MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

THE EXCAVATION OF A MULTICOMPONENT ANASAZI SITE (LA 50337) IN THE LA PLATA RIVER VALLEY, NORTHWESTERN NEW MEXICO

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ARCHAEOLOGY NOTES 49

SANTA FE 1986 NEW MEXICO

ADMINISTRATIVE SUMMARY

Buried cultural deposits were exposed during utility relocation work being completed as part of a project to reconstruct State Road 170, near Farmington in San Juan County. Subsequent field inspection identified a large multicomponent Anasazi site, 30 by 70 m of which lies within the right-of-way. The site was considered eligible for the *National Register of Historic Places* and a data recovery plan was produced for excavation of the portion of the site to be affected by the construction project.

LA 50337 is situated on the second terrace along the west side of the La Plata River[redacted]. First use of the site area within the right-of-way dates to roughly the sixth century A.D. and is represented by an isolated hearth and a charcoal and ash discard pile. A pit structure containing Cortez Black-on-white sherds and radiocarbon dates of ca. A.D. 750 represents the second period of occupation. The third and largest occupation of the site consists of a pueblo of about 30 rooms, a small room block with about six rooms, a single isolated room, and a kiva (the pueblo was not excavated because it is outside the right-of-way, beneath an existing structure). Ceramics associated with these features include Cortez and Mancos Black-on-white. Ceramics and radiocarbon dates indicate that these structures were used during the tenth and eleventh centuries A.D. The fourth occupation at the site includes a large roasting pit that contained both Mancos and McElmo Black-on-white ceramics. It appears to represent a twelfth-century A.D. use of the site area. The final occupation of the site took place during the thirteenth and fourteenth centuries. It is associated with an isolated hearth and disturbed deposits including both McElmo and Mesa Verde Black-on-white pottery.

MNM No. 41.362
NMSHTD Project No. RS-1331[4]

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ACKNOWLEDGMENTS

The field personnel included Bradley Vierra (project director), Richard Sullivan (field assistant), and the following crew members: Kurt Anschuetz, Cindy Bunker, Dave Bunker, Drew Davis, John Ellis, Amy Hill, Melba King, Jim Lancaster, Ann Noble, and Steve Post. A special thanks must be given to Gene Walker, owner of A-Z Auto Parts for allowing us access to his restrooms and soda machine, two very important things on a long hot summer's day. Gene also kept a watchful eye on the site over the weekends when we were gone. This project was a discovery situation and the site was found during highway construction work. Steve Koczan (highway archaeologist) and Robert Baker (project manager) were both very supportive and understanding, considering the difficulties this brought for the highway department. We would also like to acknowledge Mountain Bell for bringing this site to our attention.

Laboratory personnel included Richard Sullivan, Steve Post, and Dorothy Zamora. Volunteers, like Carole Potter, Anthony Martinez, Art Panaro, and Betty Weber, helped in a number of ways from washing and labeling to ceramic vessel reconstructions. Illustrations for this report were drafted by Ann Noble, the technical editing was done by Robin Gould, and artifact photographs were taken by Nancy Warren.

INTRODUCTION

In April 1985 during utility relocation activities conducted in association with a road construction project, subsurface cultural deposits were exposed along State Road 170 (the La Plata Highway, NMSHTD Project RS-1331[4]). At this time the cultural material exposed consisted of a human tibia and some Mancos Black-on-white sherds, which were observed in the backdirt pile. These presumably represented the remains of a previously disturbed Anasazi burial. The discovery of buried cultural deposits was brought to the attention of New Mexico State Highway and Transportation Department and the utility company. Although the area had been previously surveyed (see Lancaster 1982), there are no surface indications of the site within the right-of-way.

Archaeologists from the Research Section, Laboratory of Anthropology, Museum of New Mexico, and the Cultural Resource Management Program at San Juan College monitored inital construction and determined that intact cultural deposits were present along the eastern side of the road, including a trash deposit, a pit feature, and an ash/charcoal lense. More cultural deposits were unearthed in a southern extension of the backhoe trench along the eastern side of the road, and portions of three rooms were exposed in a grader cut along the western side of the road. Because of the nature of the cultural material within the project limits, more extensive investigations were needed to recover important materials.

On May 23, 1985, representatives of the New Mexico State Highway and Transportation Department, State Historic Preservation Officer, Federal Highway Administration, Inter-Agency Archeological Services, and the Laboratory of Anthropology met for a field inspection of the site to determine the appropriate procedures to be implemented for a discovery situation. The site was considered eligible for the *National Register of Historic Places* on the basis of criterion "d" by the State Historic Preservation Officer and a data recovery plan was proposed by the Research Section. This evaluation and the data recovery plan for LA 50337 were reviewed by appropriate agencies.

Work was completed at LA 50337 on July 18, 1985. The site was revisited by Steve Koczan and Bradley Vierra on October 9, 1985, to determine the nature and extent of subsurface cultural deposits exposed under the pavement of the existing road. A backhoe trench was dug and only one isolated trash deposit was identified.

ENVIRONMENT

Richard B. Sullivan

LA 50337 is located within the San Juan slope area of the San Juan Basin, a physiographic subdivision of the Colorado Plateau Province.

The San Juan Basin is characterized by an expanse of broad plains dissected by mesas and buttes of generally low relief. Drainages within the basin consist of sandy bottomed ephemeral washes and perennial riparian environments (Bierei 1977).

The site is situated at the western edge of the city of Farmington, New Mexico on the second terrace above the west side of the La Plata River at an elevation of 1,735 m (Fig. 1). Approximately 2.2 km south of the site is the confluence of the La Plata and San Juan rivers. Directly west of the site is the mouth of an ephemeral unnamed tributary of the La Plata, which cuts a mesa 1,797 m in elevation. Alluvial deposits from the ephemeral wash and colluvium from the mesa contribute to the aggradation of the site locale.

The valley bottom in the site area is made up of flood plain deposits containing sand, silt, clay pockets, and some gravels, which are mainly flat but include terraces to about 6 m high (Hunt 1977). To the east of the La Plata, the flood plain is approximately 450 m wide and consists of two distinct terraces, while to the east, the flood plain is approximately 50 m wide with one terrace evident. The terraces are comprised of a thin layer of sand overlying a gravel substrate and are dissected by numerous tributaries of the La Plata; erosion of the first terrace is the most severe (Lancaster et al. 1983).

Geology

Within the San Juan Basin there are many exposed geologic units. However, only those formations appearing near the site area will be discussed.

Within or near the site area are four exposed stratigraphic units. From youngest to oldest these are: the Galisteo Formation, the Nacimiento Formation, the Ojo Alamo Formation, and the Kirtland/Fruitland Formation.

The Galisteo Formation, occurring on the mesa west of the La Plata River, consists of gravel terraces formed by Pleistocene melt. These terraces are found up to 82 m above present stream channels and contain gravels with a diameter of 15 cm or more (Hunt 1977). Common lithic material types among these gravels are cherts, hornfels, quartzite, vitrophyre, plus other metamorphic and igneous types (Warren 1985).

The Nacimiento Formation, which forms the escarpment and mesa to the east of the river, contains gray and black shales with interbedded sandstone. Quartzite, sandstone, and silicified wood are common within this formation (Warren 1985).

