware

These sherds are like the thick brown sherds in several respects but thinner, better polished, and lacking in the conspicuousness of the mica. Sherd thickness has a mean of 5.25 mm and a mode of 5 mm. The pastes, tempers, and colors are similar to the thick browns. Surface polishing, normally good, varies from streaky to well done.

These sherds are obviously related to the thick brown sherds, and it is entirely possible that the same villages made both. As indicated above, the area of manufacture was probably east of the Rio Grande.

Socorro Black-on-white

About half of the sherds in this category are excellent examples of the type. A number, however, are not as good because the designs are less well executed, even sloppy, and reminiscent of those pictured in Marshall (1980b:Fig. 13A). They are typed as Socorro because of their paste characteristics, surface finish, and general design style.

Rio Grande Copy of Red Mesa Black-on-white (?)

Two bowl sherds from separate vessels have fine-grained "Rio Grande" paste with finely ground sherd temper and relatively thin walls (4.5-5.0 mm). One has a white slip inside and out, well-smoothed and -polished interior and exterior surfaces, and black mineral paint designs in lines and solids. The other has the slip only on the interior, and its design is a massive, black key or stepped figure. Both sherds have an appearance strongly reminiscent of Red Mesa Black-on-white, and the pastes suggest that they may be a Rio Grande copy of the type. Similar sherds have been identified elsewhere in the region (Marshall 1980a:183; Marshall 1980b:72).

Imported Pottery Types

Thirteen named pottery types and several unidentified miscellaneous sherds comprise the wares imported to the Belen Bridge site from regions in western and north-central New Mexico and adjacent parts of Arizona and Colorado. In addition, two other named pottery types may be present. As mentioned earlier, the even distribution of St. Johns Black-on-red and Polychrome and closely related types in the Belen Bridge deposits warrants special attention, and several details of these sherds will be given here. Also, a carbon-paint variety of Tularosa Black-on-white is present and deserves consideration, particularly since it has been seen at a site in the Sierra Blanca region.

St. Johns Polychrome and Black-on-red and Related Types

The most striking aspect of the St. Johns sherds is the variation in several attributes, particularly the paste and the surface colors. In brief, 5 paste colors not attributable to firing conditions, 3 temper types, 12 Munsell surface color values, and 4 colors of paint were recorded. While this amount of variation is perhaps not surprising for the type, we consider it potentially significant for the relatively small number of sherds in a site well outside of the known region of manufacture.

Tularosa Black-on-white with Carbon Paint

A number of sherds representing at least seven vessels have most of the attributes of Tularosa Black-on-white, yet with a couple of crucial differences. The Tularosa attributes include white paste, sherd temper, rather thick walls, squared rims, excellent interior and exterior polish, crazed surfaces, and Tularosa design style (Fig. 52). The differences are a decidedly chunky, crumbly paste, silvery mica on the surfaces of three of the vessels, and dark gray carbon paint. A sherd of this type was observed in the collection excavated from the Robinson site (LA 46326), a Lincoln-phase (twelfth-thirteenth century) pueblo in the northern Sierra Blanca region, 165 km (100 mi) southeast of Belen. The excavations were jointly conducted by Jane H. Kelley (University of Calgary) and Joe Stewart (Lakehead University). The point of origin of the pottery is currently unknown, but the general Magdalena-Winston region, 80 or more km (50 mi) southwest of Belen, is suspected.

MANUFACTURING MATERIALS, DEBRIS, AND TECHNOLOGIES

The materials discussed in this section include chipped lithic debris, bead manufacturing items, and miscellaneous rocks brought into the site, presumably with the intent of making artifacts.

Chipped Lithic Debris and Technology

by Karen L. Wening

A total of 2,764 chipped stone artifacts were analyzed from the Belen Bridge site: 2,534 pieces of debitage (2,277 flakes, 257 angular debris), 59 informal tools, 7 formal tools, 162 cores, and 2 pieces of unmodified raw material. Informal or flake tools are discussed in "Artifacts." Strip-zone flakes and shatter were culled from the analysis due to budgetary constraints, but 100 percent of the tools, cores, and obsidian from the strip zone were analyzed to increase the overall sample size of these items. Thus, 62 percent of the lithic artifacts from the site were analyzed.

The reduction techniques performed on the various materials at the Belen Bridge site indicate an abundance of available raw material. Reduction methods that spared lithic material were infrequently employed. Cores with a series of hinged, or unsuccessful, flake removals and/or obtuse platforms were discarded rather than salvaged. Cores were prepared and reduced to obtain certain flake sizes and were rarely reduced beyond that point, even when further flake removals were possible. Although the nearby source made this selective, limited use of raw material possible, the most frequently used reduction techniques at the site were simple and consistently used among various material types, and they resulted in a fairly well-controlled flake size. More complex, apparently less successful, reduction methods were also used among various materials, though far less frequently.

Methods

All debitage was monitored for type (core, flake, or angular debris), material type and color, presence or absence of heat treatment, percentage of cortex (none, 1-25 percent, 26-50 percent, 51-75 percent, 76-99 percent or 100 percent), dimensions in millimeters, and weight in grams. Flakes were additionally monitored for condition (whole, proximal, distal, or lateral), percentage of cortex on available surface (platform and dorsal surface), termination (feather, step/hinge or modified feather), flake type (core reduction, biface/uniface reduction, platform rejuvenation, bipolar, or hammmerstone), and platform type.

Materials

Seven material categories were used in the analysis: chert, chalcedony, silicified wood, quartzite, obsidian, igneous, and unidentified sedimentary. With the exception of some of the obsidian, all of the material probably derives from the Rio Grande gravels.

Cherts. Cherts (N=311, or 11 percent) vary considerably in quality, though most exhibit good conchoidal fracture. Chert is opaque, with translucence occurring on only the thinnest edges. Because the material came from river deposits, inherent faults do occur, though among crypto-crystalline siliceous materials at the site, chert is by far the best for knapping. The color of the chert is primarily white, gray, brown, and yellow-brown, besides small amounts of red, pink, green, black, and gray-banded. Clastic, fossiliferous, and oolitic chert are also present in small amounts. The majority of the white chert resulted from overexposure to heat, creating an opaque white patina that obscures the internal color of the chert. In cases where the internal color could be seen, that color, rather than the white, heat-treated color was recorded.

Chert debitage is more frequently heat-treated than other lithic materials (N=94, or 31 percent). It also usually exhibits the internal cracks and fire-popped craters typical of overexposure. Most of these damaged pieces are small and have received no modification following heat exposure. This suggests that the treatment was incidental and not deliberate, since almost all other heat-treated materials are not overexposed.

Chalcedony. Chalcedony (N=343 or 48.5 percent), the largest material group at the site, is also the most varied in quality, ranging from an excellent fracture virtually free of internal irregularities to a poor quality, fracture-riddled material with crystalline inclusions. Most of the chalcedony falls between these two extremes, perhaps indicated by a low hinge fracture percentage as compared to some other site materials (N=261, or 20 percent). Chalcedony is distinguished from chert by its translucence, with opaque areas occurring on thick portions of a piece of debitage. Its color is primarily clear, with various combinations of brown, black, and white inclusions. Red, pink, yellow-brown and gray inclusions were also observed. Chalcedony with some combinations of clear, white, and black inclusions is generally high quality, while that with brown, yellow, and yellow-brown tends to have internal fractures. Fossiliferous, clastic, and oolitic chalcedony is also represented within this material group. Chalcedony occurs in the Santa Fe gravels of the Rio Puerco as waterworn cobbles as large as 25 cm maximum dimension (Chapman 1982:189).

A third of all chalcedony is heat-treated (N=389, or 31 percent), resulting in improved quality in most (N=320, or 82 percent). The presence of a clear to milky patina on the chalcedony sometimes gives a heat-treated appearance. This patina may have been erroneously recorded as heat treatment and would thus affect the percentage of heat-treated lithics for chalcedony. However, modification after heat exposure usually revealed an internal surface that could be accurately analyzed.

Silicified Wood. Silicified wood (N=98, or 3.5 percent) varies in quality, though the vast majority exhibits excellent conchoidal fracture, only a few small pieces possessing a splintery structure poorly suited for knapping. Most silicified wood is light or dark brown; other examples are white, pink, gray, yellow-brown, and black. One red palm wood flake in the assemblage probably originated outside the immediate site area. A small percentage (N=9, or 9 percent) of the silicified wood assemblage is heat-treated, virtually never to the point of over-exposure. Silicified wood also occurs in the Santa Fe gravels of the Rio Puerco as water-worn blocks.

Quartzite. Quartzite (N=493, or 18 percent), a locally abundant material, nevertheless comprises a small portion of the assemblage. Although it is characteristically dense, it exhibits a uniform internal structure and displays the lowest hinge fracture percentage among site materials. Gray, purple, white, pink, and brown quartzite predominate, but the considerable color range also includes red, green, yellow, black, gray-banded, and combinations of the above colors. The quartzite is also notable for the large size of the cores and debitage compared to other materials, with the exception of the igneous group. A small portion of quartzite is burned (N=4 percent, or 17), though obviously not for the purpose of improving knapping quality.

Obsidian. Obsidian (N=103, or 4 percent) is mostly of two kinds (N=80, or 79 percent)--smooth opaque black and rough opaque black with clear crystalline inclusions. According to an x-ray fluorescence study of representative examples of each variety by the Obsidian Hydration Laboratory (Eastern New Mexico University), the rough opaque black obsidian with crystals comes from a Rio Grande source in the Los Lunas vicinity. The smooth opaque obsidian comes from Rio Grande gravels in the vicinity of Cochiti between Albuquerque and Santa Fe (J. Montgomery, report on file).

Nineteen small pieces of clear gray Jemez Mountain obsidian and two pieces of clear brown obsidian are also present. Representative examples were also submitted for sourcing, and they, too, came from the Cochiti area river gravels.

Unidentified Igneous. Unidentified igneous rocks (N=411, or 15 percent) are mostly fine-grained, uniformly textured, basalt-like material. Green, brown, and black fine-grained igneous material and a red, granitelike material comprise this group. Twenty cores of the basalt were recovered, and, like quartzite, cores and debitage are large compared to those of other materials.

Unidentified Sedimentary Rocks. Unidentified sedimentary rocks (N=5, or 0.2 percent) are a white, limestonelike material. All five flakes originated from the same cobble core.

Flakes

Core Flakes

Core flakes (N=2,215, or 97 percent), are flakes that have been detached from cores. They comprise the vast majority of flakes.

Platform Rejuvenation Flakes

Platform rejuvenation flakes have been detached from a core to remove an unsuccessful platform edge. The dorsal surfaces of these flakes exhibit a longitudinal ridge with the old platform on one side and a series of hinged or stepped flake scars on the other. Thick triangular cross sections are typical. Platform rejuvenation flakes at LA 53662 were detached from the side of the old platform, often taking advantage of a pseudo-dihedral platform.

Biface/Uniface Reduction Flakes

Biface/uniface reduction flakes (N=12, or 0.5 percent) were produced during biface or uniface manufacture. Platforms are unidirectionally or bidirectionally retouched and have platform/dorsal surface angles of 40 degrees or less. Lipping is sometimes present. The flakes are thin and commonly exhibit multiple dorsal flake scars.

Bipolar Flakes

Bipolar flakes (N=1, or 0.05 percent) are represented by a single example with a shattered platform and bulb of force at the distal end of the flake.

Hammerstone Flakes

Hammerstone flakes (N=14, or 0.6 percent) were unintentionally detached from hammerstones as a result of breakage during use. All hammerstone flakes are quartzite and exhibit battered platforms. All but one are feathered at the termination.

Single-Flake Scar Platforms

Single-flake scar platforms (N=529, or 26.4 percent) have one flake scar covering the entire platform.

Multiple-Flake Scar Platforms

Multiple-flake scar platforms (N=93, or 4.6 percent) have two or more randomly removed flake scars.

Faceted platforms (N=22, or 1 percent) exhibit three or more patterned flake scar removals, which are parallel to one another across the platform thickness.

Pseudo-dihedral platforms (N=237, or 13.6 percent) are the result of two flake scars intersecting to form a "pitched roof" silhouette when viewed from the dorsal face. This platform shape can also be formed by the juncture of a flake scar edge and a cortical section. This ridge extends across the platform from the dorsal edge to the ventral edge, giving the knapper a restricted area at which to aim the flake-detaching blow and therefore greater control over the result. The term "pseudo-dihedral" is a modification of the Old

World lithic analysis term "dihedral" and differs from that type of platform in that the true dihedral platform is a purposeful construct on the core.

Pointed Platforms

Pointed platforms, (N=177, or 8.8 percent) are at the top of an exaggerated peak. The platform area is minimal, "restricted to the apex of the cone of percussion" (Geier 1973:13). The shoulders of the flake fall away rapidly from this point down to the lateral flake edges, giving the flake a tapered shape. Though pointed platforms are the result of specific core preparation in Old World lithic assemblages, they appear to be opportunistic in New World ceramic-period lithics.

Cortical Platforms

Cortical platforms (N=453, or 22.6 percent) have 100 percent cortex, are usually flat to rounded, and comprise about one-quarter of each material group. Obsidian is an obvious exception to this, having double the percentage of cortical platforms of other materials. This appears to be directly related to the small size of the raw material. An interesting aspect of all platform types as a group, but particularly of cortical platforms, is the location of the bulb of percussion along the platform edge. The bulb is rarely centered on the platform, but is located close to a lateral edge, giving the knapper greater control.

Ridge Platforms

Ridge platforms (N=220, or 10.9 percent) are thin, linear platforms; the surface is usually less than 1 mm wide. This platform type is caused by impact close to the platform edge and is not the result of platform preparation. Ridge platforms are recognized in the analysis because of their high frequency and are further discussed in the analysis results. Flakes with ridge platforms are usually wider than they are long, with lateral edges contracting sharply from the platform toward the termination. The flakes are usually triangular in plan.

Unidirectionally Retouched Platforms

Unidirectionally retouched platforms (N=2, or 0.09 percent) are present on flakes that are the by-product of uniface reduction. Whereas a biface reduction flake platform exhibits two adjacent retouched edges, a uniface reduction flake exhibits a retouched edge adjacent to a flake scar. Platform angles are acute and occasionally lipped, and the dorsal flake surface exhibits multiple-flake scars.

Other Platforms

Other platforms (N=232, or 11.6 percent) include six types: shattered, battered, rounded, cortex and single-flake scar, cortex and multiple-flake scar, and abraded. These platform groups are separated because of their low frequencies and because they exhibit traits that are not necessarily the result of a particular reduction technique, but rather of a fortuitous circumstance (e.g., rounded, cortical/single-flakescar and cortical/multiple-flake scar), material impurities and/or excessive impact to the platform (shattered, battered), hammerstone use (battered), or platform preparation (abraded). The single abraded platform was observed on an obsidian flake. The platform is ground along the intersection of the dorsal surface and platform, a preparation technique that gives greater stability to brittle materials by increasing the friction of the platform. Although the platform is weakened, the hammerstone will not slip following abrasion, and less force is needed to detach a flake (Crabtree 1972:8).

Analysis

Two dominant characteristics emerge from the analysis of the assemblage: an abundance of lithic raw material is indicated, not only by the nearby source of the Rio Grande and Rio Puerco, but also by the treatment of the material; and reduction methods among various materials are nearly identical regardless of the success of those methods on a particular material. Percentages of various platform types vary little among materials (Tables 12 and 13).

Table 12. Percentages of platform types by material

Platform Type	Chert	Chalcedony	Silicified Wood	Quartzite	Obsidian	Igneous	% Range
Single-flake scar	32.4	26.4	27.5	24.2	21.3	25.8	11.1
Multiple-flake scar	2.7	6.0	6.2	2.8	3.2	3.6	3.5
Faceted	0.4	1.4		0.7		1.3	1.0
Pseudo-dihedral	11.5	12.4	10.0	15.6	9.8	18.2	8.4
Pointed	7.8	8.1	7.5	12.0	6.5	8.2	5.5
Cortical	22.6	21.5	21.2	23.4	37.7	22.5	16.5
Unidirectionally retouched	0.4	0.1					0.3
Ridge	9.2	9.9	12.5	11.7	13.1	13.9	4.7
Other	12.5	13.9	15.0	9.1	8.1	6.2	8.8
Total	99.5	99.7	100.1	99.5	99.7	99.7	

Note: sedimentary examples (N=3) excluded

Table 13. Frequencies of platform types by material

Platform Type	Chert	Chalcedony	Silicified Wood	Quartzite	Obsidian	Igneous	Total
Single-flake scar	70	253	22	93	13	78	529
Multiple-flake scar	6	58	5	11	2	11	93
Faceted	1	14		3		4	22
Pseudo-dihedral	25	119	8	60	6	55	273
Pointed	17	78	6	46	4	25	176
Cortical	49	206	17	90	23	68	453
Unidirectionally retouched	1	1					2
Ridge	20	95	10	45	8	42	220
Other	27	134	12	35	5	19	232
Total	216	958	80	383	61	302	2,000

Note: sedimentary examples (N=3) excluded

Simple reduction methods dominate the assemblage, as shown by the high percentage of single-flake scar and cortical platforms (Tables 12 and 13). Cores were either being decorticated by "peeling" all of the cortex from the cobble, or else were prepared by the removal of single large flakes, one at a time as needed. The resulting scars then served as a platform. The use of these methods is remarkably consistent considering the varying size and character of lithic materials at the site.

Two exceptions to this are the slightly higher occurrence of pseudo-dihedral platforms among dense materials (igneous and quartzite), and the high percentage of obsidian cortical platforms (Table 12). The first exception was expected, since pseudo-dihedral platforms offer a less restricted, stable area to receive impact, which would be necessary for materials requiring a harder blow to accomplish flake removal. While durable materials could absorb this impact to a small surface area without shattering, brittle materials could not.

The second anomaly in Tables 12 and 13, the high frequency of obsidian cortical platforms, is to be expected given the small size of the raw material. However, even with the above contrasting percentages, low variance in material treatment is characteristic of the assemblage. The low range of percentages for all platform types across a wide range of material types and qualities perhaps best illustrates this consistency. The outstanding exception to this is the cortical platform category, which is fairly evenly represented among all materials except obsidian. The regularity of cortical platforms is probably related primarily to the initial form of most materials--the cobble--and less to a uniform reduction strategy. Other than cortical platforms, single-flake scar, pseudo-dihedral, and pointed platforms exhibit the greatest regularity of occurrence among all material types. Interestingly, obsidian also exhibits the smallest percentage of single-flake scar platforms, indicating less platform preparation for obsidian than for other materials. Small raw material size may be the cause of single- or multiple-flake removals, for it would not be possible to prepare the platform and still leave enough material for flake production.

With this consistent material treatment in mind, an attempt was made to determine the success of these methods on materials of contrasting character. This was done by calculating the percentages of feather vs. hinge fracture for each material group and platform type (Table 14).

The materials in Table 14 are roughly ordered from the most brittle to the most durable with the expectation that a contrast would occur between the more brittle types (obsidian, chalcedony, chert, and silicified wood) and the more durable types (igneous and quartzite).

Considering the nearly equal platform type distribution among materials in Table 14, it is interesting to note that hinge termination occurrence is far from consistent. Ridge, faceted, and multiple-flake scar platforms, in particular, have low percentages, and the others have relatively high percentages, indicating greatly contrasting success rates for flake removal among materials. Sample size does not appear to be the reason for these differences, because they are also apparent within larger material groups, chert in particular.

Why the greatest variations occur among ridge, multiple-flake scar, and faceted platforms may be the result of a few factors. Small sample size may be the biggest factor in the varying percentages of faceted and multiple-flake scar platforms (22 and 93, respectively). The reason for the variation among ridge platforms, on the other hand, is less obvious. Ridge platforms are caused by impact close to the platform edge and are therefore not the result of core preparation per se. Although this may appear to be a high-risk procedure (since impact to such a thin edge would be far more likely to produce shattered platforms or extremely thin, hinged flakes), the opposite may in fact be true. Production of thin flakes would require less thinning for projectile point manufacture, in effect decreasing the risk factor for that particular type of tool manufacture.

Table 14. Percentage of hinge fracture termination among material types in order of durability

More Fragile to More Durable							
Platform Type	Obsidian	Chalcedony	Chert	Silicified Wood	Igneous	Quartzite	% Range
Single-flake scar	50	39	34	41	32	25	25
Multiple-flake scar		21	71	50	40	44	51
Faceted		33			33	50	17
Pseudo-dihedral	40	37	29	20	29	29	20
Pointed	33	21	56	25	25	23	35
Cortical	56	29	41	23	22	23	34
Unidirectionally retouched		100					0
Ridge	40	40	53	67	38	17	50
Other	100	29	35	29	50	15	85

However, a comparably high failure rate for ridge platforms is shown by the lowest mean feather fracture percentage for all materials. Since it is doubtful that the high occurrence of ridge platforms is accidental, these broken flakes with ridge platforms may be the result of efforts to maximize flake yield from small cores or unsuccessful efforts to produce thin flakes suitable for formal tool manufacture.

Where other platform types fluctuate in hinge fracture rates, material quality may be the cause. Chert, for example, exhibits greatly contrasting feather termination percentages among all platform types, with the lowest rates occurring with platform types of least stability, the ridge and pointed types (with the exception of multiple-flake scar). Interestingly, over half of the pointed platforms in the chert assemblage are heat-treated, most to the point of overexposure. This high degree of heat "treatment" decreases the stability of the material, necessitating a softer impact to the platform to avoid shattering. This softer impact, while keeping the platform intact, evidently was insufficient to detach many flakes successfully and resulted in a frequent hinged terminations. The extremely high percentage of heat treatment alone may explain the unpredictability of chert. Some analysts believe that the high density of local chert could be successfully ameliorated only by heat treatment (J. Moore, personal communication). Chert appears to have been most successfully reduced where it was treated as a durable material rather than a brittle one.

To summarize, all materials were clearly being reduced in a like manner despite varying success rates. Perhaps an abundance of lithic material obviated the need to maximize material yield. This is evidenced not only by the debitage, but also by the cores and tools. Cores frequently exhibit abandoned, obtuse angled platforms with hinged flake scars and were simply discarded at that point even if the core was large and could have been salvaged. For this analysis, cores were termed exhausted only for extremely small cores, since small size and/or numerous obtuse platforms alone are insufficient indicators of core exhaustion (Shelley 1980).

In addition to consistent material reduction, debitage of various materials exhibits remarkable uniformity (Table 15).

Table 15. Complete flake dimensions (cm) by material type

	Length	Width	Thickness
Chert			
Mean	2.2	2.0	0.6
Range	0.7-5.1	0.7-6.9	0.1-2.1
Number	148	218	241
Chalcedony			
Mean	2.0	1.8	0.6
Range	0.4-6.8	0.2-5.2	0.1-2.5
Number	707	967	1,080
Silicified Wood			
Mean	2.0	1.9	0.5
Range	0.7-5.8	0.5-4.5	0.1-3.3
Number	55	81	88
Obsidian			
Mean	1.7	1.6	0.4
Range	0.7-3.9	0.5-3.8	0.1-2.1
Number	48	69	79
Igneous			
Mean	2.7	2.6	0.7
Range	0.4-7.8	0.7-7.8	0.1-2.9
Number	228	314	339
Sedimentary			
Mean	1.9	1.8	0.3
Range	1.2-3.2	0.9-4.2	0.2-0.7
Number	5	5	5

The large number of complete flakes is noted for intensively occupied, ceramic-period sites in Arizona and is the result of intensive core reduction to produce flakes suitable for use as tools without further modification (Sullivan and Rozen 1985:763). Cores from these sites are frequently reduced to the point of exhaustion. Although the Belen Bridge site has a comparably high percentage of complete flakes (58.5 percent), the percentage of exhausted cores is quite low (25, or 15.4 percent), and is yet another indication of the abundance of raw material and/or knapper inability, because salvaged cores would indicate a firmer grasp of reduction skills. The scarcity of exhausted cores and the consistent size of the debitage may be evidence that cores were being reduced to produce flakes that could serve as tools in their unmodified form, or that raw material size varies little among lithic types.

Cores

Single-platform Cores

Single-platform cores (N=66, or 40.7 percent) usually are cortical, though flake-scar platforms are also represented. Flake-scar platforms are made by the removal of one large flake along the core length, creating a platform from which flakes are removed along the core's thickness. Flake-scar platforms are also removed across the thickness of a cobble, with flakes detached along the length. Single-platform cores dominate the assemblage and are primarily chalcedony and quartzite.

Two Adjacent Platform Cores

Two adjacent platform cores (N=49, or 30.2 percent) are the next most common type, with chalcedony, quartzite, and igneous materials present in nearly equal amounts. In quartzite cores, the two platforms are usually located at one end of an oval shaped cobble; the core is reduced "bifacially" at that end. Igneous and chalcedony cores are discoidal forms with platforms running around the perimeter, resulting in a bifacially or bimarginally reduced cobble.

Two Parallel Platform Cores

Two parallel platform cores (N=22, or 13.6 percent) have irregular shapes and few flake removals. Each platform rarely exceeds two flake removals, and scars are usually large, in some cases splitting the cobble into halves or thirds. Although the removal of some of these large flakes creates suitable platforms for further flake removals, no scars are present on those platforms.

Other Cores

Other cores (N=25, or 15.4 percent) include three minor types: three platforms (N=15, 9.2 percent); four platforms (N=9, or 5.6 percent); and five platforms (1, or 0.6 percent); for a total of 25 (15.4 percent) (percentages are of the total number of cores in the analyzed sample, 162). These cores are various combinations of the three major types just described. Though each type is represented by a small number of specimens, it was felt that any discernable pattern of flake removal should be noted. In defining these patterns, any platform with at least two flake removals was taken into account when determining platform relationships. In the case of adjacent platforms, minimal flake removals such as these may be the result of platform preparation. Flake-scar sizes from both platforms are comparable, however, resulting in serviceable flakes for tool use. It is interesting to note that cores are rarely reduced to the point where multiple platforms are present, an indication of the abundance of raw material at the site and the preference for a certain flake size.

Analysis

Flake removals cluster along one axis of the core in the vast majority of cases. Both the long and short axes of cores are used for flake removals, though trends exist within material groups (Table 16).

Interestingly, the smaller cores of chert, chalcedony, and silicified wood show flake removals mostly along the length, while the large cores of igneous and quartzite materials show flakes removed across the width, indicating a preference for flakes of comparable size and/or flakes of a certain maximal size for all materials. The success of this attempt can perhaps best be shown by the remarkable uniformity in flake size regardless of material (see below).

Cores at Belen Bridge invariably occur in cobble form, accounting for the high frequencies of cortical platforms for all lithic materials. The invariable occurrence of cores in cobble form and the reduction methods used at the site may explain the high frequencies of cortical platforms. Cortex

Table 16. Predominant axis of flake removal from cores

	Frequency	Percentage of All Cores
Majority of flakes removed lengthwise	71	43.8
Majority of flakes removed across width	72	44.4
Equal removals from length and width	18	11.1
Indeterminate axis of flake removal	1	0.6
Total	162	99.9

Table 17. Core dimensions by material (cm)

	Length	Width	Thickness
Chert (N=12)			
Mean	5.0	4.4	3.4
SD	1.8	0.8	0.8
Range	3.2-8.2	3.0-6.0	1.9-5.1
Chalcedony (N=72)			
Mean	4.2	3.3	2.5
SD	9.8	8.0	6.2
Range	2.2-6.8	1.9-5.0	1.3-4.5
Silicified Wood (N=5)			
Mean	4.9	3.2	2.5
SD	1.7	0.3	0.2
Range	3.3-7.0	2.6-3.5	2.2-2.9
Quartzite (N=45)			
Mean	7.2	5.9	4.1
SD	2.5	1.3	1.6
Range	3.9-16.9	3.2-9.3	1.6-8.9
Igneous			
Mean	6.6	5.0	3.4
SD	1.8	1.7	1.1
Range	3.5-10.9	3.3-8.7	1.9-6.2

Table 18. Lithic assemblage distribution by provenience

	Frequency	Percentage of Lithic Assemblage
Pithouses	1,856	66.1
Storage pits	757	27.3
Hearth/firepits	70	2.5
Storage/firepit strip zone	31	1.1
Trenches	19	0.6
No feature association	31	1.1
Total	2,764	99.7

Table 19. Projectile point preform data

Provenience	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Material	Remarks
Pithouse 1, Strata 2 and 3	24+	16	5	1.5+	clear chalcedony with black inclusions	triangular with straight base; thinning problems; tip missing (Fig. 40j)
Pithouse 2, upper fill	20+	14	3	0.8+	clear black obsidian with ash streaks	triangular with slightly concave base; tip missing
Pithouse 4, floor fill	19+	16	5	1.3+	clear black obsidian	triangular with straight base; thinning problems; tip missing
Pithouse 4, floor fill	17	10	2	0.2	frosted clear chalcedony	teardrop shape; complete (Fig. 40k)
Pithouse 7, lower fill	13+	10	3.5	0.7+	opaque black obsidian with crystals	triangular with straight base; probable thinning problems; lower half (Fig. 40l)
Pit 24a fill	25	13	4.5	1.2	black speckled clear chalcedony	leaf-shaped; complete; thinning problems at tip (Fig. 40m)

percentages cluster in the 50 percent and higher range for all cores, possibly because material impurities lowered the intensity of core reduction.

Cores at Belen Bridge are rarely exhausted (25, or 15.4 percent). A common occurrence, particularly on quartzite and chalcedony cores, is a series of hinged flake scars occurring on a single platform of a large piece of material. Efforts to salvage these cores are rarely apparent, perhaps because of the small mean core dimensions. Cores of quartzite and igneous materials are possible exceptions (Table 17).

Measurements were also recorded for complete feather fractured flake-scar lengths on all cores to compare debitage and scar lengths. For all material types, mean core scar lengths are greater than mean flake lengths (utilized flakes included). A few factors account for this: smaller flakes removed prior to the measured scar would not be included in mean calculations, nor would flakes broken after removal. Also, debitage originating from large core fragments rather than cores would lower the mean length of flake debitage.

Distribution of the Lithic Assemblage

The majority of the lithic assemblage is associated with the fills of the five pithouses at the site (Table 18).

Pithouse fill contained large amounts of lithic debris in the top 30 cm of fill, with frequencies decreasing sharply 30 cm below datum level to negligible amounts nearest the floors. Within the structures, Pithouses 1 and 4 yielded the highest lithic counts. Lithic activity and/or disposal was almost entirely focused in the southern portion of the site in and around Pithouses 1, 4, and 7 and Pit 18, where an impressive 71 percent (N=1,964) of all lithic material was found. The clustering of lithic debris in this area is to be expected since major trash deposits were located there. Tools are also overwhelmingly located in this southern area (N=58, or 88 percent). Most of the lithics in this southern area were recovered near the surface, although Pit 18 contained large amounts of lithics down to Level 6 (60-70 cm below datum level). Moving north through the site, lithics decrease rapidly in all features, including pithouses.

Over half of the cores (N=88, or 54 percent) originated in the fill of Pithouses 1 and 4 and Pit 18, though cores are not as restricted to the southern concentration as lithic debitage. Pithouse 2 fill contained 26 cores.

The numerous small storage pits and firepits around the site yielded extremely small numbers of lithics except for Pit 18 and Pit 5a (58 lithics).

Distribution of heat-treated lithics was examined to discern associations with any particular feature type, especially hearths and firepits. Heat-treated material was found to be evenly distributed across the site, with all feature types containing one-quarter to one- third heat-treated lithics, including hearths and firepits.

Debris from Miscellaneous Manufacturing

by Regge N. Wiseman

Arrowpoint Manufacturing

Evidence of arrowpoint manufacturing was not plentiful at Belen Bridge. Only six preforms for arrowpoint manufacturing were recovered (Table 19).

Although not all preforms show it, the longitudinal cross section of several clearly indicate that they were made from flakes (i.e., they curve like a flake). One face of these preforms displays ventral surface remnants of the original flakes. These preforms were essentially edge-trimmed into shape and minimally thinned by the removal of pressure flakes from the dorsal surface. It appears likely that some of the points were worked down from thicker flakes or chunks of material that did not leave evidence of the original form.

Two of the six preforms are complete; the rest are missing their tips (see Figs. 40j-40m). Two have convex bases, three have straight bases, and one has a concave base. All but the smallest show thinning problems that, in addition to or in spite of the breakage, probably explains why they were discarded. The only one not showing thinning problems is the smallest; its size would have hampered gaining an effective hand hold by which to complete the flaking into a finished product. The preforms are made of chalcedony and obsidian.

Bead Manufacturing

A small slab of a white crystalline material (calcite?) has been ground down on both surfaces, presumably preparatory to cutting it into smaller pieces for manufacturing beads similar to those recovered from the site (Fig. 53). The edges have not been shaped but instead retain the irregular outline of the raw slab. It measures 8.0 by 4.6 by 0.5 cm and comes from Level 3 of Pithouse 1.

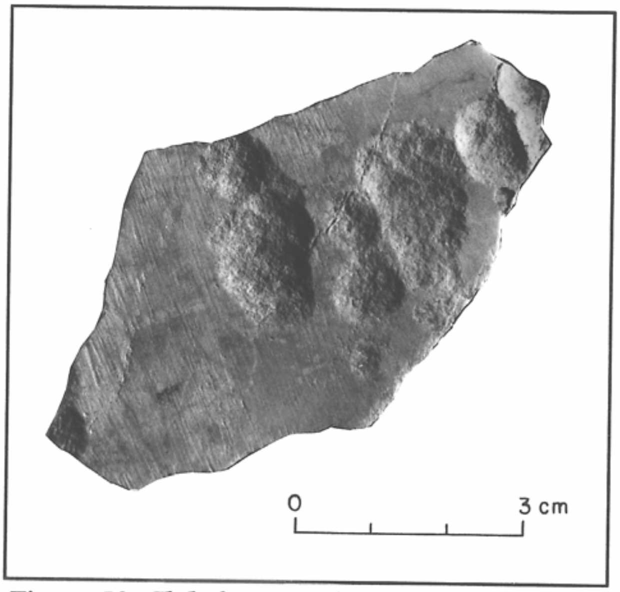


Figure 53. Slab for manufacturing beads.

Raw Materials

Several items were transported to the site, evidently for making artifacts or for use as abrading materials.

Pumice and Tuff. The four small pieces of pumice and one of tuff are all rounded like river cobbles and probably were obtained locally from exposures of the Santa Fe formation. One of the pumice pieces is partly burned, probably accidentally. All are from general trash proveniences.

Mica Schist. The single slab of highly micaceous schist is essentially identical to that used for certain kinds of artifacts frequently found in sites further north along the Rio Grande and its tributaries. It appears to have been intentionally broken, for it has fresh-looking faces. Otherwise, it is unmodified. No artifacts of this material were recovered from Belen Bridge. Its provenience is general trash.

Scoria. One small piece of scoriaceous basalt from the general trash is unmodified.

FAUNAL ANALYSIS

by Nancy J. Akins

At a site just east of the Rio Grande, we would expect some use of riverine fauna by the prehistoric inhabitants of the Belen Bridge site. While fish, turtle, and a number of species of ducks and a shore bird are present in the faunal assemblage, riverine mammals are absent. Artiodactyl and possible artiodactyl remains are relatively scarce (10.0 percent of the total). Rabbits, especially jackrabbit, make up the bulk of the collection. Overall identifiability of the remains was high. Only 34 percent was not assignable to at least the family level. This is fairly remarkable since the condition of the bone was generally poor. Root etching and erosion was found on nearly all of the unburned bone, yet breakage was not so extensive that it hindered identification. For a breakdown of the faunal remains by provenience, consult the New Mexico Cultural Records Information System of the Archeological Records Management Section.

Methodology and Variables Recorded

Most of the identifications (rabbits and some rodents) were made with personal comparative collections. The remainder of the potentially identifiable elements was taken to the University of New Mexico Museum of Southwestern Biology and identified using those collections. Fish bones were identified by Dr. Manuel Molles of the Museum of Southwestern Biology. Elements that could not be identified were placed in the unknown category, which reflects the size and kind of animal represented. Size was fairly easily determined, but the prevalence of root etching and erosion made distinctions between small mammals and between medium to large birds less certain.

Information recorded for each piece of bone included taxon, body part, portion present, age of the individual, burning, evidence of butchering, and other taphonomic observations such as root etching, checking, and staining. Freshly broken pieces of the same element were counted as one piece, and pieces of the same element with old breaks were counted separately. Articulated skeletons and partial skeletons were considered as single elements to keep from inflating the counts.

Taxa Recovered

A total of 1,461 elements were analyzed. Table 20 gives their distribution by scientific and common name, or, for the unidentifiable elements, by size group. MNIs (minimum number of individuals) are presented in a variety of ways. The absolute minimum treats the entire assemblage as a single sample considering only the taxon, body part, and ages represented in the calculation. The cumulative MNIs are sums from the provenience tables given in that section. The minimum uses each major unit, such as a pit structure, as the unit of analysis. The cumulative maximum is the total MNI when each of the provenience divisions suggested by the site excavator is calculated separately and added. While the various MNI figures may bracket the range of animals present and demonstrate the effect of progressively smaller divisions within the site, none are a really satisfactory measure of species use. Factors such as how animals of different body size are disposed of, the size and identifiability of the individual element, and removal of parts of the site by previous road building have an undetermined effect on the assemblage composition.

Cottontail Rabbit

Of the three species of cottontail rabbit (*Sylvilagus* cf. *audubonii*) found in New Mexico, the desert cottontail is the most likely to be represented in this sample. Found throughout the

Table 20. Summary of fauna recovered from Belen Bridge

Taxon	Common Name	Elements	Absolute Minimum	Cumulative Minimum	Cumulative Maximum
Sylvilagus cf. *audubonii*	desert cottontail rabbit	153	10	18	24
Lepus californicus	black-tailed jackrabbit	500	12	31	45
Spermophilus spilosoma	Spotted ground squirrel	3	2	2	2
Large sciurid	size of prairie dog	5	1	3	3
Thomomys bottae	Botta's pocket gopher	36	8	13	17
Dipodomys ordii	Ord's kangaroo rat	4	1	2	3
D. spectabilis	Banner-tailed kangaroo rat	60	6	11	18
Small cricetidid	size of *Peromyscus* or *Onchomys*	1	-	-	-
Reithrodontomys sp.	harvest mouse	1	1	1	1
Peromyscus sp.	mouse	6	4	4	6
Neotoma sp.	woodrat	6	1	2	2
Taxidea taxus	badger	1	1	1	1
Cervidae	deer or elk (antler)	4	-	-	-
Odocoileus hemionus	mule deer	7	1	3	4
Antilocapra americana	pronghorn	7	1	5	6
Ovis canadensis	mountain sheep	2	1	2	2
Anatidae	waterfowl	7	1	2	2
Anas platyrhynchos	mallard	6	1	2	2
Anas cf. *strepera*	gadwall	2	1	2	2
Spatula clypeata	shoveler	2	1	1	1
Anas cf. carolinensis	green-winged teal	4	1	1	1
Anas s.o. *carolinensis*	size of green-winged teal	1	1	1	1
Aythya americana	redhead	3	1	1	1
Oxyura jamaicensis	ruddy duck	1	1	1	1
cf. *Aquila chrysaetos*	golden eagle	1	1	1	1
Meleagris gallopavo	turkey	18	1	1	2
cf. *Callipepla*	scaled quail	3	1	2	2
Chadriiformes	shorebird	2	1	1	1

Eremophilia alpestris	horned lark	6	2	2	3
Corvidae	jay	1	1	1	1
Passeriformes	small perching bird	2	1	2	2
Bufo sp.	toad	14	4	5	5
Testudinata	turtle	32	-	4	4
Trionyx spiniferus	Texas spiny softshell turtle	2	1	2	2
Chrysemys picta	painted turtle	19	1	2	2
Colubridae	snake	6	1	1	2
Osteichthyes	fish	1	-	1	1
Lepisosteus osseus	longnose gar	6	1	1	1
Carpiodes carpio	river carpsucker	14	1	1	2
Ictiobus sp.	buffalofish	2	1	2	2
Pylodictus olivaris	flathead catfish	2	1	1	1
Aplodinotus	drum	1	1	1	1
Herp	reptile or amphibian	1	-	-	-
Rodent	rodent	9	-	-	-
Large rodent	woodrat or larger	4	-	-	-
Small mammal	jackrabbit or smaller	199	-	-	-
Small/medium Mammal	coyote or smaller	18	-	-	-
Medium mammal	jackrabbit to coyote	5	-	1	1
Carnivore	coyote/bobcat size	2	1	1	1
Medium/large mammal	coyote or larger	41	-	1	1
Large mammal	artiodactyl or larger	33	-	1	1
Artiodactyl	even-toed ungulates	96	1	4	6
Small mammal/medium to large bird	-	41	-	-	1
Medium mammal/large bird	coyote/turkey	3	-	1	1
Small bird	quail or smaller	4	-	-	-
Medium bird	duck size	13	-	-	-
Medium/large bird	duck to turkey	11	-	1	1
Small unknown	-	5	-	-	-
Unknown		22	-	-	-
Total		1,461	80	149	193

Sonoran zone, they are especially numerous in hillside areas cut by arroyos but are found in virtually all locales (Findley et al. 1975; Ivey 1957).

Cottontail rabbit is the second most common animal represented in both numbers and MNIs. They are only a third as common as jackrabbits, and they are also less widespread within the proveniences (occurring in only 15, compared to 23 for jackrabbit). In samples with more than a few elements, cottontail is more numerous than jackrabbit only once, in the lower fill of Pithouse 4.

Black-tailed Jackrabbit

Lepus californicus is found in most habitats of the Middle Rio Grande Valley but are most often encountered in the arroyos of the alluvial slopes on the sides of the Rio Grande and Rio Puerco valleys and in the tamarisk-saltgrass flats of the river bottoms (Ivey 1957).

One third of the bone recovered is from jack rabbits. Burning is common, and most provenience divisions contain the remains of this taxon.

Spotted Ground Squirrel

The small *Spermophilus spilosoma* occupies open country between the river bottom and foothills (Ivey 1957). The three elements recovered were from the same structure and represent a young adult and a full-sized squirrel. None of the elements is burned, and since this species burrows, they could be postoccupational intrusives.

Large Ground Squirrels

A small number of undiagnostic elements from a large squirrel are present. The most likely species to be represented is the prairie dog (*Cynomys gunnisoni*), which once lived on the mesas and in the valley, or the rock squirrel (*Spermophilus variegatus*), which is found along the bottoms of arroyos adjacent to the river bottom and in the ditch banks of irrigated areas (Ivey 1957).

Botta's Pocket Gopher

Thomomys bottae is abundant in old fields off the Rio Grande and in tamarisk-saltgrass flats but also occurs on the mesas and alluvial slopes, especially in areas of denser vegetation (Ivey 1957).

This small gopher is often found as a postoccupational burrower in archaeological sites; however, burned elements were found in Pithouse 4 and extramural Pit 18, implying that some were dietary items. The elements found are often the largest body parts. Mandible and maxilla fragments comprise over half of those collected. Recovery of so many large parts suggests that pocket gophers (and the other rodents) are underrepresented in the collection. Most parts will pass through 1/4 inch screen.

Ord's Kangaroo Rat

Dipodomys ordii inhabits open range land, including sand-drift shrub areas and edges of the tamarisk-saltgrass flats of the Rio Grande Valley (Ivey 1957). None of the elements recovered are burned.

Larger Banner-tailed Kangaroo Rat

D. spectabilis inhabits well-developed grasslands with heavier soils that will support their complex and deep burrow systems (Findley et al. 1975). The relatively large number of elements and individuals, fairly frequent burning, and occurrence in a number of proveniences indicate that special effort was given to procuring this species. They are solitary and primarily nocturnal (Reichman 1983), suggesting the use of traps left near active dens.

Harvest Mice

Two species of harvest mice are found along the Middle Rio Grande, *Reithrodontomys* *montanus*, the plains harvest mouse; and *R. megalotis*, the western harvest mouse. The latter has been found around Belen (Findley et al. 1975) and commonly occupies disturbed or ecotonal areas including tamarisk-saltgrass flats of the river floodplain and areas of shifting sand with shrub cover (Ivey 1957). Nests are made in bushes and under grasses and weeds (Bailey 1971), suggesting the element found did not result from burrowing by that individual.

Deer Mice

At least two species of *Peromyscus* have been noted for the Belen area: *P. eremicus*, the cactus mouse; and *P. leucopus*, the white-footed mouse. The white-footed mouse is most characteristic of river bottom areas, including tamarisk-saltgrass flats, marshes, cottonwood forests, and lower mesa slopes (Findley et al. 1975). The cactus mouse is less likely since it favors dry areas peripheral to the valley (Hink and Omart 1984).

Two partial skeletons, one from near the floor of Pithouse 3 and the other from the lower fill of Pithouse 5, are consistent with its role as a common human commensal that may not burrow but will move into the burrows of other rodents or structures when food or scraps are present (Bailey 1971).

Woodrats

Neotoma albigula, the white-throated woodrat, is the only woodrat specifically noted in Belen. It is a grasslands species that lives around the bases of chollas or in burrows along the sides of arroyos. *N. micropus*, the southern plains woodrat, occupies the same locations but has not been reported along the Rio Grande in Valencia County. The other species of woodrat are generally found in more mesic locations, especially piñon-juniper woodlands (Findley et al. 1975).

The few *Neotoma* elements found are not identifiable to species. They were found in two features (Pithouse 5 and Pit 18), and none are burned.

Badger

An atlas vertebra from *Taxidea taxus* was the only identifiable carnivore element in the collection. Badgers are found throughout New Mexico, and the numbers are greatest in valleys where burrowing rodents are abundant (Bailey 1971:343).

Deer/Elk

Antler from deer or elk is present. These are generally small pieces and either could be represented. Elk (*Cervus elaphus*) does not occur near Belen, but antler could have been traded and cannot be ruled out. Since antlers are shed annually, they do not necessarily mean that an animal was procured.

Mule Deer

Odocoileus hemionus are found throughout New Mexico, with densities determined by habitat. Relatively large numbers are found in mountain-foothill habitats and fewer in other areas. The white-tailed deer (*O. virginianus*) is considered a riparian deer, but they are found further south (Findley et al. 1975). The few elements--two first phalanges, a third phalanx, and a maxillary molar--are consistent in size with mule deer.

Pronghorn

Antilocapra americana inhabits open grasslands below woodlands and was much more widespread and abundant in earlier times (Findley et al. 1975). They tend to form herds during winter, then break up by age and sex into small groups or solitary animals (Kitchen and O'Gara 1982). Pronghorn elements are slightly more common than those of deer but have a similar body part distribution, all either foot elements or teeth.

Mountain Sheep

Ovis canadensis inhabits rugged cliffs or rocky areas adjacent to feeding areas. They are found in the Sandia Mountains (Findley et al. 1975) and represent imports to the site. The two elements recovered are a brouse pad and a third phalanx or hoof core.

Artiodactyl sp.

Two parts of a small fawn were found, a scapula and a metacarpal fragment. These compare best to pronghorn but indicate and animal shorter and stouter than the available comparative specimens. Pronghorn young are born in May, and these elements indicate an individual procured in early summer.

Parts identified as artiodactyl or large mammal consist largely of long bone shaft fragments but also include (in order of occurrence) rib shaft fragments, vertebra fragments, foot elements, and skull parts. The distribution of parts suggests that at least some animals were returned to the site complete or in large parts.

Carnivore

Two elements, a distal femur and skull or sternal fragment, of an immature carnivore were found in Pit 18. These represent a coyote, dog, or bobcat-sized carnivore.