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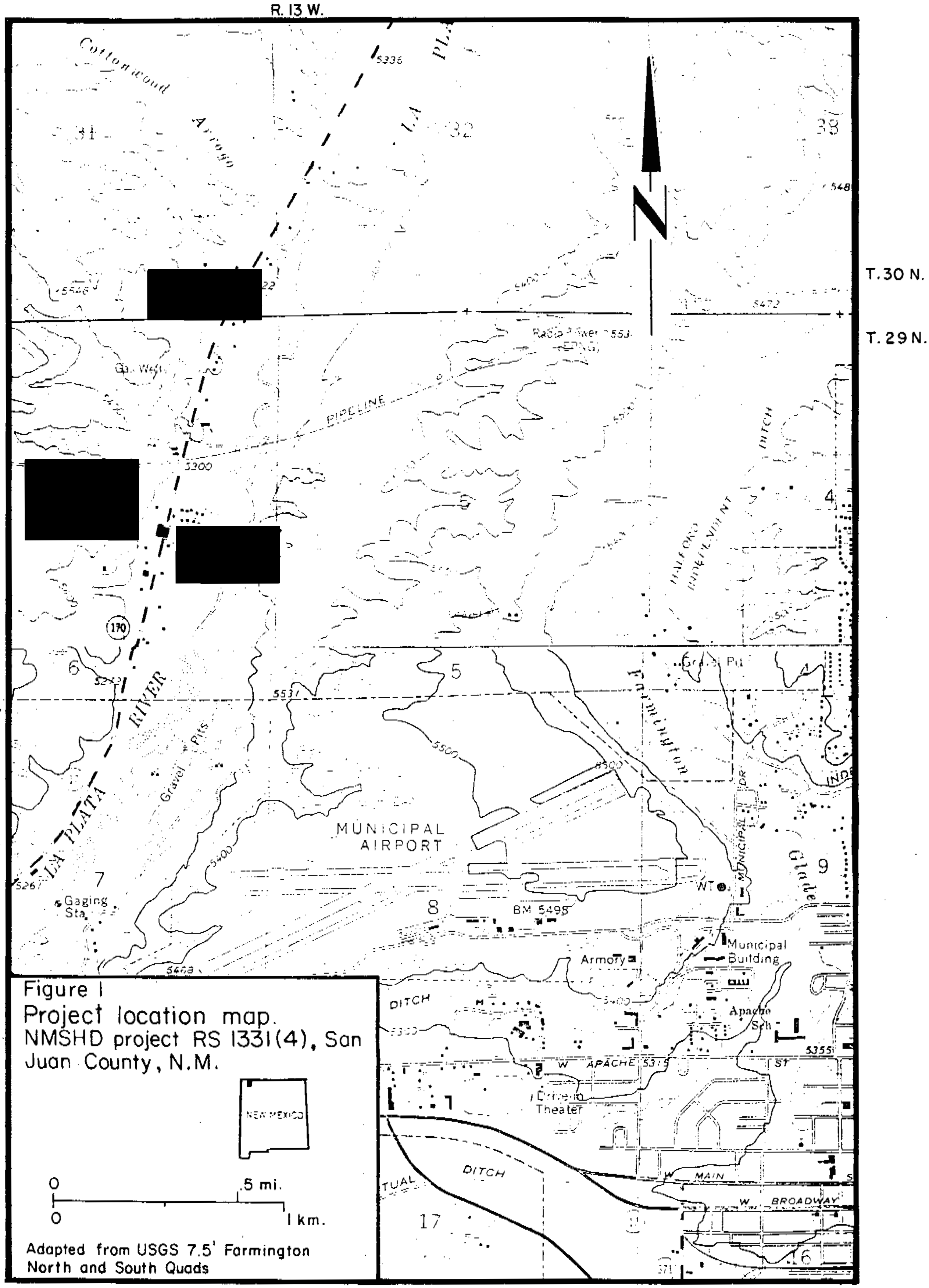


Figure 1
Project location map.
NMSHD project RS 1331(4), San Juan County, N.M.

Adapted from USGS 7.5' Farmington North and South Quads

The Ojo Alamo Formation forms a portion of the mesa west of the river and consists of conglomeratic sandstone, shale, chert, chalcedony, silicified wood, rhyolite, granite, gneiss, schist, and other cobbles (Warren 1985).

The Kirtland/Fruitland Formation makes up the escarpment and part of the mesa to the west of the river. This formation contains sandstone, shale, coal, silicified wood, barite, aragonite, and gypsum (Warren 1985).

As can be seen from the above description, the Galisteo and Ojo Alamo formations offer the most potential for lithic materials; these formations are thought to be the primary quarry areas for LA 50337.

Soils and Flora

The soils found in the vicinity of the site are members of the group Light Colored Soils of the Cool Desertic Region. There are three major associations represented: the Werlow-Fruitland-Tarly in the flood plain, the Doak-Shiprock found on the sloping tops of elevated benches and mesas, and the Hilly-Gravelly found on the escarpments and steep sides of the old river terraces (Maker et al. 1973).

The soils of the Werlow-Fruitland-Tarly association typically occur in the valleys of the La Plata, San Juan, Animas, and Los Pinos rivers and in their intermittent tributaries. These soils form in stratified alluvium of mixed origin and are level to gently sloping. Historically, this association is the most extensively cultivated in the site area. Corn and alfalfa are the chief crops. Rural noncultivated areas are used for grazing livestock and as forage for wildlife. Native flora in the noncultivated area of this association include western wheat grass *(Agropyron smithii)*, four-winged saltbush *(Atriplex canescens)*, Indian ricegrass *(Oryzopsis hymenoides)*, sand dropseed *(Sporobolis cryptandrus)*, galleta grass *(Hilaria jamesii)*, alkali sacaton *(Sporobolis airoides)*, blue gramma *(Bouteloua gracilis)*, snakeweed *(Gutierrezia sarothrae)*, and cottonwood *(Populus fremonti)* (Maker et al. 1974).

The Doak-Shiprock association occurs on mesa tops and benches, forming in thick alluvial deposits on old stream terraces and alluvial fans. Although the soils of this association are suitable for agriculture, erosion has eliminated much of the landscape. Isolated remnants of this association have been left on mesas up to 100 m above watercourses, making irrigation under present circumstances unfeasible. Grazing livestock is the principal economic use for these soils. Native flora in this association includes Indian ricegrass, galleta, blue gramma, sagebrush *(Artemisia filifolia)*, snakeweed, and a number of annuals (Maker et al. 1973).

The Hilly-Gravelly land association occurs on the steep sides of old river terraces and mesas. Typical of this association is a thin layer of gravelly alluvium. Grazing is the only practical use of this association. Vegetation is sparse with blue gramma, sand dropseed, Indian ricegrass, three awn *(Artistida longeseta)*, ring muhly *(Muhlenbergia torreyi, M. pungens)*, western wheat grass, sagebrush, rabbitbrush *(Chrysothamnus nauseosus)*, and juniper *(Juniperus monosperma)* represented (Maker et al. 1973).

Of the three soil associations present in the site area, the relatively flat alluvial soils of the Werlow-Fruitland-Tarly association have a slightly higher clay content, increasing their water holding capacity. The geographic location of this association (i.e., valley bottoms) augments the water available from direct rainfall due to runoff from adjacent landforms giving this association the greatest potential for agriculture both historically and prehistorically in the site area.

Climate

The climate in the San Juan Basin has been described as having little cloudiness, large annual and diurnal variation in temperature, moderate to high winds, meager precipitation, and low relative humidity.

Yearly precipitation in the basin varies greatly. Records show a low of 103 mm in 1950 and a high of 469 mm in 1941, as measured at the Farmington 3NE station. The mean annual precipitation at this station for the 33 years in which there are records, between 1914 and 1954, is 203 mm (Reynolds 1954). The San Juan Basin is known to have intense rainfalls in New Mexico with steady prolonged storms rare. Thunderstorms between July and October account for nearly one-half of the yearly average rainfall while June and November are the driest recorded months.

Potential evapotranspiration, which is defined as evaporation from the soil and transpiration from the plants when the water supply in the ground is unlimited (Tuan et al. 1973), averages between 660 mm and 762 mm annually in the site area, resulting in a moisture deficit between 355 mm and 457 mm.

Mean monthly temperatures near the site area range from a low of -1.6 degrees C in January to 24.4 degrees C in July, recorded extremes are -29.1 degrees C at Bloomfield and 43.3 degrees C at Fruitland. The frost-free season in the site area averages between 160 to 180 days and ranges from a high of 214 days in 1926 to a low of 115 days in 1914. Although the frost-free season appears adequate for most crops, the growing season is generally shorter because plant growth usually does not occur under 5.5 degrees C. The duration of the growing season may also vary due to local climate or geographical factors, for example, cold air drainage into narrow valleys such as the La Plata.

Fauna

LA 50337 is situated in what Whitford (1978) refers to as a true riparian habitat. A habitat is defined as an "area where a particular abiotic environment supports an assemblage of species, distinct from other such units" (Whitford 1978:177).

Within this environmental unit there is an assortment of mammalian and avian species that may have been exploited by the prehistoric inhabitants of this area. The major species presently extant in the site area are den mouse *(Peromyscus maniculatus)*, valley pocket gopher *(Thomomys bottae)*, eastern cottontail *(Sylvilagus floridanus)*, desert cottontail *(Sylvilagus audubonii)*, jackrabbit *(Lepus californicus)*, coyote *(Canis latrans)*, striped skunk *(Mephitis mephitis)*, badger *(Taxidea taxus)*, bobcat *(Lynx rufus)*, porcupine *(Erethizon dorsatum)*, Mexican woodrat *(Neotoma mexicana)*, Gambel's quail *(Lophortyx gambelii)*, and various migratory water fowl (Werford 1978). Antelope *(Antilocapra americana)* were last reported in the area in 1883 (Bailey 1931).

Mule deer *(Odocoileus hemionus)* are still found on the wooded mesas of Farmington.

ANASAZI OVERVIEW

Kurt Anschuetz

The purpose of this chapter is to provide a current, albeit synoptic, synthesis of Anasazi prehistory in the La Plata Valley to highlight the range of subsistence and social organizational strategies that local prehistoric Puebloan populations followed in an attempt to adjust to their changing natural and cultural environments. To accomplish this task, the following methods are taken. First, a general cultural historical summary of the Anasazi occupation of northwestern New Mexico and southwestern Colorado is presented. The cultural historical summary emphasizes the events that occurred in the Chaco Canyon and Mesa Verde areas, because the prehistoric Puebloan occupation of the La Plata Valley was greatly influenced by the cultural processes in these settings.

The second section of this chapter is composed of an explicit identification of the general behavioral trends seen through time. This discussion is presented to counteract the tendency of archaeologists to treat major cultural periods as temporally independent entities rather than as heuristically defined slices of a cultural continuum. The systemic, cultural-ecological ramifications of these trends are examined in the third section of this chapter. This discussion, which is derived from Anschuetz (1984), is essentially a general explanatory model for the behavioral patterning observed in the archaeological record. It focuses on the variables of demography, settlement, subsistence, social organization, and selected aspects of material culture. The interactions of these variables are examined, and the possible roles of cultural decisions and climatic flux in helping to condition the observed behavioral change are considered.

Anasazi Background

Basketmaker II (A.D. 0 to 400)

Most Basketmaker II sites on the Colorado Plateau have been dated between A.D. 1 and 400 (Berry 1982), although Volger (pers. comm., 1983) reports finding probable Basketmaker II remains with slightly earlier dates within the Navajo Indian Irrigation Project (NIIP) in northwestern New Mexico. Other early Basketmaker II sites have been recorded near St. Johns and Snowflake in east-central Arizona and on Black Mesa in northeastern Arizona (Berry 1982). Basketmaker II sites have been excavated in southwestern Colorado (Martin et al. 1938; Morris and Burgh 1954), northeastern Arizona (Morris 1959), and northwestern New Mexico (Eddy 1961, 1966; Schoenwetter and Eddy 1964; Foster 1982). In southeastern Utah, Basketmaker II remains have been documented in Castle Wash (Sharrock et al. 1963) and on Cedar Mesa (Hall 1973; Lipe and Matson 1971, 1975; Berry 1982).

Excavations have allowed the identification of three Basketmaker II site types. The first site type consists of small hamlets composed of 1 to 11 irregularly placed shallow circular pithouses with associated lithic scatter (Eddy 1961, 1966; Matson and Lipe 1978). These hamlets occur primarily on promontories with commanding views of the surrounding territory, and Cordell (1979a:134) suggests that proximity to diverse vegetation zones may have been an important determinant of site location. The presence of an oversized pithouse depression at some of the Basketmaker II communities in the Navajo Reservoir district is interpreted as evidence of an intracommunity kiva (Eddy 1966:477). The second site type is composed of complexes of storage and burial cists that are typically found excavated into the floors of rock shelters (for example, Morris and Burgh 1954). The third site type is composed of surface artifact scatters that have been largely documented through site surveys (Cordell 1979a). Because of difficulties in properly identifying these remains as Basketmaker II assemblages, Plog (1979:114) notes that the distribution of these surface sites is still a major problem in Southwestern archaeology.

Pithouse architecture during this period varies across the northern Southwest, although structures tend to be remarkably uniform within local areas (Berry 1982). Artifact assemblages are dominated by lithic tools, including numerous one-hand manos and basin metates, and chipped stone debitage (Plog 1979). Projectile points are generally dart-sized and corner-notched; they resemble the En Medio points described by Irwin-Williams (1973) for the Arroyo Cuervo area northwest of Albuquerque. A small amount of oxidized brown ware pottery (Los Pinos Brown) has also been reported at some Basketmaker II sites in northwestern New Mexico (Cordell 1979a; Foster 1982). This pottery resembles early Mogollon and Hohokam ceramic types, although Eddy (1966:386) reports that it is uncertain whether these early wares were manufactured locally or were obtained in trade from the south. Maize is unambiguously associated with Basketmaker II remains (Berry 1982).

Basketmaker III (A.D. 400 to 700)

There is considerable evidence of occupation across most of the northern Southwest during this period (Plog 1979:114). Settlements range in size from 1 to 20 pithouses, although communities of three or four houses are most common. Although shallow and deep structures are reported (Cordell 1979a:134; Plog 1979:114), pithouse architecture across the region is less variable than it was during the preceding period and the use of large antechambers and four roof-support posts is standardized (Berry 1982:117). In the northern San Juan Basin, pithouses tend to be roughly oval to rectangular (Roberts 1929; Eddy 1966). Wing walls, slab-lined hearths, deflectors, and vents are common interior features. Kivas may be distinguished for the first time on the basis of specialized architectural features. Exterior work areas, distinguished by the presence of slab-lined hearths and storage bins and cists, are common features of Basketmaker III villages, for example Shabik'eschee Village (Roberts 1929) and Sambrito Village (Eddy 1966).