Anatidae

A large number of species of waterfowl is commonly found in the Middle Rio Grande Valley. A checklist of birds of New Mexico (Hubbard 1978) and a biological study (Hink and Omart 1984) suggest as many as 20 species of duck are possible. The Museum of Southwestern Biology, Bird Division, has specimens of only 15 of these, resulting in some reluctance to assign a species designation to specimens that were not identical to those in the collection.

Elements left at the Anatidae level (a distal coracoid fragment, a proximal humerus, a proximal radius, an acetabulum, and a distal tibia) either do not match any of the comparative specimens, were not complete enough for positive identification, or are nondiagnostic. The amount of partial burning of waterfowl elements definitely suggests they were used as food.

Mallard

Anas platyrhynchos is the most common of the identified ducks, although only one individual is suggested by body parts. It is one of the larger ducks and hybridizes with *A. diazi*, the Mexican duck, in the Middle Rio Grande Valley. The mallard is a resident of the Middle Rio Grande Valley and winters statewide. Both are surface-feeding ducks (those which feed in the shallows of marshes) and are common in ponds and freshwater marshes. Large groups can be seen in drains, ponds, and marshes along the Rio Grande. They are abundant in winter and fairly common in summer (Hink and Omart 1984; Hubbard 1978; Robbins et al. 1966).

Mallard parts were found in two proveniences. Those from Pithouse 1 include a left humerus, ulna, and radius that were probably disposed of as a unit. The Pithouse 4 elements are more diverse and include a humerus, coracoid, and tarsometatarsus.

Gadwall

An ulna and a carpometatarsus very similar to *Anas* cf. *strepera* were found. This species of duck is nearly as large as the mallard and considered locally resident in the Middle Rio Grande Valley. It, too, is a surface feeder, although it does dive (Hubbard 1978; Robbins et al. 1966).

Northern Shoveler

Spatula clypeata is an irregular resident in the Middle Rio Grande Valley and is fairly common in winter but rare to uncommon the rest of the year. It migrates and winters statewide and is found mainly in ponds and marshes where it feeds in shallow water (Hink and Omart 1984; Hubbard 1978; Robbins et al. 1966).

The two elements, both from Pithouse 4, include a partial tibia and a tarsometatarsus.

Green-winged Teal

Although some elements were quite close to the green-winged teal, no comparative specimens for the cinnamon teal (*A. cyanopera*) or the blue-winged teal (*A. discors*), both similar in size to the green- winged teal (*Anas* c.f./s.o. *carolinenis*), were available. The green- winged teal is resident in the Middle Rio Grande Valley, common in winter and early spring but uncommon in summer and fall. The other teals migrate and summer almost statewide and are common in winter and early spring. The blue-winged teal is rare in summer, while the cinnamon is locally common in summer. All three are surface feeders (Hink and Omart 1984; Hubbard 1978; Robbins et al. 1966).

A diverse array of body parts was found, including a furculum, coracoid, humerus, and scapula, probably discarded as a unit, and a partial sternum. All are from Pithouse 4.

Redhead

Aythya americana migrates and winters almost statewide and is casual to occasional in summer. It is a bay duck (ducks which dive and swim under water) and often joins in large flocks with other bay ducks (Hubbard 1978; Robbins et al. 1966).

Elements include a sternum fragment, a coracoid, and a furculum fragment, again from Pithouse 4.

Rudy Duck

Oxyura jamaicensis is resident locally in the western two-thirds of New Mexico and rare to fairly common in wetlands. It migrates and winters almost statewide. In the Middle Rio Grande Valley it is common in winter on estuaries, lakes, and rivers, uncommon in other seasons but breeds in the Isleta swamp (Hink and Omart 1984; Hubbard 1978; Robbins et al. 1966).

A coracoid, found in Pithouse 4, is the only representative of this species.

Golden Eagle

A middle phalanx that compares well with golden eagle (cf. *Aquila chrysaetos*) was found. Eagles are resident almost statewide (Hubbard 1978).

Turkey

Studies of the distribution of *Meleagris gallopavo* remains in the Southwest suggest that the turkey was not present until sedentary agriculture based on domestic cultigens was well established and that turkeys were an import from Mesoamerica. Wild turkeys are believed to be feral birds escaped from captivity (Rea 1980), possibly as early as A.D. 500 (McKusick 1980). McKusick recognizes two groups of domestic turkeys, the small Indian domestic, which first appeared in the Mogollon culture area between 300 and 50 B.C., and the large Indian domestic, which appeared in the Anasazi area about A.D. 400. The small Indian domestic is found in Gran Quivira faunal collections dating around A.D. 1275 (McKusick 1980).

The number of turkey elements in Table 20 is misleading. An articulated skeleton was found on the floor of Pithouse 3, and the remainder of the elements, consisting of rib fragments, coccygeal vertebrae, and phalanges, were probably separated from the skeleton by rodents or other natural processes. The presence of egg shell and the burial of a bird do suggest a domestic captive. It is a full-sized female bird, but it is not possible to determine which group of turkeys it represents. The humerus measurement falls between those of females identified as large and small domestic from Antelope House (McKusick 1986); yet, both the tibiotarsus and tarsometatarsus measurements are larger than those of Antelope House small Indian domestic males.

A near absence of turkey from the site is not that unusual. Natural forage (piñon nuts, acorns, and juniper berries in winter; flower buds, grass and other seeds, wild oats, berries, prickly pear, other fruits, and insects in summer [Schorger 1966:210]), especially winter forage, is not found along the river, and food stores would be needed to feed captive birds. Historic accounts suggest that flocks of turkeys were associated with large amounts of surplus corn (Bolton 1964).

Scaled Quail

Callipepla squamata is primarily a grassland species but is seen at the outer margins of the riparian zone (Hink and Omart 1984). The single element, a carpometacarpus, agrees well with comparative specimens.

Bobwhite

A femur and tibiotarsus agree with cf. *Colinus virginianus*. Bobwhites are more common to the east but are casual in the Albuquerque area (Hubbard 1978). They are similar in size to quail and are found in brush, abandoned fields, and open pinelands (Robbins et al. 1966).

Small Shore Birds

A number of Chadriiformes are found in the Middle Rio Grande Valley (Hink and Omart 1984). The two elements, a distal humerus and a distal tibiotarsus, indicate a small bird with long thin legs and wings but could not be identified to species. Likely candidates include the killdeer (*Charadrius vociferus*) and various sandpipers.

Corvidae

A carpometacarpus, probably of a jay, is the single representative of this group. The steller jay (*Cyanocitta stelleri*) is a rare but regular visitor to the bosque, the scrub jay (*Aphelocoma coerulescens*) a regular migrant and visitor, and the piñon jay (*Gymnorhinus cyanocephalus*) a regular visitor throughout the Middle Rio Grande Valley (Robbins et al. 1966).

Horned Larks

Eremophilia alpestris is primarily found in agricultural fields and are uncommon in migration and winter along the river (Robbins et al. 1966). Six elements, including two sterna, represent this species.

Small Birds

Two elements that could represent any of a number of Passeriformes were found. They are not consistent with elements from the other two small birds identified, the shore bird and the horned lark.

Toads

Toad bones were found in several proveniences within the site. While many are relatively fresh looking and could represent postoccupational intrusives, one element is completely burned and may suggest some consumption of toads. A number of species of *Bufo* are found in the area. The specimens agree well with *B. cognatus* (the great plains toad), but a species was not determined. Other *Bufo* in the area include the red-spotted toad (*B. punctatus*) and Woodhouse's toad (*B. woodhousei*) (Hink and Omart 1984).

Turtles

A number of carapace fragments from a hard shelled turtle were found. These could not be further identified and may represent either the terrestrial form, the ornate box turtle (*Terrapene ornata*) or the aquatic painted turtle (*Chrysemys picta*). Many of the shell fragments and a humerus and scapula fragment are burned or partially burned, suggesting a food item.

Texas Spiny Softshell Turtle

Trionyx spiniferus is represented by a piece of the shell and a scapula; the former is burned. This species of turtle is found along the Rio Grande from the state line north to Bernalillo. Habitats include all permanent bodies of water, but it is primarily a river-dwelling turtle (Degenhardt and Christiansen 1974).

Painted Turtle

A mostly burned central portion of a carapace, a femur shaft, and a portion of another longbone represent *Chrysemys picta*. They are found in a variety of habitats including ponds at rivers' edges and rivers. They are known to migrate over dry land (Degenhardt and Christiansen 1974).

Snake

Six vertebrae from a snake were found in different areas of Pithouse 4. They are not gopher or garter snake and are not identified further.

Fish

At least five species of fish are represented in the assemblage: *Carpiodes carpio* (river carpsucker) and *Ictiobus* (buffalofish) from the sucker family (Catostomidae); *Pylodictus olivaris* (flathead catfish); a drum (Sciaenidae); *Aplodinotus*; and *Lepisosteus osseus* (longnose gar).

All occupy similar habitats, which include lowlands, uplands, big rivers, and streams. However, the drum, the flathead, and the gar have not been recorded for the upper Rio Grande. The drum and the flathead are presently found in the Pecos River and the lower Rio Grande (Smith and Miller 1986). No concerted attempt was made to sample fish in the area until 1902 (Miller 1977), and both species were already absent.

The buffalofish, probably either *I. bubalus*, (smallmouth buffalofish) or *I. niger* (black buffalofish), is the most commonly reported of the fish taxa. It has been recovered at LA 187 (Kuaua), AL-12 (LA 35493; Akins 1987b), and Chamisal (Kit Sargeant, personal communication). Chamisal also had flathead catfish. The drum element is the more unusual find, although a skull of one was found in a site at Cochiti Reservoir (Manuel Molles, personal communication). River carpsuckers are found in the Rio Grande. While no other positive identifications have been made, possible *Carpiodes* is recorded in the Chamisal collection.

Egg Shell

Fifty-four fragments of egg shell were found. These represent large, cream-colored eggs, most likely turkey eggs. Reconstructed, the shell would amount to less than one egg, but its dispersal throughout the site suggests more. Some burning was found, which may have resulted from disposal with domestic refuse.

Age and Seasonality

The age of the animal may be important in determining which season(s) a site was occupied. Immature individuals (less than two- thirds adult size) of the small mammals are generally found in spring and summer, while young adults (up to full size but with unfused epiphyses) are found from summer into winter. A prevalence of mature individuals in a fairly large sample may suggest winter deposition. Mixing of deposits and storage complicate the issue, and generally all that can be confidently concluded is that some deposition took place during the warm part of the year. Cold weather occupation is much more difficult to demonstrate through faunal remains.

Ducks are more commonly found during winter, as indicated in the following section. The presence and the diversity of species may suggest winter exploitation since ducks would be abundant during that portion of the year.

Table 21 gives the breakdown of age groups for potential food animals and by structure. For the most part, samples with a fair number of bones include relatively few immature and young adult elements. Pithouse 4 had the highest rates. Most proveniences had none but are small samples.

Table 21. Percent of faunal elements by age

Provenience/Taxon	Number	Percent Immature	Percent Young Adult	Percent Adult
Pithouse 2				
L. californicus	52	1.9		98.1
D. spectabilis	8	25.0		75.0
Pithouse 4, Stratum 1				
L. californicus	64	4.7	1.6	93.7
T. bottae	4		25.0	75.0
Pithouse 4, Stratum 2				
D. spectabilis	3		33.3	66.7
Artiodactyl	3	66.7		33.3
Pithouse 4, Stratum 3				
Sylvilagus sp.	10		20.0	80.0
L. californicus	29		3.4	96.5
Pithouse 4, Stratum 4				
Sylvilagus sp.	18	5.5	5.5	88.9
L. californicus	11	9.1		90.9
North fill				
Sylvilagus sp.	60	25.0	10.0	65.0
L. californicus	99	2.0	9.1	88.8
S. spilosoma	2		50.0	50.0
T. bottae	8		12.5	87.5
D. spectabilis	33	3.0	3.0	94.0
Artiodactyl	21	4.8		95.2
Pithouse 6				
L. californicus	1		100.0	
Pithouse 7, lower fill				
L. californicus	28		7.1	92.9
Pithouse 8, fill				
L. californicus	1		100.0	
Pithouse 8, floor fill				
medium mammal	1		100.0	
Pit 18, Levels 1 and 2				
Sylvilagus sp.	2		50.0	50.0
L. californicus	31		3.2	96.8

Pit 18, Levels 3-7				
Sylvilagus sp.	21		19.0	80.9
L. californicus	84	1.2	5.9	92.9
T. bottae	13		7.7	92.3
D. spectabilis	3		33.3	66.7
Artiodactyl	4	25.0		75.0
Pit 48b, fill				
Sylvilagus	2		50.0	50.0

Burning

Burning was recorded as scorched, partial, or complete. A few elements also had a waxy texture and brown discoloration suggestive of boiling ("cooking brown"). This was especially true of the fish remains, which may have been prepared by boiling.

Inferences on cooking methods can be made from the amount of burning. A scorch or partial burn could indicate roasting or discard into a smoldering firepit. Complete burning is problematical in that no method of cooking should result in complete burns, and discard into a firepit during preparation, consumption, or cleaning is the best explanation. Table 22 summarizes burning by taxon to determine if patterns of cooking are suggested. Species with no burning are not included and groups of similar species are lumped: ducks, turtles, and artiodactyls.

Complete burning, suggestive of discard, is the most common heat alteration to those taxa commonly thought of as food items (rabbits and artiodactyls) and to the unknown specimens most likely to represent them (small mammal and large mammal). The small amount of burning for the rodent and pocket gopher taxa suggests only occasional use as food and that some of the specimens were postoccupational burrowers.

Partial burning and/or scorching was present in most groups and may suggest a fair amount of roasting. Ducks, medium bird, and the large kangaroo rat are especially high in these forms of alteration, which may indicate that roasting was the principal means of preparation.

Turtle was by far the most heat altered of the taxa, but this may reflect little more than the fragility of burned shell. Some of the nonshell parts are partly burned, which suggests roasting as a means of preparation.

Butchering

Evidence of butchering, such as small cuts and portions removed, are rare in the collection. However, much of this is due to the etched and eroded condition of the bone, which may obscure or destroy marks.

Of the seven observed incidences of butchering, all but one appear to have resulted from cutting off a foot or portion of a limb. These include a cut removing part of a cottontail radius shaft; cuts on a metatarsal, tibia shaft, and pubis of a jackrabbit; and removal of a distal tibia and a portion of a shaft from another distal tibia of a kangaroo rat. The remaining example is a possible vertebra from a medium mammal or large bird that was cut lengthwise.

Table 22. Heat alteration of faunal materials (N>10)

Taxon	Number	Percent Burned	Percent Partly Burned	Percent Scorched	Percent with Cooking Brown	Percent Total Alteration
Sylvilagus sp.	153	10.4	2.6	5.9	1.3	20.3
L. californicus	500	14.8	4.6	1.6		21.0
T. bottae	36	2.8				2.8
D. spectabilis	60	5.0	6.7	10.0		21.7
Rodent	12		8.3			8.3
Small mammal	199	21.1	5.0	3.5		29.6
Small to medium mammal	18	22.2	11.1			33.3
Artiodactyl	110	31.8	9.1		0.9	41.8
Medium to large mammal	41	14.6	17.1			31.7
Large mammal	33	30.3	6.1			36.4
Anatidae	26	11.5	19.2	11.5		42.3
Medium bird	13		15.4			15.4
Medium to large bird	11	9.1				9.1
Small mammal/medium to large bird	41	29.3				29.3
Bufo sp.	14	7.1				7.1
Testudinata	53	37.7	18.9	22.6		79.2

Bone Weathering

Nearly all of the unburned bone is weathered in some manner. Root etching is so common that it was not tabulated. The few elements that escaped this process may represent postoccupational intrusives such as toads and some mice. Most of the fish remains are also unaffected, but this may result from whatever caused the waxy brown discoloration.

Checking, or cracking from exposure, was limited to a few large elements such as those from the artiodactyls. The small amount found suggests relatively rapid burial in the two features that contained the bulk of the bone.

Discussion

The faunal remains suggest that the prehistoric inhabitants of Belen Bridge were using a number of habitats to procure various animal forms. The majority of the small mammals are characteristic of saltgrass flats, while the presence of ducks, aquatic turtles, and fish suggest use of marshes and possibly the river itself.

Jackrabbit was the most common animal utilized. It is the most numerous in terms of elements and all breakdowns of the MNIs, and it was found in more proveniences than any other species. Its strong association with arroyos in alluvial slopes and saltgrass flats, as well as the many other taxa associated with these zones, strongly suggests primary use of those habitats.

Cottontail rabbit is the second most common contributor to the fauna. Its presence in all habitats does not add to our information on areas exploited.

Of the mice, the large kangaroo rat appears to be the most frequently used. Its habits (nocturnal and solitary) and burning in proportions similar to those of the rabbits are better evidence of deliberate procurement than for any of the other rodents.

There is minimal evidence of artiodactyl use in the faunal assemblage. Deer and pronghorn could possibly have been procured nearby. Small group size or differential deposition of the remains of large mammals are possible explanations for the small amount of artiodactyl bone.

The ducks, and possibly turtles, are the best indications that marshes were present nearby. Turtle remains are widespread at the site. Ducks (and fish) are confined to the lower levels of two structures, indicating less systematic use.

The single turkey, found articulated on the floor of a structure, does not suggest a food role for this species. Turkey is known from earlier sites in the area but appears to take on an economic role slightly later than the occupation at Belen Bridge.

In summary, a wide variety of animals was exploited, including those commonly found in assemblages from other sites in the area. The use of various rodents, turtle, fish, and possibly toad indicate broad use of the environment, yet rabbits formed the basis of the animal diet.

The Belen Bridge faunal assemblage is consistent with others from the Middle Rio Grande Valley. Sites dating through early Pueblo III are mainly located in the Albuquerque area but are remarkably similar (Akins 1987a). Jackrabbit, followed by cottontail rabbit, are the most common taxa recovered, and a wide range of rodents and other fauna were exploited. Elements from turkey, turtle, deer, and pronghorn were found at most sites, but in small numbers.

The presence of fish at Belen Bridge is one of the earliest reported from Middle Rio Grande assemblages. At least five species are represented by 26 elements. This site and AL-12 (LA 35493) are the only Pueblo III sites to contain fish, more common in Pueblo IV sites. The faunal assemblage at AL-12, north of Albuquerque at Rio Rancho, is quite similar to the Belen Bridge sample and differs mainly in the species of birds found (Akins 1987b). Rabbits are characteristic of both sites, as are turtle and fish. Neither has many turkey or artiodactyl bones. Birds found at LA-12 include crane and quail; ducks were found at Belen Bridge.

Perhaps the most significant implication of the faunal analysis is that turkey is not present in sufficient quantities to suggest it played a significant role in the diet. Common in Pueblo IV assemblages and quite possibly a correlate of irrigation agriculture and crop surplus, during Pueblo III turkeys may not yet have become a common food item.

POLLEN STUDY

Karen H. Clary

A total of 28 pollen samples was analyzed from the Belen Bridge site (Tables 23-27). The goals of the analysis were threefold:

1. To document the subsistence base of the site inhabitants by the recovery of pollen of both economic and environmentally indicative pollen. The pollen of economic plants such as cultivars and noncultivated, seasonally available "wild" and weedy taxa collected from features would give an indication of site and feature function, revealing the kinds and balance of subsistence practices undertaken by site inhabitants. The identification of pollen of environmentally indicative plants would shed light upon the kinds of plant communities present in the general vicinity of the site that contained taxa impacted by human occupation.

2. To examine a component of the pre-Conquest economic history of the Middle Rio Grande. A profile of the pollen of economic taxa would give some indication of the kinds of economic plants utilized by site inhabitants prior to the sixteenth- and seventeenth-century introduction of European cultivars such as sweet melons, fruits, and cereals. Spanish chroniclers of the entrada era (1540-1598) cited prosperous Piro pueblos further south in the Socorro area, where corn, beans, squash, tobacco, and perhaps cotton were successfully grown and traded (Hammond and Rey 1966:219-220, cited in Winter 1980:34, 35). The examination of the pollen remains could illuminate whether or not such practices were extant during the thirteenth century as well.

3. To compare the subsistence patterns of LA 53662 with those at other sites of similar age along the Middle Rio Grande. The subsistence base of prehistoric inhabitants of the Middle Rio Grande is largely undocumented because of a lack of archaeological investigations in the area and a lack of appropriate sampling of archaeobotanical remains. The results of this analysis will be compared to the few other pollen studies conducted for the Middle Rio Grande: LA 282, south of Socorro (Fish 1987); Qualacu' Pueblo, also south of Socorro (Clary 1987a); LA 15260, in south Albuquerque (Clary 1987b); and Nuestra Señora de Dolores Pueblo in Bernalillo (Clary 1982).

Methods

Chemical Extraction

The samples were processed using a modification of the method described by Mehringer (1967).

1. A 20-22 g sample was taken from the bag and weighed on a triple-beam balance.

2. The sample was washed through a 230 um mesh brass screen with distilled water into a 600 ml beaker.

3. Tablets of quantified *Lycopodium* spores were dissolved in each sample to serve as a control for pollen degradation and to calculate absolute pollen sums to determine whether or not sufficient pollen was available per sample for data interpretation (Stockmarr 1971).

4. Carbonates were removed by adding 50 ml of 40 percent hydrochloric acid (HCl) to each beaker. When effervescence ceased, each beaker was filled with distilled water, and the sediments were allowed to settle for at least three hours. The water-dilute HCL was carefully poured off after settling, leaving the sediments and the pollen behind in the beaker.

Table 23. Relative pollen frequencies

Taxon	FS 0-46 Surface Control (%)	FS 5-3 Extramural Pit 5a Bottom Contact (%)	FS 10-33 Pithouse Floor Contact (%)	FS 14-61 Pithouse Stratum 2, top 23 cm BLD (%)	FS 14-62 Pithouse Contact 35 cm BLD	FS 14-93 Pithouse Stratum 3, 65 cm BLD (%)
Pinus sp. (pine)	8	3	6	5	(2)	11
Juniperus sp. (juniper)	+					
Quercus sp. (oak)	+					
Populus sp. (cottonwood)	11	9	10	3		5
Salix sp. (willow)	2	2	2	+		
Juglans sp. (walnut)	1					
Prosopis glandulosa (mesquite)	+					
Prosopis juliflora (mesquite)	2					
Eleagnus angustifolia (Russian olive)	+					
Cheno-am (chenopod-amaranth)	49a	66a	51a	68a	(62)a	43a
Sarcobatus sp. (greasewood)	+		+	3	(2)a	+
Poaceae (grasses)	1	2a	3			2a
High-spine Asteraceae (high-spine sunflowers)	12		3	4		4a
Low-spine Asteraceae (low-spine sunflowers)	7	1	13a	4	(10)a	6a
Artemisia sp. (sage)	2		1			
Ambrosia sp. (ragweed)		1	+	2		2
Ephedra sp. (ephedra)	+	6	3			
Ephedra torreyana (torrey ephedra)	+	6	1	5	(6)	20a
Larrea sp. (creosotebush)	2		Ra			
Allionia-type (four o'clock)		+	1Ra	R	R	R

Yucca sp. (yucca)						
Oenothera sp. (primrose)			R			
Sphaeralcea sp. (globemallow)			R			1
Kallstroemia sp. (desert "poppy")		Ra	R	2	R	
Platyopuntia (prickly pear)						
Cylindropuntia (cholla cactus)		R	R	R	R	R
Cleome sp. (beeweed)		1	+	3		
Typha sp. (cattail)		Ra				+R
Brassicaceae (mustard family)						
Fabaceae (bean family)						
Gossypium sp. (cotton)						
Cucurbita sp. (squash)		R	R			
Zea mays L. (maize)		C	2Ca	+C	(2)Ca	1Ca
Unidentified	+	4	2	1		6
Total number	207	205	206	200	84	200
Total percent	100	100	100	100		100
Absolute number of pollen grains per gram of sediment	12,650	5,742	6,441	1,880	2,455	4,268

Key:
+ = present in a relative frequency of less than 1 percent
() = real numbers in samples with less than 200 pollen grains
R = rare occurrence (1-10 pollen grains) in larger fraction (> 45 um) count
C = common occurrence (11-100 pollen grains) in larger fraction (> 45 um) count
A = abundant occurrence (> 100 pollen grains) in larger fraction (> 45 um) count
a = aggregates of pollen noted

Table 24. Relative pollen frequencies

Taxon	FS 14-94 Pithouse Stratum 3, 90 cm BLD (%)	FS 14-129 Pithouse Floor (%)	FS 16-10 Extramural Pit (%)	FS 17-60 Pithouse Floor Contact, NE corner (%)	FS 18-42 Extramural Pit, Bottom Contact	FS 20-33 Pithouse Floor Contact, NE corner
Pinus sp. (pine)	10	20	8	2	(4)	(12)
Juniperus sp. (juniper)						
Quercus sp. (oak)			1			
Populus sp. (cottonwood)	+	2	6a	3	(6)	(2)a
Salix sp. (willow)						
Juglans sp. (walnut)						
Prosopis glandulosa (mesquite)						
Prosopis juliflora (mesquite)						
Eleagnus angustifolia (Russian olive)						
Cheno-am (chenopod-amaranth)	39a	33a	27a	46a	(12)a	(64)a
Sarcobatus sp. (greasewood)	+	2	2	+	(2)a	(2)
Poaceae (grasses)	1a	2	10a		(2)a	(4)
High-spine Asteraceae (high-spine sunflowers)	2a	5	1	+	(2)	
Low-spine Asteraceae (low-spine sunflowers)	8a	11a	11	10	(4)	(26)a
Artemisia sp. (sage)		+				(2)
Ambrosia sp. (ragweed)	1		1			
Ephedra sp. (ephedra)	7	+				
Ephedra torreyana (torrey ephedra)	24a	22a	10	12	(20)	(10)
Larrea sp. (creosotebush)				9a		
Allionia-type (four o'clock)	Ra	+R	1a	Ra	R	C

Yucca sp. (yucca)	1					
Oenothera sp. (primrose)		R	R	2Aa		
Sphaeralcea sp. (globemallow)						
Kallstroemia sp. (desert "poppy")		R	R			R
Platyopuntia (prickly pear)						
Cylindropuntia (cholla cactus)	R	R	R		R	R
Cleome sp. (beeweed)	+	1	1	2a		
Typha sp. (cattail)	+			Ra		(4)
Brassicaceae (mustard family)	+	2	2	4		
Fabaceae (bean family)	1	+				
Gossypium sp. (cotton)						
Cucurbita sp. (squash)		R	R		R	
Zea mays L. (maize)	Ra	Ca	17Aa	8Ca	(2)Ca	(10)Ca
Unidentified	3	2	2	2	(2)	
Total number	206	203	206	200	98	136
Total percent	100	100	100	100		
Absolute number of pollen grains per gram of sediment	1,489	1,807	4,775	5,378	768	1,758

Key:
+ = present in a relative frequency of less than 1 percent
() = real numbers in samples with less than 200 pollen grains
R = rare occurrence (1-10 pollen grains) in larger fraction (> 45 um) count
C = common occurrence (11-100 pollen grains) in larger fraction (> 45 um) count
A = abundant occurrence (> 100 pollen grains) in larger fraction (> 45 um) count
a = aggregates of pollen noted

Table 25. Relative pollen frequencies

Taxon	FS 20-34 Pithouse Strata 1 and 2 Contact	FS 20-35 Pithouse Strata 2 and 3 Contact	FS 20-36 Pithouse Strata 3 and 4 Contact (%)	FS 20-37 Pithouse Stratum 2, Middle (%)	FS 20-38 Pithouse Stratum 4, Middle (%)	FS 20-39 Pithouse Stratum 3, Middle
Pinus sp. (pine)		(14)	2	11	9	
Juniperus sp. (juniper)			2			
Quercus sp. (oak)						
Populus sp. (cottonwood)	(4)		1	7	+	(2)
Salix sp. (willow)					+	
Juglans sp. (walnut)						
Prosopis glandulosa (mesquite)						
Prosopis juliflora (mesquite)						
Eleagnus angustifolia (Russian olive)						
Cheno-am (chenopod-amaranth)	(22)	(40)a	1	27a	44a	(46)a
Sarcobatus sp. (greasewood)	(2)	(1)	+	+	11a	
Poaceae (grasses)	(1)	(4)	3a	3	2	(4)
High-spine Asteraceae (high-spine sunflowers)			+	+	1a	
Low-spine Asteraceae (low-spine sunflowers)	(2)		+	5	12a	(8)
Artemisia sp. (sage)	(2)	(2)				
Ambrosia sp. (ragweed)				Ra		(2)
Ephedra sp. (ephedra)						
Ephedra torreyana (torrey ephedra)	(8)	(12)a	+	+	12	(4)
Larrea sp. (creosotebush)				+		
Allionia-type (four o'clock)		(2)Ca	R	R	R	R

Yucca sp. (yucca)				+		
Oenothera sp. (primrose)		R				
Sphaeralcea sp. (globemallow)					+	
Kallstroemia sp. (desert "poppy")						
Platyopuntia (prickly pear)	R			R		
Cylindropuntia (cholla cactus)	(2)Ra	(14)	4C	4R	R	(2)C
Cleome sp. (beeweed)	Ra			+		
Typha sp. (cattail)				+	+	
Brassicaceae (mustard family)			1	1	R	1
Fabaceae (bean family)						
Gossypium sp. (cotton)						
Cucurbita sp. (squash)					R	
Zea mays L. (maize)	(12)Ca	(16)Ca	83Aa	29Aa	4Ca	(10)Ca
Unidentified	(1)			3	3	(4)
Total number	56	105	203	210	202	83
Total percent			100	100	100	
Absolute number of pollen grains per gram of sediment	777	598	4,264	2,741	1,325	2,325

Key:
+ = present in a relative frequency of less than 1 percent
() = real numbers in samples with less than 200 pollen grains
R = rare occurrence (1-10 pollen grains) in larger fraction (> 45 um) count
C = common occurrence (11-100 pollen grains) in larger fraction (> 45 um) count
A = abundant occurrence (> 100 pollen grains) in larger fraction (> 45 um) count
a = aggregates of pollen noted

Table 26. Relative pollen frequencies

Taxon	FS 20-40 Pithouse Stratum 1, Charcoal (%)	FS 24-2 Extramural Pit 24a, Bottom Contact	FS 24-3 Extramural Pit 24b, Bottom Contact (%)	FS 34-13 Pithouse Floor Contact, NE Corner (%)	FS 35-3 Burial (%)	FS 36-3 Burial (%)
Pinus sp. (pine)	5	(8)	13	12	21	11
Juniperus sp. (juniper)						
Quercus sp. (oak)						
Populus sp. (cottonwood)	3a		3a	2	1	2a
Salix sp. (willow)			1		+	
Juglans sp. (walnut)						
Prosopis glandulosa (mesquite)						
Prosopis juliflora (mesquite)						
Eleagnus angustifolia (Russian olive)						
Cheno-am (chenopod-amaranth)	50a	(44)	42a	41a	25a	15a
Sarcobatus sp. (greasewood)	+		1	5	2	
Poaceae (grasses)	1		1	2	3a	2
High-spine Asteraceae (high-spine sunflowers)	3		3	2	3	+a
Low-spine Asteraceae (low-spine sunflowers)	22a	(10)	15	14	8a	6
Artemisia sp. (sage)	+		1			
Ambrosia sp. (ragweed)	+		1	2	2	
Ephedra sp. (ephedra)						
Ephedra torreyana (torrey ephedra)	1	(22)	13	11	24	11
Larrea sp. (creosotebush)		(4)		1	Ra	1

Allionia-type (four o'clock)	R	R	R	R	Ra	R
Yucca sp. (yucca)						
Oenothera sp. (primrose)	R		R	R		
Sphaeralcea sp. (globemallow)	Ra		1			Ra
Kallstroemia sp. (desert "poppy")	R				R	
Platyopuntia (prickly pear)						
Cylindropuntia (cholla cactus)	2Ca	R	R	R	R	
Cleome sp. (beeweed)			1	+	2	Ra
Typha sp. (cattail)				2		2
Brassicaceae (mustard family)	2		1		2	
Fabaceae (bean family)						
Gossypium sp. (cotton)					R	
Cucurbita sp. (squash)						
Zea mays L. (maize)	9Aa	Ra	1Ra	5Ca	7R	46Aa
Unidentified	+	(1)	1	3	1	2
Total number	213	89	202	200	200	205
Total percent	100		100	100	100	100
Absolute number of pollen grains per gram of sediment	2,888	2,043	2,130	2,997	1,416	8,106

Key:
+ = present in a relative frequency of less than 1 percent
() = real numbers in samples with less than 200 pollen grains
R = rare occurrence (1-10 pollen grains) in larger fraction (> 45 um) count
C = common occurrence (11-100 pollen grains) in larger fraction (> 45 um) count
A = abundant occurrence (> 100 pollen grains) in larger fraction (> 45 um) count
a = aggregates of pollen noted

Table 27. Relative pollen frequencies

Taxon	FS 43-7 Pithouse Floor Contact	FS 45 Pithouse Floor Contact (%)	FS 47-7 Pithouse Floor Contact (%)	FS 48b-10 Extramural Pit Bottom Contact (%)
Pinus sp. (pine)	(12)	11	10	2
Juniperus sp. (juniper)				
Quercus sp. (oak)				
Populus sp. (cottonwood)	(5)a	4a	4	+
Salix sp. (willow)				
Juglans sp. (walnut)				
Prosopis glandulosa (mesquite)				
Prosopis juliflora (mesquite)				
Eleagnus angustifolia (Russian olive)				
Cheno-am (chenopod-amaranth)	(46)a	28a	48a	38a
Sarcobatus sp. (greasewood)	(3)	+	2	
Poaceae (grasses)	(4)a	2	3	+
High-spine Asteraceae (high-spine sunflowers)	(1)	1	3	
Low-spine Asteraceae (low-spine sunflowers)	(38)a	10	17	26
Artemisia sp. (sage)	(1)			
Ambrosia sp. (ragweed)	(4)	5	1	23
Ephedra sp. (ephedra)				
Ephedra torreyana (torrey ephedra)	(14)	18a	12	3
Larrea sp. (creosotebush)	(1)	2a		
Allionia-type (four o'clock)	(1)R	R	R	R

Yucca sp. (yucca)				
Oenothera sp. (primrose)	(1)R	2R	+	R
Sphaeralcea sp. (globemallow)				+a
Kallstroemia sp. (desert "poppy")			+R	
Platyopuntia (prickly pear)	(1)R	R		
Cylindropuntia (cholla cactus)			R	R
Cleome sp. (beeweed)		1	1	Ra
Typha sp. (cattail)	(3)	1a	1	+
Brassicaceae (mustard family)		1		
Fabaceae (bean family)				
Gossypium sp. (cotton)				
Cucurbita sp. (squash)			+	
Zea mays L. (maize)	(6)Aa	7Aa	R	6Ca
Unidentified	(6)	4		
Total number	147	210	201	206
Total percent		100	100	100
Absolute number of pollen grains per gram of sediment	3,593	2,718	2,632	3,147

Key:
+ = present in a relative frequency of less than 1 percent
() = real numbers in samples with less than 200 pollen grains
R = rare occurrence (1-10 pollen grains) in larger fraction (> 45 um) count
C = common occurrence (11-100 pollen grains) in larger fraction (> 45 um) count
A = abundant occurrence (> 100 pollen grains) in larger fraction (> 45 um) count
a = aggregates of pollen noted

5. Each beaker was filled again with distilled water, stirred, and allowed to settle for three hours before pouring off.

6. Beakers were filled one-third full with distilled water and stirred with clean stirring rods without creating a vortex to suspend sediments and pollen. Fifteen seconds after stirring stopped, the lighter soil particles and the pollen grains were poured off into a second clean beaker, leaving the heavier

sand particles behind in the first beaker. The procedure was repeated twice using 10 second settling periods to separate the heavier sand from the lighter sediments and the pollen grains. The heavier fraction was discarded.
7. The sediments were transferred to 50 ml test tubes.

8. Silicates were removed by adding 50 ml of 48 percent hydrofluoric acid (HN) to each tube. The tubes were placed in a hot water bath for 30 minutes. Upon removal from the water bath, the samples were cooled and rinsed three times with distilled water.

9. To remove fine carbon and organics, a 5 percent aqueous solution of trisodium phosphate was added to each sample (L. Scott Cummings, personal communication). The samples were rinsed with distilled water three to five times until the supernatant was clear, using centrifugation to float out the fine organics.

10. Organics were removed by the following process: The samples were rinsed with 30 ml glacial acetic acid, centrifuged, then poured off. A fresh acetolysis solution was prepared of nine parts acetic anhydride to one part sulfuric acid. Thirty ml were added to each test tube and stirred, and the test tubes were placed in a hot-water bath for 10 minutes. Tubes were removed and cooled, then centrifuged, and the liquid was poured off. The tubes were rinsed with glacial acetic acid, centrifuged, and poured off.

11. The centrifuge tubes were filled with distilled water, stilled, centrifuged, and poured off. This was repeated twice.

12. Droplets of the pollen-bearing sediment were placed on microscope slides and mixed with glycerine jelly. A 22 by 40 mm coverslip was placed on each slide, and the slide was allowed to cool, fixing the pollen in the glycerine jelly.

13. The slides were examined using a Nikon microscope under magnifications of 200, 400, and 1,000. Pollen identification was made using Kapp (1969), Erdtman (1952), and the comparative collection of modern reference pollen. An attempt was made to reach a count of 200 pollen grains for each sample to derive relative pollen frequencies for the interpretation of the pollen record (Barkley 1934).

14. The pollen was counted, and the absolute pollen number was computed (Stockmarr 1971). The absolute pollen number of fossil pollen is a quotient derived from the relationship between the number of control pollen grains counted and the number of fossil pollen grains counted:

Absolute pollen number = (number fossil pollen grains counted x number exotics added)
divided by
(number exotics counted x weight of sample)

15. After attempting a 200 grain count the pollen sample was examined specifically for maize and other pollen types larger than 45 um. This was accomplished by sieving the pollen residue through 45 um mesh screen and collecting a sample of the larger pollen grains that remained on the screen with a pipette. The residue was mounted on a 22 mm x 40 microscope slide and examined.

Interpretation

In the pollen record, the identification of plant taxa of economic importance is based upon several considerations that are weighed in conjunction with each other:

1. The occurrence in a set of samples (i.e., from cultural features at a site) of a taxon in a frequency greater than would occur in a set of samples collected from the natural pollen record (i.e., surface or subsurface off-site control samples).

2. The occurrence of individual pollen grains of a taxon in numbers greater than would occur in the natural pollen record.

3. The consistent occurrence of aggregates of

undispersed pollen from taxa that are known to disperse pollen grains singly rather than in clumps. The use of pollen aggregates centers around the observation that most pollen is normally dry and nonadherent at maturity. The grains that do adhere to each other are likely to fall a short distance from the plant because of their added weight (Bohrer 1981:140). The presence of pollen aggregates is an indication of the collection of plants bearing flowering stalks before the process of pollination has been completed, or of the collection of fruits with senescent flower parts still attached. This is particularly true for insect-pollinated plants that are limited in pollen dispersal. Wind-pollinated plants present greater interpretive difficulties since aggregates of these types of plants (i.e., herbaceous cheno-ams and the sunflower family) will disperse over wide distances, and actual plant presence in the sampling locale may or may not be indicated (Gish 1982:101). A portion of the aggregates found in the pollen record from archaeological sites probably reflects proximity of herbaceous plant abundances from localized site disturbance rather than culturally derived plant introduction within an archaeological context (Gish 1982:103). As Gish (1982:103) notes:

> The pollen record from an archaeological context is essentially a conglomeration of both natural and cultural events and influences. Interpretation is an attempt to identify the contributing factors and to select the most plausible explanation or explanations for the resulting pollen record. Since contexts generally represent such admixtures, the resultant relative pollen frequencies can be arbitrary. Tabulations of aggregates are helpful in identifying the most influential pollen types and therefore the most probable conditions, factors, and processes which contributed to the pollen record.

When the frequent recovery of pollen aggregates consisting of 6 to 20 grains in archaeological contexts compatible with human use occurs, an interpretation of human introduction should be carefully considered (Bohrer 1981:141). The comparison of taxa with pollen aggregates to the list of identified utilized taxa from the macrobotanical and flotation record is useful in sorting out which plants were culturally introduced and which were not.

The collection of plants bearing aggregates may occur during the harvest of cultivated and semicultivated plants such as cereals (maize included) and edible "weedy" herbaceous plants (i.e., cheno-ams, globemallow, primrose, sunflower family, mints, beeweed, and purslane, to name a few). Seasonally available wild taxa, especially grasses, when collected en masse, will also contain aggregates that may be indicative of their harvesting. Flowers collected for consumption will also bear aggregates that indicate their choice as a food item. In the American Southwest, the flowers of yucca, squash, cactus, and cottonwood were regularly collected by aboriginal peoples for consumption. These taxa, when used in the context of features, will shed both pollen and aggregates, creating a record of paleoethnobotanic use.

4. Identification in the ethnobotanical literature of the use of a specific taxon. The ethnobotanical literature reveals the manner in which the flora of the American Southwest was used historically. The comparison of ethnobotanically indicated plant taxa found in the archaeobotanical record permits the assessment of the botanical aspect of subsistence patterns. The literature describes the specifics of plant use, such as the period of availability and collection, the manner of use (food, medicine, construction, dye, etc.), the manner of preparation (dried, crushed, steeped, boiled, baked, stored, etc.), and the locus of preparation. In addition, the literature tells whether a plant was of major or minor economic importance to a particular group of Southwestern peoples.

5. The occurrence and abundance of economically suspect taxa in the large fraction scan. The large fraction scan was developed to expand the list of taxa found at the site and to enhance the explanatory utility of the pollen analysis. The method is used to locate the taxa of important

economic plants that are not well represented in the pollen record because of the vagaries of taphonomy--poor concentration, poor preservation, or the relative overabundance of other taxa. Better feature and site comparability is created by increasing the distribution of a taxon in a set of samples. For example, pollen tends to be poorly preserved in hearth contexts, yet hearths, as loci of direct human economic activity, offer one of the most promising contexts for identifying the use of economic plants. Because of the reasons mentioned above, the standard 200 grain count may be ineffective in locating important economic taxa such as maize in the context of a particular feature. The use of a large fraction procedure concentrates the pollen of maize by removing obfuscating plant debris and smaller pollen, allowing for identification of the taxon and a relative count of the pollen grains that may be compared to the number of pollen grains in other samples in which the same method is employed. Like the standard 200 grain count, the frequency of taxa encountered may be compared to the surface or subsurface control samples to determine the economic implications for the presence of a particular taxon. In this study, note was made of the numbers of pollen grains that occurred per taxon for maize, squash, prickly pear, cholla, primrose, globemallow, desert "poppy," four o'clock, and cattail. These are categorized as rare (1-10 pollen grains per slide), common (11-100 grains), and abundant (more than 101 grains). The abundance of a taxon gives some indication of the use of a feature. With a few exceptions, high pollen numbers likely indicate direct use, and low numbers likely indicate the use of a taxon in the general vicinity of a feature or the infrequent use of a taxon in the context of a feature. In addition, because aggregates of pollen are also concentrated by this method, their occurrence was also recorded.

Description of Pollen Samples from Archaeological Features

Pithouse 1

Sample 14-61 was collected near the top of Stratum 2. Maize pollen, the only cultivar, was common. The pollen record was dominated by cheno-ams (67 percent).

Sample 14-62 was collected from the contact between Strata 2 and 3. Although a standard 200 grain count was not achieved, maize pollen was common.

Sample 14-93 was collected from 65 cm below datum in Stratum 3. This sample was notable in that a variety of economically indicated pollen types (cheno-ams, grasses, sunflower family, ephedra, maize) occurred with numerous aggregates of pollen, implying the purposeful collection of these taxa (see Interpretive Methods).

Sample 14-94 was collected from 90 cm below datum in Stratum 3. Maize pollen was rare, and the sample was dominated by cheno-ams and ephedra. Aggregates of four o'clock were noted, bolstering the implication that this taxon was used by site inhabitants, although the use of this plant by humans is not documented in the ethnobotanical literature.

Sample 14-129 was collected from floor contact. Maize pollen, with aggregates, was common. The economic pollen spectrum was dominated by cheno-ams, ephedra, pine, and sunflower family, indicating these taxa were used within the context of the pithouse.

Pithouse 2

Sample 10-33 was collected from the floor. Economic pollen of cultivars maize and squash, as well as an abundance of weedy edible and otherwise useful cheno-ams and sunflower family (low spine type) were encountered. Occurring in scant frequency was the pollen of medicinally indicated taxa globemallow, four o'clock, primrose, and desert "poppy."

Pithouse 3

Sample 17-60 was collected from floor contact in the northeast corner of the pithouse. Taxa of economic importance recovered were maize, cattail, beeweed, very abundant primrose, four o'clock, creosote bush, and cheno-ams, indicating that these taxa were used within the context of the structure.

Pithouse 4

Sample 20-33 was collected from floor contact in the northeast corner of the structure. Although pollen concentrations were low, economically indicated taxa include maize, four o'clock, cheno-ams, and sunflower family.

Sample 20-34 was collected from the contact between Strata 1 and 2. Although pollen was poorly preserved in this sample, maize was common.

Sample 20-35 was collected from the contact between Strata 2 and 3. Again, pollen was not well preserved. However, maize and four o'clock were common in the sample, indicating the use of these taxa by site inhabitants.

Sample 20-36 was collected from the contact between Strata 3 and 4. Maize pollen was extremely abundant, and cholla pollen was common, indicating the use of these taxa by site inhabitants.

Sample 20-37 was collected from the middle of Stratum 2. Maize pollen was abundant, and other economically indicated taxa were cholla and cheno-ams.

Sample 20-38 was collected from the middle of Stratum 4. Both maize and squash were encountered, along with relatively abundant pollen of cheno-ams, greasewood, sunflower family, and ephedra, indicating use for economic purposes.

Sample 20-39 was collected from the middle of Stratum 3. Although pollen was poorly concentrated and a standard 200 grain count was not achieved, cholla and maize pollen was common in the sample, indicating that these taxa were used economically.

Sample 20-40 was collected from the middle of Stratum 1. Taxa of economic importance include cholla, maize, cheno-ams, and sunflower family.

Pithouse 5

Sample 34-13 was collected from floor contact in the northeast corner of this structure. Economic taxa encountered were cheno-ams, sunflower family, and maize, indicating at least the use of these taxa within the context of the structure occupation.

Pithouse 6

Sample 43-7 was collected from floor contact. Although pollen was poorly concentrated in this sample, and a standard 200 grain count was not achieved, the pollen of maize was abundant, along with cheno-ams, sunflower family, and ephedra, indicating that these taxa were used within the context of the structure.

Pithouse 7

Sample 45-14 was collected from floor contact. The sample was dominated by the pollen of economics, including cheno-ams, sunflower family, ephedra, and maize. In addition, the presence of aggregates of cattail and creosote suggest that these taxa may also have been used within the context of the structure.

Pithouse 8

Sample 47-7 was collected from floor contact. The economic pollen in this sample was composed primarily of cheno-am, sunflower family, ephedra, scant squash, and maize, indicating that these taxa were used within the context of this structure.

Extramural Pit 5a

Sample 5-3 was collected from the bottom of the pit. Both maize and squash were present as well as economically indicated cheno-ams, grasses, desert "poppy," cholla, and cattail, indicating that these taxa may have been used within the context of the pit.

Extramural Pit 16

Sample 16-10 was collected from the bottom contact of the pit. Maize pollen was abundant, along with scant squash, indicating that these cultivars were used or perhaps stored within the feature. In addition, the pollen of cottonwood (with aggregates), cheno-ams, (with aggregates), grasses (with aggregates), and four o'clock (with aggregates) was present in frequencies sufficient to indicate economic association with the feature as well.

Extramural Pit 18

Sample 18-42 was collected from bottom contact. Both maize (common in sample and with aggregates) and squash were encountered, along with scant cholla, four o'clock, grasses, cheno-ams, ephedra, and sunflower family, indicating that these taxa were used within the context of the pit.

Extramural Pit 24a

Sample 24-2 was collected from bottom contact in Pit 24a. Pollen was poorly concentrated in this sample, and it was not diagnostic except to show that the economic taxa maize and cholla were present in scant amounts, perhaps as remnants of stored or processed plant products.

Extramural Pit 24b

Sample 24-3 was collected from bottom contact in Pit 24b. Pollen of maize and cholla was scarce, although cheno-ams, sunflower family, and ephedra pollen was abundant. However, since these latter taxa may occur in abundance as a result of natural pollen production, rather than human importation to the site, it is difficult to determine whether or not the presence of these taxa is of economic significance in this context.

Burial 1

Sample 35-3 was collected from the soil matrix of this burial. The pollen spectrum was very similar to the pollen spectra from elsewhere at the site with the notable exception that a grain of cotton pollen was present. No other cotton pollen was found at the site. In addition, the frequency of ephedra pollen was greater here than in most other samples, indicating that this taxon may have been deposited with the burial.

The overall similarity of the pollen spectrum to those of other samples implies that the individual was buried during an occupational period when human-induced disturbance influenced the pollen spectrum in the soil matrix used for burial. The growing season, summer through early fall, is indicated. However, as Fish (1987:109) notes, "It is difficult to evaluate the sources of pollen associated with burials. The matrix into which the burial pit intrudes may furnish some [pollen]. Soil from upper layers used to fill the pit may introduce pollen contemporary with the occupation of the burial. The close resemblance of burial samples and others implies that the pollen recovered reflects the time of interment."

Burial 2

Sample 36-3 was collected from the soil matrix of this burial. Like that of Burial 1, the pollen spectrum exhibited great similarity to the other pollen samples analyzed from elsewhere at the site. This indicates that the individual was laid to rest during the growing season or else that the soil used as fill for the burial was contemporary with the occupation during which the individual died. Lending support to the implication of interment in the harvest season is the abundance of maize pollen (46 percent, with numerous aggregates), indicating that the individual was buried with maize plant parts (i.e., stalks, cobs, or shelled kernels) which included tassels or tassel fragments. This burial contained the second highest frequency of maize pollen found at the site, indicating that the deposition of maize plant parts was purposeful and not from pollen that had been integrated into the fill over a period of time prior to burial.

Results

Pollen Recovery

Seventy-one percent (20 of 28) of the samples contained pollen in numbers sufficient for a standard 200 grain/slide count (Barkley 1934). Samples in which good recovery was achieved contained both a quantity of pollen sufficient for a 200 grain count and absolute pollen numbers in excess of 1,000 grains per gram of sediment processed (after Hall 1981:205). Samples 14-62, 20-33, 20-39, 24-2, and 43-7 were poorly concentrated due to an overabundance of microscopic charcoal and plant debris, and 200 grain counts were not achieved even though absolute numbers were in excess of 1,000 grains per gram of sediment processed. Samples 18-42, 20-34, and 20-35 were poorly preserved as indicated by pollen counts of less than 200 grains and absolute numbers not in excess of 1,000 grains per gram.

Comparison of the Modern and Prehistoric Pollen Spectra

The surface control sample collected in "pinch" fashion from an adjacent off-site location is useful to compare the modern pollen spectrum with the prehistoric one (Tables 23-27). Differences and similarities can be compared to determine aspects of vegetation change and plant use at the site. Present in the modern but not in the prehistoric record is the pollen of the introduced Russian olive, as well as the northward-moving mesquite (*Prosopis glandulosa* var. *glandulosa* and *P. glandulosa* var. *juliflora* pollen types). In 1846, W. H. Emory, while traveling southward along the west side of the Rio Grande, first encountered mesquite and creosote bush just above Socorro, 60 km south of Belen (Gardner 1951:382). The absence of mesquite in the prehistoric pollen record implies either that it was absent from the site vicinity or did not grow in a quantity sufficient to have its presence recorded in the pollen record at LA 53662. The presence of small amounts of mesquite wood charcoal in flotation samples (Toll, this report) suggests that the wood was imported to the site from elsewhere.

Present in both records is the pollen of arboreal pine, juniper, oak, cottonwood, willow, nonarboreal cheno-ams (shrubs and weedy taxa), shrub species such as greasewood, sage, ephedra, creosotebush, and grasses. Creosotebush pollen was present in low frequencies, suggesting that its presence in the pollen record was due to introduction from a plant community that was likely closer to Belen than the 60 km distance recorded in 1846. In addition, the presence of pollen aggregates and a moderately high frequency of creosotebush pollen (9 percent) in one sample from a feature indicates that the plant was imported to the site for economic use.

The consistent occurrence of ephedra in moderately high frequencies in the prehistoric record indicates that it was more abundant prehistorically than at present in the vicinity of the site. Perhaps it was a component of a surrounding ephedra-grass-yucca plant community, today seen in sandy, less impacted tracts along the terraces above the Rio Grande. These results lend support to the hypothesis that "in their original condition, the table lands bordering the Rio Grande were generally grass covered, with scattered shrubs among grasses. Shrub- dominated areas represent grazing disclimax or stages in the primary succession (Gardner 1951:383) brought about by environmentally or humanly influenced vegetational disturbance. In both pollen records, disturbance indicators, primarily taxa of the cheno-am group and the sunflower family, occur.

Notably absent from the modern record but present in the prehistoric one is evidence of agricultural production and wild plant food gathering. Cultivated taxa include maize, squash, and cotton, and wild gathered taxa include prickly pear, cholla, primrose, globemallow, desert "poppy," scant yucca, four o'clock, and cattail.

Economic Taxa Used Prehistorically

Several plant taxa are known to be of potential economic importance because their use has been documented for aboriginal Southwestern peoples. Two insect-pollinated species, the desert "poppy" (*Kallstroemia*, in the Zygophyllaceae) and the four o'clock (*Allionia*, in the Nyctaginaceae) have not been so documented, yet they occur in the Belen Bridge Site pollen record in high enough frequencies (with aggregates) to indicate their use. Future pollen research in the Middle Rio Grande area will hopefully confirm or deny this observation.

Along with cheno-ams, maize appears to have been the economic staple of the site inhabitants (Table 28). It occurs in all of the prehistoric samples (absent in the modern sample) in low to extremely high frequencies. Cultivars squash and scant cotton further indicate an agricultural function for the site.

Of the noncultivated, "wild" plants available for human exploitation, the pollen record from LA 53662 reveals three different levels of plant use. Based upon a high ubiquity (greater than 40 percent) and a common to abundant occurrence, four o'clock, primrose, and cholla appear to have been used frequently at LA 53662. Taxa that appear to have been used less frequently (based upon a range of low relative frequencies that occur for a particular taxon), or whose use is difficult to detect palynologically, are cottonwood, grasses, sunflower family, beeweed, and ephedra. Their high ubiquity and generally low to moderate relative frequencies in the pollen record indicate that they grew within the general vicinity of the site but were used less frequently than maize, four o'clock, primrose, and cholla. Creosotebush and cattail, of low ubiquity and low frequency, appear to be present generally as the result of deposition from an unknown distance. However, the presence of a moderate amount of creosote pollen in one samples and cattail aggregates in others suggests that these taxa were imported to the site for occasional use. Taxa that appear to have been present and available for use but bear no direct palynological indication of their use are globemallow, desert "poppy," and prickly pear.

Comparison of the Subsistence Record at LA 53662 to Other Anasazi Sites along the Middle Rio Grande

A comparison of the pollen record at LA 53662 with those of four sites with pithouse or pueblo architecture situated along the Middle Rio Grande that are dated primarily from the twelfth to the sixteenth centuries A.D. (Table 29) reveals that farming was practiced at each site. The subsistence system was heavily reliant upon the cultivation of maize and was augmented by the collection of wild, noncultivated and semicultivated, nutritious weedy taxa from both riparian and desert shrub grassland habitats. The use of pollen analysis as opposed to other archaeobotanical techniques influences the recovery of plant remains, presenting a skewed list of taxa. Table 29 is representative of but a partial range of plants used economically by aboriginal peoples in the Middle Rio Grande. Future pollen

Table 28. Ubiquity of selected economic taxa from features

Taxon	Ubiquity (%)	Relative Frequency (%)	
Populus sp. (cottonwood)	26	+ - 11	not found in larger fraction scan
Cheno-am (chenopod-amaranth)	100	15 - 60	not found in larger fraction scan
Poaceae (grasses)	86	+ - 10	not found in larger fraction scan
High-spine Asteraceae (sunflower family)	75	+ - 12	not found in larger fraction scan
Low-spine Asteraceae (sunflower family)	96	1 - 26	not found in larger fraction scan
Ephedra torreyana (ephedra)	100	+ - 12	not found in larger fraction scan
Larrea sp. (creosotebush)	36	+ - 9	not found in larger fraction scan
Allinonia-type (four o'clock)	93	+ - 1	rare-common
Onothera sp. (primrose)	43	+ - 2	rare-abundant
Sphaeralcea sp. (globemallow)	29	+ - 1	rare
Kallstroemia sp. (desert poppy)	36	+ - 2	rare
Platyopuntia (prickly pear)	14	0 - (1)	rare
Cylindropuntia (cholla cactus)	83	0 - 4	rare-common
Cleome sp. (beeweed)	57	+ - 3	not found in larger fraction scan
Typha sp. (cattail)	46	+ - 2	rare
Gossypium sp. (cotton)	4	1	rare
Cucurbita sp. (squash)	25	+	rare
Zea mays L. (maize)	96	1 - 83	rare-abundant

+ = present in a relative frequency of less than 1 percent

Table 29. Economically indicated pollen taxa from sites along the Middle Rio Grande

Taxon	Sites				
	LA 677	LA 15260	LA 282	LA 757	LA 53662
Prosopis sp. (mesquite)				X	
Populus sp. (cottonwood)				X	
Cheno-am (chenopod-amaranth)	X	X	X	X	X
Poaceae (grasses)			X		X
Low-spine Asteraceae (sunflowers)	X				X

Platyopuntia (prickly pear)		X		X	
Cylindropuntia (cholla)		X	X	X	X
Typha sp. (cattail)			X	X	X
Sphaeralcea sp. (globemallow)				X	
Oenothera sp. (primrose)					X
Zea mays L. (maize)	X	X	X	X	X
Cucurbita sp. (squash)		X	X	X	X
Gossypium sp. (cotton)					X

Age of sites:

LA 677, Bernalillo, A.D. 1388-1440 (Clary 1982)
LA 15260, Albuquerque, A.D. 1120 ± 60 (Clary 1987b)
LA 282, Socorro, A.D. 1480-1520 ± 50 (Fish 1987)
LA 757, Bosque del Apache, A.D. 1400-1540 (Clary 1987a)
LA 53662, Belen (this report)

research will likely increase the ubiquity of the taxa listed as well as add new ones.

The similarity of taxa in the subsistence record in both the spatial and chronological frameworks is not surprising given the limited number of cultigens available prehistorically and the widespread regional distribution of the same weedy and wild plant resources. Common to all sites was evidence for the economic use of maize and cheno-ams. Pollen evidence for squash and cholla use was recovered at four of the five sites studied. Present at fewer sites are cattail, low-spine sunflowers, prickly pear, grasses, mesquite, cottonwood, and primrose. The lower ubiquity of these latter taxa is to some extent a function of pollen production, dispersal, postdepositional processes, and the seasonal nature of their availability.

Cotton pollen was present in scant frequency only at LA 53662. The low frequency of this pollen taxon can be explained in part by the fact that little pollen is produced compared to other taxa. This is because the flower has fallen off the boll before the plant is harvested for fiber, and only the harvested boll would be imported into a site for processing. The presence of cotton pollen is intriguing since it is not clear in the historical documents (e.g., Winter 1980:34, 35) whether cotton was cultivated in the valley or the fiber solely traded into the Middle Rio Grande from elsewhere. The presence of cotton pollen, augmented by high ubiquities and relative frequencies, would support the idea of local cultivation of cotton.

Summary and Conclusions

The pollen analysis of soils from features at LA 53662 revealed that a pattern of subsistence in part reliant upon the cultivation of maize, squash, and perhaps cotton existed throughout the history of the occupation. Because pollen of cotton was very scant, it is not possible to determine if cotton cultivation was part of the subsistence system at LA 53662. The presence of cotton in future pollen samples from this area will confirm or deny this observation. In addition, the collection of wild plants (cholla, grasses, cattail, creosote bush, and primrose) and weedy species (cheno-ams, sunflower family) indicates that site inhabitants made use of a wide range of nutritious and medicinally useful taxa from both riverine and mesa habitats.

The analysis of pollen from two burials indicated that both maize and ephedra were perhaps used ritually in the context of burial. Based upon similarity of pollen spectra, the soils used for interment appear to have been contemporaneous with the occupation, implying that the individuals were interred during the farming season.

A comparison of the pollen spectrum of economic taxa from LA 53662 with those of four other sites of late prehistoric affiliation along the Middle Rio Grande revealed little difference with respect to major taxa (maize, squash, cholla, cheno-ams) used for subsistence. Such a pattern may be explained by the widespread distribution of the same useful species and the limited number of cultigens available prehistorically to agriculturists.

BOTANICAL STUDY

Mollie S. Toll

Excavation of the Belen Bridge site has produced a substantial collection of botanical data to contribute to our infant but growing understanding of human subsistence in the Rio Abajo. The Rio Grande corridor in central and southern New Mexico has long evaded detailed archeological scrutiny, but in the 1980s survey (Marshall and Walt 1984) and excavation (Winter 1980; Marshall 1987a, 1987b; Earls 1987) have opened up this dimly known area. Despite generally low levels of trash and other artifact classes at LA 53662, flotation and macrobotanical remains are taxonomically varied and relatively abundant. The 58 flotation samples and 30 macrobotanical samples provide detailed coverage of this extensive site (Table 30).

Flotation, charcoal, and macrobotanical analyses at LA 53662 can now shed some light on the range of human subsistence adaptations with respect to time, site type, and geographic space in the middle and southern Rio Grande Valley. Botanical studies available for comparison include a smaller, twelfth-century pithouse settlement on Albuquerque's south side (Toll 1987d), and three larger, contemporary and later pueblos south of Belen (Toll 1986, 1987b, 1987c).

Composition of the Assemblage as a Whole

The Belen Bridge flotation and macrobotanical assemblages show in some detail a prehistoric economy based solidly on corn agriculture, and supplemented by gathering of a variety of weedy annuals, grasses, and perennials. Corn remains were found in nearly every sample and feature as pollen and cob or kernel fragments (see Table 40). Squash cultivation was documented more thoroughly by pollen recovery than by larger remains, while the rare appearances of beans were limited to flotation and macrobotanical samples. Because taphonomic factors strongly affect preservation of squash and bean remains, the prehistoric role of these two cultigens was likely greater than that suggested by their proportions in the archeobotanical assemblages.

The list of annual weeds exploited at LA 53662 is relatively short. Goosefoot, pigweed, beeweed, bugseed, winged pigweed, and purslane occurred as charred seeds in hearths and trash fill, and are likely food debris. Weedy species that appeared only as unburned seeds and/or pollen and have not been documented as economic species in the ethnohistoric record and are most likely intrusives deposited during or after site occupation. These contaminants included four o'clock, primrose, desert poppy, globemallow, spurge, and stickseed. Tansy mustard occurred in only two samples as unburned seeds and may also be a contaminant. The ethnographic use of this species has been extensively documented (Castetter and Underhill 1935:24; Curtin 1949:84), and on the Colorado Plateau it has been found archeologically in far greater frequency, including charred specimens (Toll 1983: Table 17.5; Toll 1987e: Table 5.3).

Economic grass species were dominated by ricegrass (found in over a third of the features). Ricegrass is common in sandy areas and is especially valuable because it matures very early in the growing season, when few other wild crops were available and stored foods were low.

An extensive array of perennial species was found at LA 53662. Prickly pear, hedgehog cactus, and yucca seeds, and cholla pollen attest to the use of succulent species growing nearby on the flats and gravel terraces. Sedge seeds and cattail pollen signify utilization of plant food products in the riparian zone. The presence of mesquite pollen and charcoal without seeds or pods is an ambiguous message: apparently the prehistoric

Table 30. Flotation, charcoal, and macrobotanical sample locations

Provenience	Flotation Samples	Charcoal from Flotation	Charcoal for Carbon-14	Macrobotanical Specimens
F. 4, extramural hearth	4-1			
F. 10, pithouse	10-45	10-45	10-39	10-8 C
				10-22 C
				10-35 C
				10-37 C
F. 14, pithouse	14-119	14-119	14-11	14-39 C
	14-120	14-120		14-44 C
	14-121	14-121		14-48 C
				14-57 C
				14-73 C
				14-103 C
				14-111 C
				14-128 C
F. 15, extramural pit	15-9			
F. 16, extramural pit				16-2 B
F. 17, pithouse	17-120	17-120	17-20	17-1 B
	17-123	17-123	17-112	17-93 C
	17-124	17-124	17-113	17-136 C
F. 18, extramural pit	18-43		18-19	18-29 B
	18-46	18-46		18-30 C
				18-38 C
F. 20, pithouse	20-103		20-52	20-62 ?
	20-104		20-64	20-72
	20-105	20-105	20-92	20-98 C
	20-106	20-106		
	20-107	20-107		
	20-108	20-108		
F. 21, extramural pit	21-2			
F. 23, extramural pit	23-5			
	23-6			
	23-7			
	23-8			
	23-9			
	23-10	23-10		
F. 27, extramural hearth	27-3			
	27-4	27-4		
F. 29, extramural hearth	29-2			

Provenience	Flotation Samples	Charcoal from Flotation	Charcoal for Carbon-14	Macrobotanical Specimens
	29-3			
F. 32, extramural pit	32-8			
F. 34, pithouse	34-16	34-16	34-10	
	34-17			
F. 38, extramural pit				38-2 ?
F. 42, extramural hearths	42a-1			
	42b			
	42c-3			
	42d			
	42d			
	42d-5			
	42g			
	42g-10			
	42g-11			
	42g-12	42g-12		
	42h-15			
	42i-16			
	42j-8			
	42j-19			
	42k-21			
	42m-23			
	42r-25			
F. 43, pithouse	43-9	43-9		
	43-10	43-10		
F. 44, extramural hearth	44a-1			
	44b-3	44b-3		
F. 45, pithouse	45-15	45-15		45-4 C
	45-16			45-12 W
F. 46, extramural hearth	46-1			
F. 47, pithouse	47-8			
	47-9			
	47-10	47-10		
F. 48, extramural hearths				48a-2 W
				48b-8 C
				48-11 W
Total samples	58	18	10	30

C = corn
B = beans
W = wood or charcoal

Table 31. Flotation Results, Features 4, 10, 14, 15, and 17

Taxon	4-1	10-45	14-119	14-120	14-121	15-9	17-120	17-123	17-124
Economic Weeds									
Chenopodium (goosefoot)		8/1.3*	2/0.3*				3/1.1	2/1.3*	
Amaranthus (pigweed)			2/0.3*	1/0.3			4/1.4*		1/0.2*
Portulaca (purslane)								2/1.3*	
Cleome (beeweed)			1/0.2						
Compositae (sunflower family)								2/1.3*	
Nicotiana (wild tobacco)		57/17.1							
Grasses									
Oryzopsis (ricegrass)			1/0.2			19/4.4*			
Perennials									
Atriplex			1/0.2				1/0.4*		
Pinus edulis (piñon)						1/0.2			
Scirpus (sedge)		2/0.5*							
Phragmites (reed)								s*	
Cultivars									
Zea mays (corn)	c*	c*	c* 1/0.2*	c*	c* 13/2.1*	c*	c* 1/0.4*	c* 11/3.7*	c* 2/0.3*
Cucurbita (squash)			r*				r*		
Phaseolus (bean)								1/0.3*	
Total economic taxa	0	4	7	2	1	3	5	6	2
Seeds per liter	0	18.9	1.4	0.3	2.1	4.6	3.3	7.9	0.5
Probable Contaminants									
Euphorbia (spurge)	13/16.3					2/0.5	2/0.7		
Total contaminant taxa	1	0	0	0	0	1	1	0	0
Seeds per liter	16.3	0	0	0	0	0.5	0.7	0	0
Unidentifiable			5/0.8*				2/0.7*		
Unknown			1/0.2*						

* Some or all items charred.
x/x Number before slash indicates actual number of seeds recovered; number after slash indicates adjusted number of seeds per liter of soil, taking into account any subsampling and sample sizes other than 1 liter.
c = cupules (cob fragments)
r = rind (exocarp)
s = stem

Table 32. Species composition of charcoal samples from flotation

Flotation Sample	*Juniperus* (Juniper)	*Atriplex* (Saltbush)	*Sarcobatus* (Greasewood)	*Artemisia* (Sage)	*Chrysothamnus* (Rabbitbrush)	*Prosopis* (Mesquite)	*Populus/Salix* (Cottonwood/Willow)	Undetermined Nonconifer	Total
10-45				6 0.4 g			14 0.2 g		20 0.6 g
14-119	1 +	14 0.2 g		2 +			3 0.1 g		20 0.3 g
14-120							15 0.3 g	5 +	20 0.3 g
14-121				3 0.1 g	10 0.4 g		3 0.1 g	4 0.1 g	20 0.7 g
17-120							18 0.8 g	2 0.2 g	20 1.0 g
17-123		2 0.1 g					18 0.5 g		20 0.6 g
17-124		11 1.2 g			2 0.3 g		7 0.2 g		20 1.7 g
18-46		4 0.2 g			1 +		13 0.3 g	2 +	20 0.5 g
20-105		8 0.2 g			2 0.1 g		10 0.2 g		20 0.5 g
20-106		5 0.2 g			5 0.2 g	2 0.1 g	8 0.1 g		20 0.6 g
20-107		3 0.1 g		2 +	1 +		14 0.2 g		20 0.3 g
20-108	10 0.3 g					2 0.1 g	7 0.1 g	1[a] +	20 0.5 g
23b-10					2 0.1	13 0.6 g	5 0.2 g		20 0.9 g
27-4						5 0.2 g	15 0.5 g		20 0.7 g

Flotation Sample	*Juniperus* (Juniper)	*Atriplex* (Saltbush)	*Sarcobatus* (Greasewood)	*Artemisia* (Sage)	*Chrysothamnus* (Rabbitbrush)	*Prosopis* (Mesquite)	*Populus/Salix* (Cottonwood/Willow)	Undetermined Nonconifer	Total
34-16		2 0.2 g	2 0.2 g		2 0.2 g	3 0.4 g	11 0.6 g		20 1.6 g
42-12						6 +	14 0.3 g		20 0.3 g
43-9		12 0.4 g	6 0.2 g				2 0.1 g		20 0.7 g
43-10		11 0.3 g	7 0.3 g		1 +		1 0.1 g		20 0.7 g
44b-3		2 0.1 g		7 0.4 g	7 0.2 g			4 +	20 0.7 g
45-15		4 +	1 +				14 0.1 g	1 +	20 0.1 g
47-10		2 0.1 g	7 0.3 g	8 0.1 g			3 0.2 g		20 0.7 g
Total Pieces									
Number	1	90	23	28	33	31	195	19	420
Percent	+	21	6	7	8	7	46	5	100
Total Weight									
Grams	+	3.6	1.0	1.0	1.5	1.4	5.1	0.3	14.0
Percent	+	26	7	7	11	10	37	2	100
Frequency									
Percent samples	5	67	24	29	48	29	95	33	[n=21]
Percent features	8	69	31	38	62	38	92	46	[n=13]

+ less than 0.05 g or 0.5 percent
* *Larrea* (creosotebush)

Table 33. Species composition of charcoal submitted for Carbon-14 analysis

Flotation Sample	Juniper (*Juniperus*)	Saltbush (*Atriplex*)	Greasewood cf. *Sarcobatus*	Sage (*Artemisia*)	Rabbitbrush (*Chrysothamnus*)	Mesquite (*Prosopis*)	Cottonwood/Willow (*Populus/Salix*)	Undetermined Nonconifer	Total
10-39		4 1.3 g		2 0.9 g	5 0.7 g	1 0.1 g	13 1.7 g	5[a] 0.5 g	30 5.2 g
14-11				5 1.2 g	8 2.1 g		5 1.1 g	2[b] 0.1 g	20 4.5 g
17-20							10 1.2 g		10 1.2 g
17-112							10 2.5 g		10 2.5 g
17-113		19 3.0 g		5 0.4 g	3 0.5 g		10 0.3 g	3 0.2 g	40 4.4 g
18-19		18 3.2 g		4 0.8 g	5 0.4 g	1 0.1 g	12 1.7 g		40 6.2 g
20-52		9 3.4 g			4 1.4 g		7 1.8 g		20 6.6 g
20-64		5 1.2 g		2 0.6 g			12 3.3 g	1 0.2 g	20 5.3 g
20-92		5 0.8 g			2 0.2 g		13 1.7 g		20 2.7 g
34-10	1 0.1 g	14 3.1 g		3 0.2 g	6 0.7 g	1 +	14 1.2 g	1 0.1 g	40 5.4 g
Total Pieces									
Number	1	74	0	21	33	3	106	12	250
Percent	+	30	0	8	13	1	43	5	100
Total Weight									
Grams	0.1	16.0	0	4.1	6.0	0.2	16.5	1.1	44.0
Percent	+	36	0	9	14	+	38	3	100
Frequency									
Percent samples	10	70	0	60	70	30	100	50	[n=10]
Percent features	17	83	0	100	100	50	100	83	[n=6]

+ less than 0.05 g or 0.5 percent
[a] *Larrea* (creosotebush) = 1 (0.1 g)
[b] Cf. *Eurotia* (winterfat) = 1 (<0.05 g)

Table 34. Flotation results, Features 18, 20, and 21

Taxon	18-43	18-46	20-103	20-104	20-105	20-106	20-107	20-108	21-2
Economic Weeds									
Chenopodium (goosefoot)				1/0.5		1/0.5	2/0.2*		
Amaranthus (pigweed)	3/6.2*		1/0.4*	1/0.5*	4/0.7*	2/1.0*		2/0.4*	
Portulaca (purslane)	1/2.1*			1/0.5*	1/0.2*				
Corispermum (tickseed)					9/1.5*	6/3.0*	10/1.2*		
Cycloloma (winged pigweed)		1/0.9*			2/0.3*			1/0.2*	
Cleome (beeweed)					1/0.2				
Compositae (sunflower family)								2/1.3*	
Grasses									
Oryzopsis (ricegrass)					3/0.5*	1/0.5*	1/0.1*		
Sporobolus (dropseed)							1/0.1*		
Perennials									
Atriplex (saltbush)		2/1.3*					1/0.1*		
Juniperus (juniper)					t*				
Scirpus (sedge)							1/0.1*		
Opuntia (pricklypear)	2/0.5								

Taxon	18-43	18-46	20-103	20-104	20-105	20-106	20-107	20-108	21-2
Yucca (yucca)	3/0.8*								
cf. *Gutierrezia* (snakeweed)	1/1.0*								
Cultivars									
Zea mays (corn)	c* 6/3.1*	c* 1/0.4*	c*	c*	c*	c*	c* 2/0.2*	c* 3/0.6	c*
Total economic taxa	6	3	2	4	8	5	7	4	1
Seeds per liter	13.7	3.9	1.4	1.5	3.6	5.0	2.0	1.2	0
Probable Contaminants									
Euphorbia (spurge)			1/0.4						1/0.7
Compositae (sunflower family)				1/0.5					
Total contaminant taxa	0	0	1	1	0	0	0	0	1
Seeds per liter	0	0	0.4	0.5	0	0	0	0	0.7
Unidentifiable					4/0.7*				

* Some or all items charred.

x/x Number before slash indicates actual number of seeds recovered; number after slash indicates adjusted number of seeds per liter of soil, taking into account any subsampling and sample sizes other than 1 liter.

c = cupules (cob fragments)

r = rind (exocarp)

s = stem

Table 35. Charcoal composition by stratum in Feature 20

Stratum	Saltbush (%)		Riparian (%)		Presence of Other Types			
	Number	Weight	Number	Weight	Sage	Rabbitbrush	Mesquite	Creosotebush
Stratum 2, 20-92 (n=20/2.7 g)	25	30	65	63		+		
Stratum 3, 20-52, 20-108 (n=40/7.1 g)	48	48	35	27		+	+	+
Stratum 4, 20-64, 20-105 (n=40/5.8 g)	33	24	55	60	+	+		
Charcoal lens, 20-106 (n=20/0.6 g)	25	33	40	17		+	+	
Hearth, 20-107 (n=20/0.3 g)	15	33	70	67	+	+		

Table 36. Flotation results, Features 23 and 27

Taxon	23c-5	23a-6	23f-7	23e-8	23d-9	23b-10	27-3	27-4
Economic Weeds								
Chenopodium (goosefoot)			1/0.1*			2/0.2	2/0.4*	
Amaranthus (pigweed)							1/0.2*	
Descurainia (tansymustard)							5/0.9	
Grasses								
Oryzopsis (ricegrass)						2/0.2*		
Gramineae (grass family)			1/0.1*					
Perennials								
Pinus edulis (piñon)	1/0.6*							
Cultivars								
Zea mays (corn)		c*	c*	c*	c*	c*	c* 1/0.2*	c* 1/0.1*
Total economic taxa	1	1	3	1	1	4	4	1
Seeds per liter	0.6	0	0.2	0	0	0.4	1.7	0.1
Probable Contaminants								
Kallstroemia (Arizona poppy)	2/1.1		2/0.3		1/0.9	1/0.1		
Euphorbia (spurge)	1/0.6		21/2.7	1/2.9	4/3.6	10/1.3	1/0.2	17/2.2
Croton (doveweed)								1/0.1
Cryptantha (hiddenflower)						1/0.1	2/0.4	1/0.1
Total contaminant taxa	2	0	23	1	2	3	2	3
Seeds per liter	1.7	0	3.0	2.9	4.5	1.5	0.6	2.4
Unidentifiable		1/0.2	1/0.1				1/0.2	2/0.2*

* Some or all items charred.
x/x Number before slash indicates actual number of seeds recovered; number after slash indicates adjusted number of seeds per liter of soil, taking into account any subsampling and sample sizes other than 1 liter.
c = cupules (cob fragments)

Table 37. Flotation results, Features 29, 32 and 34

Taxon	29-2	29-3	32-8	34-16	34-17
Economic Weeds					
Chenopodium (goosefoot)		4/0.5*			
Amaranthus (pigweed)			34/5.5*	19/6.3*[a]	
Corispermum (tickseed)				1/0.3*	1/0.3*
Cycloloma (winged pigweed)			1/0.2*	1/0.3*	
Grasses					
Oryzopsis (ricegrass)			21/3.4*		1/0.3*
Sporobolus (dropseed)		1/0.1*			
Perennials					
Atriplex (saltbush)				1/0.3*	
Scirpus (sedge)			3/0.5*		
Cultivars					
Zea mays (corn)		c*	c* 1/0.2*	c*	c*
Cucurbita (squash)				1/0.3[b]	
Total economic taxa	0	3	5	6	3
Seeds per liter	0	0.6	9.8	7.5	0.6
Probable Contaminants					
Kallstroemia (Arizona poppy)		1/0.1	1/0.2		
Euphorbia (spurge)	1/1.3	12/1.4			
Cryptantha (hiddenflower)		14/1.6	4/0.6		
Descurainia (tansymustard)		2/0.2	2/0.3		
Total contaminant taxa	1	4	3	0	0
Seeds per liter	1.3	3.3	1.1	0	0
Unidentifiable		1/0.1*	10/1.7*		

* Some or all items charred.
x/x Number before slash indicates actual number of seeds recovered; number after slash indicates adjusted number of seeds per liter of soil, taking into account any subsampling and sample sizes other than 1 liter.
c = cupules (cob fragments)
[a] Of these, 13 (or 4.3 per liter) were classified as cheno-ams, due to erosion and/or distortion from burning
[b] Cf. *Cucurbita mixta* (green striped cushaw)

Table 38. Flotation results, Feature 42

Taxon	42a-1	42b	42c-3	42d	42d	42d-5	42g	42g-10	42g-11	42g-12	42h-15	42i-16	42j-8	42j-19	42k-21	42m-23	42r-25
Grasses																	
Oryzopsis (ricegrass)									1/?[a]								
Perennials																	
Echinocereus (hedgehog cactus)										1/0.2*							
Cultivars																	
Zea mays (corn)	c*	c*	c*	c*	c*	c*	c*	c*	c*	c* 1/0.1*	c*	c*	c* 1/0.2*	c* 1/0.1*	c*	c*	
Total economic taxa	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	0
Seeds per liter	0	0	0	0	0	0	0	0	1[a]	0.1	0	0	0.4	0.1	0	0	0
Probable Contaminants																	
Chenopodium (goosefoot)								1/0.2[a]									
Sphaeralcea (globemallow)							1/0.2										
Euphorbia (spurge)								1/0.2		2/0.2							
Kallstroemia (Arizona poppy)										1/0.1							
Total contaminant taxa	0	0	0	0	0	0	3			2	0	0	0	0	0	0	0
Seeds per liter	0	0	0	0	0	0	0.6			0.3	0	0	0	0	0	0	0
Unidentifiable	0	0	1/0.4	0	0	0	4/0.9										

* Some or all items charred.
x/x Number before slash indicates actual number of seeds recovered; number after slash indicates adjusted number of seeds per liter of soil, taking into account any subsampling and sample sizes other than 1 liter.
c = cupules (cob fragments)
[a] Volume of original soil sample was not recorded, so seed density per liter is not known.

Table 39. Flotation results, Features 43, 44, 45, 46, and 47

Taxon	43-9	43-10	44a-1	44b-3	45-15	45-16	46-1	47-8	47-9	47-10
Economic Weeds										
Chenopodium (goosefoot)		14/3.9		1/0.4•				2/0.7		
Amaranthus (pigweed)	3/0.9									
Corispermum (tickseed)	2/0.6*	6/1.7*						4/1.4		
Perennials										
Atriplex (saltbush)	2/0.6*	3/0.8*							1/0.3* 1*	
Pinus edulis (piñon)								1/0.4*		
Cultivars										
Zea mays (corn)	c* 1/0.3*	c* 3/0.8*			c*	c*	c*	1/0.4*	c*	
Total economic taxa	4	4	0	1•	1	1	1	4	0	1
Seeds per liter	2.4	7.2	0	0.4	0	0	0	2.9	0	0.3
Probable Contaminants										
Kallstroemia (Arizona poppy)		1/0.3								
Euphorbia (spurge)		2/0.6			1/0.2					
Gramineae (grass family)		1/0.3								
Total contaminant taxa	0	3	0	0	1	0	0	0	0	0
Seeds per liter	0	1.2	0	0	0.2	0	0	0	0	0
Unidentifiable		7/1.9*	1/0.7					1/0.4	1/0.3	

* Some or all items charred.
x/x Number before slash indicates actual number of seeds recovered; number after slash indicates adjusted number of seeds per liter of soil, taking into account any subsampling and sample sizes other than 1 liter.
c = cupules (cob fragments)
• May be intrusive, rather than prehistoric and economic.

Table 40. Ubiquity of selected taxa in pollen and flotation samples

Taxon	Percent of Pollen Samples (n=28)	Percent of Flotation Samples (n=58)	Percent of Features, Flotation (n=19)
Annuals			
Cheno-ams	100		
Chenopodium (goosefoot)		24	58
Amaranthus (pigweed)		24	42
Allionia (four o'clock)	93	0	0
Cleome (beeweed)	57	3	11
Corispermum (bugseed)	0	14	21
Cycloloma (winged pigweed)	0	9	21
Kallstroemia (desert poppy)	36	16	32
Oenothera (primrose)	43	0	0
Portulaca (purslane)	0	7	16
Sphaeralcea (globemallow)	29	3	11
Grasses (Poaceae)	86	n.a.	n.a.
Oryzopsis (ricegrass)	n.a.	14	37
Perennials			
Atriplex (saltbush)	n.a.	14	37
Ephedra (Mormon tea)	100	0	0
Juniperus (juniper)	4	2	5
Pinus sp. (pine)	50		
Pinus edulis (piñon)		5	16
Larrea (creosotebush)	36	0	0
Platyopuntia (pricklypear)	14	2	5
Cylindropuntia (cholla)	83	0	0
Yucca (yucca)	4	2	5
Scirpus (sedge)	0	5	16
Typha	46	0	0
Cultivars			
Cucurbita (squash)	25	5	11
Gossypium (cotton)	4	0	0
Phaseolus (bean)	0	2	5
Zea mays (corn)	96	88	95

Table 41. Morphometrics of *Zea mays* kernels, LA 53662 and other Rio Grande Valley sites

Site	Length			Width			Thickness		
	Mean (mm)	CV	Number	Mean (mm)	CV	Number	Mean (mm)	CV	Number
Belen Bridge 17-93 pithouse 18-29 extramural pit	8.1	.127	12	7.9	.104	13	6.1	.115	14
LA 282[a]	8.5	.136	238	7.3	.126	238	4.7	.186	238
Santiago[b]	8.5	.143	87	7.0	.143	87	4.1	.194	87
Chamisal[b]	8.1	.114	29	7.1	.099	30	4.4	.092	30
Pargas Pueblo,[c] Room 1	8.3	.183	60	7.4	.103	60	4.7	.155	60
Pargas Pueblo,[c] Room 2	10.3	.098	30	8.5	.118	30	4.3	.143	30
LA 54147[b]	6.9	.135	792	6.7	.126	946	4.9	.142	942

[a] Toll (1987b:102)
[b] Toll (1987a:14)
[c] Toll (1986:7)

Table 42. Morphometrics of *Zea mays* cobs, LA 53662 and other Rio Grande Valley sites

Site	Average Cob Diameter		Row Number (%)						Average Cupule Size			
	Completely Eroded	Partially Eroded	8	10	12	14	16	Average	Width (mm)		Height (mm)	
									Completely Eroded	Partially Eroded	Completely Eroded	Partially Eroded
Belen Bridge[a]	11.9	16.6	15	33	30	15	7	11.3	5.7	7.2	3.3	3.3
CV	.207	.131						.202	.102	.081	.135	.131
Number	21	6						27	21	21	21	6
LA 282[b]	11.2	12.7	2	18	43	27	10	12.5	5.4	7.4	3.1	3.1
CV	.235	.197						.150	.218	.180	.190	.147
Number	77	51						100	187	61	187	61
Qualacu[c]	11.4	15.0	0	25	29	36	11	12.6	5.6	6.7	3.3	3.3
CV	.124	.206						.157	.122	.134	.062	.161
Number	5	23						28	4	23	4	23

[a] 10-8 Pithouse, 10-22, 10-35, 10-37; 14-39 pithouse, 14-44, 14-48, 14-57, 14-103, 14-111, 14-128;18-38 Extramural pit; 20-72 Pithouse, 20-98, 20-111, 20-112; 45-4 Pithouse; 48b-8 extramural hearth

[b] Toll (1987b:102)

[c] Toll (1987d:117)

Table 43. Morphometrics of *Phaseolus* specimens

Site	Length			Width			Thickness		
	Mean (mm)	CV	Number	Mean (mm)	CV	Number	Mean (mm)	CV	Number
Whole Beans									
Belen Bridge FS 16-2, extramural pit	11.3	-	1	7.3	-	1	7.0	-	1
LA 282[a]	12.2	-	1	7.3	-	1	6.2	-	1
Santiago[b]	10.0	-	1	6.3	-	1	5.3	-	1
LA 54147[c]	9.1	.107	51	5.7	.107	51	3.9	.174	51
Single Cotyledons									
Belen Bridge FS 17-1, pithouse	12.2	-	1	6.4	-	1	3.7	-	1
Santiago[b]	10.9	-	5	6.4	-	6	2.4	-	6
LA 54147[c]	10.6	.154	223	5.9	.126	272	2.4	.180	275

[a] Toll (1987b:103)
[b] (also known as Puaray); Toll 1987a:18
[c] Toll 1987a:18

Table 44. Comparison of food plant remains in flotation assemblages at Rio Grande Valley sites

Site	Number of Samples	Weedy Annuals			Grasses			Perennials			Cultivars		
		Number Taxa	Percent Samples	Percent Seeds	Number Taxa	Percent Samples	Percent Seeds	Number Taxa	Percent Samples	Percent Seeds	Number Taxa	Percent Samples	Percent Seeds
Belen Bridge	58	8	45	45	2	19	7	9	28	6	3	88	9
South													
LA 282[a]	22	7	64	12	1	23	7	6	64	48	2	77	27
Qualacu[b]	16	9	75	19	1	56	23	6	88	36	3	88	2
Pargas[c]	5	5	60	11	0	0	0	5	80	2	3	100	79
North													
Coors Road[d]	16	4	88	49	1	69	39	1	13	1	1	88	1
LA 677[e]	23	7	57	26	1	9	7	6	52	25	1	52	1
Arroyo Hondo[f]	?	7	56	78	1	7	9	6	?	3	3	32	10

[a] Toll 1987b
[b] Toll 1987c
[c] Toll 1986
[d] Toll 1987d
[e] Toll 1982
[f] Wetterstrom (1986:12). Corn kernels were not included in any seed counts in this report.

The observant reader will note that percent seeds does not add up to 100 percent for any given site. The remaining seeds were composed of probable contaminants and unidentifiable/unknowns. For instance, at Belen Bridge economic seeds totaled 67 percent, while contaminants comprised 27 percent and unknowns 6 percent. Figures in this table are distinctly influenced by sample size (e.g., Pargas). Dependence on weedy annuals in the Colorado Plateau shows the most extreme contrast with the Rio Abajo; in northwestern New Mexico annuals are far more diverse in the archaeological record. But note here the clear difference in percentage of the total seed assemblage for weedy annuals north vs. south of LA 53662.

Table 45. Comparative wood use at Rio Grande Valley sites

Site	Number	Weight (g)	Saltbush/Greasewood		Sage/Rabbitbrush		Riparian Woods		Mesquite		Conifers	
			% by Number	% by Weight	% by Number	% by Weight	% by Number	% by Weight	% by Number	% by Weight	% by Number	% by Weight
Belen Bridge	670	58.0	28	36	17	22	45	37	5	3	<0.5	<0.5
LA 282[a]	261	20.6	11	28	0	0	49	39	0	0	12	9
Qualacu[b]	260	22.8	8	7	1	<0.5	77	79	10	1	2	1
Pargas[c]	99	1.7	10	12	0	0	61	65	6	6	1	<0.5
Coors Road[d]	60	1.2	28	42	2	<0.5	27	25	0	0	19	8
Rio Rancho[e]	228	12.6	<.05	<.05	<0.5	<0.5	18	13	<0.5	<0.5	63	73

[a] Toll 1987b
[b] Toll 1987c
[c] Toll 1986
[d] Toll 1987d
[e] Toll 1987a

range of mesquite was close enough to allow wind transport of mesquite pollen and small-scale use of the dense wood for manufacturing and/or fuel, but the nutrituous, high-carbohydrate seed pods were not exploited for food. Charred mesquite pod fragments and seeds have been recovered at other Rio Abajo sites (Toll 1987b, 1987c).

The large sample size and diverse floral assemblage at LA 53662 must preclude any serious anxieties about recovery bias here; there simply is no evidence of using mesquite for food. Saltbush, a shrub common in an extensive area around LA 53662, was found throughout site deposits in two forms. Carbonized saltbush fruits occurred in eight flotation samples (accounting for over a third of the sampled features at the site), and saltbush charcoal was found in two-thirds of samples and features, comprising about a quarter of all charcoal by weight. Significant use of saltbush fruits for food has not been documented in the ethnobotanic record. The fruits at LA 53662 can reasonably be linked with fuel rather than food use because every feature in which fruits occur also contains saltbush charcoal. In contrast, juniper twigs (consisting of a series of overlapping scale leaves), which could also be expected to relate closely to fuel use, do not fit such a pattern at LA 53662. The single occurrence of a juniper twig (Pithouse 4) does not correspond with the little juniper charcoal recovered (Pithouses 1 and 5).

The charcoal assemblage, totalling 670 pieces, documents wood utilization in 13 of the site's excavated features. All of this material was general trash, presumably household firewood, though some may originally have been selected as construction or manufacturing material. The largest segments of the wood assemblage were fast-growing riparian woods (cottonwood/willow; nearly half of the assemblage by number, but a little over a third by weight) and the local chenopodiaceous shrubs saltbush and greasewood (together about a third of the assemblage by both number and weight).

Two other local shrubs, sage and rabbitbrush, provided another significant component of the wood array (15 percent of flotation specimens, 21 percent of radiocarbon specimens). Two southern woody species, marginal today in the Belen area, made smaller contributions to wood use at LA 53662. Mesquite comprised 7 percent of flotation specimens (10 percent by weight) but only 1 percent of radiocarbon wood, while only 2 of the 670 samples were creosotebush.

Macrobotanical materials consisted chiefly of carbonized corn remains (21 of 29 macrobotanical samples), most of which were cob fragments. Cobs are an exceedingly durable by-product, differentially resistant to both biological deterioration processes and consumption during carbonization; together with charcoal they are by far the most common direct artifacts of agricultural-period plant utilization in the Southwest. Two beans (in Feature 16 and Pithouse 3) were spotted during excavation and saved as macrobotanical specimens. No squash was collected during excavation. Other macrobotanical items included charred seeds of an unidentified perennial, probably a shrub (20-62 and 38-2), and charcoal (17-136, 45-12, 48a-2, 48b-11).

Comparison with Other Pueblo III and IV Sites of the Rio Grande Valley

Physical characteristics of cultivated crops are best seen when compared to those of other sites of the late Puebloan period in the Rio Grande Valley. Corn kernels were well within the general size and shape range of other sites in the comparative sample (see Tables 41 and 42), but thicker. Burning experiments have revealed that, in kernels, thickness is the most plastic dimension (Cutler 1956; Pearsall 1980). Thus it is possible that the thicker Belen Bridge kernels do not represent any varietal disjunction but simply a taphonomic effect such as greener kernels charred by a hotter fire. The small cob sample from LA 53662 had cob diameter and cupule sizes and shapes very similar to those of other measured populations, but it was higher in lower row number cobs (more 8 and 10 row cobs, and fewer

12 and 14 row cobs).

The single whole bean, from Feature 16, fit within the tiny population of measured beans from Rio Abajo sites (see Table 43). Beans (presumably bartered from a large nearby pueblo) recovered from a sixteenth-century Spanish encampment west of present-day Bernalillo are at the small end of the range observed for these sites. All of these beans are well within the range Kaplan (1956) noted for Anasazi *Phaseolus vulgaris* specimens (length 7.4 to 18.5 mm, width 4.9 to 10.8 mm, thickness 3.4 to 8.5 mm).

The Belen Bridge botanical assemblage occupies an intermediate position between sites to the south in the Rio Abajo and sites further north, handily lending conviction to the observation of distinct differences in subsistence emphases in the northern vs. southern Rio Grande Valley (Toll 1983). Weedy annuals at Belen Bridge are diverse on a *sitewide* basis, probably because of the large sample size, but do not approach the diversity, ubiquity, and abundance found at Anasazi sites of the northern Rio Grande and Colorado Plateau (see Table 44). To the south, weedy annuals decrease further in importance. Perennials (yucca, cacti, mesquite) and riparian species such as sedges are present at Belen Bridge, but in low frequency and quantity. To the south, these plant types become far more prominent archeologically than seen in the north. The emphasis on perennial food products where they were obtainable in quantity suggests that the large carbohydrate or oil reserves in fruit or root tissues offered a greater nutritive return for energy expended.