The basic intrasite settlement pattern characteristic of the Anasazi period was established during Basketmaker III times (Jennings 1968). This pattern consists of a village orientation along a northwest-southeast axis. The pithouses occupy the southeast end of the settlement, and the storage bins and cists are behind the habitation structures to the northwest (Gladwin 1954, figs. 2, 3). The storage features are often contiguous, forming short linear blocks that were fronted by ramadas (Hays 1981:25). Habitation sites are commonly located on alluvial terraces or the first benches of major drainages (Cordell 1979a), and Glassow (1972) argues that this apparent preference for proximity to arable land is indicative of an increased reliance on agriculture.

Pottery is abundant on Basketmaker III sites. Most ceramics are plain Lino Gray wares, although a simple decorated variety painted with mineral-based pigments (Lino Black-on-gray) appears toward the end of the eighth century. These pottery types were fired in a reducing atmosphere, a technique that is considered to be uniquely Anasazi (Cordell 1979a:134). Other common Anasazi ceramic types include La Plata Black-on-gray and White Mound Black-on-white. Both bowl and jar forms were produced. Various oxidized ceramic types, including Sambrito

Brown and Tallahogan Red, continue to be produced in northern New Mexico. The widespread distribution of all of these pottery types is suggestive of extensive trade and exchange networks (Anschuetz 1984). Rectangular one- and two-hand manos and trough metates begin to replace the earlier cobble manos and simple grinding slabs.

Glassow (1972) contends that the architecture, the abundance of storage facilities, and the widespread use of ceramics are indicators of sedentism. Decreasing projectile point size suggests the adoption of the bow and arrow.

Pueblo I (A.D. 700 to 900)

The transition from Basketmaker to Pueblo adaptations has traditionally been characterized by architectural changes and technological innovations in ceramic manufacture, although Plog (1974) has stressed that there was variation in the timing and the significance of the changes from one area to another. Jennings (1968:271) contends that the Pueblo I period, as traditionally defined by the Pecos Classification (Kidder 1927), is actually restricted to the "Anasazi heartland," i.e., the central San Juan Basin, and has little validity along its peripheries.

General demographic patterns include the gradual increase in regional population densities and the growing size of habitation sites, as suggested by the increase in the total number of sites with Pueblo I components or the total number of rooms assigned to the Pueblo I period in a number of local and regional data bases (Cordell 1982b). Lipe (1978) contends that population is clustered in the northern periphery of the San Juan Basin during Pueblo I in comparison to the relatively homogeneous distribution of sites observed during the preceding period. On the basis of his survey of Wetherill Mesa at Mesa Verde, Hayes (1964:106) concludes that local populations may have peaked--or have been very close to their peak--during Pueblo I. He does indicate the same for Chaco Canyon at this time (Hayes 1981). Large Pueblo I population aggregations are also reported in southeastern Utah, for example, Alkalai Ridge (Brew 1946). Cordell (1982a:66) reports that the portions of the San Juan Basin that manifest densest Pueblo I occupation (in terms of raw site frequencies) are either along the northeast periphery or next to permanent streams. This patterning, she argues, may reflect the unsuitability of the central basin for sedentary populations dependent upon both agricultural produce and wild plant foods.

In the San Juan Basin, Pueblo I is defined by the construction of above-ground, rectangular habitation rooms. The first surface rooms, which appeared during Basketmaker III, were used simply for storage of increased quantities of agricultural foodstuffs, while pithouses were retained as dwellings. Then, during Pueblo I, above-ground habitation room blocks were constructed, and with this shift, pithouses were kept only for use as kivas. Early Pueblo I villages are described as arcs of rooms, usually constructed of jacal with simple masonry footings. Fully masonry rectilinear room blocks appeared toward the end of the period. In contrast, the use of pithouses for habitation persisted in the Lupton and Manuelito areas south of the San Juan Basin (Gumerman and Olson 1968; Weaver 1978) and in portions of the northern Rio Grande drainage to the east (Cordell 1979b).

Pueblo I villages in the San Juan Basin are generally situated in the same kinds of topographic settings as the Basketmaker III settlements, but there is also an expansion of habitation sites into areas of greater elevation (Cordell 1979a:136), including the Navajo Reservoir district (Eddy 1966). A number of camp sites have also been identified in these higher elevation settings (Hall 1944; Hunter-Anderson 1976). These remains are believed to represent loci of seasonal hunting and gathering activities (Cordell 1979a:136). Elsewhere, for example, the Manuelito and Hough areas (Gumerman and Olson 1968; Weaver 1978), Pueblo I pithouse villages are observed to shift from the low benches along major streams to more upland areas.

Kana'a Gray, a neck-banded utility ware, is considered to be the major diagnostic temporal marker for Pueblo I, although plain gray pottery (Lino Gray) continued to dominate the ceramic assemblage. White Mound Black-on-white and the various brown ware types from the preceding period are also common. A proliferation of black-on-white decorated pottery types is apparent during the late ninth century, including Rosa Black-on-white, Kiatuthlanna Black-on-white, Red Mesa Black-on-white, Cortez Black-on-white, Abajo Red-on-orange, and La Plata Black-on-red (Windes 1977; Marshall et al. 1979; Cordell 1979a). Although the later trend toward the differentiation of ceramic assemblages across geographic space has its roots in the Pueblo I period, Cordell and Plog (1979:416) argue that many of the new painted wares appear to have been widely traded from relatively few centers of manufacture.

Reliance on agriculture increased in some areas, as indicated by the first evidence of intensified agricultural production, including the construction of grid gardens, terraces, and irrigation ditches (Plog 1979:115). Projectile points are thin and side-notched, presumably reflecting the established dominance of the bow and arrow. Two-hand manos and open-end trough metates are common grinding tools.

Pueblo II (A.D. 900 to 1050)

Pueblo II is characterized by significant population shifts in many areas of the northern Southwest (Cordell 1979a), and Lipe (1978) describes it as the maximum geographic dispersal of Anasazi settlement. Although small "unit type houses" (Prudden 1903; Morris 1939) were the dominant residence, year-round habitation settlements became increasingly aggregated (Plog 1979), and formal, well-planned communities composed of multistory room blocks and enclosed plazas appeared in some areas, for example, Chaco Canyon (Hayes 1981; Lekson 1984, 1986).

Neck-banded ceramics are considered diagnostic of the early portion of the period. By late Pueblo II, the neck-banded ceramics gave way to fully corrugated wares, which increased in abundance relative to simple plain wares. Red Mesa Black-on-white, which was widely distributed across the northern Southwest between ca. A.D. 850 or 900 and 1125 (Breternitz 1966), has traditionally been used by archaeologists as the diagnostic ceramic for this cultural period. Nevertheless, there was increasing stylistic differentiation among decorated ceramics across geographic space, as manifest by the proliferation of local pottery styles. Plog (1979) observes that later Anasazi lithic technologies are expedient (generally wasteful of raw materials) and well-made tools are rare. The major difference in stone tool assemblages is the introduction of side-notched points. The importance of agriculture is believed to have increased, as suggested by the construction of labor-intensive water and soil conservation facilities in some areas of the region.