Variation in wood use along the Rio Grande indicates differential dependence on shrubby species vs. fast-growing but inferior riparian woods (see Table 45). Shrubs were in all cases dominated by the more common saltbush and greasewood, but at Belen Bridge sage and rabbitbrush put in their most prominent appearance. Shrubs as a whole were relied on most heavily at Belen Bridge, Coors Road, and LA 282. Riparian woods were popular at Qualacu and Pargas. Conifers were rarely used except at the Spanish camp, where habit and superior transportation may have played a role.

The observant reader will note that the percentages of seeds do not add up to 100 percent for any given site. The remaining seeds were probable contaminants and unidentifiable/unknowns. For instance, at Belen Bridge economic seeds totaled 67 percent, while contaminants comprised 27 percent and unknowns 6 percent. Figures in this table are distinctly influenced by sample size (e.g., Pargas Pueblo). Dependence on weedy annuals in the Colorado Plateau shows the most extreme contrast with the Rio Abajo; in northwestern New Mexico annuals are far more diverse in the archaeological record. But note here the clear difference in percentage of the total seed assemblage for weedy annuals north and south of LA 53662.

Methods

The 58 soil samples collected during excavation were processed at the Office of Archaeological Studies by the simplified "bucket" version of flotation (see Bohrer and Adams 1977). Flotation samples ranged in volume from 350 to 8,600 ml, with an average size of 4,087 ml (cv = .544). Each sample was immersed in a bucket of water, and a 30-40 second interval allowed for settling out of heavy particles. The solution was then poured through a fine screen (about 0.35 mm mesh) lined with a square of chiffon fabric, catching organic materials floating or in suspension. The fabric was lifted out and laid flat on coarse-mesh screen trays until the recovered material had dried. Each sample was sorted using a series of nested geological screens (4.0, 2.0, 1.0, 0.5 mm mesh) and then reviewed under a binocular microscope at magnifications of 7 to 45. Because some of the floated samples were very large, it was necessary to subsample some screen sizes in six of the samples and calculate an estimated number of seeds for the total sample. In Tables 31 and 34-37, the actual number of seeds is reported for each taxon, as well as an adjusted number of seeds per liter, which takes into account both subsampling and the considerable variation in sample size.

From each flotation sample with sufficient charcoal (21 samples), a sample of 20 pieces of charcoal was identified (10 from the 4 mm screen, and 10 from the 2 mm screen). Each piece was snapped to expose a fresh transverse section and identified at a magnification of 45. Low-power, incident-light identification of wood specimens does not often allow species- or even genus-level precision but can provide information useful in distinguishing broad patterns of utilization of a major resource class. Charcoal from ten locations was also submitted for identification prior to radiocarbon dating, providing some additional species composition information.

Macrobotanical remains consisted largely of carbonized corn cobs and kernels, and carbonized beans. Cobs were measured to the nearest 0.1 mm with dial calipers, according to parameters defined by Nickerson (1953). All kernels, beans, and single-bean cotyledons were counted and measured (length, width, and thickness) when more than half of the specimen was present. Smaller fragments were not counted.

Results

Pithouse 1

Stratum 2 contained a wide variety of economic species, including abundant corn remains; a piece of charred squash rind; and seeds of saltbush, ricegrass, goosefoot, pigweed, and beeweed (flotation sample 14-119). Pollen from the same provenience was limited to corn and cheno-ams (Clary, this volume). Charcoal from Stratum 2 was notable for one of two sitewide occurrences of juniper. Charcoal was dominated by saltbush, with some sage and riparian wood. Floor fill (Stratum 4, 14-121), on the other hand, contained only a great deal of corn, both cob parts and kernels. Pollen from floor contact (14-129) confirmed the use of corn here, and added cheno-ams, Mormon tea, pine, and the sunflower family (Clary, this volume). Floor-fill charcoal was heavy on rabbitbrush; sage and cottonwood/willow were also present. The hearth (14-120) contained abundant charred corn cupules and cob fragments (no kernels) and a single unburned pigweed embryo. Nearly all charcoal in the hearth was riparian. An ash/charcoal lens was dominated by rabbitbrush charcoal, and sage and cottonwood/willow were present in smaller amounts (14-11; Table 33). Corn collected as macrobotanical remains from Pithouse 1 included 10 measurable cobs, with 8, 10, and 12 rows; all were small and very eroded.

Pithouse 2

Flotation sample 10-45, from the hearth, contained carbonized corn cupules, charred goosefoot and sedge seeds, and numerous wild tobacco seeds. Charcoal from this provenience included small pieces of riparian wood and fewer, larger pieces of sage (Table 32). Charcoal from floor fill was a similar assemblage, with many small pieces of cottonwood/willow and fewer, larger pieces of saltbush and sage; rabbitbrush, mesquite, and creosotebush were also represented (10-39; Table 33). Six measurable corn cobs (plus nine fragments) were collected as macrobotanical specimens from Pithouse 2; all were small cobs with 8 or 10 rows. Pollen from the floor of this pithouse revealed the utilization of squash as well as corn and cheno-ams (Clary, this volume).

Pithouse 3

Floor fill (17-120) contained limited charred remains of squash rind, corn, and pigweed seeds (Table 31). A burned saltbush fruit was present, but no wood of this species was found in the charcoal sample (predominantly cottonwood/willow; Table 32). Goosefoot seeds were unburned in floor fill, but charred in vent shaft fill (17-123). Composition of the vent shaft fill suggests secondary trash deposition: charred economic plant remains are abundant and varied. Carbonized corn kernels and cupules are more numerous in this provenience and accompanied by a charred bean cotyledon. (Fourteen corn kernels and a second bean cotyledon were recovered from this provenience as macrobotanical specimens 17-1 and 17-93, respectively.) A segment of common reed stem was present in flotation, as well as three weedy annuals (purslane and a composite, in addition to goosefoot). Charcoal in the vent is again predominantly cottonwood/willow, with some saltbush. The hearth, a more likely locus of fill relating to original use, contained only pigweed and corn (17-124). Charcoal composition here shifted to predominantly saltbush, with some rabbitbrush and cottonwood/willow. Elsewhere in Pithouse 3, charcoal was all cottonwood willow (17-20, 17-112; Table 33) or a mixed assemblage weighted heavily towards saltbush (17-113).

Pithouse 4

This rectangular pit structure is distinguished by the only stratified trash at LA 53662. Flotation remains show general consistency from top (20-103) to bottom (20-106), with economic annuals prominent, and corn in all samples. Pigweed was recovered from five of six samples in this structure, tickseed and goosefoot in three samples, and purslane and winged pigweed in two. Ricegrass appeared in three samples, and dropseed grass in one. Perennials included saltbush fruits, juniper twigs (Stratum 4, 20-105), and a sedge seed. Plant remains were most diverse in Stratum 4 and the hearth, and in greatest density in a charcoal lens 10 cm above the floor (20-106). Macrobotanical remains supplemented the flotation recovery of corn, with seven measurable cob fragments ranging from 8 to 16 rows (20-72, 20-98, 20-111, 20-112). These cobs averaged slightly larger (13.5 mm in diameter, with cupules 6.6 mm wide and 3.5 mm high) than the sitewide sample.

Charcoal composition shifted slightly from cottonwood/willow dominance in Stratum 2, to saltbush dominance in Stratum 3, to cottonwood/willow dominance in Stratum 4 and the hearth (Table 35). Other wood types combined totaled 10 to 35 percent by number of pieces, or < 1 percent to 50 percent (in the charcoal lens) by weight. Rabbitbrush was found in every stratum, with sage, mesquite, and creosotebush less common.

Pollen preservation was generally poor in Pithouse 4, with corn present in most strata, and cholla found in Strata 1, 2, 3, and 3/4 (Clary, this volume). Cheno-am pollen (Strata 1, 4, and floor contact) may reiterate use of annual weeds and/or saltbush seen in flotation and charcoal remains.

Pithouse 5

Pithouse 5 had no trash in the fill. Flotation samples derived from two interior features. Both contained a variety of charred economic plant debris, with no recent contaminants. An ash pit (34-16) had remains of corn, green-striped cushaw squash, saltbush, and several weedy annuals (pigweed, bugseed, and winged pigweed), as well as juniper, saltbush, rabbitbrush, mesquite, and cottonwood/willow charcoal. The hearth (34-17) contained abundant corn remains, together with single charred seeds of ricegrass and bugseed. Pollen from floor contact (34-13) contained corn and cheno-ams matching flotation remains and introduced a further potential economic group with the presence of sunflower family pollen (Clary, this volume).

Pithouse 6

Two samples from the hearth of this structure (43-9 and 43-10; Table 35) indicated a variety of food and fuel materials were utilized. Corn remains, including kernels, were found in both samples, as well as saltbush fruits and bugseeds. Charred pigweed seeds were limited to 43-9, and goosefoot seeds to 43-10. A few intrusive seeds (spurge, Arizona poppy) were present only in 43-10. Charcoal was very similar in both samples: saltbush and greasewood dominated, with small quantities of rabbitbrush and cottonwood/willow.

Corn pollen from floor contact (43-7; Clary this volume) corresponded with corn from flotation, while cheno-am pollen may have been linked to saltbush, goosefoot, or pigweed remains.

Pithouse 7

The hearth in this structure contained small amounts of corn cupules in both samples (45-15, 45-16) and a single modern spurge seed in 45-15. Charcoal was very fragmentary and principally riparian, with a few small pieces of saltbush and greasewood. Pollen from floor contact in Pithouse 7 included corn, cheno-ams, and several taxa not recorded in flotation or macrobotanical remains (sunflower family, Mormon tea, cattail, and creosotebush; Clary, this volume).

Pithouse 8

This pithouse sported a hearth with a somewhat aberrant flotation assemblage. Though pollen remains from floor contact included a few grains of corn (Clary, this volume), corncob fragments were entirely absent from three flotation samples taken from the hearth. One charred corn kernel (47-8) was the only flotation or macrobotanical indicator of this food staple so widespread at LA 53662. Piñon nutshell put in a rare appearance in this hearth. Charcoal was also a little off the general pattern, with sage most numerous, and greasewood exceeding saltbush and riparian woods. Squash, indicated by a few pollen grains, did not appear in the flotation or macrobotanical assemblages.

Extramural Hearth 4

Feature 4 is not clearly associated with any habitation structure. Pithouse 5 is the closest candidate at about 13 m to the west. The flotation sample documenting this feature (4-1) contained a single carbonized corn cupule (Table 39). Also present were unburned seeds of two species of spurge (*Euphorbia glyptosperma* and *Euphorbia* sp.) and numerous insect parts, all likely contaminants, either contemporary with or following site occupation.

Extramural Pit 15

The Feature 15 fill contained charred ricegrass caryopses, two carbonized corn cupules, and two small fragments of probable piñon nutshell. Two unburned spurge seeds were likely contemporary or postoccupational contaminants. Charcoal was scanty and very fragmentary but included both saltbush and cottonwood/willow. If this pit functioned as a storage area, the possible piñon nutshell is the only clue to past contents. Charred ricegrass and corn are more likely concomitants of redeposited trash from later food processing elsewhere at the site.

Extramural Pit 16

A single charred bean (16-2) at 50-70 cm BLD is another probable representative of secondary fill. Corn and squash pollen from the contact layer at bottom of the pit (Clary, this volume) more likely relates to original pit use.

Extramural Pit 18

This large extramural pit held plant materials not found elsewhere at the site. A charcoal lens in the uppermost fill (18-43) contained charred seeds of both pricklypear cactus and yucca (Table 34). These two succulent species occur in distinctly higher abundance and ubiquity in several pueblos further south (Toll 1986, 1987b, 1987c). Charred annual weed seeds were found in low density in both upper fill (pigweed and purslane) and bottom fill (18-46; winged pigweed). Charred corn was abundant in both levels, complementing corn pollen recovered at floor contact (18-42; Clary this volume). Carbonized saltbush fruits appeared in the lower level, linked with a dominance of saltbush wood in a mixed charcoal assemblage (cottonwood/willow, sage, rabbitbrush, and mesquite were also present; Table 33). Macrobotanical specimens from this pit included a corn kernel (18-29), a segment of corn shank (18-30), a 12-rowed cob, and 31 cob fragments (18-38). The diversity of burned economic plant remains in this pit probably relate to secondary trash deposition rather than original pit use, which is postulated as storage.

Extramural Pit 21

Flotation samples from Feature 21 provided only a moderate number of tiny corn cob fragments (the background material in nearly all LA 53662 flotation samples) and a single unburned spurge seed (probably a contaminant).

Feature 23 Hearths and Pits

The Feature 23 cluster of hearths and pits is documented by a series of six flotation samples (Table 36). Economic taxa were low in abundance and diversity in these pits. Low-frequency corn cupules occurred in all pits but 23c, which contained a fragment of possible piñon nutshell. Goosefoot seeds appeared in Pits 23b and 23f, and ricegrass was present in Pit 23b. Corn, piñon, goosefoot, and ricegrass remains were all carbonized and most likely represent redeposited trash. Probable contaminants were common in Feature 23 and included spurge (five of six samples), Arizona poppy (four of six samples), and stickseed (one sample). A sufficient sample of charcoal was found only in Sample 23b-10; mesquite was the predominant element in this pit.

Extramural Hearths 27 and 29

Two of three extramural hearths comprising Feature 27 contained small quantities of carbonized corncob and kernel fragments. Hearth 27b also held a few burned seeds of common economic annuals. A variety of weedy contaminants (including tansymustard, stickseed, spurge, and doveweed) were present in the fill of Hearths 27 and 29. Charcoal was largely riparian but also included some mesquite (Table 32).

Fill in 29b was empty of botanical remains except for a fragment of a modern spurge seed (Table 37). The larger Hearth 29a contained some charred corn cupules, goosefoot seeds, and a possible dropseed caryopsis, as well as unburned seeds of four probable contaminant species.

Extramural Pit 32b

Flotation Sample 32b-8 documents abundant and varied floral remains in this pit. Abundant charred corn cob fragments were accompanied by a single kernel. Other carbonized economics included ricegrass caryopses, and pigweed, winged pigweed, and sedge seeds.

Extramural Pit 38

Macrobotanical Sample 38-2 contained a single charred shrub seed. No flotation or charcoal was submitted from this feature, so the seed cannot be linked to food or fuel use.

Feature 42 Hearths and Pits

The hearths and pits in Feature 42 were sampled extensively. In all, 17 flotation samples were taken from 11 features. Charred floral remains were present in low density as a whole within this group of features. Corn was the primary link between these features, with cob fragments present in all but Hearth 42r (Table 38). Cupules and cob fragments were most abundant in Features 42b, 42d, 42g, and 42i, and kernels appeared only in Features 42g and 42j. Other economic plant species occurred only rarely: a single ricegrass caryopsis in Feature 42g, and a single hedgehog cactus seed in 42j. Modern contaminants were found only in Features 42c and 42g. Charcoal was not abundant in any of the sampled hearths of Feature 42. The single flotation sample containing sufficient charcoal for a 20-

piece sample (42g-12) was predominantly riparian, with some mesquite.

Extramural Hearths 44a and 44b

Hearth 44a produced only a single unburned and badly damaged seed, while Hearth 44b contained just one unburned goosefoot seed (Table 39). Charcoal from Hearth 44b was slightly different from that seen in most LA 53662 burn features: sage and rabbitbrush dominated.

Extramural Hearth 46

Hearth 46 was located in postoccupational fill above Feature 47. Moderate quantities of corn debris (21 cupules) indicate that the ubiquitous corn processing continued in this later occupation.

Extramural Hearths 48a and 48b

Hearth 48b produced a single charred corn cob with 12 rows (48b-8). Charcoal samples were submitted from Hearths 48a and 48b. Riparian wood dominated in both samples. Sample 48b-11 also contained a substantial proportion of rabbitbrush and minor quantities of sage and saltbush.

Summary

Taxa recovered by flotation, macrobotanical, and charcoal analyses include shrubs found in the immediate site vicinity (saltbush fruits and charcoal, rabbitbrush and sage charcoal) and low frequencies of higher-elevation conifers (juniper twigs and charcoal, piñon nutshell). Succulents most common on the well-drained terraces (prickly pear, hedgehog cactus, yucca) are present only as seeds in one flotation sample each. Riparian or bosque species are represented by sedge achenes, and cottonwood/willow and mesquite charcoal. Among weedy annuals, growing in various habitats in the valley bottom, gravel terraces, and uplands, goosefoot and pigweed are most prominent, followed by bugseed, winged pigweed, purslane, beeweed, and mallow.

LA 53662, located between northern Rio Grande sites, where weedy annuals predominate, and Rio Abajo sites, where succulent and woody perennials become more important, shows an intermediary adaptation in its floral assemblage. Belen Bridge's transitional position on this spectrum helps confirm the existence of this geographic shift in adaptive focus and helps pinpoint the geographic dimensions of this shift.

HUMAN INTERMENTS

Ann Noble

Six burials were recovered at Belen Bridge. They occurred in two groups of three each and were located in Pithouses 5 and 8. An adult female (35 to 40 years old), a 5- to 6-year-old child, and a 10- to 12-year-old child (Burials 1-3) were buried in the fill of Pithouse 5. Three children--aged 7 to 8 years, about 9 years, and 10 to 12 years (Burials 4-6)--were buried in the fill of Pithouse 8.

Five of the burials were found in room fill and had been placed along the walls of the pithouses. The sixth (Feature 51), was placed in a pit below the floor of the pithouse and was very tightly flexed. It is quite possible from the position of the arms and legs that during original interment the child's body had been wrapped, but no evidence of any wrapping material survived. All burials were oriented toward the east.

The burials were analyzed according to age, stature where possible, pathological conditions and trauma, and anomalies. The adult was sexed, but none of the children exhibit the secondary sexual characteristics that permit sexing. The age of each individual was determined from tooth eruption sequences, occlusal wear, epiphyseal union, and degenerative changes such as arthritic lipping of the vertebrae. Two of the children have pathologies that could have contributed to their deaths. The other three and the adult show no cause of death that can be determined from skeletal pathologies.

Description of Burials

Feature 35 (Burial 1)

Burial 1 is an adult female, 35 to 40 years old at the time of death. The body was placed with the head oriented east and the face toward the pithouse wall in a flexed position. It was in room fill just above the floor. The skull has been badly damaged. The facial area has been broken off from just below the superior portion of the orbits, leaving it in two main portions: the calvarium, including the superior orbits and most of the base of the skull; and the facial area, including the nasal area, maxilla, and zygomatics. The mandible is intact. The dentition of both the mandible and the maxilla is intact. All permanent teeth are fully erupted. The left M/3 has been lost antemortem, and some remodeling of the socket has occurred. There are tiny caries in the occlusal surfaces of the three remaining third molars. The right M/3 has a Carabelli's cusp. All but the third molars exhibit moderate attrition. The lower incisors are extremely worn. The teeth are basically free from calculus deposits. Hypoplasia is evident in the upper central incisors. The lower incisors are too worn to detect hypoplasia. The maxillary incisors are shovel-shaped. The condition of the postcranial bones ranges from good to poor.

Sex determination was made by skeletal characteristics of the innominates, skull, and maximum diameter of the femoral head, 38 mm. A diameter of less than 42.5 mm is regarded as female (Stewart in Bass 1987:220).

Age determination was based on attrition sequences (Bass 1987:69) and arthritic lipping of the vertebral centra (Stewart in Bass 1987:19).

The stature of this individual is based on lengths of the left femur and left tibia, using Genoves's formula (Bass 1987:29). The left femur measures 44.2 cm (17.4 in), which gives a stature estimation of 5'5" (167 cm) at the high end, 5'4" (162.5 cm) for the mean, and 5'2" (157 cm) for the low. The left tibia measures 33.4 cm, which gives a stature estimation of 5'2" (157 cm) at the high end, 5'1" (154 cm) for the mean, and 5'0" (152 cm) for the low. Taking these figures into account, this woman was probably about 5'3" tall.

The pathological conditions noted in this skeleton are the caries in the occlusal surfaces of the molars, noted above, hypoplasia in the central incisors, and slight arthritic lipping of the majority of the centrums. Nothing in the skeleton indicates cause of death.

Anomalous conditions in this skeleton consist of a Carabelli's cusp in the right M/3, shovel-shaped maxillary incisors, two mental foramen on the left side of the mandible, bilateral foramen that connect the incisive fossa and the nasal sill, unintentional artificial deformation of the parietals and occipital at the lambdoidal suture (cradle boarding), a depressed area on the external surface of the parietals which involves the parietal foramen and may be associated with cradle boarding, and a widening of the second rib at mid-shaft that forms an articulation with the first rib.

Feature 36 (Burial 2)

Feature 36 is the skeletal remains of a child five to six years old at the time of death. The head was oriented toward the east in a semiflexed position with the face toward the north wall of the pithouse. The body was placed on the pithouse floor.

The cranium is in fair condition. It is missing the base of the skull and the anterior portion of the alveolus. The mandible is broken on both sides posterior to M/1. The ascending rami were both recovered.

The postcranial skeleton is in fair to good condition. Most of the skeleton was recovered, including epiphyses, although many of the long bones are broken at the ends of the diaphyses.

Age estimates were based on tooth eruption sequences (Brothwell 1965:59) and epiphyseal closure (Bass 1987).

The stature of this individual was not calculated because of breakage in the femora and the tibiae.

The following pathological conditions were observed: the second permanent molars in the maxilla are erupting through the lateral portion of the alveolus, the PM/1's are erupting anteriorly under the m/1's in the mandible, and the second and third cervical vertebrae are fused.

Anomalies include shovel-shaped incisors, zygomatic spurring, and a prenasal fossicula.

Feature 37 (Burial 3)

Feature 37 is the remains of a child 10 to 12 years old at death, possibly male. The child was buried in the southwest corner of the pithouse in room fill. The head was facing east, and the vertebral column was placed against the wall. It was partially flexed, the right leg was sharply bent, and the left was extended. It appears that little care was taken with body placement during interment. Two large rocks were placed on the body, one covering the face and one between the left leg and right arm.

The skull is in poor condition. It has been severely damaged, and the facial area and the base of the skull are no longer attached. The maxilla is complete except for breakage posterior to the left first molar. The occipital and the temporals are in fragments. The mandible is complete but broken.

Age was based on tooth eruption sequences, epiphyseal union, and long bone lengths. Femur length is 32 cm, or 12.5 in, resulting in a mean age estimate of closer to eight (Bass 1987:217, after Anderson et al. 1964:Table 1). The tooth eruption and epiphyseal union sequences place the age closer to 10 to 12, resulting in an estimate of 10 at death. The age sequences in Bass are taken from orthorotentgenographic measurements of present-day children and therefore not as reliable for dry bone measurement and nonwhite children, which might also account for these discrepancies.

The sex of this individual cannot be determined with any accuracy because of the lack of secondary sexual characteristics at this age. This skeleton does exhibit a very curved sacrum, a well developed mastoid process for the size of the skull, and a low palate. Also, the zygomatic ridge extends over the external auditory meatus. These characteristics could indicate a male.

The left femur measurement gives a stature estimate of 4'5" for the low end, 4'5" (134 cm) for the mean, and 4'7" (139 cm) for the high end. The right tibia stature estimate is 4'7" (139 cm) for the low end, 4'8" (142 cm) for the mean, and 5'0" (152 cm) for the high end. The average of the two stature estimates is 4'8" (142 cm).

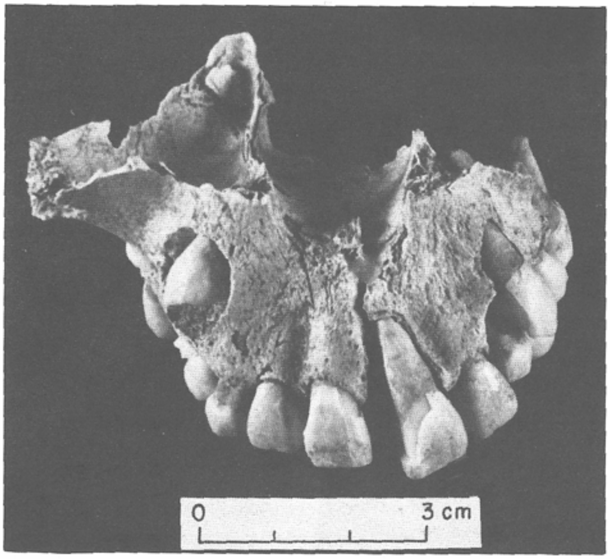


Figure 54. Dental pathologies of Burial 3.

Pathologies include a heterotopic canine erupting from the body of the right maxilla, the left canine erupting superior to the premolars, and retained deciduous canines (Fig. 54). There are also caries present on the right and left M/1's. The occlusion between the maxilla and the mandible is quite bad. The mandible has a much smaller arc than the maxilla (the maxilla measures 3.6 m between the first molars, and the mandible measures 2.9 cm between the first molars).

Several anomalies are present in this skeleton. The incisors are shovel shaped. The lateral incisors are almost barrel shaped near the base of the crown, and the central incisors are slightly double shovel shaped. The lambdoidal suture is very complex, and the nasal sill has a prenasal fossicula.

Feature 49 (Burial 4)

Feature 49 is the skeleton of a child who was seven to eight years of age at the time of death. The head was facing east with the back along the south wall of the pithouse. It was placed in a flexed position just above the floor in fill.

Although most of the skull is present, the cranium is in poor condition, broken into the parietals, the occipital, the base with the foramen magnum, and the facial area, including the frontal. The occipital is extremely thin with some of the bone absent. The parietals have possible porous areas, and the nasal area is missing. There may also be a lesion on the left frontal area, although erosion of the bone from burial makes this hard to confirm. The mandible is intact.

The postcranial skeleton is in fair condition. Most of the bones are represented, but many of the epiphyses are absent.

The age of this individual is based on tooth eruption sequences and epiphyseal closure.

Sex was not determined because of the absence of manifested secondary sexual characteristics.

Stature was based on the length of the right tibia using Trotter and Gleser's 1952 and 1958 formulae (Bass 1987:238). The femur was not used because of breakage. The low estimate for stature is 4'1" (124 cm), the mean is 4'3" (129 cm), and the high is 4'4" (132 cm).

The pathological processes evident in this individual are mainly confined to the cranium. The

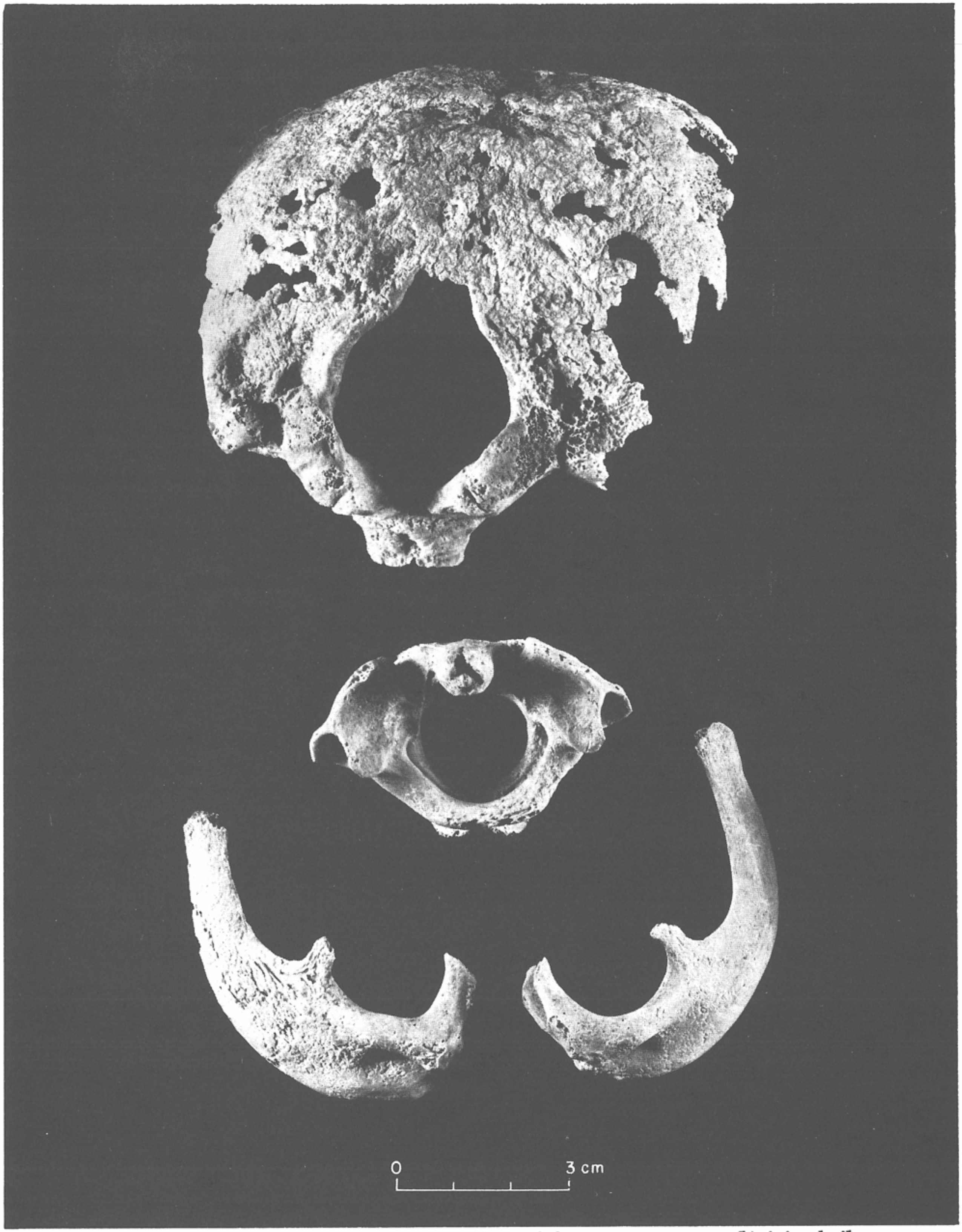


Figure 55. Skeletal pathology of Burial 4: (a) malformed foramen magnum; (b) joined ribs.

exceptions are cervical vertebrae 1 and 2. The atlas has an unfused anterior arch, and the axis has a slightly malformed odontoid process. The foramen magnum is also malformed, with a continuation of the foramen into the occipital bone (Fig. 55a). How these pathologies relate to each other is not clear.

The cranium is extremely thin in the occipital area. In several areas the bone appears perforated. The bone around the perforations is very smooth, and both the external surface and the cerebral surfaces are intact. There also appears to be a problem in the external surface of the occipital along the occipital crest, although it is difficult to define because of soil erosion. Some of the other portions of the skull are quite eroded from soil conditions as well, which may account for some of the pathological appearance. It does seem that there are some problems with the ossification processes in the skull. The central incisors show evidence of hypoplasia, which indicates nutritional stress, but the lack of Harris lines in the femora and tibiae indicate that the stress was long-term rather than seasonal: chronic disease, calcium metabolism problems, or malnutrition (Steinbock 1976). Nancy Akins (personal communication, 1990) analyzed a skull from Chaco Canyon burials that appeared very similar in the thinning of the occipital and the malformed foramen magnum, but it was from a nine-month-old child, so it is hard to tell what would have manifested had the child survived to the same age as Burial 4.

The other pathology noted in the cranium is the eruption of the first molars through the posterior part of the alveolus.

Anomalies include shovel-shaped central and lateral upper incisors and attrition of the occlusal surfaces of the deciduous teeth. The bodies of the first and second ribs have ossified together bilaterally (Fig. 55b). The clavicles are normal, so apparently this anomaly did not affect arm movement. Zygomatic spurring is present.

Feature 50 (Burial 5)

This feature is the skeletal remains of a child approximately nine years old at death. It was interred in a pit just above the floor in a flexed position. The body was placed with its back to the pithouse wall and its head to the north, but the face was turned toward the east.

The cranium is in good condition compared to the others from the site. The top of the skull is fractured postmortem, and portions of the left temporal superior and posterior to the mastoid process are missing. The nasal bones are also missing. The mandible is complete. All teeth were recovered intact with the exception of the left c/1, which was probably lost antemortem.

The postcranial skeleton is in good condition. There is minimal breakage, and most of the epiphyses were recovered. Age was based on tooth eruption sequences and epiphyseal closure. The stature of this individual was estimated between 130 cm (4'2") and 138 cm (4'5"), with a mean estimated height of 133.84 (4'3").

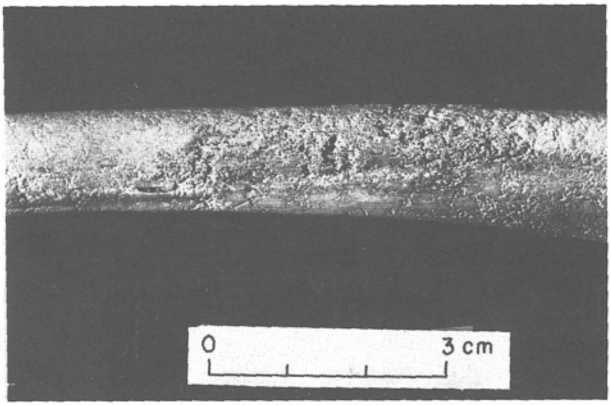


Figure 56. Left femur shaft of Burial 5.

Pathological conditions were mostly apparent in the long bones. Some periosteal reactive bone is found in the left femur shaft (Fig. 56), and porosity in the radial tuberosity of both radii. It is difficult to tell because of weathering whether the left mastoid was the locus of infection or not (Fig. 57), but if so, the mastoid could be the underlying

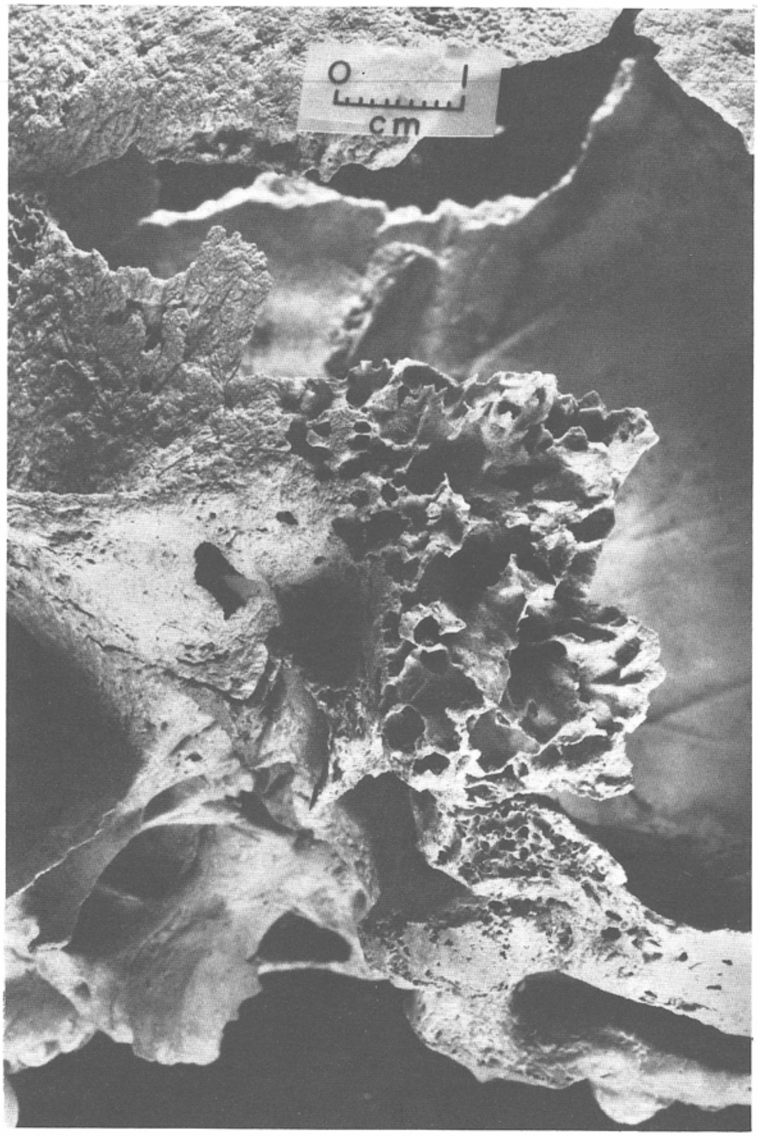


Figure 57. Skeletal pathology of Burial 5.

cause of the reactive tissue (Ortner and Putschar:123). In any case there was apparently a general infection in the child's system, and it could have caused death. There is no evidence of hypoplasia, suggesting this condition was fairly short lived.

Anomalous conditions in this individual include shovel-shaped central and lateral incisors, attrition of the occlusal surfaces of the deciduous teeth, an inca bone in the lambdoidal suture, unintentional artificial deformation of the dorsal portion of the skull (cradle boarding), and spurring of the zygomatics.

Feature 51 (Burial 6)

Feature 51 is the remains of a child approximately six years old. It was placed in a pit dug into the floor with its head oriented to the east and its face and torso facing the wall of the pithouse. The child was apparently wrapped before interment. The skull is in poor, mainly fragmentary condition. The majority of the teeth were recovered. The mandible is also mostly in fragments.

The postcranial skeleton is in surprisingly good condition compared to the skull. Most of the bones are complete with the exception of some of the long bones (which are missing the ends of the diaphyses), and some of the epiphyses are missing. The innominates are in poor condition.

The age estimate was based on tooth eruption sequences and epiphyseal closure. Stature was not estimated because of breakage of the leg bones and the poor condition of the epiphyses.

The only pathology evident is slight hypoplasia in the central and lateral incisors.

The only anomalies apparent are unintentional artificial deformation of the occipital and parietals (cradle boarding) and shovel shaping of the central and lateral incisors (both upper and lower).

Discussion

The skeletal remains recovered from the Belen Bridge site, while not numerous enough to give us accurate information on population structure, do allow us to draw some conclusions about the inhabitants.

Infant mortality rates for most Anasazi sites are quite high, often exceeding 30 percent (Akins 1986:61). Surprisingly, there are no infants in this group. Since all of the children in this assemblage are between five and ten years of age, factors associated with weaning, which often results in the death of infants and young children, were apparently not the cause of death. Cultural practices such as selecting only those individuals over a certain age for interment in the houses could result in these biases.

There is strong evidence for nutritional stress over long periods of time rather than short-term interruptions in growth caused by severe illness. This is apparent because of the high percentage of hypoplasia in the central and lateral incisors (83 percent of the population) and the lack of Harris lines in the two individuals that were radiographed. As Steinbock wrote, "A population chronically malnourished will not exhibit as many transverse [Harris] lines as a population with seasonal periods of starvation and good nutrition."

There is also some evidence for infectious disease as a factor in the deaths of these individuals since one of the children exhibits periosteal reactive bone remodeling. Because there is little evidence in the skeletons other than this for the deaths of this population, it may follow that infectious disease was to some degree responsible. Other factors that can contribute to long-term nutritional stress are parasites that inhibit absorption of important nutrients, weakening the system so other diseases are able to get a foothold.

There does not seem to be a case for iron deficiency anemia since none of the skulls shows any evidence of cribra orbitalia or porotic hyperostosis.

The stature estimates in relation to the ages of the children are a bit low, which may indicate that they were not growing as fast as they might have, given better nutrition.

Culturally, there was selection for burial position. All of the burials were found in a flexed position, and in all cases but one, heads were oriented toward the east. The one exception had the face turned in this direction.

All but one of the burials exhibit cradle boarding. The child who did not, Burial 4, was the one that may have had calcium metabolism problems.

Intrasite Temporal and Spatial Patterning

The large number of structures and extramural features, the minimal charcoal staining, the small quantities of cultural items (sherds, lithics, artifacts, and floral and faunal remains), and the differential distribution of the staining and cultural items across the site suggest that the individual structures and features were not used for long periods of time, nor were they all contemporaneous. Additionally, the sherd-matching, vessel-identification study showed that the sherds of any one vessel might occur in several proveniences, some of them widely separated. By looking at the distributions of the sherds of individual vessels, it should be possible to correlate strata, structures, and features. Those vessels with sherds spread throughout the fill of an individual structure can, likewise, be used to assess the relationships and integrity of the deposits within that particular structure. All of this information, in conjunction with the absolute dates, can then be used to explore the data for within-site temporal patterning.

Dating the Occupation(s)

Provenience Correlations through Vessel Sherd Distribution. The sherd-matching, vessel-identification study yielded 63 vessels useful for the provenience correlation study (see introduction to Ceramics section for a discussion of the identification techniques and Appendix 1 for a list of the vessels identified). These vessels involve both local and imported products, including Elmendorf Black-on-white (N=20), St. Johns Polychrome and/or St. Johns Black-on-red (N=12), Tularosa Black-on-white with carbon paint (N=5), Socorro Black-on-white (N=4), Tularosa Black-on-white (N=3), Chupadero Black-on-white (N=3), unnamed black-on-white B (N=3), Cebolleta Black-on-white (N=2), Los Lunas Smudged (N=2), Santa Fe Black-on-white (N=2), Springerville Polychrome (N=2), unnamed black-on-white A (N=2), Kowina Black-on-white (N=1), McElmo-like Black-on-white (N=1), and unidentified black-on-white (N=1).

The sherds of these vessels represent most of the pithouses and large pits and several of the extramural features and strip areas.

One of the first facts discovered during this study is that the sherds of a number of vessels came from widely separated proveniences, some of them literally from opposite ends of the site. For example, sherds from Vessel 35, a partly reconstructed Elmendorf Black-on-white bowl (#20), came from the stripping and fills of Pithouses 1, 3, and 7 and the stripping and a hearth in the Feature 23 group. Sherds from Vessel 42, another Elmendorf Black-on-white bowl (#56), came from the fills of Pithouses 2 and 4, Pit 18, and the stripping over Pits 32a, 48a, and 48b. The sherds of Vessel 3, a Socorro Black-on-white bowl (#8), ranged from the fill of Pit 24a at the north-central edge of the site to the fill of Pit 48b, at the southeast edge of the site; additional sherds of this vessel came from Pithouses 4 and 5. While these are the three best examples, several others can be found in the vessel list (Appendix 1).

Intrasite relationships were assessed by compiling individual feature lists (Appendix 2). Study of these lists resulted in a relative abandonment and filling sequence for most of the structures but only a few of the minor features at the site. While the interpretation of the data should be relatively straightforward, a number of ambiguities become apparent. Prehistoric human and rodent disturbance of the deposits and excavation error are probably the major sources of this ambiguity. Used with caution, however, the results inform on a variety of aspects of the prehistoric occupation of the site.

The result is four groups that are at least partly temporally distinct. The situation was probably more complex, for there is reason to believe that some structures within at least one of the groups were abandoned before the others. However, the quality and resolution of the data, plus the rather crude analytical approach used here, precludes elucidation of greater detail. Further, we have no way of knowing the scale of temporal differences within and between the groups. We believe that the scale may be as little as one or two years but probably is not more than a few decades. Although a comparison and discussion of these results will be made with the archaeometric dates obtained for the site, we acknowledge that a strict interpretation of the radiocarbon intercept dates is risky for several reasons.

The basic groupings derived in this study are as follows (Table 46 and Fig. 58). The data used to delineate the groupings are given in Appendix 3.

Four aspects of the analysis are immediately obvious. First, the early-middle and late-middle occupations made use of virtually the entire site area. Second, although many extramural features are grouped, those for which we have data (Pit Groups 23, 24, and 32) clearly suggest that not all of the pits and hearths in a specific group were abandoned at the same time; thus, it is possible that not all were built and used at the same time, indicating that the groupings may be spurious in some cases. Third, the different styles of pithouses and pits apparently do not have a temporal dimension. The early-middle period is especially instructive in this regard, for the oval Pithouse 7, the squarish Pithouse 2, and the rectangular Pithouse 1 all belong to this period. And fourth, the major structures and features filled at different rates.

The one curious aspect of the correlation is that virtually all of the correlatable shallow pits fall within the early-middle group, and all but one of the correlatable hearths fall within the late-middle group. Several factors, including vagaries of sherd dispersal and perhaps occupational differences, may be responsible, but we cannot be certain which pertain in any specific instance.

Absolute Dating Techniques. The Belen Bridge site produced a small suite of pottery types. Although many have been dated elsewhere by tree-rings, not all are equally well dated. For this reason, and because of recent developments in radiocarbon studies and the improving status of archaeomagnetic dating, it is highly desirable to obtain additional absolute dates by which to increase our level of confidence in ceramic cross-dating. No specimens suitable for tree-ring dating were obtained at Belen Bridge. The reports received from the dating laboratories are in Appendixes 4, 5, and 6.

Radiocarbon. Eight carbon samples were submitted for dating. Prior to submission, the samples were carefully culled of juniper to remove the potential for "old wood" problems. Where possible, samples were restricted to species of the same metabolic pathway (either 3-carbon or 4-carbon). In a couple of instances, samples of mixed species were used because the samples were too small for subsampling.

Generally speaking, the samples were small because charcoal and charcoal-staining were rare at the site. Nevertheless, we were successful in obtaining five pure 3-carbon samples, one pure 4-carbon sample, and two mixed samples. These were sent to Beta Analytic for carbon isotope fractionation (C13/C12) and dating. One of the samples was so small it was subjected to extra counting time to reduce the statistical error. The resulting raw dates were then calibrated by Dr. J. D. Stewart using ATM20 of the Stuiver and Pearson (1986) program for the bidecadal curve. No lab error multiplier was used, and the sample age span was not applicable.

The results are gratifying in several particulars (Table 47 and Appendix 4). First, the calibrated dates of the 3-carbon samples, representing Pithouses 1, 2, 3, and 4 (Strata 3 and 4), clustered in the thirteenth century, the time frame expected from the pottery. The dates of the

Table 46. Provenience correlations through sherd/vessel identification (feature numbers)

Provenience	Early	Middle		Late	Unassigned
		Early	Late		
Structures	3	1, 2, 7	4, 5, 6		8
Extramural Facilities					
Hearths	32c		23b, 31b, 32a, 33b		numerous (N=31)
Deep pits		26		18	16
Shallow pits		24a, 24b, 32b, 42d, 48a, 48b	5a		numerous (N=10)
Postholes and sockets					all (N=15)
Miscellaneous					numerous (N=13)

Table 47. Radiocarbon dates

Provenience	Sample Composition	Calibrated Date Range (intercept) @ 1 SD	Comments
Pithouse 1, ash lens 10 cm above floor (Beta-21279)	all 3-carbon	1169-1267 (1230)	agrees with pottery
Pithouse 2, floor fill (Beta-21278)	all 3-carbon	1182-1275 (1252)	agrees with pottery
Pithouse 3, floor and hearth fills (Beta-21280)	all 3-carbon	1272-1398 (1290)	earlier intercept agrees with pottery
Pithouse 4, Stratum 4 (Beta-21283)	all 3-carbon	1169-1277 (1252)	agrees with pottery
Pithouse 4, Stratum 3 (Beta-21282)	all 3-carbon	1182-1279 (1259)	agrees with pottery
Pithouse 4, Stratum 2 (Beta-21284)[a]	3-carbon and 4-carbon	900-1160 (1018)	about 200 years too early
Pithouse 5, floor fill (Beta-21285)	3-carbon and 4-carbon	888-1021 (980)	about 200 years too early
Pit 18, 6-36 cm above bottom (Beta-21281)	all 4-carbon	888-1027 (985)	about 200 years too early

Note: Calibration file ATM20.14C supplied by J. Stewart (see Appendix 4).
[a] Small sample; given extra counting time.

Table 48. Archaeomagnetic dates (A.D.)

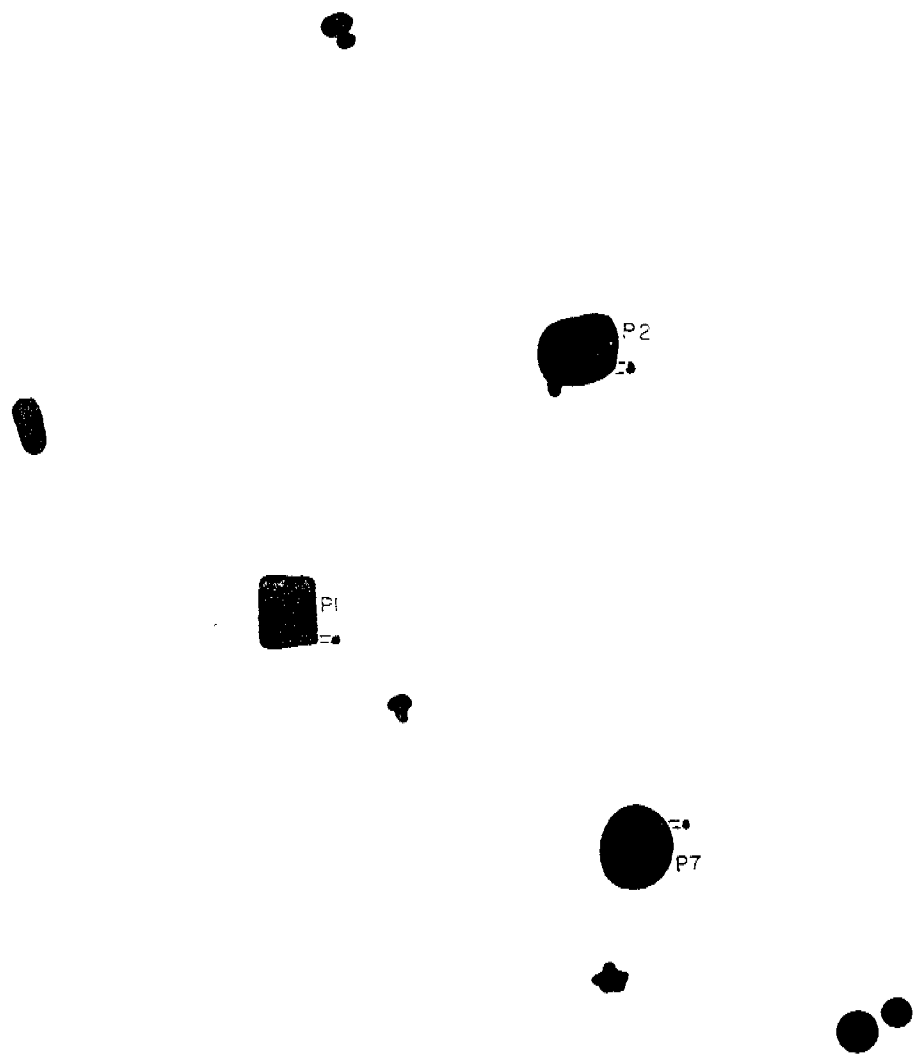
Sample Number	Provenience	Eighmy Date (A.D.)	Wolfman Date
53662-3; BB14	Pithouse 1	1200-post 1450	1220-1300[a]
53662-4; BB10	Pithouse 2	plot too dispersed to assign unambiguous cutoff date	1005-1275
53662-2; BB17	Pithouse 3	1150-1250	1230-1360
53662-5; BB20	Pithouse 4	1175-1450	1215-1285[a]
53662-6; BB34	Pithouse 5	1150-1250	1195-1275
53662-1; BB23A	Hearth 23a	1200-post 1450	1255-1350[a]
	site average	1200 (range 1175-1275)	

Note: See Appendixes 5 and 6 for the full reports from the Archaeometric Laboratory (J. Eighmy, director) and the Archaeomagnetic Dating Laboratory (D. Wolfman, director).
[a] Probable dates; see explanation in Appendix 6.

Table 49. Summary results (A.D.) of the three dating techniques for the major structures

Provenience	Ceramic Correlation	Radiocarbon One-Sigma Range and (Intercept) (A.D.)	Archaeomagnetism (A.D.)	
			Eighmy	Wolfman
Pithouse 1	early Middle	1169-1267 (1230)	1200-1450	1220-1300
Pithouse 2	early Middle	1171-1276 (1252)	no date obtained	1005-1275
Pithouse 3	early	1272-1398 (1290)	1150-1250	1230-1360
Pithouse 4	late Middle	1158-1284 (1252)	1175-1450	1215-1285
Pithouse 5	late Middle	date rejected	1150-1250	1195-1275
Pithouse 6	late Middle	no date or data	no date or data	no date or data
Pithouse 7	early Middle	no date or data	no date or data	no date or data
Pithouse 8	no date or data	no date or data	no date or data	no date or data
Pit 18	Late	date rejected	no date or data	no date or data
Hearth 23a	no date or data	no date or data	1200-1450	1255-1350


P3


P2
P1
P7

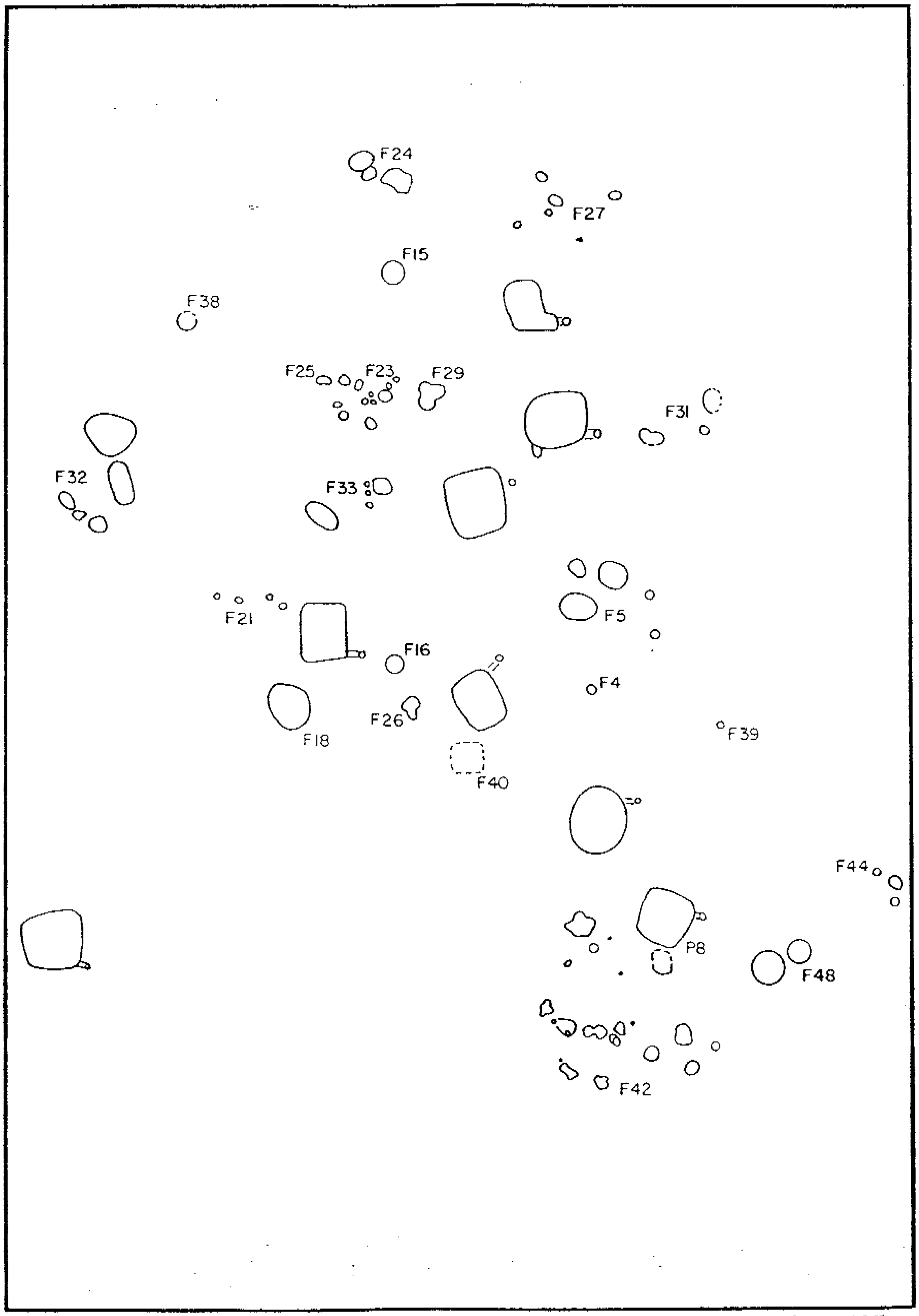


Figure 58. Occupation sequence of dated features: (a) early; (b) early middle; (c) late middle; (d) late.

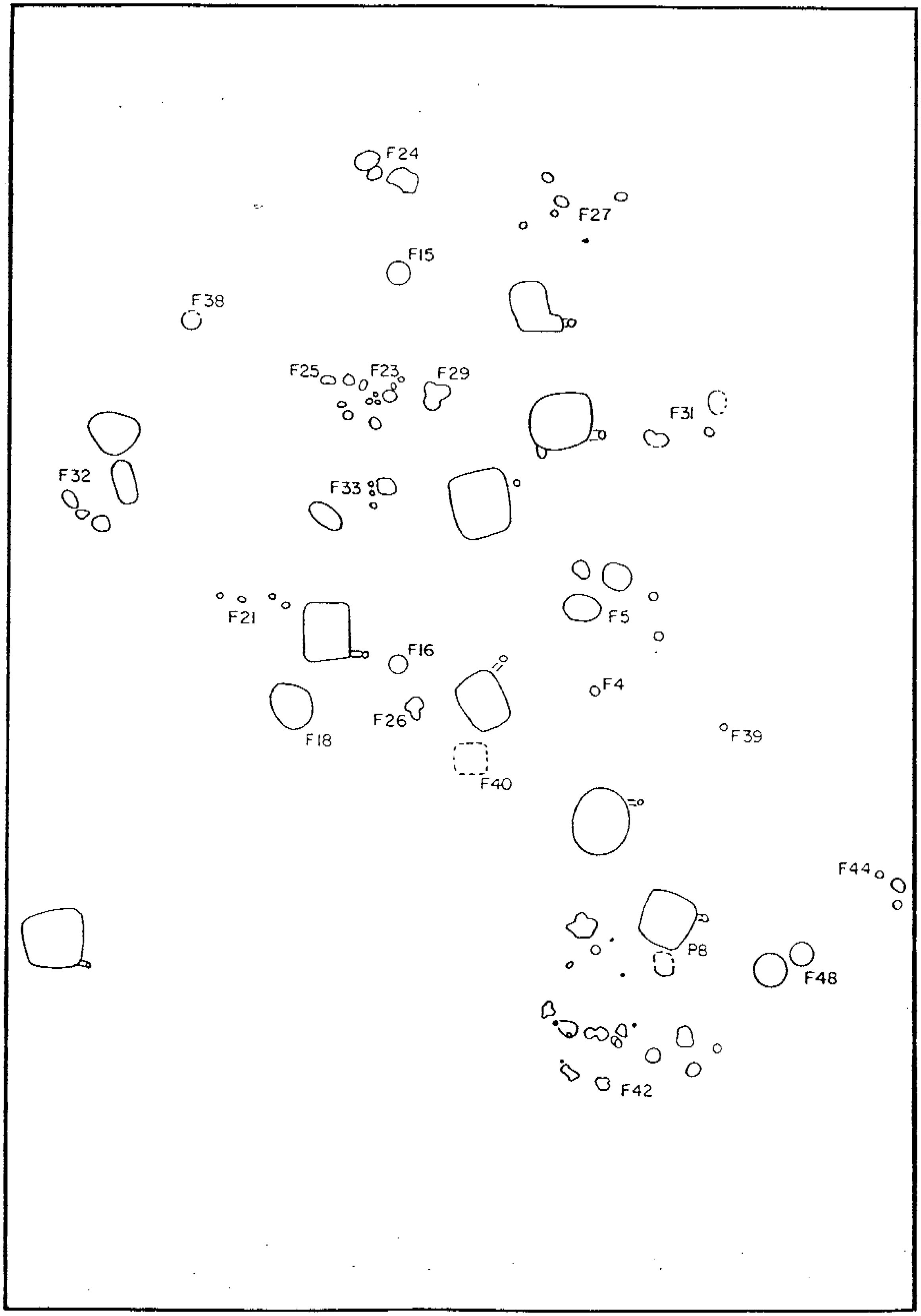


Figure 58. Occupation sequence of dated features: (a) early; (b) early middle; (c) late middle; (d) late.

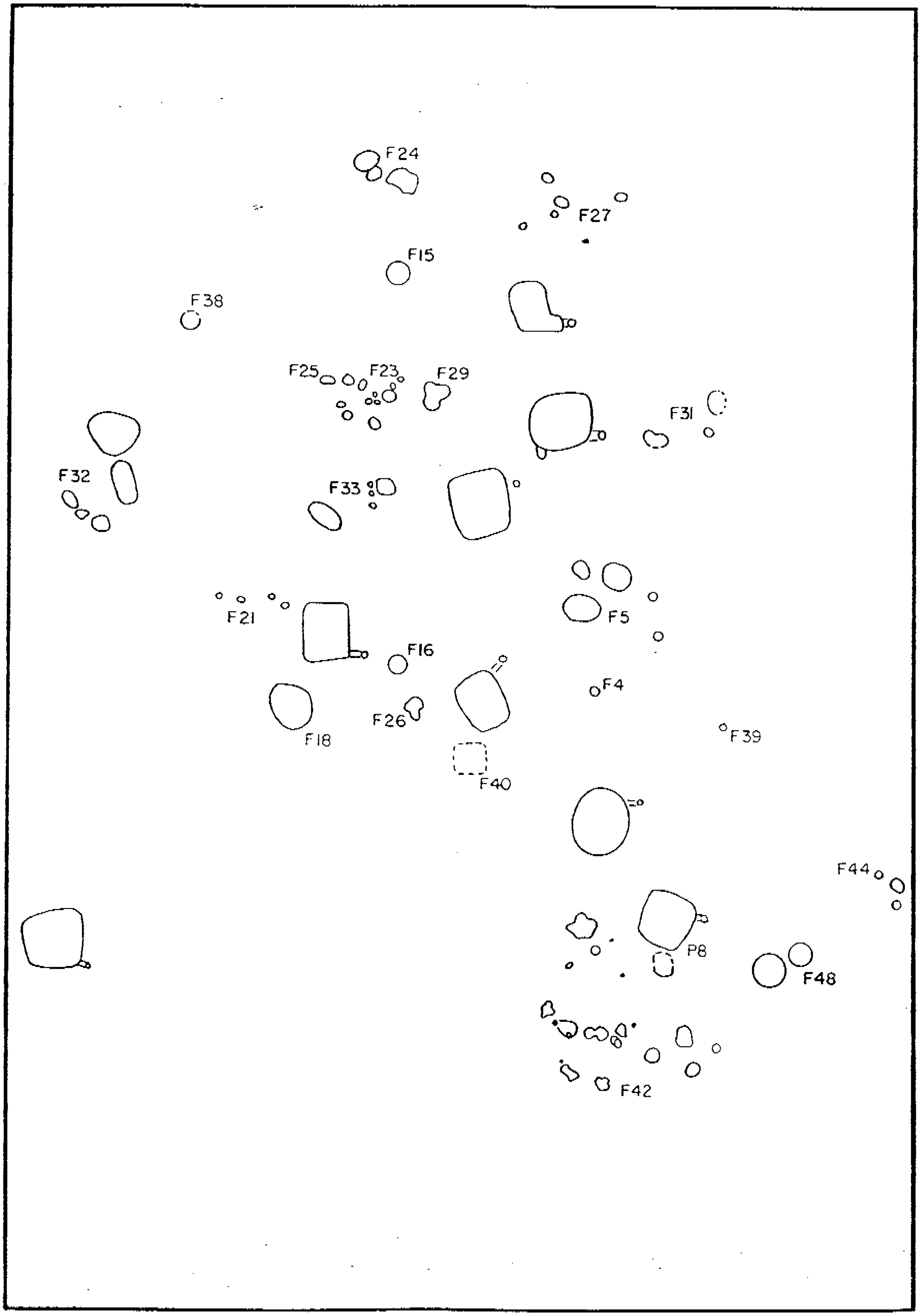
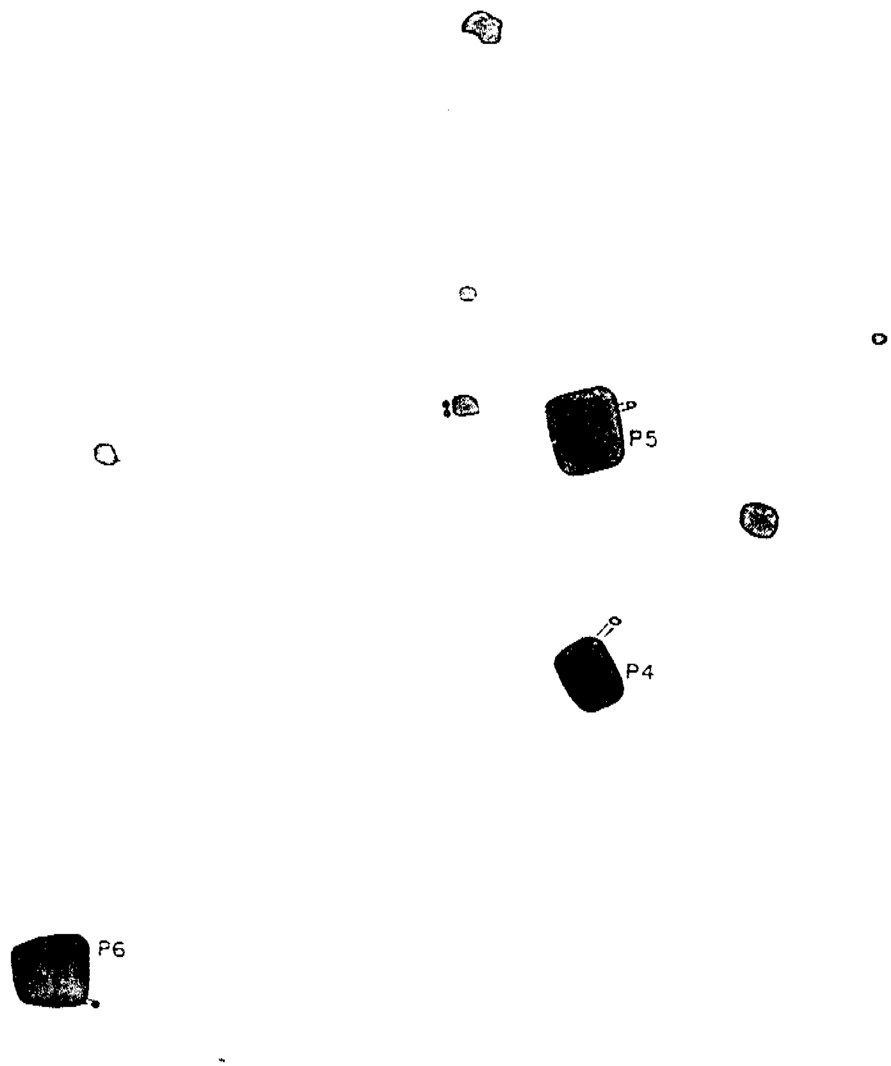


Figure 58. Occupation sequence of dated features: (a) early; (b) early middle; (c) late middle; (d) late.


P5
P4
P6

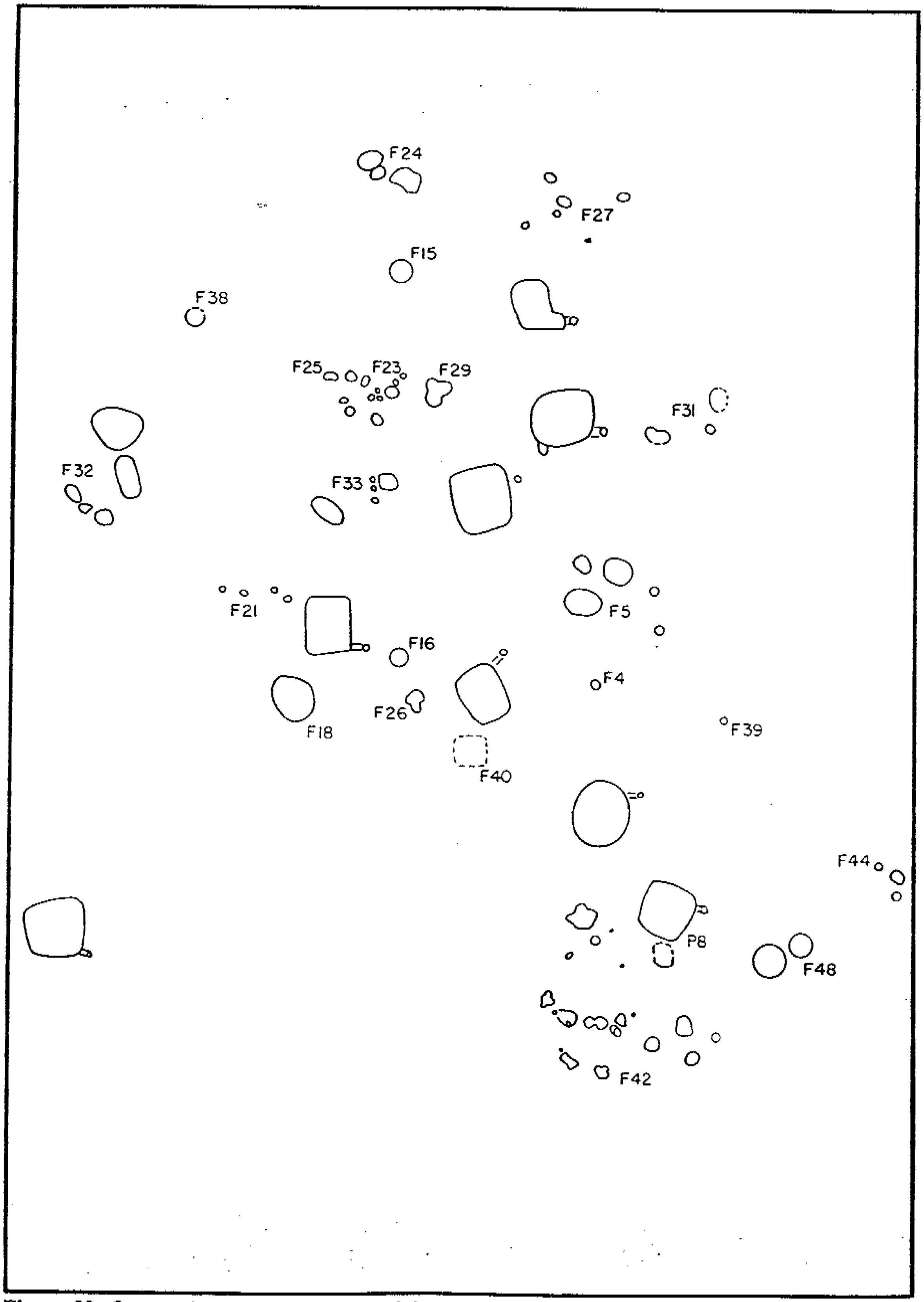


Figure 58. Occupation sequence of dated features: (a) early; (b) early middle; (c) late middle; (d) late.

4-carbon and the mixed samples, representing Pithouse 4 (Stratum 2), Pithouse 5, and Pit 18 (lower fill), are too early by some 200 years. They are much too early to be directly relevant to the occupation of the Belen Bridge site.

One of the more interesting aspects of the dates is that the ranges for Pithouses 1, 2, and 4 (Strata 3 and 4) are almost identical, suggesting that the three structures were basically contemporaneous. The date range for Pithouse 3 is later and, at 1 standard deviation, barely overlaps the date ranges of Pithouses 1, 2, and 4. Although the 2-standard-deviation ranges for all four dates overlap to a much greater degree, we suggest that the difference is real, that Pithouse 3 was actually built and occupied later than Pithouses 1, 2, and 4.

Archaeomagnetic Dating. Samples for archaeomagnetic dating were taken from the hearths of all structures and from one of the extramural hearths. The samples from Pithouses 1, 2, 3, 4, and 5 and Hearth 23a were sent to the Archaeometric Laboratory, Colorado State University, for dating (Appendix 5). The inferior nature of the first six samples resulted in large alpha-95 values (Table 48; see J. Eighmy's explanation in Appendix 5). Therefore it was decided not to date the samples from Pithouses 6, 7, and 8 at this time.

Subsequent to receiving Eighmy's report, Daniel Wolfman started the Archaeomagnetic Dating Laboratory at the Office of Archaeological Studies, Museum of New Mexico. In an effort to obtain more definitive dates for the site, I asked Wolfman to plot Eighmy's data on his curve (Table 48; Appendix 6).

Both sets of archaeomagnetic dates are in general agreement with each other and with the dates estimated through pottery analysis. Two differences of potential import are: (1) most of Wolfman's date ranges are shorter and therefore potentially more useful; and (2) in several instances, Wolfman's dates run slightly later on average than Eighmy's. The importance of this last aspect to the present study appears to be negligible.

Discussion. The use of several lines of evidence for dating sites is a widely recognized approach favored by archaeologists. However, almost invariably, the comparison of the results of two or more techniques encounters ambiguities. The Belen Bridge site data are no exception.

The Belen Bridge radiocarbon, ceramic, and archaeomagnetic data are in close agreement on one thing--the overall occupation of the site took place primarily during the A.D. 1200s. The problems arise when attempting more refined, intrasite dating of structures and features. Table 49 presents comparisons of the three techniques for all sites, and Table 50 presents a simplified rank ordering of Pithouses 1-5, the proveniences that produced the most dating information.

It had been hoped that the comparison of the various techniques would assist in determining a sequence of intrasite occupancy. Clearly, the results are not only disconsonant, they are totally undependable beyond confirming that the overall occupation of the site took place in the thirteenth century and perhaps in the first half of the fourteenth century. The dating for Pithouse 2 is the most consistent of the five structures, but its early to middle ranking cannot be called particularly satisfactory. The individual rankings for Pithouses 1, 4, and 5 include all possibilities. Pithouse 3 is the most perplexing in that two techniques indicate an early ranking and two a late one.

For the time being, we will assume that ceramic correlation makes a reasonable, if imperfect, working hypothesis as to the temporal relationships among the structures and extramural features of the site. As such, it provides some insight into the temporal-spatial use of the site.

Feature Patterning

The overall spatial organization of the site centers on a vague alignment of the pithouses. The

Table 50. Rank ordering of dates for Pithouses 1-5

Pithouse	Ceramic Correlation	Radiocarbon Range	Archaeomagnetism
1	2	1	3
2	2	1	-
3	1	2	1
4	3	1	2
5	3	-	1

Note: Values are 1 through 3 (earliest to latest); no value = missing data or rejected date.

order, from north to south, is: Pithouse 3, 2, 5, 1, 4, 7, and 8. Pithouse 6, west of the south end of the alignment, is the one exception. Since the pithouses were abandoned at different times, and therefore may have been built and occupied at different times, their near alignment was probably not for reasons of social organization, rather the result of topographic or geologic factors.

The extramural hearths, pits, postholes, and other features occur as clusters peripheral to this alignment, isolates away from the structures, and elements among the structures. The clustered and individual features, in a clockwise direction starting at the north end of the site, are outlined in Table 51.

Two things are immediately apparent when examining the table. One is that the clusters usually contain two or more types of features. Thus, the functions within the clusters were varied, if in fact some of the clusters represent the same component (see above discussion regarding temporal integrity of features within clusters). Secondly, only one type of feature, the deep pit, is limited to one area of the site, the vicinity of Pithouses 1 and 4.

As discussed earlier, the distribution of sherds from various vessels provides insight into intrasite use, but it is important to keep the limitations of the data in mind. First and foremost, the vessels do not link all of the site features. Nor are the data sufficiently fine-grained to allow for more than the delineation of very general temporal relationships, herein expressed in terms of four groups of features. Intragroup temporal relationships are partly supported and partly contradicted by other dating information.

With these problems in mind, we can postulate the following:

1. The space within the confines of the site, as currently known, was apparently used more or less in its entirety during most periods. That is, there was a tendency for the occupants to spread out their use-areas and to broadly scatter their trash over the entire site.

2. Even though the extramural hearths, pits, and other features tend to cluster, evidently not all features in a given cluster date to the same occupation or period of use. Certainly, not all of them were abandoned at the same time. Proximity of features does not necessarily indicate contemporaneity.

3. Our limited data suggest that there is no temporal correlation of specific structural forms or types of extramural features. There is no sequence of pithouse shapes, apparently reflecting the importance of personal preference rather than cultural dictate. For the most part, the size,

Table 51. Composition of the extramural feature clusters

Cluster	Feature Number	Feature Type
Feature 24	24a	borrow pit (?)
	24b	shallow pit (lined)
	24c	shallow pit (lined)
Feature 27	27a	unlined hearth
	27b	unlined hearth
	27c	unlined hearth
	27d	pot rest?
	27e	trash-filled low spot
	27f	pot rest?
Feature 31	31a	unlined hearths (2)
	31b	unlined hearth
	31c	shallow pit
Feature 5	5a	shallow pit
	5b	shallow pit
	5c	shallow pit
	5d	unlined hearth
	5e	unlined hearth
Feature 44	44a	rock-lined hearth
	44b	unlined hearth
	44c	unlined hearth
Feature 42	42a	rock-lined hearth
	42b	rock-lined hearth
	42c	rock-lined hearth
	42d	pit (conjectural)
	42e	rock-lined hearth
	42f	unlined hearth
	42g	rock-lined hearth
	42h	rock-lined hearth
	42i	unlined hearth
	42j	rock-lined hearth
	42k	rock-lined hearth

Cluster	Feature Number	Feature Type
	42k	posthole prior to 42k
	42l	post socket
	42m	trash-filled low spot
	42n	shallow pit
	42n	post socket next to 42n
	42o	shallow pit
	42p	post socket
	42q	post socket
	42r	unlined hearth
	42s	post socket
	42t	shallow pit
Feature 21	21a	posthole?
	21b	posthole?
	21c	posthole?
	21d	posthole?
Feature 32	32a	unlined hearth
	32b	shallow pit
	32c	shallow pit
	32d	unlined hearth
	32e	unlined hearth
Feature 33	33a	shallow pit
	33b	unlined hearth
	33c	post socket
Features 23, 25, 29	23a	adobe-lined hearth
	23b	unlined hearth
	23c	miscellaneous pit associated with 23b
	23d	miscellaneous pit associated with 23b
	23e	miscellaneous pit associated with 23b
	23f	unlined hearth
	23g	posthole
	23h	pit (conjectural)

Cluster	Feature Number	Feature Type
	23i	trash-filled low spot
	23j	trash-filled low spot
	23k	post socket
	23l	posthole
	25	unlined hearth
	29a-29d	four unlined hearths
	29e	posthole
	29f	pit
Isolated features	15	shallow pit
	4	unlined hearth
	39	unlined hearth
	48	two shallow pits
	41	trash-filled low spot
	38	shallow pit
Features among structures	16	deep pit
	18	deep pit
	26	deep pit
	40	function unknown

shape, and depth of hearths also lacked temporal correlates; the restriction of the undated partially and fully rock-lined hearths to the southern margin of the site may be an exception. Pit sizes, shapes, and depths also appear to lack temporal correlates, suggesting a variety of functional uses that spanned all, or potentially

In summary, the cultural content (particularly the structures and extramural hearths and pits) of the Belen Bridge Site was varied. We have some evidence for temporal differentiation among individual features or types of features, but we cannot ascertain whether the uses of the site changed during the history of the occupation. Given the relatively short span of the total occupation, we will assume that site use changed little, if any, during that time.

Subsistence Patterns

The Belen Bridge site has produced a wealth of biological information. The 100 lots of bone (1,461 elements), 58 flotation samples, 28 lots of plant macro-remains, and 28 pollen samples represent virtually all proveniences at the site.

Fauna

The variety of animal species, including fish and migratory waterfowl, is unusual. Like the plants, the list of exploited species is probably reasonably complete and therefore gives us fairly reliable data about this aspect of prehistoric life at Belen Bridge. The wide range in body sizes and habits represented by the many species indicate that almost every available vertebrate--small mammals, birds, fish, turtles--was used as the opportunity arose. Most of the species are normally available in the river, in the marshes along the river, in the saltgrass flats, or along the arroyo margins in the vicinity of the site.

Deer and pronghorn can be expected on an occasional basis in the bosque along the river, where they sometimes go for water and shelter. However, the primary deer habitat is mountain woodlands, and that of the pronghorn is the wide expanses of grasslands east of the site. It would be possible, then, to take these animals in the vicinity of the site on an occasional basis. However, we might expect that their exploitation on a regular basis would require travel to the primary habitats.

The presence of the mountain sheep and turkey in the assemblage is interesting in this regard. Both species are evidently restricted to the mountains and associated woodlands, and their procurement would have required at least several kilometers' travel each way. Thus, at least some long-distance hunting was done by the Belen Bridge site occupants.

Flora

The various botanical materials provide a fairly clear view of the species used for food, fuel, and perhaps some medicinal purposes. As Toll (this volume) points out, corn appears to have been the most important plant. The frequent use of cobs for fuel would increase the chance of preservation. However, the ubiquity of corn in the pollen samples is unusual and clearly emphasizes its importance. The frequency of corn parts and pollen are good evidence that corn was grown at or near the site.

The other plant species, however, are generally few in number and spotty in distribution. These plants evidently were gathered on an intermittent, opportunistic basis. The presence of beans and the two varieties of squash, particularly the green-striped cushaw, are noteworthy, as is the presence of the cotton pollen in the one burial.

The restriction of wild tobacco to one provenience, the hearth fill of Pithouse 2, suggests that this structure served a purpose at least in part different from that of the other pithouses. At the end of the first excavation phase and prior to the botanical analyses, this structure had been considered different on other criteria, namely its nearly round shape and the presence of two hearth and ventilator complexes. The interpretation of this structure as a kiva was contemplated. However, the finding of two more roundish structures in the second excavation phase caused this interpretation to be questioned. While the presence of the wild tobacco in Pithouse 2 tempts us to once again suggest that Pithouse 2 functioned as a kiva, the data are too ambiguous to permit a reliable interpretation.

The plant species represented in the macroremains and the flotation samples, as a group, also tell us something about the catchment area of the site. All but one of the plants (the piñon) could have been found growing in the local agricultural fields or in the general vicinity of the site. To collect them, the site occupants had only to walk a short distance from the site. Although piñon nut shell fragments were recovered from a few proveniences, evidently it was not present in quantity. Perhaps this is not so surprising considering the distance from the site to the mountains and the fact that piñon crops are intermittent and unreliable from year to year. Site function (to be discussed below) is yet another pertinent factor.

Summary

The subsistence data from the Belen Bridge site clearly indicate a reliance on numerous species of wild animals and wild and domestic plants. Species composition indicates that most of the procurement effort was spent within the riparian and lower bajada habitats near the site. The mountain sheep, turkey, and piñon (and perhaps deer and antelope) indicate some long-distance hunting and gathering was also undertaken.

Four domestic plants--corn, common beans, summer squash, and green-striped cushaw squash--evidently were all cultivated near the site. Of these, corn (cobs, kernels, pollen) is well represented, suggesting that it was the major focus of the diet. Gathered wild plants include both annual and perennial species. Gathered and/or hunted food animal species include large, medium, and small mammals, fish, migratory waterfowl, and turtles.

Site Function

Site Situation and the Local Settlement Pattern

Very little is known about the prehistoric settlement pattern of the Belen area. Judging by the few sites on record and a few others brought to our attention during the project, architectural sites dating from A.D. 1050 or 1100 to historic times are found in at least four topographic situations: the Rio Grande floodplain, the edge of the first terrace, the first terrace about 200 m back from the edge, and the edge of the second terrace. It is our impression that the earlier sites (A.D. 1050 or 1100 to 1300) are usually away from the river (edge of the second terrace and on the first terrace but away from the terrace edge), while the later sites are usually closer to the river (edge of the first terrace and on the floodplain). These observations are in at least partial disagreement with those of Marshall and Walt 1984 for the Rio Abajo, the archaeological district immediately south of Belen.

The Belen Bridge site, dating to the A.D. 1200s, is situated on the first terrace some 200 m back from the edge. This location lacks the immediate access to the floodplain, where soil and water conditions for agriculture, especially ditch irrigation, would presumably be the best, all other things being equal.

We assume that the Belen Bridge site occupants were not doing their agriculture on the floodplain, but where were they doing it? The only alternative is dry-farming on top of the terrace. Since the local annual precipitation is low for successful dry-farming (190 mm, or 7.5 inches), two conditions would have to be met for horticulture to be successful in this situation. Crops would have to be planted during years of above-average precipitation (cool, moist periods) and where moisture would be concentrated and conserved.

According to the reconstructed climate (see Environment section), three cool, moist periods occurred between A.D. 1160 and 1250: 1160 to 1180, 1190 to 1210, and 1230 to 1250. Between A.D. 1250 and 1295 the climate was warmer and drier. Although a cool, moist respite took place between 1265 and 1270, chances are that it was too short to permit significant groundwater recharge.

The second condition regards placement of the fields to take maximum advantage of the available runoff. The Belen Bridge site is located on the margin of a small, relatively short drainage having a watershed of only 1 to 2 square kilometers. While such a small drainage would not appear large enough for agriculture, particularly in an area of low precipitation, there could be advantages under the right conditions. Our experience during the two excavation phases convinced us of the ferocity of local thunderstorms. Torrents of rain fell on several occasions. Drainages with watersheds larger than Belen Bridge site wash would be more subject to flash floods generated by such storms. The larger drainages, because they would capture more rainfall, would wash away crops placed along their margins. The smaller drainages, with their smaller catchment areas, would capture smaller volumes of water from these storms and therefore appear to lack the damage potential of the larger drainages.

Structures

The presence of the pithouses implies a certain degree of residential permanence or else an anticipated regular return to the site. Why they are pithouses, rather than above-ground structures, can only be guessed. All of them evidenced time and effort in their construction, particularly with regard to the care expended in plastering the walls and hearths. The structures were so small that there was little floor space; storage features such as bell-shaped pits were few in number and occurred in only two structures. Except for the reorientation of the hearth and ventilator of Pithouse 2, none of the pithouses showed the evidence of repairs or remodeling normally considered indicative of long-term use.

The structures may be characterized as having been carefully built, probably in anticipation of either year-round or seasonal use over a series of years. Their extremely small size would seem to preclude year-round use simply because there would be virtually no room for both people and their simplest possessions.

Extramural Features

The Belen Bridge site had a large number of extramural features, including hearths, large and small pits, postholes and post sockets, and several features of unknown function. The 12:1 ratio of these features to pithouses is unusually high, perhaps in part because so much more of the site area was stripped than is normal for southwestern archaeology.

Five aspects of the extramural features are noteworthy: (1) most were formed by scooping out a hollow of the desired size and shape but involved no other labor-intensive work such as plastering, wall reenforcement, etc. (i.e., they show little concern for permanency of the facility); (2) the hearths generally show little evidence of extended use such as reddening, intense charcoal staining, or white ash in the fill); (3) many of the features occur in groups; (4) different feature types occur in any one group; and (5) the sherd matching/vessel correlation study suggests that all the features in any one group were not necessarily contemporaneous.

One of the most numerous classes consists of the presumed food storage pits. In spite of the large number of small (N = 17) and large (N = 3) pits, their total volume was about 9.5 cu m, or an average of 0.48 cu m per pit (range= 0.07-2.32; SD= 0.51). Removal of the three smallest pits from the sample and recalculation of the values gives virtually identical results (mean= 0.54; range= 0.16-2.32; SD= 0.52). With an average of 2.5 pits per structure, each structure had an average of 1.20 to 1.34 cu m of storage capacity in extramural pits.

Refuse Deposits

The refuse or trash deposits at the Belen Bridge site had two salient features. The first is their scarcity and small sizes, and the other is the intensity of dark stain in many of them. Virtually all of the deposits occurred in the upper fills of structures and large extramural pits. The virtual absence of trash outside of these locations, even in areas not deeply bladed in modern times, leads the writer to believe that most of the trash from the various occupations at Belen Bridge was deposited in the low places on the site surface. If this is true, then comparatively little trash was deposited at the site, particularly in light of the large number of structures and extramural features. This interpretation finds additional support in the fact that artifacts and other cultural debris were sparse.

Artifacts

Two aspects of the artifact assemblage are noteworthy. One is the variety in artifact types. The other is the low numbers of artifacts in each type and the general paucity of manufacturing debris at the site.

Hunting gear, plant-food-preparation tools, construction tools, 14 types of general purpose tools (including at least 6 types of informal tools), artifacts representing several kinds of ornamental/ceremonial and/or recreational activities, and sherds of many pottery vessels were recovered. Also, debris from the manufacture of stone tools and ornaments was recovered. Clearly, numerous and varied activities took place at the site, indicating that Belen Bridge was a home base rather than a limited-activity site.

But the rarity of artifacts at Belen Bridge is striking. Although many types of activities are represented, most categories of artifacts are represented by only one or at most a few items each. Complete artifacts are rare, and many of the broken ones are small fragments. These facts indicate that few artifacts were brought to the site in the first place. The underlying assumption, of course, is that the amount of tool breakage and discard at a particular location is directly related to the intensity of the activities performed there.

Subsistence Data

Two aspects of the subsistence data merit discussion. One is to reiterate that the ubiquity of corn (cobs, shanks, kernels, and pollen) at the site is a good indicator that horticulture was practiced at or near the site. Since corn pollen is scarce in known corn fields (Martin and Byers 1965:128), it is reasonable to conclude from the large number of pollen grains at Belen Bridge that corn in the husk, with tassels attached, was brought into the site. Thus, corn was undoubtedly grown at or very near the site.

Demonstrating seasonality of occupation is difficult at best. The presence of small numbers of many species of waterfowl at the Belen Bridge site is tempting in this regard. Since the Rio Grande is a migratory flyway, and the greatest number and variety of migratory species occur in the Belen area in the fall and spring, it is possible that the migratory species in the Belen Bridge site sample indicate occupation during those seasons. However, many of these same species also winter in the vicinity of Belen. Thus, about all we can deduce is that the waterfowl may indicate occupation of the site in the fall, winter, or spring, but not in the summer.

Human Interments

The presence of human burials at a site usually evokes the belief that the site was important enough for survivors to inter loved ones there. This may be arguable, but in a perusal of southwestern archaeological literature one most often finds burials at sites believed to be primary habitations, pueblos, etc., places that were in some sense permanent. In contrast, one does not expect to find burials at locations thought to be special-activity sites. The Belen Bridge site produced six burials, which suggests it was not a special-activity site.

Summary and Discussion

The salient aspects of the Belen Bridge Site can be summarized as follows:

1. The site is located along a small, intermittent drainage, which probably could be used only for runoff farming and then only in years of above-average rainfall; years which were too dry probably occurred fairly frequently, resulting in intermittent occupations.

2. Eight pithouses, all requiring some effort in their construction, are present. Not all of the structures were occupied at the same time. As few as one and perhaps as many as three were used at any one time (the site was used over a period of perhaps 100 years). All structures are extremely small, averaging only 3.88 sq m of floor area (range = 2.6-5.2 sq m). Interior fire pits indicate human occupancy of the structures, as opposed to a strictly storage function. Most structures lack facilities (floor pits, etc.) or floor space that would permit much storage. Only Pithouse 2 shows remodeling, perhaps to correct a problem rather than to renovate the structure to extend its use-life.

3. A large number of extramural features are present at the site. Although most of these features occur in groups, evidently not all features within a group date to the same occupation. The numerous hearths show little or no sustained burning; reddening around the edges, when it occurs, is minimal in intensity and extent. The numerous pits are believed to have been used to stored foodstuffs; the average storage volume per pit is 0.48 cu m, or 1.2 to 1.34 cu m per pit structure (at 2.5 pits per structure).

4. Refuse deposits were mainly in the fills of structures and the large extramural pits. For the site overall, the amount of refuse, whether measured in terms of size and number of trash deposits or in total number of artifacts, was small.

5. Comparatively few formal and informal artifacts were recovered. The numerous classes and categories of artifacts represent a wide variety of activities, suggesting that the site served as a home base more or less the year round.

6. However, most classes and categories of artifacts are represented by only one or at most a few examples, suggesting that the actual amount of work performed in any one activity was fairly low.

7. Corn agriculture was practiced near the site, and the harvest was stored and/or processed in the structures.

8. Six human burials seems a large number for such a small site, suggesting the site was considered important (as in a spiritual center or home place?), like a main village, as opposed to something more ephemeral, like a fieldhouse.

These observations are contradictory in terms of characterizing the occupation of the site. Most points (1-4, 6, and 7), taken together, support a comparatively short-term occupation: either as one short-lived "permanent" occupation (i.e., an occupation intended to be long-term but which failed soon after it was established), or as two or more even shorter occupations on a seasonal basis, such as for farming. The radiocarbon dates for the structures, the differential distribution of trash in the structures, and the ceramic evidence for noncontemporaneity of some features within the extramural groups rule out the former interpretation, at least as the only explanation.

Points 5 and 7, on the other hand, support the interpretation that the site was permanent. However, regarding the numerous activities inferred from the great variety of formal artifacts, it is perhaps useful to remember the paper by L. Binford on the Inuit (1978), in which numerous, diverse activities were carried on during the wait at a hunting blind. Farmers, during breaks from farming or while protecting crops, might do any number of things to pass the time in a useful manner. As in the case of the Inuit, these activities might then leave a variety of evidence and mislead the archaeologist into interpreting the site as a "permanent" habitation rather than a special-use site. Thus, in spite of points 5 and 7, interpretation of the site as a special-use location seems to be more in keeping with the data.

If the Belen Bridge site was a special-use location (a "fieldhouse" site), there is no ready explanation for the large number of burials. Assuming that the basic, untested assumption regarding burial tendencies (discussed above) is valid, one may postulate any variety of conditions to explain the Belen Bridge situation. One of the more attractive possibilities is that the site was occupied over several decades by successive generations of the same family. Under these conditions, the site could have become a favored location and therefore a suitable place for burial.

Ambiguities aside, the interpretation made here is that the Belen Bridge site was a seasonal farm used during wetter than average years. It is believed that the people, who used only one, two, or three of the structures at a time, were growing their crops along the small, intermittent drainage that forms the north boundary of the site. The general paucity of refuse clearly indicates they were relatively short and involved a variety of activities associated with day-to-day living. If this interpretation is correct, then the site and its owners belonged to a larger, more permanent village located elsewhere.