Early Pueblo II architecture in Chaco Canyon is typically composed of simple rectilinear room blocks (Hayes 1981:27). A small kiva is often found in the front plaza. The 36 single-component Pueblo II houses in the canyon average only four rooms (Hayes 1981:50), although larger sites typically have later multiple components that obscure the extent of Pueblo II occupation.

Lekson (1984, 1986) reports that construction of the well-known "town" sites began between A.D. 900 and 960, which is believed to indicate local population increases. These early towns, including Peñasco Blanco, Pueblo Bonito, and Una Vida, were large, multistoried, arc-shaped structures that were fronted by a line of kivas. Suites, which cross-cut the axis of the room block, may be identified. The suites are composed of ramadas, front living quarters, large featureless interior rooms, and paired small storage rooms at the back. Although the scale of the construction is much greater, Lekson (1984:56) notes that the layout of the towns resembles the plan of small early Pueblo II buildings throughout the San Juan Basin. A second major cycle of construction, completed in late Pueblo II between ca. A.D. 1020 and 1050, shows continuity of the tenth-century plan (Lekson 1984, 1986). This building featured the construction of the first enclosed plazas in the canyon and the more substantial use of masonry in room walls and kivas, which typically possess stone benches, ventilators, and fire deflectors (Cordell 1979a).

Settlement patterns at Chaco show an increased focus toward the canyon bottom, and by late Pueblo II the mesa tops and plains north and south of Chaco Wash were virtually uninhabited (Hayes 1981:29). There was a simultaneous increase in the number of small sites within the Chuska Valley at the western edge of the San Juan Basin (Wait 1982, figs. 7.8, 7.9).

Red Mesa Black-on-white and Tohatchi Banded are considered to be the diagnostic wares for early Pueblo II in Chaco Canyon (Hayes 1981:27), although, as noted above, Red Mesa Black-on-white spans the entire period. During late Pueblo II, Red Mesa Black-on-white is supplanted by Escavada Black-on-white and Gallup Black-on-white, and Coolidge Corrugated replaces Tohatchi Banded as the major utility ware (Hayes 1981:29). Ceramic data indicate that more than 60 percent of the ceramics found in Chaco Canyon were made locally (Toll 1984).

Chalcedonic cement sandstone, a tempering material believed to come from the vicinity of Red Mesa Valley more than 45 km to the south of Chaco Canyon (Toll et al. 1980:97), occurs in 30 percent of the gray wares that date between A.D. 920 and 1020. At the same time, the use of trachyte temper (Shepard 1956; Warren 1976; Loose 1977; Windes 1977; Arnold 1980) indicates that 10-20 percent of the gray wares and a smaller percentage of the decorated white wares were manufactured in the Chuska Valley 60 km to the west (Toll 1984:115). By the end of the eleventh century, nearly 60 percent of the utility wares may have come from the Chuska area. Small numbers of sherds manufactured in the San Juan drainage and in northeastern Arizona have also been reported.

Shepard (1963) uses a variety of ceramic data to argue that specialists in the Chuska Valley were manufacturing the trachyte-tempered utility wares. With the apparent emergence of specialists in the San Juan Basin controlled by Chaco (Toll et al. 1980), various economic redistribution models have been proposed (Grebinger 1973; Altschul 1978; Judge 1979; Schelberg 1982) to describe the circulation of goods through a formalized trade network that incorporated much of the San Juan Basin and even extended beyond its boundaries. The emphasis of these models has invariably focused on the ability of the developing Chaco system to "moderate not only local food surpluses and shortfalls but regional imbalances within the basin as a whole" (Sebastian 1983:447). The proponents of the economic redistribution models have argued that food surpluses were moved to local areas experiencing crop failures and that Chaco leaders manipulated the surpluses to mobilize labor needed for massive construction projects, such as large additions to the towns. (See Sebastian 1983 for a concise critique of the Chaco economic redistribution models.) Other researchers (Cordell 1979a; Cordell and Plog 1979; Irwin-Williams 1980, 1983a; Powers et al. 1983) have alternatively suggested that the trade networks functioned to maintain and expand social relationships, thereby extending a group's access to resources beyond their local area. These alliances, then, could have been used to allow the emigration of populations at the time of local crop failure to areas with surpluses.

While Chaco Canyon was experiencing demographic growth, upland portions of the northern San Juan Basin, notably the Mesa Verde (Hayes 1964) and Navajo Reservoir (Eddy 1966:505-506) areas, were suffering population loss. During late Pueblo II, settlement shifts from upland areas to locations within the canyons began in Mesa Verde (Hayes 1964). As will be discussed in the following sections, settlement in the northern San Juan Basin, in general, became increasingly focused within the lower elevations adjacent to the San Juan River and its major tributaries.

Pueblo III (A.D. 1050 to 1300)

The trends through Pueblo III are essentially a continuation of those identified for Pueblo II. Population centers continued to shift, and year-round habitation settlements became increasingly aggregated and formalized (Cordell 1979a). Ceramic styles continued to diversify among the various local areas of dense habitation. In addition, labor-intensive water and soil conservation devices became more common in the zones of aggregated population. The major diagnostic attribute differentiating Pueblo III from the preceding period is the introduction and widespread use of carbon-based pigments in pottery decoration across much of the northern Southwest, although Breternitz et al. (1974) note that mineral-based pigments persist west of Mesa Verde. Polychrome pottery appears during the thirteenth century. The end of Pueblo III in the northern Southwest is characterized by the abandonment of the San Juan Basin by Anasazi agriculturalists.

Early Pueblo III is dominated by events in Chaco Canyon. The trend toward the aggregation of population along the major drainages is manifest by the construction of large, formal "Bonito phase" towns (Gladwin 1945). The towns were multistoried structures that usually enclosed a plaza (Hayes 1981; Lekson 1984, 1986). Their massive walls were constructed of unshaped rubble cores and faced with finely fitted stone veneers. Small "Hosta Butte phase" villages (Gladwin 1945) were retained, and although the linear arrangement of suites prevailed, the villages underwent some architectural changes (Hayes 1981). Room blocks tended to be somewhat larger than their late Pueblo II counterparts, new walls were made of compound masonry without veneers, and an L-shaped wing was sometimes added to the main room block to partly enclose the frontal kiva.

Ceramics associated with this occupation included corrugated wares in general and Chaco Corrugated in particular. Gallup Black-on-white and Escavada Black-on-white were the major decorated wares; Chaco Black-on-white, which is a refined version of Gallup Black-on-white, was introduced but never became overly common (Hayes 1981:30). Trade wares include Wingate Black-on-red and Puerco Black-on-red from the south, McElmo Black-on-white from the San Juan drainage in the north, and carbon-painted, trachyte-tempered black-on-white wares from the Chuska Valley (Toll et al. 1980; Toll 1984).

Other notable characteristics of early Pueblo III in Chaco Canyon consist of the construction of a formal road network (Judge 1979; Obenauf 1980; Kincaid 1983), a system of approximately 70 outlier communities (Marshall et al. 1979; Obenauf 1980; Powers et al. 1983) that extended to the peripheries of the basin, and extensive water and soil conservation features, including ditch irrigation (Vivian 1972, 1974). The presence of exotic items, such as turquoise, a small number of copper bells, and macaw remains have been recovered at some of the large

"Bonito phase" towns.

Chaco outlier communities found along the San Juan River and its major tributaries include Aztec (Morris 1919, 1921, 1928), Salmon Ruin (Irwin-Williams 1980, 1983a), Morris 41 (Morris 1939), and Squaw Springs (Morris 1939; Marshall et al. 1979). Irwin-Williams (1983a:4) argues that some outlier communities, for example those in the San Juan watershed, were founded primarily to reduce population pressures in Chaco Canyon, while others, like Guadalupe Ruin in the middle Rio Puerco Valley, probably reflected the extension of the Chaco "ideologic-administrative-trade system" that was established in late Pueblo II.

Late Pueblo III in Chaco Canyon is marked by the decline in population as the cultural system failed, although new sites were built (Bradley 1971) and additions were made to several of the "Bonito phase" towns, including New Alto, Kin Kletso, Casa Chiquita, and Pueblo del Arroyo (Hayes 1981). This construction, however, lacks the elaborate Chaco core-and-veneer masonry techniques and formal plaza areas. Kiva architecture displays the keyhole-shaped design and the construction of high masonry benches and pilasters, characteristics commonly associated with Mesa Verde. Pottery consisted of McElmo Black-on-white, Mesa Verde Black-on-white, and a melange of related black-on-white wares designated "Chaco-San Juan" types (Hayes 1981:32). Hayes (1981:68) views the architectural and ceramic data as evidence of the immigrations into the canyon from Mesa Verde. Alternatively, Toll et al. (1980:114) argue that temper, paste, and design stylistic attributes consistently suggest shifts in existing ceramic trade systems rather than large-scale immigration of Mesa Verde populations into Chaco Canyon. They further interpret these ceramic data as evidence that the San Juan drainage had come "to assume an ascendant position in the regional exchange system" due to "the increasing population (and thus exchange) importance of the San Juan area and the corresponding declining status of Chaco Canyon" (Toll et al. 1980:114). Similarly, Cordell (1979a:142) suggests that the changes in material remains observed in Chaco Canyon during the late thirteenth century might indicate shifts in social affiliation.

Early Pueblo III in Mesa Verde featured the construction of a few multistoried aggregate communities with 30 or more rooms. Small village sites composed of 10 to 15 rooms still dominate the settlement assemblage, but the decline in raw site numbers is believed to reflect both the aggregation of population into fewer locations and the continuation of emigration from the northern San Juan Basin (Hayes 1964). Masonry techniques included the use of shaped stone blocks and compound wall construction. Kivas were fully masonry-walled structures and were often integrated into the room blocks. The keyhole plan, considered typical of late Mesa Verde architecture, was standardized. Settlement continued to shift from the mesa tops to the talus slopes and rock shelters in the canyons.

Other major changes in Mesa Verde during early Pueblo III are confined to pottery (Hayes 1964:99). Mancos Black-on-white, a mineral-based ware that first appeared during late Pueblo II, was the dominant decorated ceramic type. The appearance of Wetherill Black-on-white and McElmo Black-on-white, albeit in low quantities, mark the beginning of the use of carbon-based pottery in the area. Mancos Corrugated was the major utility ware.

The nearly complete shift to rock shelter locations is the major distinguishing characteristic of late Pueblo III in Mesa Verde; few independent architectural innovations occurred. Cave configuration determined village layout--the constraints of available space influenced the adoption of more frequent use of multistoried construction and, in some instances, square or rectangular kiva plans (Hayes 1964). The major decorated ceramic types include

McElmo Black-on-white and Mesa Verde Black-on-white. Mesa Verde Corrugated, which replaced the earlier Mancos Corrugated, is considered the diagnostic pottery type of the period.

The Mesa Verde system apparently inherited and maintained the network of trade ties and social alliances existing within the San Juan Basin with the decline of Chaco Canyon at the end of early Pueblo III. This shift is indicated by the supposed migration of Mesa Verde populations into Chaco Canyon during late Pueblo III (Hayes 1981) or the shift in regional social affiliations and trade alliances (Cordell 1979a; Toll et al. 1980). As a result, wares manufactured in the San Juan drainage, for example, McElmo Black-on-white and Mesa Verde Black-on-white, had a wide geographic distribution. While Chuska utility wares and Crumbled House Black-on-white continued to be widely traded in Chaco Canyon and areas to the north, the Cibola series wares from the south decline greatly in importance.

The problem of the abandonment of the San Juan Basin, as well as many other portions of the northern Southwest, by Anasazi populations in the twelfth and thirteenth centuries has long been of interest to archaeologists (Cordell 1982a:72-73). Environmental change and conflict have traditionally been accepted as the most powerful explanations for regional abandonments. Environmental change has been identified as major episodes of drought (Douglass 1929), a lowering of the water table (Bryan 1954), a shift from winter to summer dominated rainfall that resulted in increased erosion, including arroyo cutting (Schoenwetter and Dittert 1968), and the adverse effects of rainfall quantities and periodicity that could not be buffered through the further intensification of traditional agricultural technologies (Jorde 1977). The factor of conflict has been described as either warfare with nomadic groups (Gladwin 1957) or among the various Puebloan groups (Jett 1964). An example of the latter explanation is provided by Hayes (1964:63-68), who describes late Pueblo III at Mesa Verde as a period of turmoil, as indicated by the widespread use of presumably defensive site locations and architecture. He also reports evidence of ritualistic cannibalism.

In recent years, archaeologists have argued that the regional abandonments result from a combination of low agricultural productivity in an arid environment, unreliable crop yields due to unpredictable localized environmental perturbations, and minor regional climatic fluctuations that undermined the stability of the late Pueblo III subsistence economy (Schoenwetter and Dittert 1968; Zubrow 1971; Judge 1979). However, as Cordell (1982a:73) aptly points out, these latter arguments still lack a theoretical argument that specifies the conditions under which regional abandonments would occur as opposed to partial population emigration that would permit the remaining groups to return to a more stable, less intensive subsistence economy.

Major Trends Through Time

A number of important and interrelated patterns may be identified with the careful inspection of the cultural historical summary for northwestern New Mexico and southwestern Colorado. The patterns include marked changes in demography, subsistence economy, settlement, social organization, and amount of stylistic variability in material culture across a wide geographic area. In turn, the latter variable appears to be related to the changing organization of Anasazi trade and exchange networks and their underlying alliance ties.

Demography

The archaeological record for the Anasazi occupation of the Four Corners region reveals marked population growth between Basketmaker II and Pueblo II, as manifest by the increased number, size, and spatial distribution of sites (ARM and SJBRUS site files; Euler 1981). This period of demographic growth is followed by the apparent leveling and slow decline of regional population densities during late Pueblo II or early Pueblo III as the processes of emigration from the central and northern San Juan Basin were established (Dean et al. 1985, fig. 1). (It should be recalled that population declines were occurring at the time that Chaco Canyon flourished [Hayes 1964, 1981].) The rate of the population decline is difficult to assess because of the factors of increased settlement relocation and the trend toward population aggregation. Both Chaco Canyon (Hayes 1981) and Mesa Verde (Hayes 1964) suffered population losses during this time. During late Pueblo III, the rate of emigration accelerated, and by A.D. 1300 the San Juan Basin was abandoned by Anasazi agriculturalists for year-round residence.