The Belen Bridge Site and the Late Elmendorf Phase

Marshall and Walt (1984:95-98) define the Late Elmendorf phase solely on the basis of survey data. This Pueblo III manifestation dates A.D. 1100 to 1300 and is marked by the addition of White Mountain Red wares to an indigenous pottery assemblage carried over from the preceding Early Elmendorf phase. The authors' description of Late Elmendorf Phase sites is worth quoting at length here:

> Late Elmendorf sites appear in two distinct situations. The isolated unit hamlets and nucleated villages continue to be built upon exposed and open benches, locations characteristic of the Tajo and Early Elmendorf pattern. Large masonry pueblos, however, appear upon elevated buttes, knolls, and benches in potentially defensible situations. The single Late Elmendorf nonstructural site is on a low terrace in a situation characteristic of scatter components throughout the regional continuum. A great variety of architectural styles and building materials were employed in the construction of Late Elmendorf structures, but the development of large, contiguous-room, masonry pueblos characterizes the period. Cobble-based and cobble masonry-based isolated hamlets . . . and nucleated village sites . . . appear to have been occupied into the Late Elmendorf period, but it is clear that less than 5 percent of the population inhabited such dwellings; it is possible that eventually all occupations in open, non-defensive locations were suspended. (Marshall and Walt 1984:95)

Regarding pithouses, the authors continue:

> There are 13 pitstructures on six sites of Late Elmendorf affinity. These pitstructures represent 3 percent of all rooms, in contrast to the Early Elmendorf period, when 16 percent of all rooms were subterranean. Late Elmendorf pitstructures often appear in plaza areas and thus, in terms of context, they resemble kivas. In some cases, however, . . . the pitstructures are simply adjacent to the surface units, and the pattern of site structure resembles that of earlier time periods. Most pitstructures are circular, 4-8 meters in diameter, with or without gravel berms. There are, however, three rectangular units, two at Bowling Green (LA 5384) and one at Veranito Pueblo (LA 6422). (Marshall and Walt 1984:97)

Clearly, the Belen Bridge site differs dramatically from the Marshall and Walt description. Ceramically speaking, Belen Bridge, with its plentiful St. Johns Polychrome and related types, qualifies as Late Elmendorf Phase. But, for all practical purposes, here the similarities end. For instance, most of the known Late Elmendorf-phase sites are located on *mesitas*, pinnacles, and along the edges of the terraces above the Rio Grande. It should be noted that some, including Upper Pueblito Village (Marshall and Walt 1984:111ff.), are situated back from a terrace edge, as is Belen Bridge.

The Belen Bridge site architecture appears to provide the strongest contrast with Late Elmendorf-phase criteria. It is clear from the description quoted above that pueblo-style buildings are thought to be the primary architectural form for the Late Elmendorf phase. Pit structure depressions, an unknown number of which might be kivas, are present at many of the Late Elmendorf pueblos. However, in the absence of excavation, nothing is known about the details of the pit structures and their functions, nor has it been demonstrated through excavation that they actually are pit structures. The Belen Bridge pithouses, which are obviously domiciles, small, and the only architectural form at the site, significantly extend the definition of the phase.

The question arises whether the Belen Bridge site is anomalous or whether sites like it were missed by the Rio Abajo survey. Given the fact that the Belen Bridge site, prior to excavation, looked like any number of small, nondescript sherd and lithic artifact scatters, oversight or misidentification during survey would not be surprising. Future archaeological surveyors will have to thoroughly search terraces (rather than just the edges), record all manifestations, and emphasize the possibilities for subsurface structures in their reports, no matter how insignificant the sites appear to be.

The Belen Bridge Site in Broader Perspective

Pithouse architecture is a hallmark of early Formative (early pottery) cultures throughout much of the Southwest (Bullard 1962). Traditional culture histories frequently make the point that pithouses were an important house form early but were later replaced by above- ground, pueblo-style structures during the Late Formative. Depending on the region, the timing of this change varied, but, in most, the switch had taken place by A.D. 900 (cf. various papers in Ortiz 1979).

For most Anasazi regions, the prevailing view is that pithouses, at the time of the switch to pueblos, evolved into the ceremonial structure, the kiva. Except as noted below, pithouses were no longer built or used. Some Southwestern archaeologists are now seeking the reasons for these changes (Gilman 1987, for instance), while others are questioning our ideas about the timing of the pithouse to kiva transition (Lekson 1988).

A major exception to the foregoing has been widely recognized for some time. Pithouses were built and used as domiciles in the Kayenta district of northeastern Arizona essentially up until the abandonment in Pueblo III times (Hobler 1974). Less well known is the number of late-dating pithouses that have been excavated throughout much of the Anasazi area in New Mexico by various contract archaeology firms over the past 15 years. Some of these pithouses are in fieldhouse contexts (Wiseman 1980a; Chapman et al. 1977), and others are in the more substantive farm village context (Wiseman 1980b). In fact, pithouses have been documented in the Rio Grande from Basketmaker II to early historic times (Reinhart 1967, Basketmaker II; Frisbie 1967, Basketmaker III-Pueblo I; Skinner 1965, Pueblo II; Wiseman 1980b, Pueblo III; Lange 1968, Pueblo IV; Oakes 1988, Pueblo V).

More importantly, we need to learn why the pithouse was used for such a long time. The traditional idea that it was an inferior house form replaced by the superior pueblo-style structures through "cultural evolution" is no longer a tenable argument, except perhaps in a limited manner, as will soon be discussed. The fact that pithouses were built and used in some areas throughout the pueblo-building period indicates important functional aspects that led to their continual use.

Stuart and Farwell, in their study of late-dating pithouses in New Mexico (1983), make several interesting observations pertinent to this discussion. These, plus the perspective offered by the Belen Bridge site, may be summarized as follows:

1. Late pithouses fall into two general temporal groups, one representing the early to mid-Pueblo III period (ca. A.D. 1102 to 1245) and the other the Pueblo III/Pueblo IV period (ca. A.D. 1304 to 1375). This leaves the hiatus ca. A.D. 1245 to 1304, during which pithouses apparently were infrequently used (Stuart and Farwell 1983:139-140). Although the absolute dates from the Belen Bridge site do not permit the pinpoint accuracy desired in such discussions, it is fairly certain that it was occupied during the hiatus as well as before it.

2. Late pithouses occur in five elevational clusters: 1,548 to 1,622 m, 1,713 to 1,798 m, 1,951 to 1,981 m, 2,085 to 2,286 m, and 2,353 to 2,514 m. Three-fourths of the sites lie above 2,085 m (6,840 ft); the two elevational groups "represent two distinct, temporarily discontinuous,

construction and settlement episodes," with the earlier sites primarily in the higher group and the later ones in the lower group. Sites bearing St. Johns Polychrome appear to be an exception (Stuart and Farwell 1983:140-143). The Belen Bridge site, with its copious quantities of St. Johns Polychrome, is situated at 1,471 m elevation and provides an exception to the foregoing, as predicted by Stuart and Farwell.

3. The later pithouse sites are generally larger than the earlier ones, though the later sites are at "atypically low (1622 meters or less) settings" and "again become smaller" (Stuart and Farwell 1983:143-146). Although the Belen Bridge site has eight structures, probably no more than three of them were in use at a time. This qualifies the site as small, thereby meeting Stuart and Farwell's expectations.

4. Late pithouse depth tends to correlate with elevation: the higher the elevation, the deeper the structure, and vice versa. The average depth of the lowest elevation group (1,548 to 1,829 m) is 0.982 m, with a standard deviation of 0.603 (Stuart and Farwell 1983:146-148). The depths of the Belen Bridge site structures fall within these values.

5. The later the pithouse sites in general, the more trade pottery they contain. Sites containing the trade type St. Johns Polychrome may in part fall within the crucial time period (second half of the 1200s), between the early and late pithouse sites, and therefore are of particular interest to Stuart and Farwell. St. Johns Polychrome sites, as a whole, lie at lower than average elevations, and the average number of structures per site generally falls between the averages for the earlier and the later sites (Stuart and Farwell 1983:152-154).

The Belen Bridge site shares most of these traits. St. Johns Polychrome is the dominant trade ware among several types, and the dates for the site are the A.D. 1200s. As discussed earlier, the site is situated at a low elevation. The potential point of difference is the number of structures used at any one time. The evidence indicates that not all were in use at the same time, and the writer guesses that no more than three were, thereby qualifying the site as small.

To summarize, the Belen Bridge site fits most of the expectations outlined by Stuart and Farwell for thirteenth-century pithouse sites at low elevations in New Mexico. Perhaps the most intriguing aspect is the presence of comparatively large numbers of St. Johns Polychrome vessels and the closely related types St. Johns Black-on-red, Springerville Polychrome, and Heshotauthla Polychrome. This pattern is discussed more fully below.

Stuart and Farwell relate the significance of their observations, at least in part, to changes in climate and seasonality of rainfall. The underlying premise is that, as conditions for agriculture deteriorated because of a prolonged drying trend, many peoples moved into the higher elevations, where more moisture was available. Pithouses were used to ameliorate the effects of the cooler climate. Climatic fickleness at the higher altitudes forced them to rely more heavily on gathered wild plants and animals than had previously been their custom. But the move to the mountains also brought them into conflict with already resident populations (Stuart and Farwell 1983:154-158).

How do the low elevation sites such as Belen Bridge fit into the picture? Stuart and Farwell touch on a few aspects that may pertain but do not attempt a comprehensive explanation. For instance, they note that, in some higher altitude sites, shallow pithouses occur beside deep ones. However, after suggesting that the shallow structures were summer structures and the deep ones winter structures, they dismiss the notion as nonsensical (Stuart and Farwell 1983:147). Elsewhere, they note that during the transition from Pueblo III to Pueblo IV, the pithouses at some sites were the first houses built, only to be replaced by pueblo-style structures later in the occupation (Stuart and Farwell 1983:157).

The writer (Farwell et al. 1993) recently restudied one of the sites considered by Stuart and Farwell, the Crockett Canyon site (LA 2315), which contained both shallow and deep pithouses. A seriation of the pottery suggests that only some of the structures were contemporary. Because some shallow structures and deep structures seriated together, they are believed to have been contemporaneous, perhaps as warm- and cold-season alternatives. This interpretation is in keeping with the fact that the site is situated in a narrow, deep valley, which is subject to cold-air drainage from the Sierra Blanca. This interpretation is contrary to that offered by Stuart and Farwell (1983).

It is interesting in this regard to consider the results of a study done by G. E. Archer (1978) on turn-of-the-century homesteading in the Texas Panhandle. As I wrote elsewhere:

> It is suggested here that the pit room may be seen as an adaptive response in at least two ways. A study by Archer (1978) revealed that, when first inhabiting the continent, and again during western expansion, homesteaders built dugouts or pit rooms because they were a quickly and easily constructed shelter which served until more satisfactory quarters could be built (Archer 1978:2). This seems to have been the intention at the eastern sector of the Alfred Herrera Site (Lange 1968) and at LA 70 (Snow 1976) where the first dwellings were aligned pit rooms. In both instances, the rooms were apparently abandoned later on when the inhabitants built and occupied nearby surface structures (pueblos). Apparently some of the pioneer Anglo families continued to lived in dugouts even after other options became available, simply because they had grown to appreciate the advantages offered by subsurface dwellings over surface dwellings (M. Freeman 1978: pers. comm.).
>
> Other adaptive consequences of pit room or dugout architecture are, in addition to their easy, cheap construction, that they are warmer in the winter, cooler in the summer, and give better protection from winds; they need less fuel to keep warm (Archer 1978:20ff). The ill effects of dugout dwellings are their susceptibility to dampness, ease of access by snakes and insects, and poor adaptation to heavy rains and snowfall (Archer 1978:20ff). Thus, depending upon [individual] tolerances, the homesteaders and presumably the Indians . . . might choose on a personal basis. (Wiseman 1980b:144-145)

One other aspect of the Belen Bridge site requires consideration. Among others, S. Upham (1982) advanced the idea that late prehistoric (Pueblo IV) peoples in northeastern Arizona had stratified societies ruled by an elite. Further, the elite formed alliances and exchanged status goods as symbols of their power and prestige. St. Johns Polychrome, the most widely traded Pueblo III White Mountain red ware, may have been a marker of the alliance and its associated exchange system in its infancy. Certainly, the differential distribution of St. Johns Polychrome in New Mexico sites as discussed by Stuart and Gauthier (1981) is most interesting and seems to lend support to Upham's thesis.

The Belen Bridge site, though, raises another question. Since status items are inherently valuable, one would reasonably expect them to be carefully protected from damage or loss. One would expect them to be kept in the main village where their display would have the most social and political impact. If the Belen Bridge site was indeed a farm site, neither of these conditions would be met. Thus, the presence of St. Johns vessels in the Belen Bridge site does not appear to be referable to an alliance system such as that described by Upham and Reed (1989). That does not mean that the exchange network highlighted by St. Johns Polychrome was not the precursor upon which an elite exchange system was built during the next century (A.D. 1300s). Pottery Mound (LA 416), about 26 km northwest of the Belen Bridge site, evidently was part of a far-reaching network, for it has produced sherds of all Hopi Yellow wares, especially Jeddito Black-on-yellow and Sikyatki Polychrome.

SUMMARY AND CONCLUSIONS

Excavations at the Belen Bridge site (LA 53662) uncovered eight small pithouses and nearly 100 hearths, pits, postholes, and other extramural features. Trash deposits were few and limited in size but relatively rich in cultural materials. The overall abundance of cultural items was low compared to the number of structures, extramural features, and area excavated.

Artifact diversity is fairly high, but the numbers of artifacts per type and category are low. Judging by the structures, features, artifacts, and plant and animal remains, occupants of the site engaged in habitation; farming; hunting; food storage, preparation, and consumption; and the manufacture and repair of hunting gear, ornaments, tools, and possibly pottery, basketry, and leather goods.

The range of activities would be sufficient under most circumstances to label the site as a permanent occupation, implying intensive use of the location for many months or years. However, several lines of evidence suggest this was not the case and that the site was an intermittent fieldhouse or farm village that belonged to a home pueblo, located elsewhere. The reasons are as follows:

1. The structures were small and evidently were not all occupied at the same time. As few as one or perhaps as many as three were in use at any one time.

2. Extramural hearths and pits show minimal effort in construction and little use.

3. Trash deposits are few, and the total number of artifacts is low.

4. The site is located away from the Rio Grande, suggesting that farming was not being done on the floodplain. Alternative farming locations are the small drainages on top of the terrace, such as the one running along the north side of the site.

5. The catchment areas of these drainages are so small that above-average moisture was probably necessary for farming.

6. Climatic reconstruction indicates that, during the occupation span of the site, the climate was characterized by cool/moist periods interspersed by warm/dry periods. Thus, the number of years during which farming was possible was limited and intermittent.

7. Several different kinds of activities were performed at the site, reflecting a situation similar to that documented by Binford for an Inuit hunting stand (1978). In that case, while waiting for game, the hunters would perform a variety of tasks, many of them not related to a hunting situation. In the same way, farmers at a field side location, during respites from farming, could be doing other tasks.

The site has been dated by several means, including relative and absolute techniques. These dates are in agreement and suggest two or more discrete occupations in the A.D. 1200s.

The pottery complex of the Belen Bridge site clearly belongs to the Late Elmendorf phase of Marshall and Walt's Rio Abajo Province (1984). The site enhances the definition of the phase in that pithouse sites are potentially more numerous and therefore more important to economic and social dimensions than previously thought.

The presence of numerous St. Johns Polychrome vessels at the site is relevant to two studies. The Belen Bridge site meets many of the criteria discussed by Stuart and Gauthier (1981) for New Mexico sites containing this pottery type: St. Johns sites have geographic characteristics indicating that they are in some sense unique. Second, the Belen Bridge site appears to contradict Upham and Reed's (1989) ideas regarding Western Pueblo stratified societies, political alliances, and exchange in status goods. But since Upham is speaking of fourteenth-century developments (not thirteenth-century ones), the exchange network marked by the spread of St. Johns Polychrome could have formed the basis for the later development of the alliance system they envisage. Certainly, the proximity of Pottery Mound several kilometers northwest of the Belen Bridge site raises intriguing possibilities.

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APPENDIX 1: Data on Pottery Vessels Used in Provenience Correlation Study

Vessel ID Number	Type	Catalog Number	Provenience
1	Socorro Black-on-white (#1)	14-12	Pithouse 1, Stratum 4 (floor fill)
		17-3	Pithouse 3, Level 1 (0-25 cm)
		17-46	Pithouse 3, Level 3 (30-50 cm)
		20-110	stripping east of Pithouse 4
		24-1	stripping (0-15 cm)
2	Socorro Black-on-white (#2) (could be same as Vessel 1)	14-90	Pithouse 1, Stratum 3 (50-60 cm)
		17-7	Pithouse 3, general stripping
		17-14	stripping east of Pithouse 17
		17-46	Pithouse 3, Level 3 (30-50 cm)
		20-2	Pithouse 4, Stratum 1
		32-6	stripping over pits, etc. 32a-32e
3	Socorro Black-on-white (#8)	20-4	Pithouse 4, floor fill
		20-19	Pithouse 4, Stratum 3
		24-4*	Pit 24a fill
		34-6*	Pithouse 5 floor fill
		40-9	test pit, stripping
		48b-9	Pit 48b fill
4	Chupadero Black-on-white (#18)	10-2	Pithouse 2, stripping (0-40 cm)
		10-13*	Pithouse 2, Level 2 (40-70 cm)
		10-14*	Pithouse 2, Level 2 (40-70 cm)
5	Chupadero Black-on-white (#2)	10-13	Pithouse 2, Level 2 (40-70 cm)
		10-41*	Pithouse 2, Level 3 (70-90 cm)
		14-33	Pithouse 1, Stratum 3 (60-80 cm)
		18-4	Pit 18, Level 3 (50-60 cm)
		18-9	Pit 18, Level 1 (20-35 cm)
		20-19*	Pithouse 4, Stratum 3
6	Chupadero Black-on-white (#3)	5-13	Stripping over Pits 5a-5c
		14-27	Stripping south of Pithouse 1
		14-79	Pithouse 1, Stratum 1, compact overburden
		18-9	Pit 18, Level 1 (20-35 cm)

		18-10	Pit 18, Level 2 (35-50 cm)
		31-3	Pit 31b fill
7	Socorro Black-on-white (#7)	10-2*	Pithouse 2, stripping (0-40 cm)
		10-13*	Pithouse 2, Level 1 (40-70 cm)
		10-43	Pithouse 2, Level 4 (90 cm-floor)
		24-4	Pit 24a fill
8	Cebolleta (?) Black-on-white (#11)	10-13	Pithouse 2, Level 1 (40-70 cm)
		20-4	Pithouse 4, Stratum 4 (floor fill)
9	Cebolleta (?) Black-on-white (#12)	14-27	stripping south of Pithouse 1
		32-6	stripping over pits, etc. 32a-32e
10	Tularosa Black-on-white (#3)	17-14	stripping east of Pithouse 3
		20-12	Pithouse 4, Stratum 2
		20-19	Pithouse 4, Stratum 3
		48b-9	Pit 48b fill
11	Tularosa Black-on-white (#7)	18-7	Pit 18, Level 5 (70 or 80-90 cm)
		32-6	stripping over pits, etc. 32a-32e
		33-3	Pit 33b fill
12	Kowina Black-on-white (#1)	5-13	stripping over Pits 5a-5c
		14-33	Pithouse 1, Stratum 3 (60-80 cm)
		15-12	Pit 15, Level 1 (0-10 cm)
		18-9	Pit 18, Level 1 (20-35 cm)
		20-2	Pithouse 4, Stratum 1
		24-1	stripping over Pits 24a-24c (0-15 cm)
		26-1	Pit 26 fill
		32-1	Pit 32e fill
		34-5	test pit fill
13	Santa Fe Black-on-white (#9)	14-33	Pithouse 1, Stratum 3 (60-80 cm)
		14-40	Pithouse 1, Stratum 3 (80-100 cm)
		14-49	Pithouse 1, Stratum 3 (33-60 cm)
		24-1?	stripping over Pits 24a-24c
14	Santa Fe Black-on-white (#10)	5-4	Pit 5a upper fill (0-15 cm)
		5-13	stripping over Pits 5a-5c
		10-13	Pithouse 2, Level 1 (40-70 cm)
		14-27	stripping south of Pithouse 1

		14-65	test pit Level 3 (40-60 cm)
		17-7	general stripping over Pithouse 3
		17-14	stripping east of Pithouse 3
		24-1	stripping over Pits 24a-24c
		45-1	Pithouse 7, stripping and upper fill
		48-1	stripping over Pits 48a-48b
15	Los Lunas Smudged	10-43*	Pithouse 2 lower fill (90 cm-floor)
		14-29*	stripping west of Pithouse 1
16	Los Lunas Smudged	18-4*	Pit 18, Level 3 (50-60 cm)
		18-10*	Pit 18, Level 2 (35-50 cm)
17	McElmo-like Black-on-white (#7)	14-27	stripping south of Pithouse 1
		14-37	Pithouse 1, Stratum 2 (ash lens)
		14-79	Pithouse 1, Stratum 1 (compact overburden)
		14-101	Pithouse 1, Stratum 2 (ash lens)
18	Tularosa Black-on-white with carbon paint (#1)	5-13	stripping over Pits 5a-5c
		14-37	Pithouse 1, Stratum 2 (ash lens)
		14-25	Pithouse 1, Stratum 4
19	Tularosa Black-on-white with carbon paint (#2)	33-5	stripping over pits, etc. 33a-33c
		33-6	Pit 33a fill
20	Tularosa Black-on-white with carbon paint (#3)	14-12	Pithouse 1, Stratum 4 (roof fall)
		14-25	Pithouse 1, Stratum 4
		14-53	Pithouse 1, Stratum 3 (100 cm to top of Stratum 4)
		14-100	Pithouse 1, Stratum 4 (ash lens)
21	Tularosa Black-on-white with carbon paint (#4)	X-12*	stripping between Pithouse 1 and Pits 5a-5c
		14-37*	Pithouse 1, Stratum 2 (ash lens)
22	Tularosa Black-on-white with carbon paint (#5)	14-37	Pithouse 1, Stratum 2 (ash lens)
		14-64*	test pit, Level 2 (20-40 cm)
		15-13	Pit 15 upper fill (0-10 cm)
		45-1*	Pithouse 7, stripping and upper fill
23	St. Johns Polychrome (#1)	18-10	Pit 18, Level 2 (35-50 cm)
		18-12	Pit 18, Level 7 (bottom fill or 120-130 cm)

		40-9	test pit, stripping
24	St. Johns Polychrome (#2)	27-2	Pit 27b fill
		32-6	stripping over pits, etc. 32a-32e
		45-1	Pithouse 7, stripping and upper fill
		47-1	Pithouse 8 fill
25	St. Johns Polychrome (#3)	5-2	Pit 5a fill
		X-19	East Area stripping (Phase 2)
26	St. Johns Polychrome (#4)	14-29	Stripping west of Pithouse 1
		14-53	Pithouse 1, Stratum 3 (100 cm to top of Stratum 4)
		14-63	Pithouse 1, Test Level 1 (0-20 cm)
		32-5?	Pit 32a fill
27	St. Johns Polychrome (#5)	18-4	Pit 18, Level 3 (50-60 cm)
		18-13	Pit 18, Level 4 (65-70 or 80 cm)
28	St. Johns Polychrome (#10)	10-41	Pithouse 2, Level 3 (70-90 cm)
		18-4	Pit 18, Level 3 (50-60 cm)
		20-4	Pithouse 4, Stratum 4 (floor fill)
		23-1	stripping over pits, etc. 23a-23l
29	St. Johns Polychrome (#12)	14-5	Pithouse 1, Stratum 4 (floor fill)
		14-33	Pithouse 1, Stratum 3 (60-80 cm)
30	Springerville Polychrome (#14)	5-10	stripping west of Pits 5a-5c
		32-6	stripping over pits, etc. 32a-32e
31	St. Johns Black-on-red or Polychrome (#19)	14-63	Pithouse 1, Test Level 1 (0-20 cm)
		14-65	Pithouse 1, Test Level 3 (40-60 cm)
32	Springerville Polychrome (#23)	X-12	stripping between Pithouse 1 and [REG?]
		5-13	stripping over Pits 5a-5c
		14-64	Test Level 2 (20-40 cm)
		18-4?	Pit 18, Level 3 (50-60 cm)
33	St. Johns Black-on-red (#24)	14-27	stripping south of Pithouse 1
		14-29	stripping west of Pithouse 1
		18-4	Pit 18, Level 3 (50-60 cm)
		18-10	Pit 18, Level 2 (35-50 cm)
		18-13	Pit 18, Level 4 (65-70 or 80 cm)
		20-19	Pithouse 4, Stratum 3

		43-4	Pithouse 5, floor fill
34	St. Johns Black-on-red (#25)	18-4	Pit 18, Level 3 (50-60 cm)
		20-2	Pithouse 4, Stratum 1
35	Elmendorf Black-on-white (#20)	14-27*	stripping south of Pithouse 1
		14-33	Pithouse 1, Stratum 3 (60-80 cm)
		17-7	stripping over Pithouse 3
		18-4*	Pit 18, Level 3 (50-60 cm)
		18-9	Pit 18, Level 1 (20-35 cm)
		18-10*	Pit 18, Level 2 (35-50 cm)
		23-1*	stripping over pits, etc. 23a-23l
		23-2*	Pit 23b fill
		45-2*	Pithouse 7, lower fill
36	Elmendorf Black-on-white (#21)	5-13	stripping over Pits 5a-5c
		14-8*	Pithouse 1, floor fill
		32-6	stripping over pits, etc. 32a-32e
		32-7*	Pit 32b fill
37	Elmendorf Black-on-white (#22)	10-14	Pithouse 2, Level 2 (40-70 cm)
		20-12	Pithouse 4, Stratum 2
38	Elmendorf Black-on-white (#23)	18-12	Pit 18 bottom fill
		24-1	stripping over Pits 24a-24c
		40-9*	test pit, stripping
39	Elmendorf Black-on-white (#28)	5-13*	stripping over Pits 5a-5c
		14-29	stripping west of Pithouse 1
		14-33	Pithouse 1, Stratum 3 (60-80 cm)
40	Elmendorf Black-on-white (#47)	5-13	stripping over Pits 5a-5c
		14-37	Pithouse 1, Stratum 2 (ash lens)
		14-63	Pithouse 1, Test Level 1 (0-20 cm)
41	Elmendorf Black-on-white (#52)	17-69	Pithouse 3, Test Level 2 (25-30 cm)
		17-92	Pithouse 3, Level 3 (30-50 cm)
		24-1	stripping over Pits 24a-24c
42	Elmendorf Black-on-white (#56)	10-13*	Pithouse 2, Level 2 (40-70 cm)
		18-17	Pit 18, Level 5 (70 or 80-90 cm)
		20-4*	Pithouse 4, Stratum 4 (floor fill)
		32-3*	stripping over Pits 32a-32c

		48-1*	stripping over Pits 48a-48b
43	Elmendorf Black-on-white (#57)	23-1*	stripping over pits, etc. 23a-23l
		33-3*	Pit 33b fill
44	Elmendorf Black-on-white (#58)	32-6*	stripping over pits, etc. 32a-32e
		33-9*	Pit 33a fill
45	Elmendorf Black-on-white (#60)	15-4	stripping east of Pit 15
		20-4*	Pithouse 4, Stratum 4 (floor fill)
		33-7*	stripping over Pits 33a-33c
46	Elmendorf Black-on-white (#61)	20-2*	Pithouse 4, Stratum 1
		20-12*	Pithouse 4, Stratum 2
		20-19*	Pithouse 4, Stratum 3
		40-9*	test pit, stripping
47	Elmendorf Black-on-white (#62)	17-4*	Pithouse 3 floor fill
		17-29*	Pithouse 3 floor contact
		17-103	Pithouse 3 floor fill
48	Elmendorf Black-on-white (#63)	17-4*	Pithouse 3 floor fill
		17-29*	Pithouse 3 floor contact
49	Elmendorf Black-on-white (#65)	X-12	stripping between Pithouse 1 and Pits 5a-5c
		14-37	Pithouse 1, Stratum 2 (ash lens)
50	Elmendorf Black-on-white (#68)	14-37*	Pithouse 1, Stratum 2 (ash lens)
		14-79*	Pithouse 1, Stratum 1 (compacted overburden)
51	Elmendorf Black-on-white (miscellaneous restored sherd)	10-2*	stripping over Pithouse 2 (0-40 cm)
		10-14*	Pithouse 2, Level 1 (40-70 cm)
		10-41*	Pithouse 2, Level 2 (70-90 cm)
52	unnamed black-on-white A (#11)	18-2	Pit 18, Level 6 (90-120 cm)
		18-7	Pit 18, Level 5 (70 or 80-90 cm)
		20-19	Pithouse 4, Stratum 3
53	unnamed black-on-white (#12)	14-79?	Pithouse 1, Stratum 1 (compacted overburden)
		18-7	Pit 18, Level 5 (70 or 80-90 cm)
		20-12	Pithouse 4, Stratum 2
		45-2	Pithouse 7 lower fill
54	unnamed black-on-white (no #)	14-68	Pithouse 1, Test Level 4 (60-80 cm)

		18-2	Pit 18, Level 6 (90-120 cm)
55	St. Johns Polychrome (#11)	10-13	Pithouse 2, Level 2 (40-70 cm)
		48b-9	Pit 48b fill
56	St. Johns Polychrome (#9)	10-41	Pithouse 2, Level 3 (70-90 cm)
		20-4	Pithouse 4, Stratum 4 (floor fill)
		45-1	Pithouse 7, stripping and upper fill
57	Elmendorf Black-on-white (#25)	14-40	Pithouse 1, Stratum 3 (80-100 cm)
		15-10*	stripping over Pit 15
		45-2*	Pithouse 7 lower fill
58	Elmendorf Black-on-white (#88)	45-1*	Pithouse 7, stripping and upper fill
		45-2*	Pithouse 7, lower fill
59	Elmendorf Black-on-white (#71)	18-2*	Pit 18, Level 6 (90-120 cm)
		40-9*	test pit, stripping
		42d-4	Pit 42d fill
60	unidentified black-on-white (#13)	18-9	Pit 18, Level 1 (20-35 cm)
		32-5*	Pit 32a fill
		32-6*	stripping over pits, etc. 32a-32e
		48-1	stripping over Pithouse 8
61	Tularosa Black-on-white (#2)	5-13	stripping over Pits 5a-5c
		43-4	Pithouse 6 floor fill
		45-1	Pithouse 7 stripping and upper fill
62	unnamed black-on-white B (#14)	14-83	Pithouse 1 overburden
		14-96	Pithouse 1, Stratum 3 (100 cm to top of Stratum 4)
		45-1	Pithouse 7, stripping and upper fill
		45-2	Pithouse 7, lower fill
63	unnamed black-on-white B (#15)	24-5	Pit 24b fill
		45-2	Pithouse 7, lower fill

* Proveniences producing sherds that fit together.
? Questionable fit

APPENDIX 2: Feature Correlation List

Vessel ID Number	Provenience	Correlated Provenience
Pithouse 1 (Feature 14)		
6	overburden	Pit 18 fill (20-50 cm)
31	fill (0-20 cm)	Pithouse 1 fill (40-60 cm)
32	fill (20-40 cm)	Pit Group 5 stripping
32	fill (20-40 cm)	stripping between Pithouse 1 and Pit Group 5
17	stripping	Pithouse 1, Stratum 1
17	stripping	Pithouse 1, Stratum 2
18	Stratum 2 (ash lens)	Pithouse 1, Stratum 4
50*	Stratum 2 (ash lens)	Pithouse 1, overburden
22	Stratum 2 (ash lens)	Pit 15 fill (0-10 cm)
2	Stratum 3 (50-60 cm)	Pithouse 3 stripping
2	Stratum 3 (50-60 cm)	Pithouse 3 fill (30-50 cm)
2	Stratum 3 (50-60 cm)	Pithouse 4, Stratum 1
14	Level 3 (40-60 cm)	Pithouse 2 fill (40-70 cm)
39*	Stratum 3 (60-80 cm)	Pit Group 5 stripping
12	Stratum 3 (60-80 cm)	Pit 18 fill (20-35 cm)
12	Stratum 3 (60-80 cm)	Pithouse 4, Stratum 1
12	Stratum 3 (60-80 cm)	Pit 26 fill
12	Stratum 3 (60-80 cm)	Pit 32e fill
12	Stratum 3 (60-80 cm)	Pithouse 5 fill (test pit)
54	Level 4 (60-80 cm)	Pit 18 fill (90-120 cm)
26	Stratum 3 (100 cm to top of Stratum 4)	Pithouse 1 overburden
13	Stratum 3 (33-100 cm)	Pithouse 1, other subunits of Stratum 3
57	Stratum 3 (80-100 cm)	Pithouse 7 lower fill
62	overburden and Stratum 3	Pithouse 7 upper and lower fills
20	Stratum 3	Pithouse 1, Stratum 4
29	floor fill	Pithouse 1 fill (60-80 cm)
1	floor fill	Pithouse 3 fill (0-25 cm)
1	floor fill	Pithouse 3 fill (30-50 cm)
36*	floor fill	Pit 32b fill
Pithouse 2 (Feature 10)		

4	stripping	Pithouse 2 fill (40-70 cm)
7*	stripping	Pithouse 2 fill (40-70 cm)
51*	stripping	Pithouse 2 fill (40-70 cm)
51	stripping	Pithouse 2 fill (70-90 cm)
8	fill (40-70 cm)	Pithouse 4 floor fill
42*	fill (40-70 cm)	Pithouse 4 floor fill
37	fill (40-70 cm)	Pithouse 4, Stratum 2
28	fill (70-90 cm)	Pithouse 4 floor fill
56	fill (70-90 cm)	Pithouse 4 floor fill
5*	fill (40-90 cm)	Pithouse 4, Stratum 3
14	fill (40-70 cm)	Pithouse 1 fill (40-60 cm)
14	fill (40-70 cm)	Pithouse 3 stripping
42*	fill (40-70 cm)	Pit 18 fill (70 or 80-90 cm)
28	fill (70-90 cm)	Pit 18 fill (50-60 cm)
28	fill (70-90 cm)	Pit Group 23 stripping
7	stripping	Pit 24a fill
7	fill (40 cm to floor)	Pit 24a fill
42*	fill (40-70 cm)	Pit Group 32 deep stripping
42*	fill (40-70 cm)	Pit 32a deep stripping
55	fill (40-70 cm)	Pit 48b fill
Pithouse 3 (Feature 17)		
14	stripping	Pithouse 2 fill (40-70 cm)
45	stripping	Pithouse 4 floor fill
2	stripping and fill (30-50 cm)	Pithouse 1 fill (50-60 cm)
1	fill (0-25 and 0-50 cm)	Pithouse 1 floor fill
41	fill (25-50 cm)	Pit Group 24 stripping
47*	floor fill	Pithouse 3 floor contact
48*	floor fill	Pithouse 3 floor contact
Pithouse 4 (Feature 20)		
2	Stratum 1	Pithouse 1 fill (50-60 cm)
12	Stratum 1	Pithouse 1 fill (60-80 cm)
34	Stratum 1	Pit 18 fill (50-60 cm)
10	Stratum 2	Pithouse 4, Stratum 3
37	Stratum 2	Pithouse 2, fill (40-70 cm)

53	Stratum 2	Pit 18 fill (70 or 80-90 cm)
5	Stratum 3	Pithouse 2 fill (40-90 cm)
5	Stratum 3	Pit 18 fill (20-35 cm)
5	Stratum 3	Pit 18 fill (50-60 cm)
33	Stratum 3	Pit 18 fill (35-50 cm)
33	Stratum 3	Pit 18 fill (60-70 or 80 cm)
52	Stratum 3	Pit 18 (70 or 80-120 cm)
5*	Stratum 3	Pithouse 2 fill (70-90 cm)
3	Strata 3 and 4	Pit 24a fill
3	Strata 3 and 4	Pithouse 5 floor fill
8	floor fill	Pithouse 2 fill (40-70 cm)
28	floor fill	Pithouse 2 fill (70-90 cm)
42*	floor fill	Pithouse 2 fill (40-70 cm)
42*	floor fill	Pit Group 32 deep stripping
45	floor fill	Pithouse 3 stripping
56	floor fill	Pithouse 7 stripping and upper fill
Pithouse 5 (Feature 34)		
12	test pit fill	Pithouse 1 fill (60-80 cm)
3*	floor fill	Pit 24a fill
3	floor fill	Pithouse 4, Stratum 3
3*	floor fill	Pithouse 4, Stratum 4 (floor fill)
Pithouse 6 (Feature 43)		
61	floor fill	Pithouse 7 stripping and upper fill
Pithouse 7 (Feature 45)		
56	stripping and upper fill	Pithouse 4 floor fill
61	stripping and upper fill	Pithouse 6 floor fill
58*	stripping and upper fill	Pithouse 7 lower fill
62	stripping and upper fill	Pithouse 7 lower fill
62	stripping, upper and lower fill	Pithouse 1 overburden and Stratum 3 (100 cm to top of Stratum 4)
57	lower fill	Pithouse 1, Stratum 3 (80-100 cm)
63	lower fill	Pit 24b fill
Pithouse 8 (Feature 47): no sherds of identified vessels		
Pit 18 (Feature 18)		

35*	stripping	Pit 18, Level 3 (50-60 cm)
35*	stripping	Pit 23b fill
12	Level 1 (20-35 cm)	Pithouse 1 fill (60-80 cm)
5	Level 1 (20-35 cm)	Pithouse 4, Stratum 3
60	Level 1 (20-35 cm)	Pit 32a stripping and fill
25	Level 2 (35-50 cm)	Pit 5a fill
16*	Level 2 (35-50 cm)	Pit 18, Level 3 (50-60 cm)
23	Level 2 (35-50 cm)	Feature 40 (test) stripping
5	Level 3 (50-60 cm)	Pithouse 4, Stratum 3
27	Level 3 (50-60 cm)	Pit 18 fill (60-70 or 80 cm)
28	Level 3 (50-60 cm)	Pithouse 2 fill (70-90 cm)
34	Level 3 (50-60 cm)	Pithouse 4, Stratum 1
6	Levels 1-2 (20-50 cm)	Pithouse 1 overburden
6	Levels 1-2 (20-50 cm)	Pit 3b fill
35*	Levels 1-3 (20-60 cm)	Pit 23b fill
33	Levels 2-4 (35-70 or 80 cm)	Pithouse 4, Stratum 3
42	Level 5 (70 or 80-90 cm)	Pithouse 2 fill (40-70 cm)
53	Level 5 (70 or 80-90 cm)	Pithouse 4, Stratum 2
11	Level 5 (70 or 80-90 cm)	Pit 33b fill
54	Level 6 (90-120 cm)	Pithouse 1 fill (60-80 cm)
59	Level 6 (90-120 cm)	Pit 42d fill (60-80 cm)
52	Levels 5-6 (70 or 80-120 cm)	Pithouse 4, Stratum 3
38*	bottom fill	Pit Group 24 stripping
38	bottom fill	Feature 40 (test) stripping
23	bottom fill	Feature 40 (test) stripping
Miscellaneous Pits Excluding Pit 18		
25	Pit 5a fill	East Area stripping (Phase 2)
43*	Pit Group 23 stripping	Pit 33b fill
35*	Pit 23b fill	Pit 18, Levels 2-3 (35-60 cm)
41	Pit Group 24 stripping	Pithouse 3 fill (25-50 cm)
38	Pit Group 24 stripping	Pit 18 bottom fill
3	Pit 24a fill	Pithouse 4, Strata 3-4 (including floor fill)
3*	Pit 24a fill	Pithouse 5 floor fill
7	Pit 24a fill	Pithouse 2 stripping

7	Pit 24a fill	Pithouse 2 fill (40 cm to floor)
63	Pit 24b fill	Pithouse 7 lower fill
12	Pit 26 fill (upper)	Pithouse 1, Stratum 3 (60-80 cm)
24	Pit 27b fill	Pit Group 32 shallow stripping
6	Pit 31b fill	Pit 18, Levels 1-2 (20-50 cm)
24	Pit Group 32 shallow stripping	Pit 27b fill
44*	Pit Group 32 shallow stripping	Pit 33a fill
42	Pit 32a deep stripping	Pithouse 2 fill (40-70 cm)
60	Pit 323a stripping and fill	Pit 18, Level 1 (20-30 cm)
36*	Pit 32b fill	Pithouse 1 floor fill
12	Pit 32a fill	Pithouse 1, Stratum 3 (60-80 cm)
45*	Pit Group 33 stripping	Pithouse 4 floor fill
44*	Pit 33a fill	Pit Group 32 shallow stripping
11	Pit 33b fill	Pit 18, Level 5 (70 or 80-90 cm)
43*	Pit 33b fill	Pit Group 23 stripping
59	Pit 42d fill	Pit 18, Level 6 (90-120 cm)
55	Pit 48b fill	Pithouse 2 fill (40-70 cm)

* Correlation involves an actual sherd fit.

APPENDIX 3: Data on Correlation of Site Features

Structure or Feature	Vessel ID Number	Observations
Pithouse 1	14	fill (40-60 cm) = Pithouse 2 fill (40-70 cm)
	1	floor fill = Pithouse 3, Levels 1 and 3 fills
	2	Stratum 2 (50-60 cm) = Pithouse 3 stripping
	2	Stratum 2 (50-60 cm) = Pithouse 3 fill (30-50 cm)
	2	Stratum 3 (50-60 cm) = Pithouse 4, Stratum 1
	12	Stratum 3 (60-80 cm) = Pithouse 4, Stratum 1
	57	Stratum 3 fill = Pithouse 7 lower fill
	62	Overburden and Stratum 3 fills = Pithouse 7 upper and lower fills (respectively)
	6	overburden = Pit 18 fill (20-50 cm)
	12	Stratum 3 (60-80 cm) = Pit 18 fill (20-35 cm)
	54	Level 4 (60-80 cm) = Pit 18 fill (90-120 cm)
Pithouse 2	14	fill (40-70 cm) = Pithouse 3 stripping
	8	fill (40-70 cm) = Pithouse 4 floor fill
	42*	fill (40-70 cm) = Pithouse 4 floor fill
	37	fill (40-70 cm) = Pithouse 4, Stratum 2
	28	fill (70-90 cm) = floor fill
	56	fill (70-90 cm) = floor fill
	5*	fill (40-90 cm) = Stratum 3
	42	fill (40-70 cm) = Pit 18 fill (70 or 80-90 cm)
	28	fill (70-90 cm) = Pit 18 fill (50-60 cm)
Pithouse 3	45	stripping = Pithouse 4 floor fill
Pithouse 4	3	Strata 2 and 4 = Pithouse 5 floor fill
	56	floor fill = Pithouse 7 stripping and upper fill
	34	Stratum 1 = Pit 18, Level 3 (50-60 cm)
	5	Stratum 3 = Pit 18, Level 1 (20-35 cm)
	33	Stratum 3 = Pit 18, Level 2 (35-50 cm)
	5	Stratum 3 = Pit 18, Level 3 (50-60 cm)
	33	Stratum 3 = Pit 18, Level 4 (60-70 or 80 cm)
	52	Stratum 3 = Pit 18, Levels 5 and 6 (70 or 80-120 cm)
Pithouse 6	61	floor fill = Pithouse 7 stripping and upper fill

Pit 5a	25	fill = stripping in East Area (Phase 2)
Hearth 23b	35*	fill = Pit 18, Levels 2 and 3 (35-60 cm)
Pit 24a	7	fill = Pithouse 2 stripping
	7	fill = Pithouse 2 fill (40 cm to floor)
	3	fill = Pithouse 4, Strata 3-4 (including floor fill)
	3*	fill = Pithouse 5 floor fill
Pit 24b	63	fill = Pithouse 7 lower fill
Deep Pit 26	12	fill = Pithouse 1, Stratum 3 (60-80 cm)
Hearth 27b	24	fill = Pit Group 32 shallow stripping
Hearth 31b	6	fill = Pit 18, Levels 1 and 2 (20-50 cm)
Hearth 32a	42	deep stripping = Pithouse 2 fill (40-70 cm)
	60	stripping and fill = Pit 18, Level 1 (20-35 cm)
Hearth 32e	12	fill = Pithouse 1, Stratum 3 (60-80 cm)
Pit 33a	44*	fill = Pit Group 32 shallow stripping
Hearth 33b	11	fill = Pit 18, Level 5 (70 or 80-90 cm)
	43*	fill = Pit Group 23 stripping
Pit 42d	59	fill = Pit 18, Level 6 (90-120 cm)
Pit 48b	59	fill = Pithouse 2 fill (40-70 cm)

* Correlation involves an actual sherd fit.

APPENDIX 4: REPORT ON RADIOCARBON DATES FROM BETA ANALYTIC, INC.

BETA ANALYTIC INC.

RADIOCARBON DATING, STABLE ISOTOPE RATIOS, THERMOLUMINESCENCE, X-RAY DIFFRACTION
P.O. BOX 248113 CORAL GABLES, FLORIDA 33124 - (305) 667-5167

July 6, 1987

Ms. Yvonne R. Oakes
Museum of New Mexico
Research Section
Laboratory of Anthropology
P.O. Box 2087
Santa Fe, New Mexico 87504

Dear Ms. Oakes:

Please find enclosed the results on the eight charcoal samples recently submitted for radiocarbon dating and carbon 13 analyses. We hope these dates will be useful in your research.

Your charcoals were pretreated by first examining for rootlets. The samples were then given a hot acid wash to eliminate carbonates. They were repeatedly rinsed to neutrality and subsequently given a hot alkali soaking to take out humic acids. After rinsing to neutrality, another acid wash followed and another rinsing to neutrality. The following benzene syntheses and counting proceeded normally.

The weighted average of the corrected dates was 850 +/- 30 BP. As requested, all of the dates and the average have been run through the dendrocalibration program. The calibrated dates printout is enclosed. When you have this in hand, would you give us a call and we will discuss the values (we have kept a copy here in your file).

We are enclosing our invoice. Would you forward this to the appropriate office for payment. If there are any questions or if you would like to confer on the dates, my direct telephone number is listed above. Please don't hesitate to call us if we can be of help.

Sincerely yours,

Murry Tamers

Murry Tamers, Ph.D.
Co-director

P.S. I'm including some data sheets for future samples or to give to your colleagues that might need our service.

BETA ANALYTIC INC.
(305) 667-5167
UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124

REPORT OF RADIOCARBON DATING ANALYSES

FOR: Yvonne R. Oakes
Museum of New Mexico
Santa Fe, NM

DATE RECEIVED: June 9, 1987
DATE REPORTED: July 4, 1987
BILLED TO SUBMITTER'S INVOICE NUMBER letter of 5/28/87

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ± 1σ	C13/C12	C-13 adjusted C-14 age	GmC
	Belen Bridge Site (LA 53662) (MNM Project 41.386)				
Beta-21278	10 - 39	790 ± 70	- 24.7	790 ± 70	
Beta-21279	14 - 11	810 ± 60	- 25.2	810 ± 60	
Beta-21280	17 - 20/112/113	680 ± 80	- 26.8	650 ± 80	
Beta-21281	18 - 19	860 ± 90	- 12.4	1,060 ± 90	
Beta-21282	20 - 52	800 ± 80	- 26.2	780 ± 80	
Beta-21283	20 - 64	800 ± 80	- 25.6	790 ± 80	
Beta-21284	20 - 92	940 ± 110	- 21.2	1,000 ± 110	0.3*
Beta-21285	34 - 10	960 ± 80	- 17.9	1,070 ± 80	

* small carbon sample given quadruple normal counting time to reduce attendant high statistical counting error.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

Stuiver & Becker (1986) Calibration of the Belen Bridge Radiocarbon Results*

Calibrations of radiocarbon age determinations are applied to convert results to calender years. The short term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, the advent of large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of medium term differences and long term (greater than 8000 BP) are still unknown.

Radiocarbon dating laboratories have analyzed hundreds of samples obtained from known-age tree rings of oak, sequoia, and Douglas fir. Curves generated from the results depicting the atmospheric carbon content at specific time periods have been incorporated into computer programs. The result of the calibration analysis applicable to your research follows.

(Caveat: these calibrations assume that the material dated was short lived, i.e., living for less than ten years like leaves, small branches, some shells, food remains, annual plants, etc.. For other materials, the "Old Wood Effect" would produce uncertainties, both the maximum and minimum ranges of age possibilities could be understated if that error source is significant. Also, but less likely, in extreme cases they might even turn out to be overstated.)

CALIBRATION FILE: ATM20.14C supplied by Joe D. Stewart.

```
Beta-21278   (Pithouse 2)
 Radiocarbon Age BP   790  +/-  70
  Calibrated age(s) cal AD  1252
                    cal BP   698
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   One Sigma**   cal AD 1182-1275 ( 768- 675)
   Two Sigma**   cal AD 1043-1106 ( 907- 844) 1110-1290 (840-660)


   Summary of the above ---
   minimum of cal age ranges (cal ages) maximum of cal age ranges:
      one sigma   cal AD 1182 ( 1252) 1275
                  cal BP  768 (  698)  675
      two sigma   cal AD 1043 ( 1252) 1290
                  cal BP  907 (  698)  660

  cal AD/BC age ranges (cal ages as above) from probability distribution
     (Method B):
   % area enclosed   cal AD (cal BP) age ranges     relative area
                                                   under probability
                                                     distribution

    68.3 (1 sigma)   cal AD 1171-1276 ( 779- 674)        1.00
    95.4 (2 sigma)   cal AD 1040-1294 ( 910- 656)        1.00
```

Beta-21279   (Pithouse 1)

```
 Radiocarbon Age BP   810  +/-  60
  Calibrated age(s)  cal AD  1230
                     cal BP   720
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   One Sigma**    cal AD 1169-1267 ( 781- 683)
   Two Sigma**    cal AD 1042-1107 ( 908- 843) 1110-1280 ( 840- 670)

   Summary of above ---
   minimum of cal age ranges (cal ages) maximum of cal age ranges:
      one sigma    cal AD 1169 ( 1230) 1267
                   cal BP  781 (  720)  683
      two sigma    cal AD 1042 ( 1230) 1280
                   cal BP  908 (  720)  670

  cal AD/BC age ranges (cal ages as above) from probability distribution
(Method B):

   % area enclosed    cal AD (cal BP) age ranges      relative area
                                                     under probability
                                                       distribution
    68.3 (1 sigma)    cal AD 1170-1267 ( 780- 683)        1.00
    95.4 (2 sigma)    cal AD 1044-1100 ( 906- 850)         .11
                             1114-1148 ( 836- 802)         .07
                             1151-1280 ( 799- 670)         .82
```

<u>Beta-21280</u>   (Pithouse 3)

```
 Radiocarbon Age BP   650  +/-  80
  Calibrated age(s) cal AD  1290
                    cal BP   660
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   One Sigma**    cal AD 1272-1398 ( 678- 552)
   Two Sigma**    cal AD 1230-1430 ( 720- 520)

  Summary of the above ---
  minimum of cal age ranges (cal ages) maximum of cal age ranges:
     one sigma    cal AD 1272 (1290) 1398
                  cal BP  678 ( 660)  552
     two sigma    cal AD 1230 (1290) 1430
                  cal BP  720 ( 660)  520

 cal AD/BC age ranges (cal ages as above) from probability distribution
   (Method B):
  % area enclosed    cal AD (cal BP) age ranges      relative area
                                                    under probability
                                                      distribution
   68.3 (1 sigma)    cal AD 1276-1323 ( 674- 627)         .47
                            1338-1393 ( 612- 557)         .53
   95.4 (2 sigma)    cal AD 1233-1426 ( 717- 524)        1.00
```

<u>Beta-21281</u>   (Extramural Hearth 23a)

```
 Radiocarbon Age BP   1060  +/-  90
  Calibrated age(s)  cal AD   985
```

```
                    cal BP   965
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   One Sigma**    cal AD  888-1027 (1062- 923)
   Two Sigma**    cal AD  780-1170 (1180- 780)

  Summary of above ---
  minimum of cal age ranges (cal ages) maximum of cal age ranges:
     one sigma    cal AD  888 (  985) 1027
                  cal BP 1062 (  965)  923
     two sigma    cal AD  780 (  985) 1170
                  cal BP 1170 (  965)  780

  cal AD/BC age ranges (cal ages as above) from probability distribution
    (Method B):
   % area enclosed   cal AD (cal BP) age ranges     relative area
                                                  under probability
                                                    distribution
    68.3 (1 sigma)   cal AD  859-1043 (1091- 907)        .97
                            1105-1112 ( 845- 838)        .02
    95.4 (2 sigma)   cal AD  769-1177 (1181- 773)       1.00
```

<u>Beta-21282</u>

```
Beta-21282   (Pithouse 4, Stratum 3)
 Radiocarbon Age BP    780  +/-  80
  Calibrated age(s)  cal AD  1259
                     cal BP   691
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   One Sigma**    cal AD 1182-1279 ( 768- 671)
   Two Sigma**    cal AD 1040-1310 ( 910- 640) 1358-1379 ( 592- 571)

  Summary of above ---
  minimum of cal age ranges (cal ages) maximum of cal age ranges:
     one sigma    cal AD 1182 (1259) 1279
                  cal BP  768 ( 691)  671
     two sigma    cal AD 1040 (1259) 1379
                  cal BP  910 ( 691)  571

  cal AD/BC age ranges (cal ages as above) from probability distribution
    (Method B):
   % area enclosed   Cal AD (cal BP) age ranges     relative area
                                                  under probability
                                                   distribution
    68.3 (1 sigma)   cal AD 1160-1287 ( 790- 663)       1.00
    95.4 (2 sigma)   cal AD 1037-1309 ( 913- 641)        .97
                            1356-1382 ( 594- 568)        .03


Beta-21283   (Pithouse 4, Stratum 4)
 Radiocarbon Age BP    790  +/-  80
  Calibrated age(s) cal AD  1252
                    cal BP   698
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   One Sigma**    cal AD 1169-1277 ( 781- 673)
   Two Sigma**    cal AD 1030-1300 ( 920- 650) 1364-1375 ( 586- 575)
```

Summary of above ---
minimum of cal age ranges (cal ages) maximum of cal age ranges:

one sigma	cal AD	1169 (1252) 1277
	cal BP	781 (698) 673
two sigma	cal AD	1030 (1252) 1375
	cal BP	920 (698) 575

cal AD/BC age ranges (cal ages as above) from probability distribution (Method B):

% area enclosed	cal AD (cal BP) age ranges	relative area under probability distribution
68.3 (1 sigma)	cal AD 1128-1132 (822- 818)	.02
	1158-1284 (792- 666)	.98
95.4 (2 sigma)	cal AD 1032-1304 (918- 646)	.98
	1361-1377 (589- 573)	.02

<u>Beta-21284</u> (Pithouse 4, Stratum 2)
Radiocarbon Age BP 1000 +/- 110
Calibrated age(s) cal AD 1018
cal BP 932
cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
One Sigma** cal AD 900-903 (1050-1047) 950-1160 (1000- 790)
Two Sigma** cal AD 780-1260 (1170- 690)

Summary of above ---
minimum cal age ranges (cal ages) maximum cal age ranges:

one sigma	cal AD	900 (1018) 1160
	cal BP	1050 (932) 790
two sigma	cal AD	780 (1018) 1260
	cal BP	1170 (932) 690

cal AD/BC age ranges (cal ages as above) from probability distribution (Method B):

% area enclosed	cal AD (cal BP) age ranges	relative area under probability distribution
68.3 (1 sigma)	cal AD 898- 915 (1052-1035)	.06
	950-1160 (1000- 790)	.94
95.4 (2 sigma)	cal AD 800-1250 (1150- 700)	1.00

<u>Beta-21285</u> (Pithouse 5)
Radiocarbon Age BP 1070 +/- 80
Calibrated age(s) cal AD 980
cal BP 970
cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
One Sigma** cal AD 888-1021 (1062- 929)
Two Sigma** cal AD 780-1060 (1170- 890) 1077-1125 (873- 825)
1135-1157 (815- 793)

Summary of above ---

minimum of cal age ranges (cal ages) maximum of cal age ranges:

one sigma	cal AD	888 (980) 1021
	cal BP	1062 (970) 929
two sigma	cal AD	780 (980) 1157
	cal BP	1170 (970) 793

cal AD/BC age ranges (cal ages as above) from probability distribution (Method B):

% area enclosed	cal AD (cal BP) age ranges	relative area under probability distribution
68.3 (1 sigma)	cal AD 878-1031 (1072- 919)	1.00
95.4 (2 sigma)	cal AD 779-1068 (1117-1114)	.92
	1071-1128 (879- 822)	.06
	1133-1158 (817- 792)	.02

References for datasets (and intervals) used:

Stuiver, M. and Becker, B., 1986, Radiocarbon, 28, 863-910.

Comments:

* Compiled from reports by Beta Analytic Inc. and J.D. Stewart, Department of Anthropology, Lakehead University, Thunderbay, Ontario, Canada.

** 1 sigma = square root of (sample std. dev. squared + curve std. dev. squared)

2 sigma = 2 x square root of (sample std. dev. squared + curve std. dev. squared)

APPENDIX 5: REPORT ON ARCHAEOMAGNETIC DATING FROM ARCHAEOMAGNETIC LABORATORY, COLORADO STATE UNIVERSITY

Colorado State University

Department of Anthropology
Archaeometric Laboratory
Fort Collins, Colorado 80523

8/31/87

Mr. Reggie Wiseman
Project Director
Belen Bridge Site Project
Museum of New Mexico
Sante Fe, New Mexico 87504-2087

Dear Reggie:

We've just finished your samples (after you called another 40 samples arrived from Arizona; so, you beat out a total of 70 samples), and I want to include a few comments along with the lab reports. For additional details, you will find a handout we provide which explains laboratory processing and an explanation of terms used in the laboratory reports.

The first observation about the samples from Belen Bridge is that three of the samples (#1, #2, and #4) had greater scatter in directions than we like to see (alpha 95s $\leq$ 3.5 degrees). As a result the errors in estimating mean locations (and, thus, time ranges) are large for these samples. We magnetically cleaned the samples, as we do all samples, and could find no evidence of secondary magnetic components.

Field notes give some indication as to why the samples were so scattered. The matrices from which the samples were collected were almost always described as sandy clay with very little oxidation. The samples with the smallest alpha 95s (#3, #5, and #6) had the darkest oxidation. Further, #5 and #6 had the best plaster coating. Therefore, at least part of the problem seems to be with the material.

To compound the problem of large age ranges, the master SW archaeomagnetic curve for the AD 1200-1330 period expected for these samples crosses an earlier curve segment. Archaeomagnetically we have to include this segment as a possible date, also. If we ignore the earlier segment (ie. the AD 1050 to 1100 segment) on the basis that it makes no archaeological sense, then your archaeomagnetic options are:

#1 1200-post 1450
#2 1150-1250
#3 1200-post 1450
#4 plot makes it hard to pick an unambiguous cut off
#5 1175-1450
#6 1150-1250

I realize these ranges are still larger than your original 'guess' date for the site. However, when we look at the plots and the above list of dates, it is clear that the archaeomagnetic dates strongly support your expectation for the age of the Belen Bridge Site. Averaging sample results is another way of extracting solid temporal conclusions from archaeomagnetic samples. Therefore, I averaged the location of all 6 samples (weighting the best samples heaviest) from the Belen Bridge Site to get a site average 'date'. The average location is 82.19 N lat and 193.53 E long which falls right at AD 1200. This site average has an alpha 95 of 2.91 degrees, resulting in a range of about AD 1175 to 1275.

Given the large alphas on three of the samples and the inherent uncertainty in archaeomagnetic dates (See Eighmy and Hathaway, 1987, in Geoarchaeology), trying to assess relative ages among the six samples will be difficult. Ignoring the early curve segment, we can make some general comparisons. As a group samples 1, 3, and 5 do seem to be older than the other three. In fact, 2, 4, and 6 seem to be averaging around AD 1200 while 1, 3, and 5, on average seem to fall at AD 1350 or later. That is, even though the above site average is right at your original guess date of AD 1200-1300, the range of archaeomagnetic samples locations suggest a range of occupation beginning as early as AD 1200 but possibly extending beyond AD 1300.

If you have any questions about the samples, reports, or these remarks, just call. We appreciate being able to work on material from central New Mexico. We don't see material from this area very often.

Sincerely,

Jeffrey L. Eighmy
Director

ARCHAEOMAGNETIC LABORATORY REPORT

Archaeometric Laboratory
Department of Anthropology
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7408 or 491-5784

Sample I.D. LA53662-1 Feature I.D. 23A

Site Latitude 34.65 N Site Longitude 253.27 E

Site Declination 11.8 E Archaeological Guess Date AD 1200-1300

Collector Joan Wilkes Date Collected 6/20/87

Laboratory Analysis

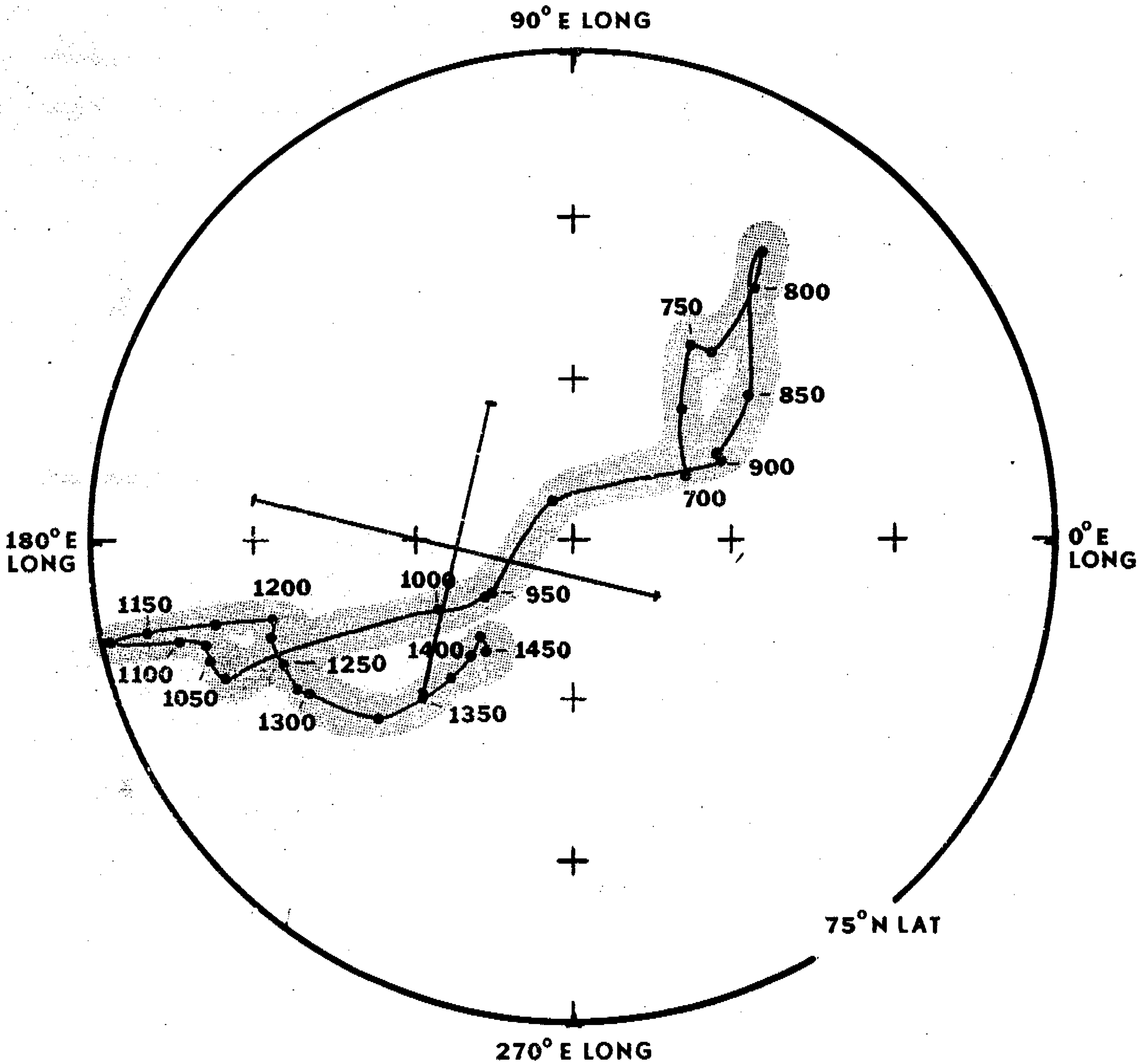
Demagnetization Steps (Oe)	NRM	50	100
Alpha 95 (degrees)	3.65	3.67	4.68
Precision Parameter - k	143	141	87
Inclination (degrees dip)	54.77	54.87	55.18
Declination (degrees E)	355.76	357.04	355.65
Mean Sample Intensity (E-07 A/m)	1.0982	.9392	.7530
No. Specimens Collected/ No. Specimens Used	12/12	12/12	12/12
Specimen No. of Outlier(s)	none	none	none

Final Processing Results

Demagnetization Level Used	100
Paleolatitude (degrees N)	86.29
Paleolongitude (degrees E)	181.21
Error Along the Great Circle - EP (degrees)	4.73
Error Perpendicular to the Great Circle - EM (degrees)	6.66

Signed Jeffrey L. Eighmy Date 8/1/87

VGP plot of samples LA53662-1



AD 910-1010
AD 1200-post 1450

curve used SWCV187

ARCHAEOMAGNETIC LABORATORY REPORT

Archaeometric Laboratory
Department of Anthropology
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7408 or 491-5784

Sample I.D. LA53662-2 Feature I.D. 17

Site Latitude 34.65 N Site Longitude 253.27 E

Site Declination 11.8 E Archaeological Guess Date AD 1200-1300

Collector ~~Regge Wiseman~~ Joan Wilkes Date Collected 7/1-2/87

Laboratory Analysis

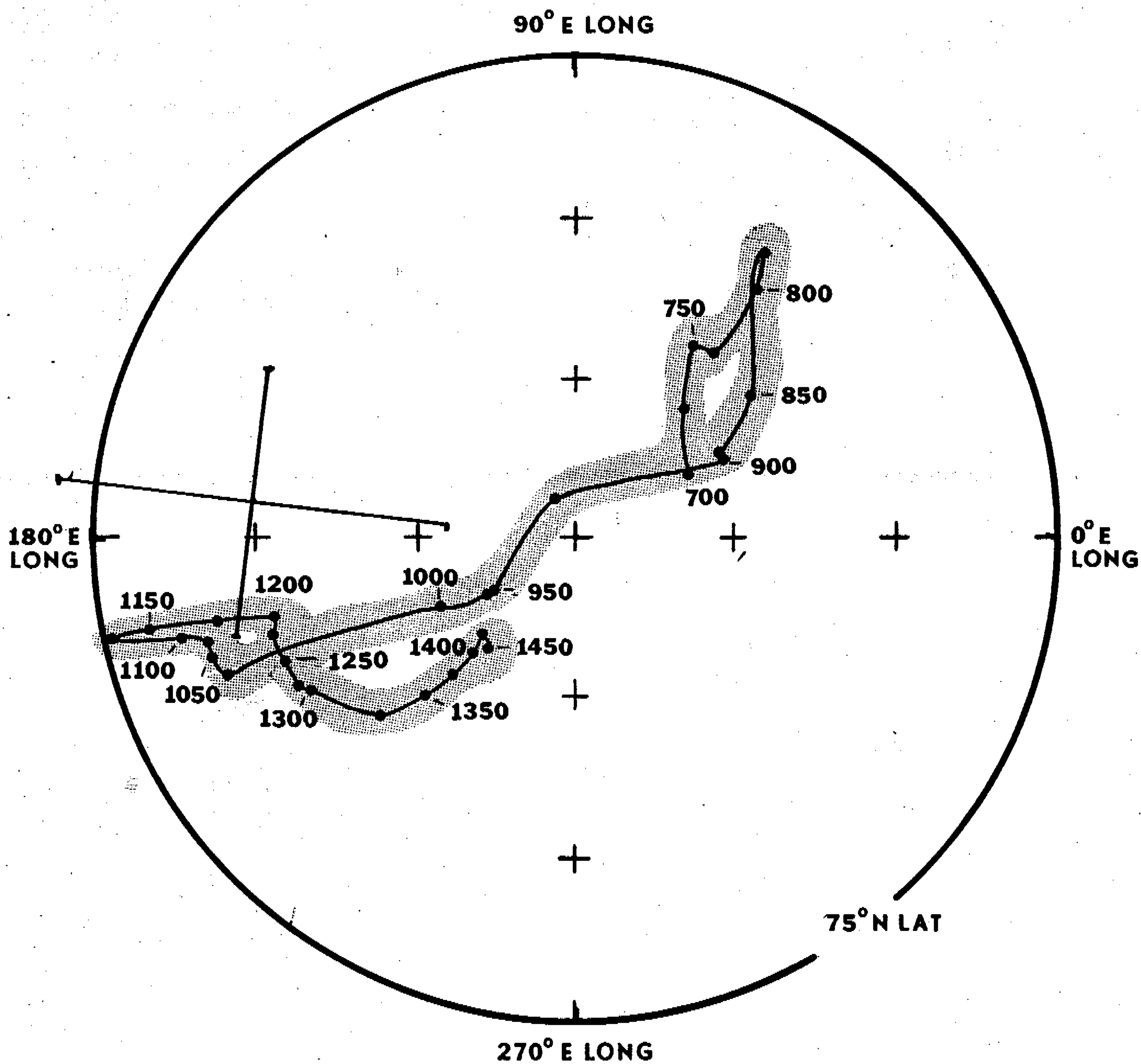
Demagnetization Steps (Oe)	NRM	50	100
Alpha 95 (degrees)	3.54	3.74	4.22
Precision Parameter - k	152	136	106
Inclination (degrees dip)	55.57	55.08	55.32
Declination (degrees E)	347.58	348.32	348.01
Mean Sample Intensity (E-07 A/m)	1.5105	1.2614	.9649
No. Specimens Collected/ No. Specimens Used	12/12	12/12	12/12
Specimen No. of Outlier(s)	none	none	none

Final Processing Results

Demagnetization Level Used	100
Paleolatitude (degrees N)	80.14
Paleolongitude (degrees E)	173.73
Error Along the Great Circle - EP (degrees)	4.29
Error Perpendicular to the Great Circle - EM (degrees)	6.02

Signed Jeffrey L. Eighmy Date 9/1/87

VGP plot of archaeomagnetic sample LA53662-2



AD 1000-1100
AD 1150-post 1450

curve used SWCV187

ARCHAEOMAGNETIC LABORATORY REPORT

Archaeometric Laboratory
Department of Anthropology
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7408 or 491-5784

Sample I.D. LA53662-3 Feature I.D. 14

Site Latitude 34.65 N Site Longitude 253.27 E

Site Declination 11.8 E Archaeological Guess Date AD 1200-1300

Collector ~~Regge Wiseman~~ Joan Wilkes Date Collected 7/2-3/87

Laboratory Analysis

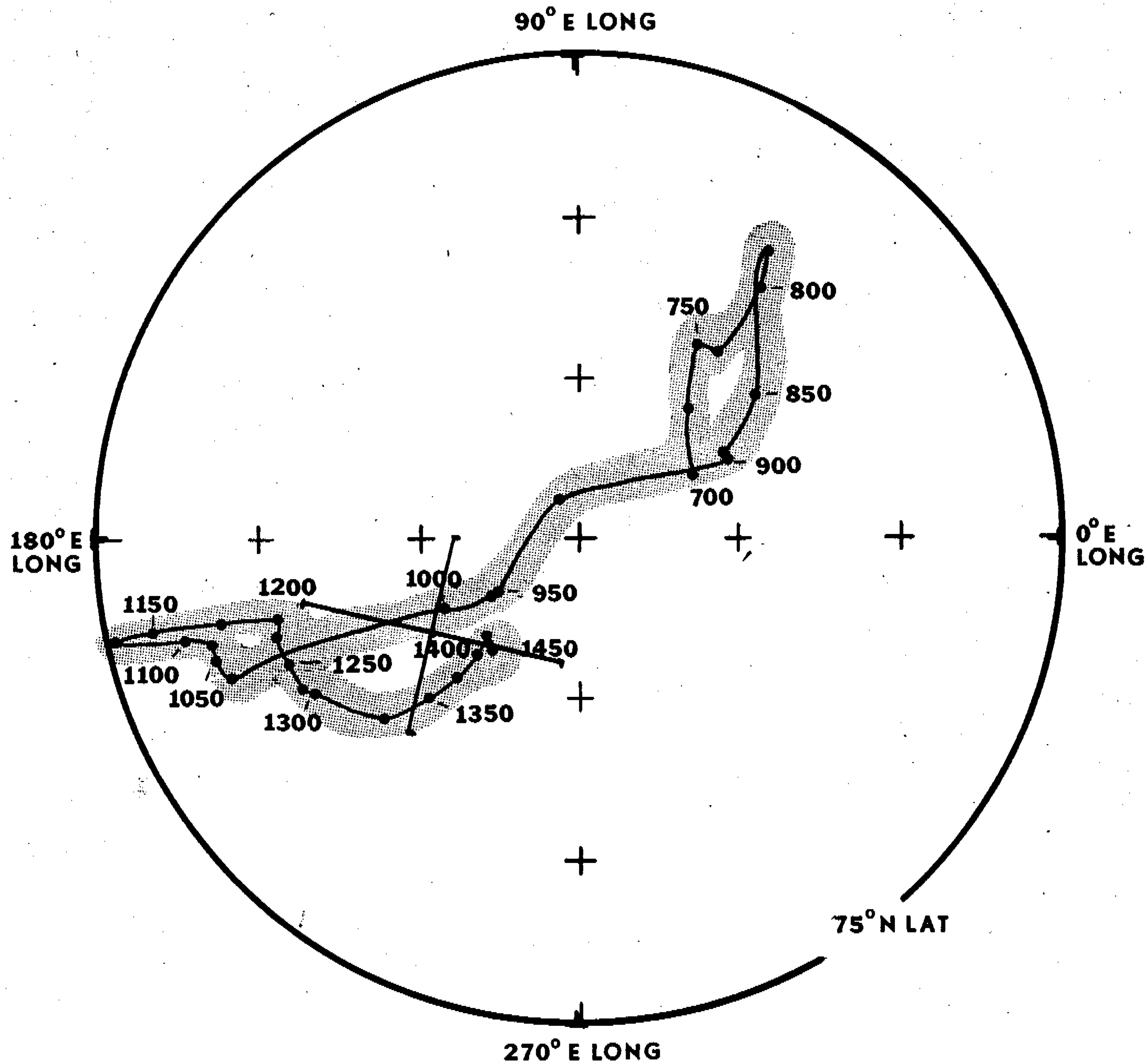
Demagnetization Steps (Oe)	NRM	50	100
Alpha 95 (degrees)	2.30	2.48	2.79
Precision Parameter - k	358	306	242
Inclination (degrees dip)	57.95	58.12	58.03
Declination (degrees E)	357.82	357.44	355.65
Mean Sample Intensity (E-07 A/m)	1.5861	1.3490	1.0472
No. Specimens Collected/ No. Specimens Used	12/12	12/12	12/12
Specimen No. of Outlier(s)	none	none	none

Final Processing Results

Demagnetization Level Used	100
Paleolatitude (degrees N)	84.66
Paleolongitude (degrees E)	213.74
Error Along the Great Circle - EP (degrees)	3.04
Error Perpendicular to the Great Circle - EM (degrees)	4.12

Signed [signature] Date 9/1/87

VGP plot of archaeomagnetic sample LA53662-3



AD 940-1020
AD 1200-post 1450

curve used SWCV187

ARCHAEOMAGNETIC LABORATORY REPORT

Archaeometric Laboratory
Department of Anthropology
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7408 or 491-5784

Sample I.D. LA53662-4 Feature I.D. 10

Site Latitude 34.65 N Site Longitude 253.27 E

Site Declination 11.8 E Archaeological Guess Date AD 1200-1300

Collector ~~Regge Wiseman~~ Joan Wilkes Date Collected 7/3/87

Laboratory Analysis

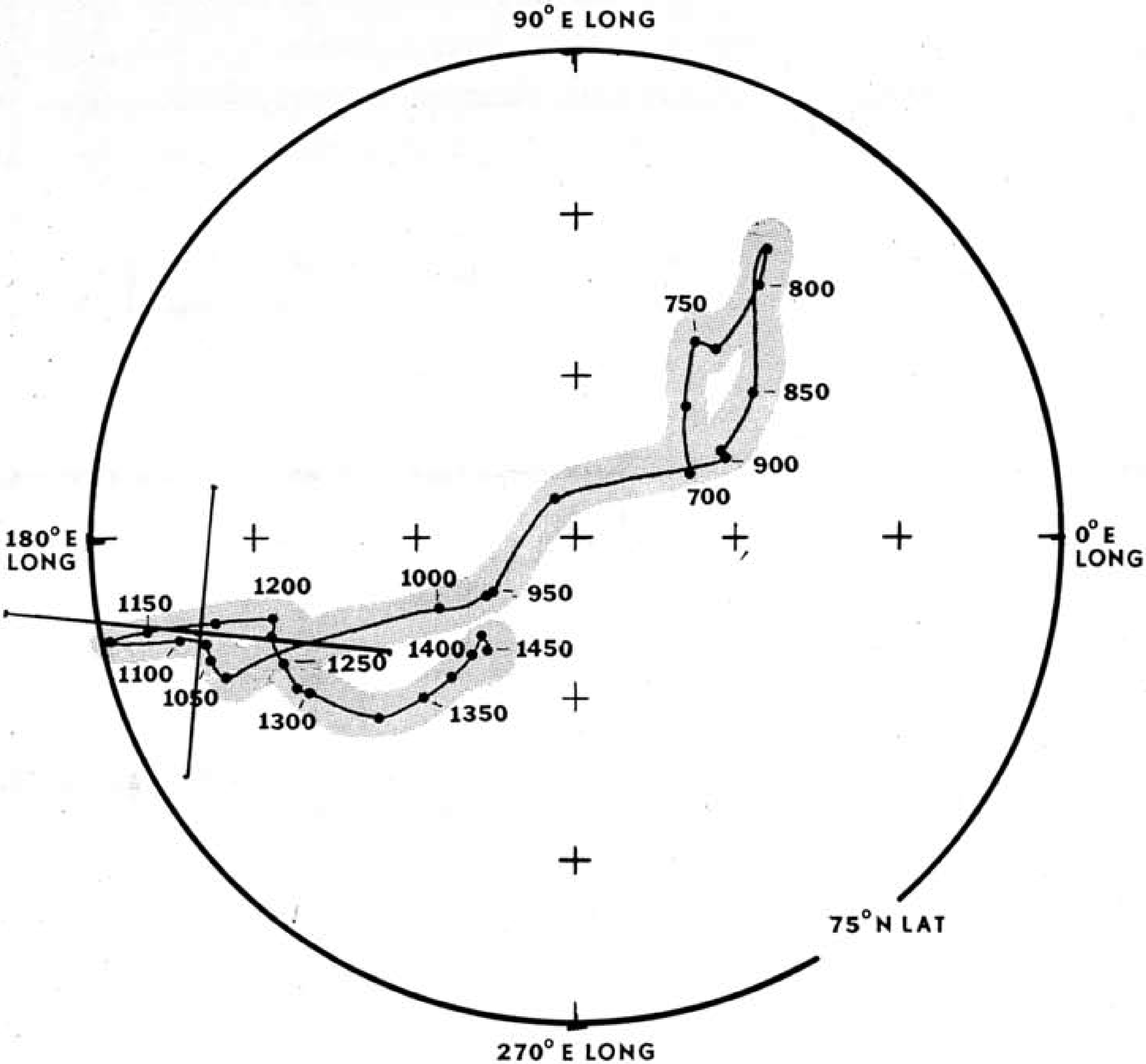
Demagnetization Steps (Oe)	NRM	50	100
Alpha 95 (degrees)	3.44	3.70	4.04
Precision Parameter - k	160	138	116
Inclination (degrees dip)	59.89	59.06	59.11
Declination (degrees E)	344.11	347.58	346.62
Mean Sample Intensity (E-07 A/m)	.8662	.7285	.5431
No. Specimens Collected/ No. Specimens Used	12/12	12/12	12/12
Specimen No. of Outlier(s)	none	none	none

Final Processing Results

Demagnetization Level Used	100
Paleolatitude (degrees N)	78.15
Paleolongitude (degrees E)	193.40
Error Along the Great Circle - EP (degrees)	4.51
Error Perpendicular to the Great Circle - EM (degrees)	6.04

Signed Jeffrey L. Eighmy Date 9/1/87

VGP plot of archaeomagnetic sample LA53662-4



AD 1010-1325

curve used SWCV187

ARCHAEOMAGNETIC LABORATORY REPORT

Archaeometric Laboratory
Department of Anthropology
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7408 or 491-5784

Sample I.D. LA53662-5 Feature I.D. Feat 20, PH 20

Site Latitude 34.65 N Site Longitude 253.27 E

Site Declination 11.8 E Archaeological Guess Date AD 1200-1300

Collector ~~Regge Wiseman~~ William Doleman Date Collected 7/13/87

Laboratory Analysis

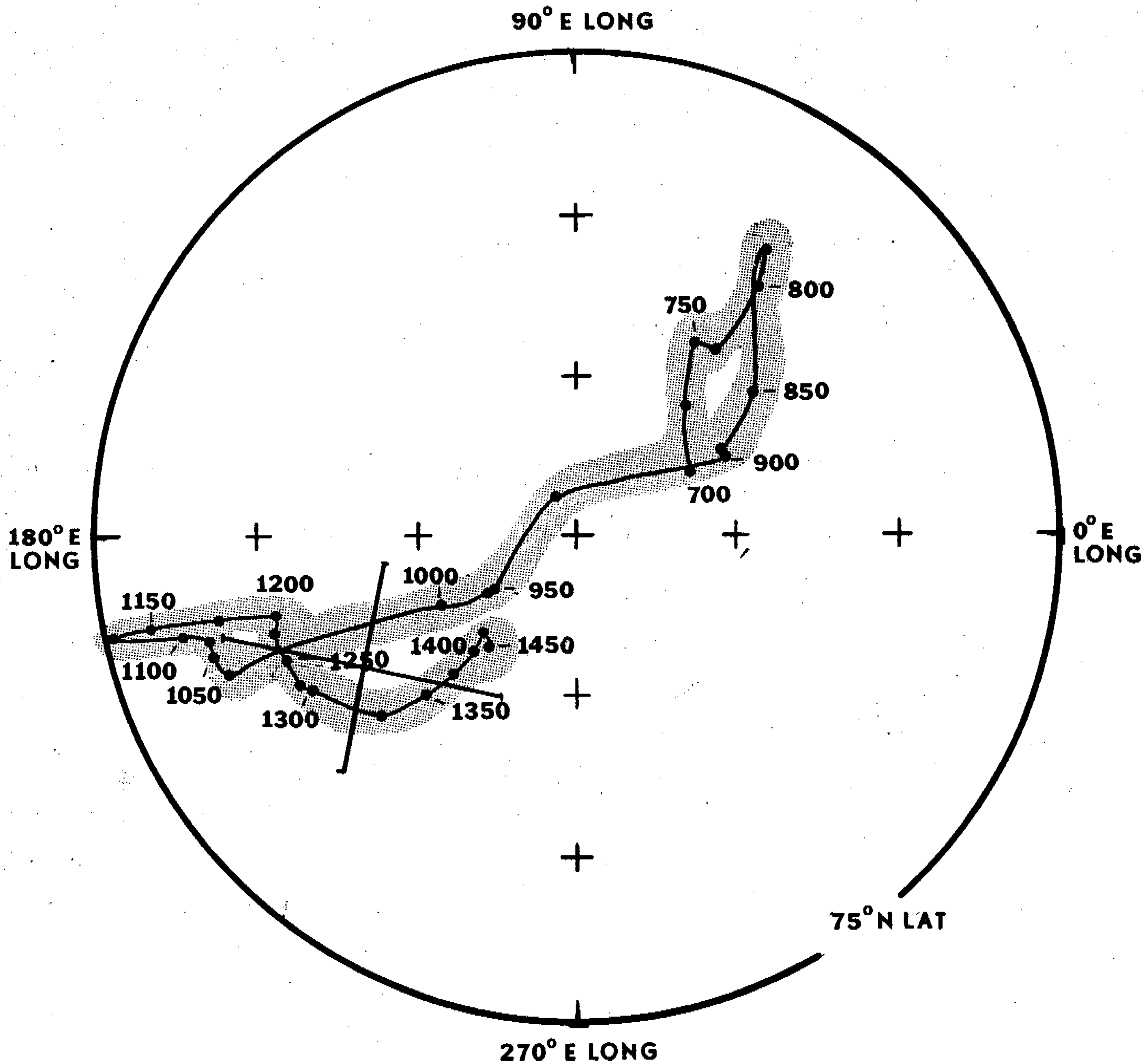
Demagnetization Steps (Oe)	NRM	50	100
Alpha 95 (degrees)	1.93	2.23	2.97
Precision Parameter - k	507	381	214
Inclination (degrees dip)	59.24	59.17	59.42
Declination (degrees E)	352.93	353.39	353.33
Mean Sample Intensity (E-07 A/m)	.2741	.2281	.1723
No. Specimens Collected/ No. Specimens Used	12/12	12/12	12/12
Specimen No. of Outlier(s)	none	none	none

Final Processing Results

Demagnetization Level Used	100
Paleolatitude (degrees N)	82.30
Paleolongitude (degrees E)	211.80
Error Along the Great Circle - EP (degrees)	3.35
Error Perpendicular to the Great Circle - EM (degrees)	4.46

Signed Jeffrey L. Eighmy Date 9/1/87

VGP plot of archaeomagnetic sample LA53662-5



AD 950-1075
AD 1175-AD 1450

curve used SWCV187

ARCHAEOMAGNETIC LABORATORY REPORT

Archaeometric Laboratory
Department of Anthropology
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7408 or 491-5784

Sample I.D. LA53662-6 Feature I.D. Feat 34, PH 5

Site Latitude 34.65 N Site Longitude 253.27 E

Site Declination 11.8 E Archaeological Guess Date AD 1200-1300

Collector ~~Regge Wiseman~~ William Doleman Date Collected 7/17/87

Laboratory Analysis

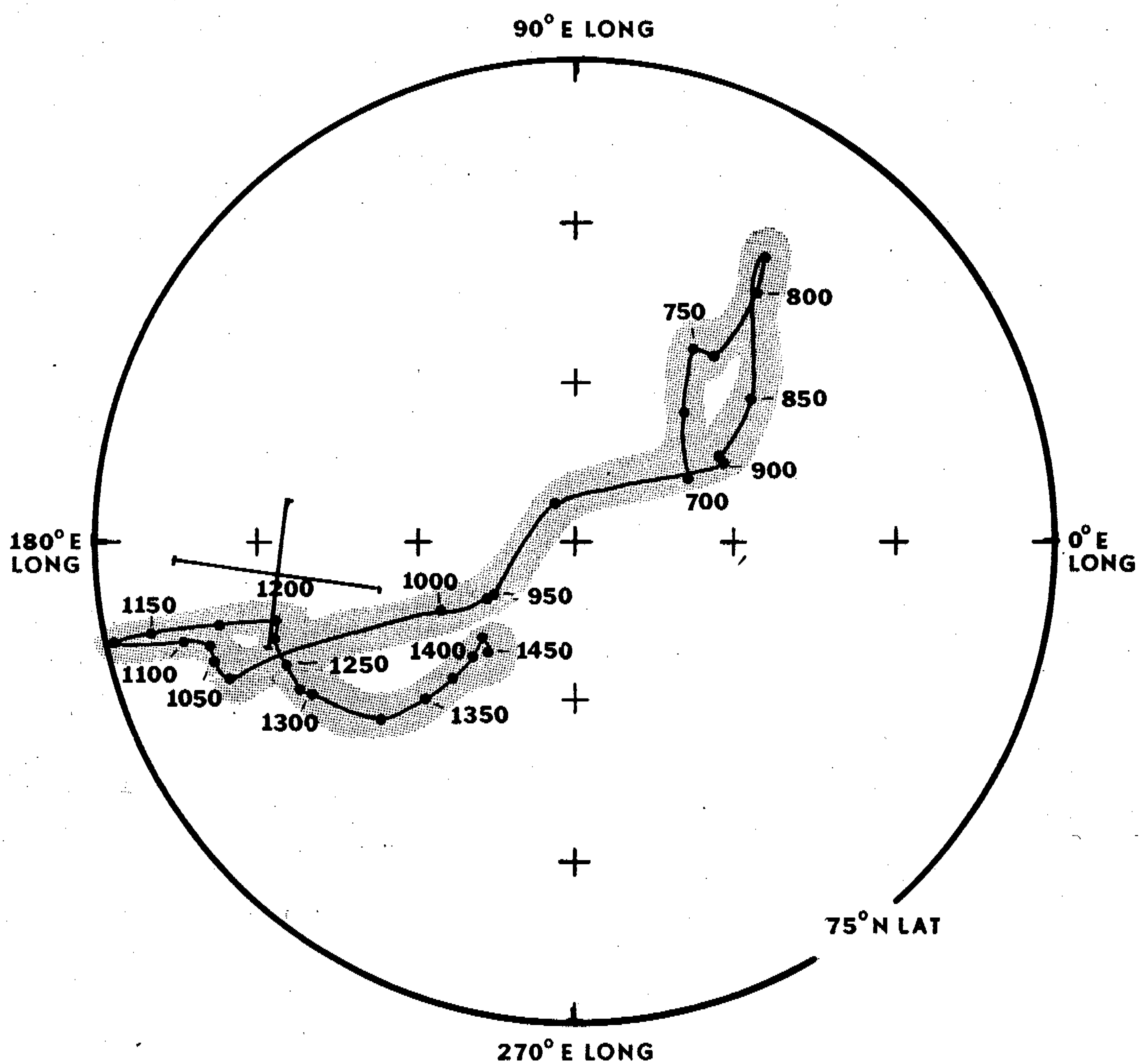
Demagnetization Steps (Oe)	NRM	50	100
Alpha 95 (degrees)	1.57	2.07	2.21
Precision Parameter - k	763	439	386
Inclination (degrees dip)	57.54	57.44	57.35
Declination (degrees E)	351.29	349.89	348.93
Mean Sample Intensity (E-07 A/m)	.4229	.3679	.2934
No. Specimens Collected/ No. Specimens Used	12/12	12/12	12/12
Specimen No. of Outlier(s)	none	none	none

Final Processing Results

Demagnetization Level Used	100
Paleolatitude (degrees N)	80.49
Paleolongitude (degrees E)	186.87
Error Along the Great Circle - EP (degrees)	2.36
Error Perpendicular to the Great Circle - EM (degrees)	3.23

Signed Jeffrey L. Eighmy Date 9/1/87

VGP plot of archaeomagnetic samples LA53662-6



AD 1010-1075
AD 1150-1250

curve used SWCV187

COLORADO STATE UNIVERSITY ARCHAEOMAGNETIC LABORATORY ANALYSIS

The following text provides the standards by which the CSU Archaeometric laboratory operates the archaeomagnetic analysis of samples. Also presented in this report is a description of the technical terms used in the archaeomagnetic reports.

Laboratory Operations

The analysis provided by the CSU Archaeometric Laboratory includes measurement of a samples' magnetic remanence in the pristine condition (referred to as Natural Remanent Magnetization - NRM) and a series of `demagnetization' steps. A Schonstedt spinner magnetometer is employed for specimen measurement and an alternating current (AC) demagnetizer is used for the demagnetization procedures. The processing of each sample is unique because of the individual qualities of each sample, but it follows general guidelines established by laboratory personnel from previous tests and experiments (Hathaway 1982, Krause 1980).

Because each feature or sample may be subjected to exterior magnetic interferences which may overprint, disrupt or alter the magnetic orientation acquired at the time of firing, the samples are `demagnetized' in an attempt to remove the unwanted `secondary' components acquired after firing (or collection). Generally, magnetic components acquired after a material has been heated are spurious and less stable than the primary magnetism acquired at firing. These secondary components may, therefore, be randomized (e.g., removed) by relatively low levels of AC demagnetization while the primary magnetism remains strong. However, occasionally, samples are subjected to very strong secondary influences which may require higher levels of demagnetization.

Demagnetization is performed in `steps' at varying levels of maximum AC fields measured in oersteds. Each step is dependent upon the results from the previous step(s); so that, weaker samples are not subjected to overlarge fields which might destroy the primary magnetism as well as the unwanted secondary components. Demagnetization is continued until the sample magnetic direction remains stable and/or the alpha 95 values increase greatly. The optimum demagnetization level is then determined based on directional stablity and sample directional cohesion (the alpha 95 value is one of the indicators of cohesion). Generally, archaeomagnetic samples can be `cleaned' of secondary components by 100 oersteds of AC demagnetization.

Occasionally, it is necessary during analysis to delete a specimen from the sample results. Such a specimen is referred to as an outlier. Outliers are defined by specimen directions which, for some reason, deviate from the sample cluster and mean direction such that it is no longer considered to be representative of the sample. Outliers are removed from the sample, and the sample results recalculated. Because outliers may effect the mean sample direction and statistical measures disportionately, their exclusion improves the estimate of the true paleodirection.

Until recently, only demagnetized samples which had alpha 95 values equal to or less than 3.5° were considered for archaeomagnetic dating purposes. This criteria was initiated in 1980 by laboratory personnel as a cutoff point at which the dating range provided was useful for cultural dating of a site. The cutoff point for dating did not represent a lack of confidence in the paleopolar direction of samples with alpha 95 values over 3.5°. Rather, the direction of samples with large confidence intervals could not be precicely defined due to the large areas described by the ovals of confidence. However, since it is often important to archaeologists to provide relative dating sequences for structures on a single site or even to provide very large-range dates based on the archaeomagnetic information, the CSU laboratory has been providing paleopole plots of all demagnetized results with our recommendations as to reliability and stability. There are, however, still practical restaints of over-large alpha 95 values. Values over 10.0° have such large ovals of confidence that the entire curve will be encompassed, thereby not excluding any temporal possibilities.

<u>Description of Archaeomagnetic Terms</u>

The archaeomagnetic information provided on each laboratory report is a complete record of laboratory processing, key data recorded at each measurement step (NRM and demagnetization processing), and a complete report of results for the optimum demagnetization level used for plotting and dating the sample (if applicable). To fully understand this report, a glossary of terms is presented below:

Sample Declination - The mean horizontal direction measured. The value indicates the East or West deflection from a true North direction.

Sample Inclination - The mean magnetic vertical deflection measured. The value indicates the dip of the magnetic direction from horizontal.

Sample VGP Latitude and Longitude - The point at which the sample's magnetic direction (declination and inclination) intersect the earth.

Alpha 95 - Represents the radius of a circle about the mean sample direction within which the true direction is expected to fall at a 95% confidence level. Smaller values indicate tighter clustering about the mean direction; values under 3.5PtoPt will enable best dating accuracies at the appropriate time period.

Estimate of precision (k) - A statistical measure of sample directional continuity based on Fisherian statistics. The larger the value, the tighter the specimens cluster about the sample mean direction.

Errors along the great circle (EP) and perpendicular to the great circle (EM) - The 'oval' of confidence derived from the polar projection of the alpha 95 'cone' of confidence. The EP is enscribed along the the great circle defined by the site location and the paleopole position. EM is perpendicular to EP. Both EM and EP are centered on the mean paleopole position of the sample.

Intensity - The strength of the magnetic signal from a sample, assuming a 5.0 cubic centimeter volume for each specimen's enclosed earthen pedestal. Generally, the stronger the signal, the better the archaeomagnetic results (e.g., smaller the alpha 95). Average samples are on the order of 5×10^{-8} Tesla.