Subsistence Economy

The increasing importance of agricultural practices is evidenced by a focus of settlement toward potentially arable land along the floodplains of major drainages during the Basketmaker III period (Glassow 1972; Cordell 1979a). In addition, there is evidence of grid garden, terrace, and canal construction at approximately A.D. 1000 to intensify agricultural production in the northern Southwest (Plog 1979), including the Mesa Verde area (Rohn 1963). Extensive water and soil control features, including grid borders, terraces, dams, reservoirs, and canals, were constructed in Chaco Canyon by early Pueblo III (Vivian 1972, 1974).

Other changes in the San Juan Basin Anasazi subsistence economy are represented by the Pueblo II expansion of settlement into upland areas, such as the east Chuska slope. Movement of population into these settings of greater elevation has been variously interpreted as evidence of population pressures that necessitated the colonization of increasingly marginal areas (Gumerman 1975), the introduction of new varieties of maize that expanded the range for agricultural production (Galinat and Gunnerson 1963), a favorable moisture regime that permitted dry farming in a wider variety of environmental settings (Schoenwetter and Dittert 1968; Euler et al. 1979; Dean et al. 1978); or the result of drought and arroyo cutting that lowered local water tables and reduced the amount of arable land in the lower elevations (Dean et al. 1978, 1985). Dean and others (1985:547) note that Anasazi populations likely varied the proportions of domesticated, hunted, and gathered resources composing their subsistence base in response to local environmental conditions, and that recent flotation and coprolitic analyses, in fact, reveal significant dietary variability across geographic space. The great increase in the number of small Anasazi sites in the Chuska Valley during Pueblo II is believed to indicate a continued reliance on simple land-extensive, dry-farm agricultural technologies, and the Chuska Valley at this time has been designated the "bread basket" for the San Juan Basin (Karen Clary, pers. comm., 1986). The dispersed settlement of this upland setting would have also functioned to distribute the Anasazi population across the landscape to allow them to efficiently hunt and gather scattered animal and plant resources. This subsistence strategy may have functioned to postpone large-scale agricultural intensification in the central San Juan Basin until late Pueblo II or early Pueblo III.

Settlement

Concomitant with the observed increases in regional population, Anasazi agriculturalists extended their range of settlement from a focus along the major floodplains in the Four Corners area into settings of greater elevation. This geographic expansion reached its apex during the Pueblo II period, when, as discussed above, the Chuska Valley was widely settled.

Contraction in settlement distribution is evident during Pueblo III (Hayes 1964, 1981; Wait 1982, figs. 7.8, 7.9) with an apparent shift from the less agriculturally optimal upland settings toward an increased focus on the alluvial deposits along the major floodplains. This is also the time that the emigration of the Four Corners Anasazi population began. This trend toward settlement contraction intensifies during late Pueblo III as populations continue to leave the San Juan Basin and the remaining groups aggregate into fewer but larger pueblos in the lowland settings. Evidence of conflict has also been reported at Mesa Verde during this period (Hayes 1964). By A.D. 1300, the San Juan Basin was abandoned by Anasazi populations.

There appears to be tremendous residential site instability in the San Juan Basin through time, although the construction of the "Bonito phase" towns in Chaco Canyon conveys an impression of permanence for the period. Regional data indicate that the pattern of residential site instability is intrinsic among the Anasazi. Sequences of settlement occupation and abandonment have been reconstructed for Cebolleta Mesa (Dittert 1959), the Rio Puerco Valley (Irwin-Williams 1983b), the San Juan drainage in northwest New Mexico (Kemrer 1983), Mesa Verde (Hayes 1964), the northern Rio Grande (Mera 1940; Cordell 1979b), and elsewhere (Berry 1982).

The last major intersite trend is the emergence of settlement hierarchies. The trend toward aggregated residential communities first appeared during Pueblo I in the upland areas of Alkalai Ridge (Brew 1946) and Mesa Verde (Hayes 1964) with the identification of clusters of several small houses. The emergence of formally planned towns with multiple room blocks, enclosed plazas, and great kivas in the Four Corners area, however, did not occur until Pueblo II and early Pueblo III in Chaco Canyon. During Pueblo III, Mesa Verde was once again a focus of aggregated, highly organized occupation.

Intrasite settlement trends include the transition from pithouse to above-ground architecture with the concomitant pairing of habitation rooms and storage space. Other trends are the increased number of rooms per average habitation locus, and the shift from accretionary haphazard settlement growth to the development of large preplanned communities.

Social Organization

Increasing socio-organizational complexity throughout the Anasazi sequence is suggested by the observed changes in intra- and intersite settlement patterns and the emergence of productive specialization. Modifications in residential site plan and organization are numerous. The most basic change in intrasite patterning is the increase in the size of villages through time. Cordell (1979b:100, citing Carneiro 1967 and Sahlins 1972) notes that village size in egalitarian societies is small. Furthermore, intragroup conflict is ultimately resolved by the fissioning of the group to create independent communities. The increasing size of habitation sites throughout the

Anasazi sequence thus carries the implications that group fissioning was no long a fully viable response and that Anasazi social organization had been changed in an attempt to neutralize, or at least minimize, the potential for social friction in the larger communities. The existence of social mechanisms to maintain intracommunity integration for at least brief periods is best illustrated by extremely large communities in the central and northern San Juan Basin during Pueblo II and Pueblo III.

The second trend in intrasite settlement patterning suggestive of socio-organizational change is the development of preplanned pueblo communities in Pueblo II and Pueblo III. Although the trend toward increasing settlement size is first noted in the northern periphery of the San Juan Basin during Pueblo I (Brew 1946; Hayes 1964), these early villages do not display evidence of a formal, preplanned design of rectilinear room blocks placed around plaza areas; instead, these villages appear to be clusters of small room blocks. The preplanned layout of the late large pueblos is used to infer the existence of decision-making bodies, which were either not present or were not institutionalized during the previous periods (Vivian 1970; Plog 1979:120).

Further evidence of socio-organizational change includes the coupling of habitation quarters with storage rooms, which Cordell (1979b:100-101; also see Gilman 1983) views as an indication of a shift from extreme egalitarianism to a situation of corporate groups attempting to retain direct control over their stored foodstuffs. Although suites of rooms characterize the basic organization unit within both the village and town sites (Lekson 1984:56), the presence of kivas, which are assumed to have functioned in the past to maintain social integration as they do in the ethnographic present (Ortiz 1969:43; Dozier 1970; Fox 1972:75-77; Ford 1972a:8-14), in the plaza may represent an attempt to minimize the segmentation of the community.

Change in intersite patterning suggestive of changes in social organization includes the development of settlement hierarchies. There was little differentiation among settlements throughout Pueblo I in the San Juan Basin. Construction of the well-known, multistoried town sites in Chaco Canyon began during early Pueblo II. With the addition of the town sites, the Chaco Canyon Anasazi settlement system revealed a bimodal distribution in the size of habitation sites, and Lekson (1984:69) notes that approximately half of the rooms in Chaco Canyon in the early A.D. 1100s were in the large towns even though most habitation sites in the canyon were composed of small structures.

Longacre (1964, 1970) views similar site size settlement patterning in the upper Little Colorado drainage between late Pueblo II and early Pueblo IV as indicative of centralized community ritual, which he argues was one means to extend and maintain social integration. Community integration could have been achieved "by creating mutual interdependence among social groups through reciprocal exchange of goods and services" (Longacre 1970:17).