Development of the Southwest VGP Curve

Dating archaeomagnetic samples requires the development of a regional virtual geomagnetic pole (VGP) curve calibrated to precise chronometric ages by independently dated archaeomagnetic pole positions. Generally, samples independently dated by tree ring or radio carbon to within a 100 year range are used for building a regional VGP curve. As the data set of independently dated samples increases, the precision of the VGP curves improve, and polar movement in previously unknown time periods are documented and calibrated. Therefore, regional curves are continually being revised to provide the archaeological community with the most current information available.

Several VGP curves have been constructed for the American Southwest in the past. Dr. R.L. DuBois provided the first curve available for the Southwest (DuBois 1975, Watanabe and DuBois 1965 and Wolfman 1979). This curve was reportedly constructed from over 500 independently dated samples collected from the southwest region. However, since the actual data has not been published or made public, this information is of little use to other archaeomagnetists working in the Southwest. Therefore, several archaeologists and geophysicists concerned with the problem began to collect their own data sets of archaeomagnetic samples from the Southwest which could be independently dated by tree ring or carbon 14. Researchers from Colorado State University and the University of Arizona have recently published lists of archaeomagnetic sample results with the associated independent dating available (Eighmy, Hathaway and Kane 1985, McGuire and Sternberg 1982, and Sternberg 1982). These data sets are now available for use by any interested individual.

Development of a VGP curve from the available data sets has been accomplished in two major ways. The method used in the past, and occasionally still used, relies upon the compilation of two sets of curves - the average values from sample declinations and inclinations - which were then combined with the site latitude and longitude to provide the north polar curve or VGP curve. Recently, however, Dr. R.S. Sternberg has developed a statistical method of calculating VGP curves from the sample VGP locations. The method utilizes a range of time, referred to as a `window', which is employed to average all the VGP sample locations dating within a given window. The length of the window is determined from the range of independent dates provided in the data set and is approximately equal to the average independent time range. Windows along an entire curve will be constructed of different time lengths based on the data available. The windows are increased along the time scale to the limits of the independent dating of the archaeomagnetic samples. The increments are generally one-half the length of the windows used. It is possible to have `gaps' in the curves where less than two samples date to a given window of time.

The criteria used to select the independently dated samples for curve-building may vary from one laboratory to another, and, so, it is important to be aware of the information used in developing a particular curve and the limitations of the curve used. Different sets of data will result in differences in the curve location and precision with which the location is known. The CSU Archaeomagnetic Laboratory criteria for samples used in curve-building is fairly strict and, therefore, not all samples with independent dating published will be used for development of a curve. The criteria includes any sample with demagnetized results of 3.5^{o} alpha 95 values or less and for which the independent dating is within a 100 year range. The sample data used in the CSU Archaeomagnetic Laboratory's version of the Southwest VGP Curve is presented in Table 1. The subsequent curve developed from this information is presented in Table 2 and visually in Figure 1. The mean dates of the windows are provided in Figure 1 (e.g., the 700 date represents the 680-720 window); dates along the curve from AD 700 - AD 900 represent 20 year windows and dates along the curve from AD 900 - AD 1375 represent 50 year windows.

Dating archaeomagnetic samples

Dating an archaeomagnetic sample ultimately relies upon the samples' juxtaposition to the regional VGP curve. The dating method may be conducted in one of two ways; visual or statistical.

Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve.

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP. DATING RANGE
DAPP 1	2.21	82.30	244.94	AD 620 - 680
DAPP 2	1.92	81.85	180.06	AD 620 - 680
DAPP 4	1.93	86.27	356.49	AD 670 - 730
DAPP 71	3.20	88.69	70.16	AD 674 - 700
DAPP 3	1.96	82.84	36.20	AD 675 - 705
DAPP 5	1.72	87.73	44.62	AD 695 - 755
DAPP 6	2.03	82.94	52.13	AD 720 - 780
DAPP 7	2.38	83.43	54.62	AD 720 - 780
DAPP 99	1.52	81.29	63.12	AD 725 - 825
DAPP 114	2.04	80.26	60.39	AD 725 - 825
DAPP 8	2.20	79.98	61.88	AD 730 - 790
DAPP 91	2.99	86.54	68.72	AD 750 - 850
DAPP 96	3.46	84.03	15.90	AD 760 - 785
DAPP 9	2.15	86.12	77.67	AD 760 - 800
DAPP 145	1.53	82.78	60.09	AD 760 - 800
DAPP 112	2.07	84.04	47.78	AD 760 - 825
DAPP 113	2.49	82.88	45.55	AD 760 - 825
DAPP 10	2.25	87.29	8.97	AD 770 - 790
DAPP 11	1.88	81.00	65.29	AD 780 - 800
DAPP 12	1.32	78.98	42.30	AD 780 - 800
DAPP 13	2.55	78.48	58.25	AD 780 - 800
DAPP 64	2.00	84.99	65.72	AD 785 - 820
DAPP 15	1.28	78.05	45.05	AD 790 - 810
DAPP 16	1.40	76.53	53.45	AD 800 - 840
DAPP 17	1.65	75.28	57.24	AD 800 - 840
DAPP 115	2.12	81.53	51.03	AD 800 - 860
DAPP 100	1.30	79.43	52.19	AD 800 - 900
DAPP 147	1.28	80.74	63.50	AD 800 - 900
DAPP 44	2.10	81.40	68.17	AD 805 - 815
DAPP 116	2.53	85.21	38.94	AD 825 - 910
DAPP 127	2.02	82.31	68.08	AD 835 - 855
DAPP 18	2.19	84.43	37.83	AD 845 - 875
DAPP 102	2.77	81.05	49.04	AD 850 - 870
DAPP 129	2.77	83.51	35.24	AD 850 - 870
DAPP 139	2.23	82.52	16.12	AD 850 - 870
DAPP 146	1.81	79.72	21.21	AD 850 - 870
DAPP 94	2.47	86.56	5.44	AD 850 - 910
DAPP 111	2.59	84.72	105.18	AD 850 - 910
DAPP 117	3.48	81.47	13.91	AD 850 - 910
DAPP 19	1.82	88.14	301.40	AD 855 - 875
DAPP 28	2.28	86.20	0.53	AD 855 - 910

Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve. (continued)

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP. DATING RANGE
DAPP 20	2.21	87.52	4.29	AD 860 - 880
DAPP 142	1.74	84.45	17.53	AD 860 - 890
DAPP 106	1.28	85.36	54.99	AD 860 - 890
DAPP 27	2.54	85.21	28.16	AD 860 - 890
DAPP 21	2.34	88.19	344.94	AD 860 - 900
DAPP 22	1.48	89.32	330.14	AD 860 - 900
DAPP 126	1.87	86.66	337.49	AD 860 - 910
DAPP 105	3.14	84.65	351.32	AD 860 - 910
DAPP 118	2.77	80.91	41.45	AD 860 - 910
DAPP 133	2.09	84.21	57.63	AD 860 - 925
DAPP 136	1.21	83.46	38.52	AD 862 - 892
DAPP 134	3.54	78.07	7.50	AD 865 - 885
DAPP 144	2.81	81.23	43.69	AD 865 - 885
DAPP 26	1.71	84.01	30.35	AD 865 - 895
DAPP 85	2.23	86.69	14.30	AD 865 - 915
DAPP 24	1.39	82.48	53.56	AD 870 - 890
DAPP 25	1.44	87.20	319.19	AD 870 - 890
DAPP 131	3.02	82.57	31.37	AD 870 - 890
DAPP 90	3.53	87.54	9.74	AD 870 - 900
DAPP 124	2.69	86.51	19.37	AD 870 - 900
DAPP 29	3.01	85.12	7.92	AD 870 - 910
DAPP 121	2.19	89.09	97.65	AD 870 - 910
DAPP 122	2.37	82.10	12.52	AD 870 - 910
DAPP 123	2.23	83.20	12.76	AD 870 - 910
DAPP 92	3.03	79.27	12.93	AD 870 - 910
DAPP 125	2.98	89.36	215.86	AD 870 - 910
DAPP 137	2.70	84.31	2.70	AD 875 - 910
DAPP 103	1.49	86.03	352.07	AD 875 - 910
DAPP 104	2.30	84.73	38.14	AD 875 - 910
DAPP 30	2.33	86.32	9.94	AD 880 - 900
DAPP 31	1.12	86.27	32.18	AD 880 - 900
DAPP 32	1.73	78.23	27.42	AD 880 - 900
DAPP 33	1.43	81.42	33.99	AD 880 - 900
DAPP 34	1.72	82.79	20.74	AD 880 - 900
DAPP 132	1.94	83.95	35.67	AD 880 - 900
DAPP 138	1.59	81.48	21.50	AD 880 - 900
DAPP 140	1.71	79.85	32.24	AD 880 - 900
DAPP 143	2.05	82.51	32.05	AD 880 - 900
DAPP 101	3.01	85.52	26.59	AD 880 - 900
DAPP 128	3.04	85.42	19.49	AD 880 - 900
DAPP 130	2.89	82.37	47.37	AD 880 - 900
DAPP 89	3.18	79.32	352.93	AD 880 - 900
DAPP 23	1.00	85.05	27.66	AD 880 - 900

Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve. (continued)

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP. DATING RANGE
DAPP 35	2.34	83.80	195.20	AD 880 - 920
DAPP 88	1.73	85.89	311.11	AD 880 - 920
DAPP 135	2.57	80.99	40.46	AD 890 - 910
DAPP 141	1.42	82.45	27.23	AD 890 - 910
DAPP 84	3.25	88.86	191.39	AD 890 - 920
DAPP 36	1.50	86.40	131.97	AD 890 - 920
DAPP 66	1.80	87.62	149.18	AD 936 - 1000
DAPP 67	2.00	83.16	239.45	AD 936 - 1000
DAPP 148	1.33	76.46	201.93	AD 1045 - 1055
DAPP 86	2.90	75.54	193.50	AD 1000 - 1100
DAPP 68	3.30	76.11	207.15	AD 1020 - 1050
DAPP 87	2.00	73.59	176.59	AD 1050 - 1150
DAPP 65	3.10	63.18	209.75	AD 1060 - 1150
DAPP 82	2.80	72.76	192.53	AD 1088 - 1097
DAPP 53	1.70	77.32	196.57	AD 1100 - 1200
DAPP 83	2.90	76.63	194.84	AD 1101 - 1130
DAPP 72	2.10	73.14	189.77	AD 1107 - 1150
DAPP 119	1.90	75.93	197.12	AD 1130 - 1170
DAPP 73	1.40	78.35	185.11	AD 1150 - 1250
DAPP 74	3.30	78.50	186.04	AD 1150 - 1250
DAPP 75	1.50	77.14	194.34	AD 1150 - 1250
DAPP 76	2.60	76.41	195.16	AD 1150 - 1250
DAPP 63	1.20	76.72	190.77	AD 1150 - 1250
DAPP 77	1.90	82.35	218.91	AD 1175 - 1275
DAPP 78	3.50	79.34	166.02	AD 1175 - 1275
DAPP 79	1.40	84.37	209.39	AD 1175 - 1275
DAPP 80	1.50	82.23	209.39	AD 1200 - 1300
DAPP 81	2.00	81.47	185.04	AD 1200 - 1300
DAPP 120	1.70	82.39	193.86	AD 1220 - 1280
DAPP 50	2.00	67.89	225.16	AD 1240 - 1300
DAPP 51	2.10	72.68	198.18	AD 1240 - 1300
DAPP 52	3.20	75.74	196.57	AD 1240 - 1300
DAPP 49	3.20	86.62	216.26	AD 1250 - 1272
DAPP 61	1.90	86.61	162.90	AD 1270 - 1300
DAPP 46	2.30	81.21	199.75	AD 1271 - 1300
DAPP 70	2.10	78.44	212.66	AD 1272 - 1300
DAPP 56	3.20	84.72	204.73	AD 1275 - 1325
DAPP 69	3.00	79.87	221.60	AD 1280 - 1300
DAPP 47	2.30	81.59	209.55	AD 1285 - 1300
DAPP 48	3.30	79.81	188.36	AD 1285 - 1300

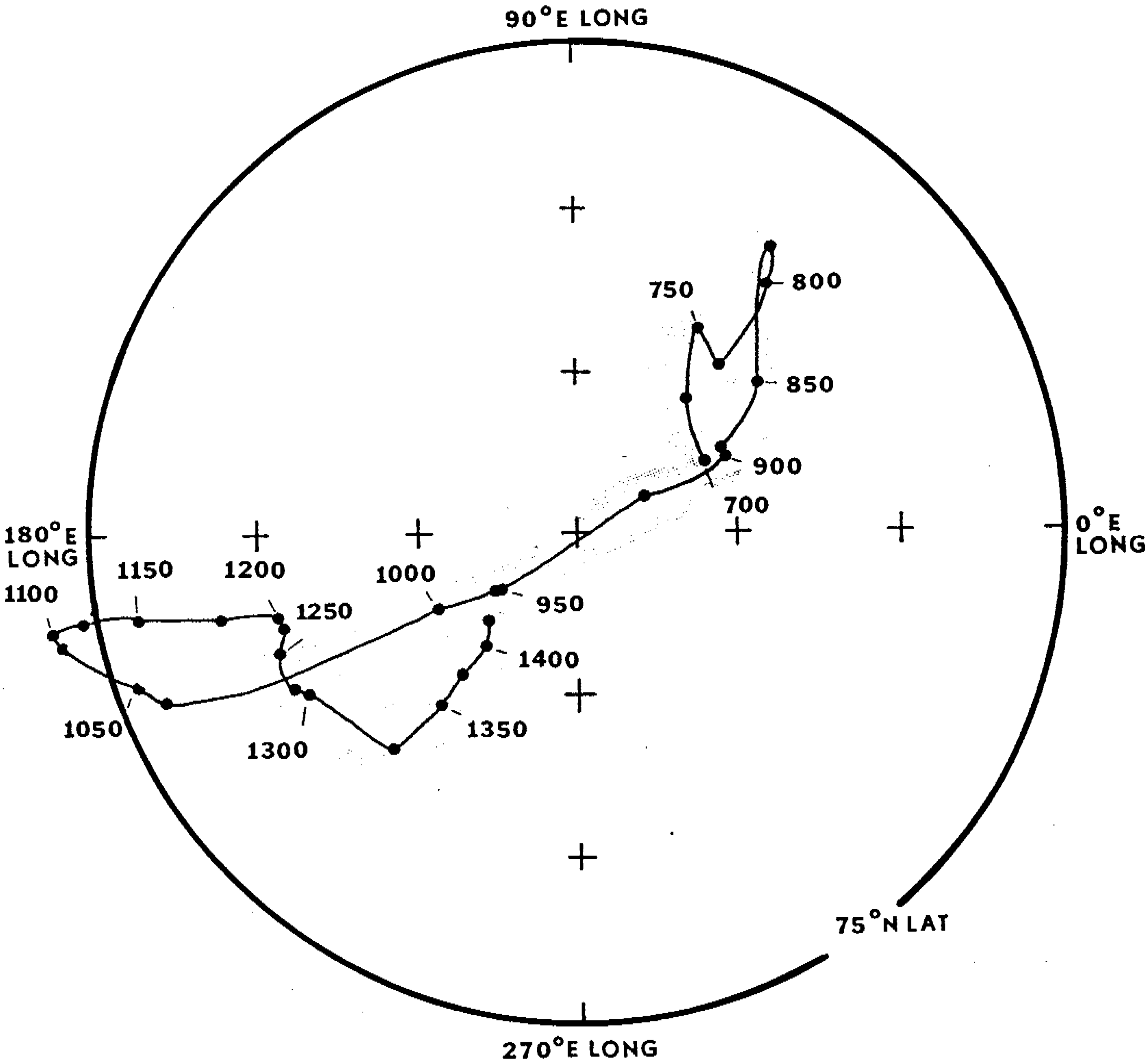
Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve. (continued)

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP. DATING RANGE
DAPP 62	3.20	80.52	211.55	AD 1300 - 1325
DAPP 58	2.50	78.05	225.38	AD 1300 - 1350
DAPP 57	2.30	82.53	256.55	AD 1300 - 1375
DAPP 55	2.10	84.17	208.42	AD 1350 - 1375
DAPP 59	2.90	83.50	238.45	AD 1350 - 1400
DAPP 60	2.60	83.06	233.73	AD 1350 - 1400
DAPP 54	1.30	85.43	228.19	AD 1385 - 1450
DAPP 97	1.93	86.86	224.65	AD 1400 - 1425
DAPP 93	2.60	76.50	299.20	AD 1850 - 1875

Table 2. VGP locations and precisions for windows of time along the current Southwest Master Curve.

WINDOW OF TIME BEGIN	END	ALPHA 95	PLAT	PLONG	NUMBER OF SAMPLES
690	710	3.53	85.98	29.61	4
715	735	2.68	84.71	49.94	7
740	760	2.19	82.80	58.53	7
765	785	1.53	83.31	47.74	16
790	810	1.39	80.38	52.52	18
815	835	1.92	79.33	55.68	12
840	860	1.88	82.72	39.32	16
865	885	0.88	85.03	28.67	57
890	910	1.00	84.90	27.65	48
900	950	1.71	87.34	27.98	27
925	975	15.69	86.79	214.22	2
950	1000	15.69	86.79	214.22	2
975	1025	6.93	85.06	207.19	4
1000	1050	2.03	76.26	202.20	3
1025	1075	3.53	75.79	198.54	5
1050	1100	4.88	73.98	192.81	5
1075	1125	3.71	73.70	191.24	7
1100	1150	3.98	74.47	191.83	6
1125	1175	1.91	76.10	192.00	11
1150	1200	2.01	78.76	193.24	10
1175	1225	2.03	80.23	194.63	12
1200	1250	2.24	80.16	196.99	14
1225	1275	2.63	80.07	203.32	18
1250	1300	2.90	80.10	207.95	17
1275	1325	2.76	80.28	209.64	16
1300	1350	4.74	81.18	228.09	4
1325	1375	3.11	83.06	229.91	5
1350	1400	1.90	84.13	229.23	5
1375	1425	1.64	85.40	229.68	4
1400	1450	2.84	85.83	227.44	2

Figure 1. The current Southwest Master VGP Curve used by the CSU Laboratory.



The statistical method is used in the final report as developed by Dr. R.L. Sternberg (Sternberg 1982). This technique depends first upon the development of a statistically-created curve (as described above). Each window location along the curve (e.g., AD 680-720 through AD 1375-1425) is then compared to the VGP location of the undated sample. The precise probability that the sample location is the same as a given window is calculated for all cases. The archaeomagnetic date is then determined based on the probabilities at the various windows. All date windows associated with a problability of .95 or less are deamed as possible 'dates' for the archaeomagnetic sample being tested (e.g., this is the 95% confidence level). The smallest date range possible for any sample is dependent upon the window range selected for the curve-building and ultimately on the range of the independent dates of samples used in construction of the curve. Although this method is accomplished through computer analysis using the demagnetized results of the samples, a visual plot of the archaeomagnetic sample with the appropriate curve is provided with the laboratory report. In addition, the mean VGP location of each of the samples is plotted with the appropriate curve for analysis of the relative order of samples from associated features or sites.

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APPENDIX 6: REPORT FROM THE ARCHAEOMAGNETIC DATING LABORATORY, OFFICE OF ARCHAEOLOGICAL STUDIES, MUSEUM OF NEW MEXICO

TO: Regge N. Wiseman

FROM: Daniel Wolfman

RE: **Belen Bridge Archaeomagnetism Results**

DATE: March 20, 1992

Enclosed are copies of a summary table of the results for all six samples, which includes my archaeomagnetic dates, and my plots of the ovals of confidence against the curve that I have developed for the Southwest for ca. A.D. 1000 - 1460. The samples are those originally measured by J. Eighmy; I simply use the data he supplied to you in his report dated 8/31/87.

To give you an idea of the manner in which I undertake archaeomagnetic dating and to help you read the table you should consult my article, "Archeomagnetic Dating in Arkansas and the Border Areas of Adjacent States", a copy of which I gave you with the report of the archaeomagnetic results from the Fox Place. Further information on archaeomagnetic dating can be found in my review article, "Geomagnetic Dating Methods in Archaeology," which appeared in volume 7 of Advances in Archaeological Method and Theory (pp. 363-458, edited by M. B. Schiffer. Academic Press, New York [1984]). Jeff Eighmy's method of curve construction was developed by Robert Sternberg. It is described in Robert S. Sternberg and Randall H. McGuire's chapter, "Techniques for Constructing Secular Variation Curves and for Interpreting Archaeomagnetic Dates," which appeared in Archaeomagnetic Dating (pp. 109-134, edited by J. L. Eighmy and R. S. Sternberg. University of Arizona Press, Tucson [1990]). A critique of Sternberg's method of curve construction is contained in my chapter "Retrospect and Prospect" which also appeared in the book Archaeomagnetic Dating (pp. 313-364). The method I use gives rise to longer broader curves than those generated using Sternberg's method. Consequently, the archaeomagnetic date ranges I obtain usually are smaller than those obtained by Eighmy. Eighmy's method of determining archaeomagnetic dates, in which he compares the sample's oval of confidence with the curve is very similar to the method I use.

Both Eighmy and I list more than one alternative when the oval of confidence cuts more than one section of curve. However, the full strength of archaeomagnetic dating is achieved when it is used in conjunction with other chronometric evidence. Archaeomagnetic dating (as used by both of us) can then pinpoint the age somewhat more precisely by choosing the alternative that falls within this range. Consequently, on the enclosed table I have marked the most likely alternative (assuming that other chronometric evidence strongly indicates that the site dates in the A.D. 1100 - 1300 range) with an asterisk (*).

I find it rather strange that the demagnetization of all six of your samples (at 50 and 100 Oersteds) increased the alpha-95 values (i.e., the dispersions) of the results. In the work I have done, demagnetization usually decreases dispersion. In addition I routinely demagnetize all samples to at least 300 oersteds (in steps of 50,100, 150, 200, and 300) and will demagnetize to higher levels if the sample continues to improve up to 300 oersteds. I would expect that using the equipment in the University of

California at Santa Barbara (UCSB) Lab, or the equipment we will be getting, that improved results (in the sense of smaller dispersion and magnetic stability [see below]) can be obtained for most, and perhaps all, of your samples. Consequently, as we have discussed, I would suggest that we get all six samples back from the Colorado State University Lab and that I continue demagnetizing and measuring at least one sample up to at least 300 oersteds as a pilot study. If improved results are obtained, I would suggest that we try to get additional funds and process the remaining five samples in the same way.

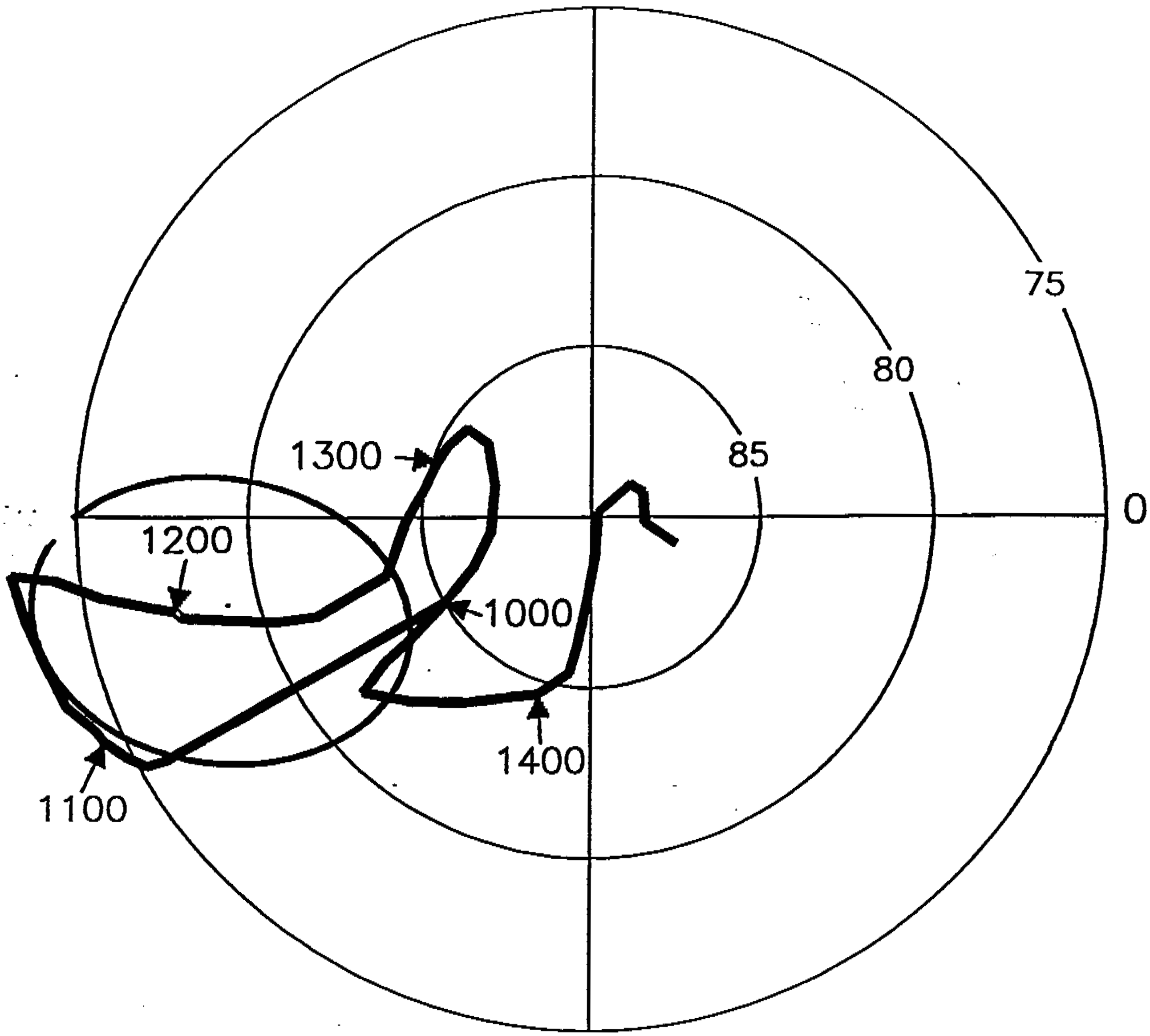
Eighmy has chosen to report all his archaeomagnetic dates using the results obtained after demagnetizing at the 100 oersted level which, in all cases, has the greatest dispersion. As I have discussed in the "Retrospect and Prospect" chapter (p. 342), selecting the "best" level of demagnetization is usually based on minimal dispersion and at a level where there is little or no change in direction taking place. For this reason I have used some results after demagnetizing at 50 oersteds and others after demagnetizing at 100 oersteds. As noted above, I think better results can be obtained with additional demagnetization.

I will, of course, be happy to provide any additional information or clarification you need.

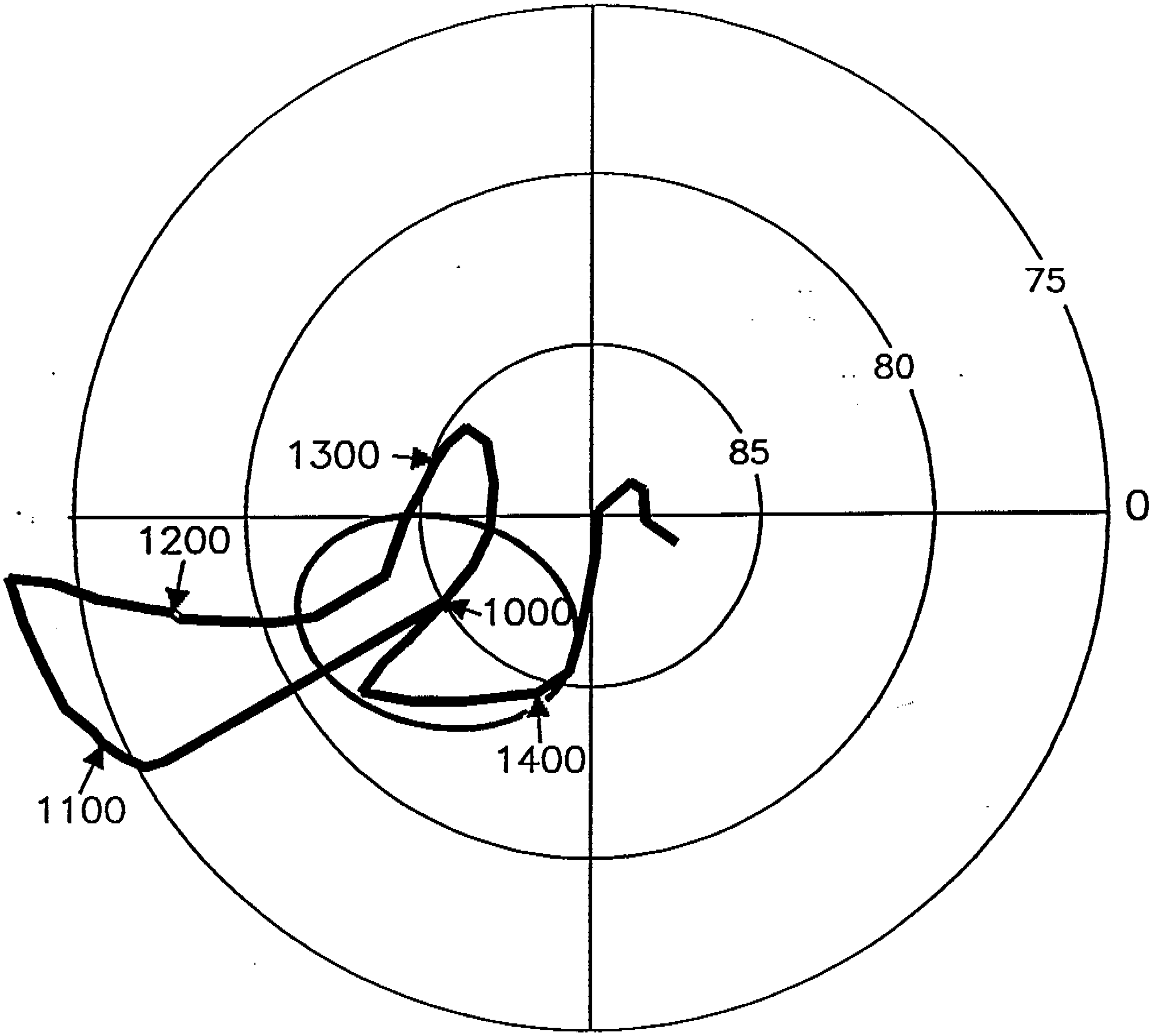
ARCHAEOMAGNETIC RESULTS, BELEN BRIDGE

Lab No.	Feature	Inclination	Declination	VGP Latitude	VGP Longitude	α_{95}	δ_p	δ_m	N	Demag.	Estimated Date (A.D.)	Archaeomagnetic Date (A.D.)
BB10	Pithouse 2 (Fea. 10)	59.06	347.58	78.9	194.6	3.70	4.1	4.1	12/12	50	1100-1300	1005-1275
BB14	Pithouse 1 (Fea. 14)	58.03	355.65	84.66	213.74	2.79	3.0	4.1	12/12	100	1100-1300	940-1040 1220-1300* 1315-1420
BB17	Pithouse 3 (Fea. 17)	55.08	348.32	80.4	172.4	4.22	3.8	5.3	12/12	50	1100-1300	1230-1360
BB20	Pithouse 4 (Fea. 20)	59.17	353.39	82.5	210.7	2.23	2.5	3.3	12/12	50	1100-1300	995-1055 1215-1285* 1340-1395
BB23a	Hearth 23a (Fea. 23a)	54.87	357.04	86.29	181.21	4.68	3.7	5.2	12/12	50	1100-1300	920-1010 1255-1350* 1405-1460
BB34	Pithouse 5 (Fea. 34)	57.35	348.93	80.49	186.87	2.21	2.4	3.2	12/12	100	1100-1300	1195-1275

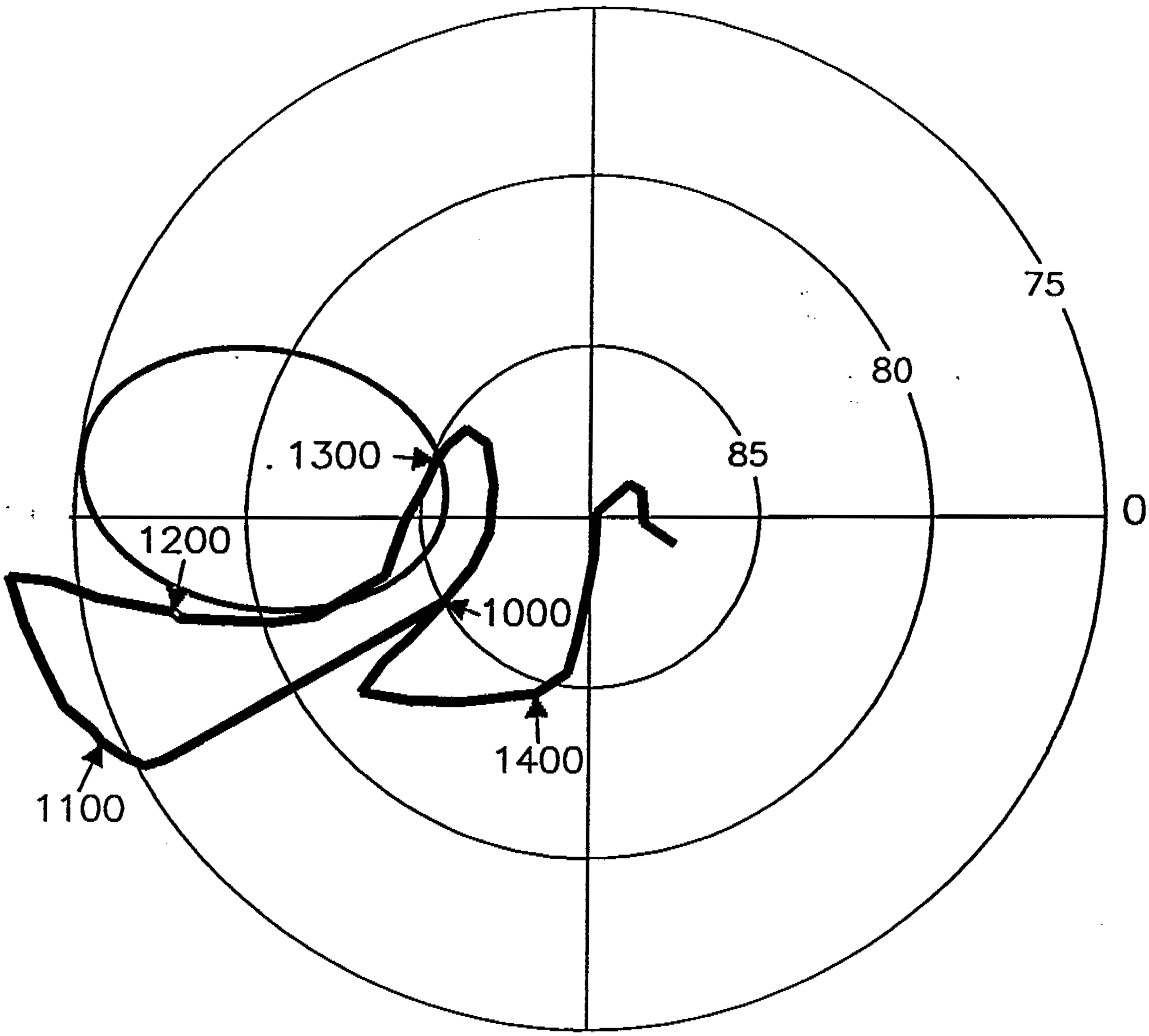
* Most likely date



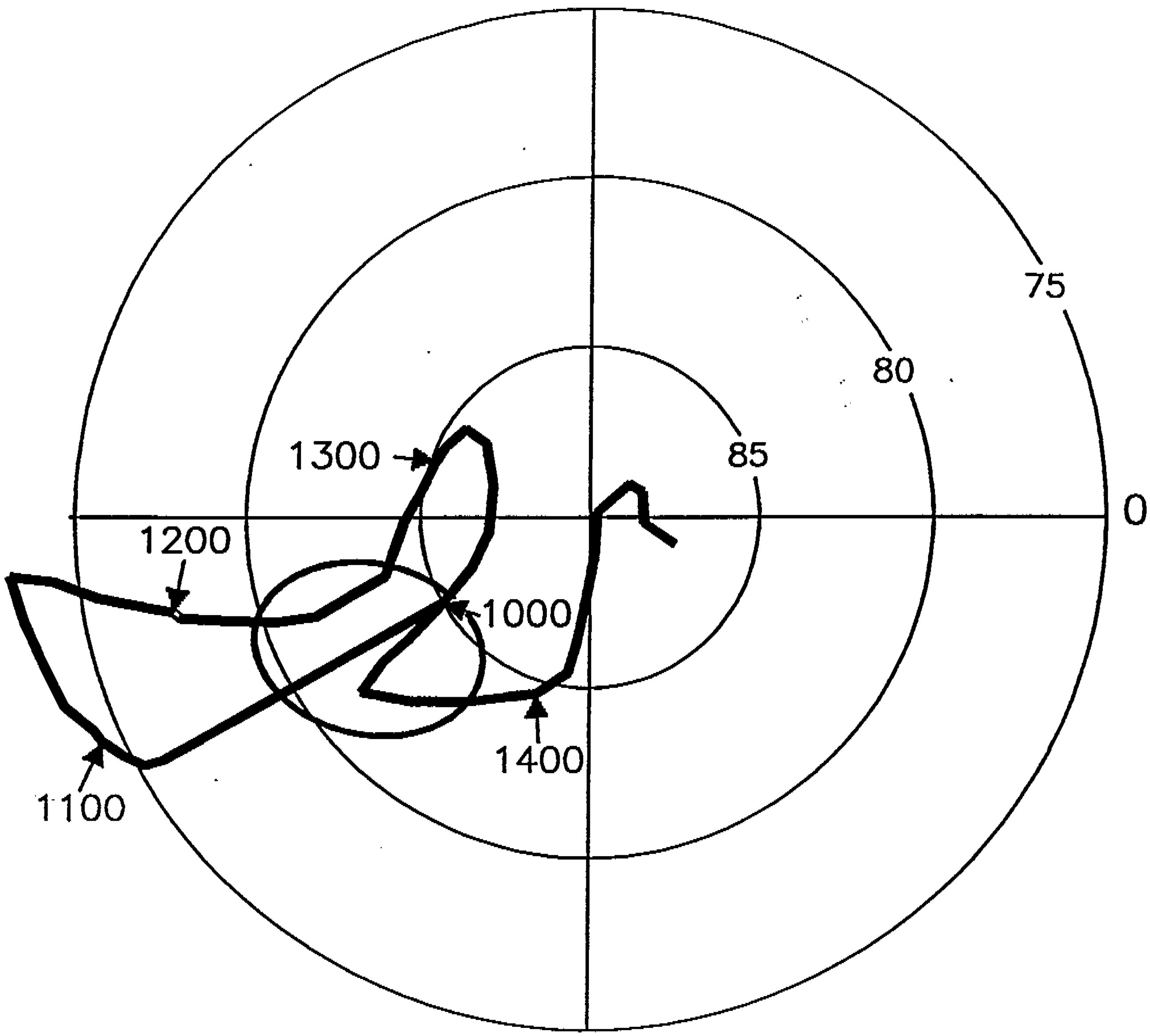
Southwest Polar Curve ca. A. D. 1000 - 1400
with the VGP for BB10 and its
95% oval of confidence



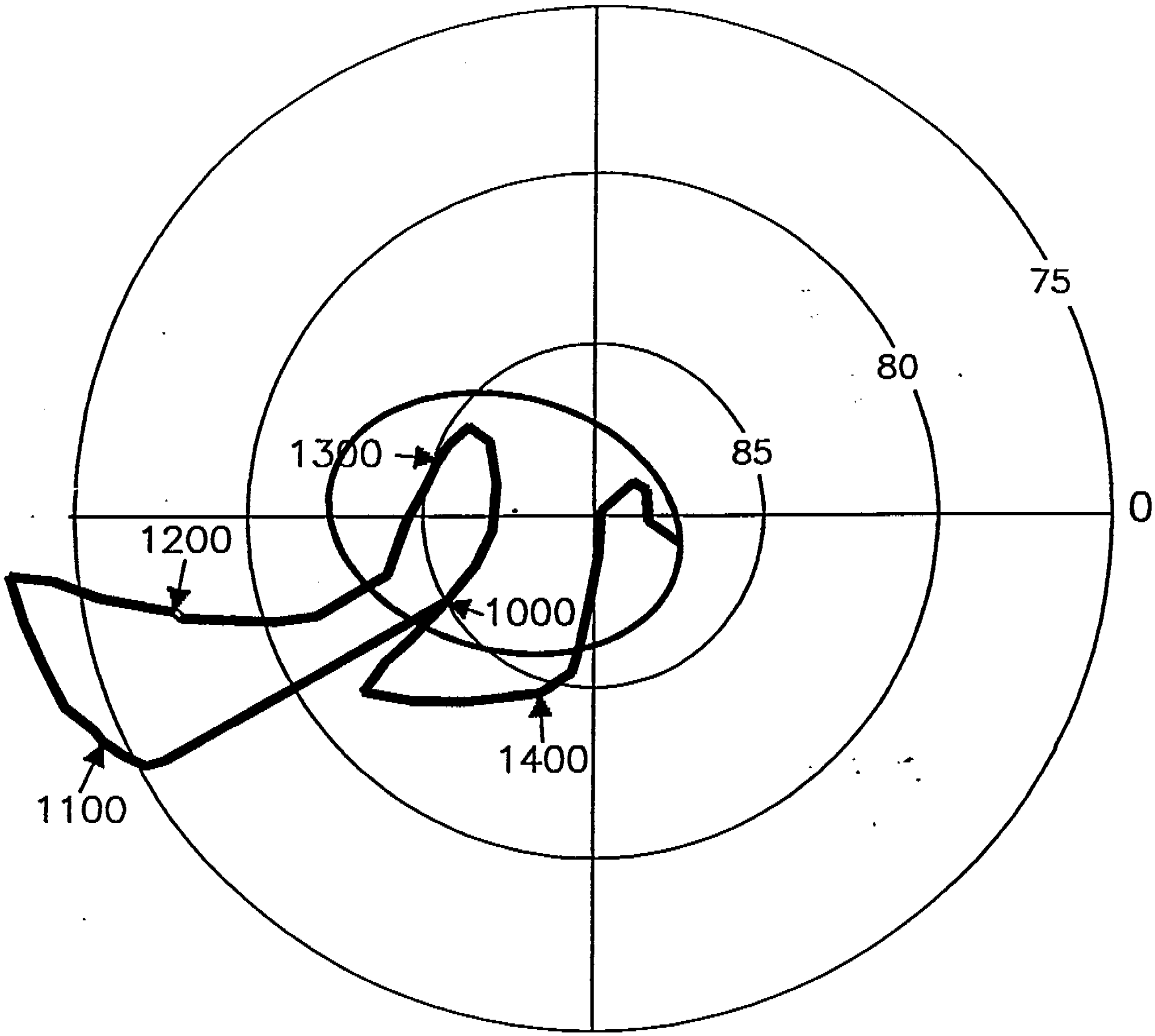
Southwest Polar Curve ca. A.D. 1000 - 1400
with the VGP for BB14 and its
95% oval of confidence



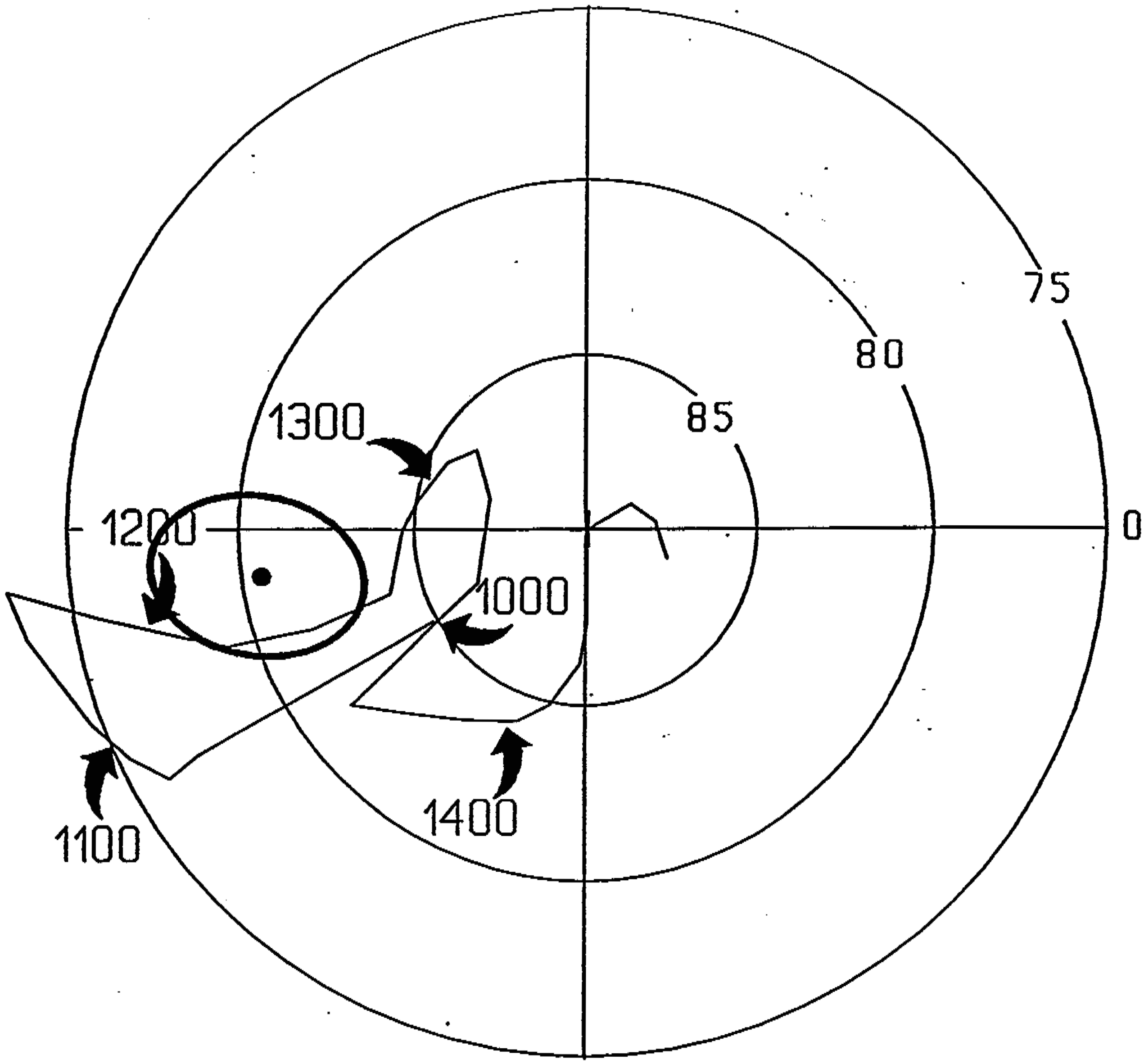
Southwest Polar Curve ca. A. D. 1000 - 1400
with the VGP for BB17 and its
95% oval of confidence



Southwest Polar Curve ca. A. D. 1000 - 1400
with the VGP for BB20 and its
95% oval of confidence



Southwest Polar Curve ca. A. D. 1000 - 1400
with the VGP for BB23A and its
95% oval of confidence



Southwest Polar Curve A.D. 1000 - ca. 1450
with the VGP for BB34 and its 95% oval of confidence