The above trends in intra- and intersite settlement patterning at Chaco Canyon accompany the emergence of specialized ceramic production in the San Juan Basin (Shepard 1963; Toll et al. 1980; Toll 1984). Cordell and Plog (1979:420) argue that greatly increased productive specialization and concomitant elaboration of exchange networks was "coordinated by elites in systems characterized by differential access to status and authority." Upham (1980, 1982) contends that access to decorated ceramics was limited to individuals of higher social status, thereby inferring that decorated pottery served as social markers.

Stylistic Variability in Material Culture

Flux in the degree of stylistic variability in material culture through time is, in part, suggestive of the changing organization of trade and exchange networks (Cordell and Plog 1979). This flux is most evident in the changing distribution of decorated ceramics and the degree of variation between localized ceramic assemblages across geographic space.

The Basketmaker III and early Pueblo I ceramic assemblages are composed of wares that are widely distributed throughout the Anasazi Southwest. In addition, the assemblages include brown and red wares commonly associated with the Mogollon culture area to the south. Kana'a Gray, an Anasazi ware, and Alma Neck Banded, a Mogollon ware, have been tentatively dated between A.D. 700 and 950 (Wasley 1959, 1960). Both wares are technologically similar in construction and design, with the use of local clays and tempers comprising the main difference. Breternitz (1982:134) suggests that although the wares are roughly contemporaneous, recent evidence indicates that neck-banded wares were slightly earlier in the Mogollon area and that Anasazi Kana'a wares are best dated between A.D. 750 and 900. Red wares in the Anasazi area are also believed to have been copied from the Mogollon, although Breternitz (1982:135) asserts that the Anasazi replicated the manufacture of red wares through the use of their local raw materials and firing technologies. Although there was a proliferation of locally manufactured black-on-white and red-on-black decorated ceramic types during late Pueblo I and early Pueblo II, this trend was partially offset by the fact that some of the new wares appear to have been widely traded from a relatively small number of centers of manufacture (Cordell and Plog 1979).

During the latter portion of the tenth century, the distribution of architectural and ceramic styles becomes increasingly restricted, thereby allowing the identification of local districts or provinces (after Dittert and Ruppé 1952), in which homogeneity in material culture is striking (Cordell and Plog 1979:421). Stylistic attributes among the provinces, however, are not mutually exclusive, and certain design styles, including Black Mesa, Sosi, Dogozshi, and Reserve-Tularosa, cross-cut ceramic types (Breternitz 1982; Hantman et al. 1984). Cordell and Plog (1979:421; Plog 1979:122; see also Graves 1984) argue that clusters of stylistic attributes reflect patterns of greater local interaction. Plog (1979) defines 11 districts in the eastern Anasazi area, including Mesa Verde. Archaeologists working in the eastern Anasazi region recognize another 12 to 15 districts, including Chaco Canyon (Cordell 1979a, 1979b; Lang 1982). Significantly, Plog (1979:122) argues "The provinces are more evident in Pueblo II and III times than in Pueblo I or IV."

Cultural-Ecological Assessment of San Juan Basin Anasazi Prehistory

The patterns of change in the demography, subsistence economy, settlement, social organization, and the amount of stylistic variability in the material culture of the San Juan Basin Anasazi may be examined from a cultural-ecological perspective, in which the dynamic interactions between human populations and their natural and cultural environments are considered. The environmental opportunities and constraints of a setting limit the range of adaptations a population can effectively pursue (Steward 1955:36-42). As the delimiting parameters of the environment undergo change due to natural and cultural factors, including a group's previous subsistence decisions, human populations attempt to adapt through adjustments within their technological, social, and ideational subsystems. The range of viable responses is restricted, and the modifications a group employs in an attempt to maintain its status quo may not necessarily be adaptive in the long-term in providing the population a distinct advantage over its competitors. The responses a group makes in the face of natural and cultural change may be evaluated in reference to their short- and long-term costs to the cultural system.

The Establishment of Anasazi Adaptations: The Basketmaker II to Pueblo I Periods

Although there has been considerable debate over the age of maize in the northern Southwest (Dick 1965; Woodbury and Zubrow 1979; Minnis 1981; Berry 1982), the best available data (Betancourt and Davis 1984; Simmons 1982a, 1982b, 1986) indicate that late Archaic hunters and gatherers in the Four Corners area of New Mexico used corn by ca. 800-1200 B.C. Irwin-Williams (1973) contends that although horticultural practices had likely long composed a small portion of the traditional late Archaic subsistence base, efforts to produce crops were informal and little concern was placed on ensuring successful harvests. Early horticultural activities probably did not consist of much more than planting seed in sheltered locations and then leaving the plants unattended while the hunting and gathering populations pursued their summer season activities. In the early fall, the Archaic groups returned to these stands to harvest whatever seeds had ripened, much in the same manner as if the crop was a wild resource (Irwin-Williams 1973).

This initial horticultural strategy was essentially a means to broaden the traditional Archaic subsistence base with little affect on social organization or mobility, and the role maize played in the economy was so minor that the Archaic populations were not faced with a crisis if the crop failed. Low regional population densities and relatively unrestricted mobility options allowed the foraging groups access to the resources and the territory necessary for their maintenance and continued viability.

Although the conditions selecting for localized and regional population growth are poorly understood (see Binford 1968; Binford and Chasko 1976), there appears to be a positive relationship between sedentism and increased birth rates. Whatever the causes, the effects of this disruption of a state of homeostasis between the human populations and their natural and cultural environments are well represented in the archaeological record, including that of the northern Southwest. In the present example, regional population-resource imbalances are viewed as the cause for the intensification of agricultural practices and the concomitant emergence of Anasazi adaptations after A.D. 0. Following Cohen (1977), it is assumed that regional population densities have a propensity to increase through time and that population-resource imbalances (Cordell 1979a, 1979b) were more common and significant among preagricultural peoples than has been usually recognized. Other natural and cultural factors, however, may also have tremendous impact upon the growth rates actually sustained by a group. The role of some of these variables are explored below.

A.D. 400 to 1049 Precipitation Pattern

Numerous efforts have recently been made to develop increasingly sensitive techniques of paleoenvironmental reconstruction in the Southwest. These efforts include local palynological studies, local sedimentological analyses, and the construction of regional dendroclimatological sequences. (See Cordell [1982a, 1982b] for a brief identification and review of this work in the

Southwest.) Much of this research has been undertaken with the explicit purpose of relating prehistoric change to climatic change (cf. Euler et al. 1979; Dean et al. 1985). However, as Cordell (1982a, 1982b) points out, these sources are neither equally precise, nor are the patterns derived from these various analyses entirely consistent. Cordell argues that, with few exceptions, paleoenvironmental reconstructions based upon regional tree-ring sequences are the most precise and reliable.

Examination of a dendroclimatological study from five widely dispersed localities across the Southwest (Jorde 1977) suggests that the prevailing patterns of precipitation during the establishment of Anasazi adaptations may have positively influenced the observed archaeological patterns in demography, subsistence economy, settlement, social organization, and stylistic variability in material culture. Jorde uses spectral analysis of variance in tree-ring width to argue that regional precipitation patterns between A.D. 750 and 1049 were subject to short-term (high frequency) cycles of periodicity, each of which averaged two years in duration. In addition, the year-to-year variance in effective moisture is greater for the period between A.D. 750 and 1049 than for the succeeding time span (A.D. 1050-1350). Jorde unfortunately does not consider the pre-A.D. 750 sequence; however, regional climatological reconstructions by Schoenwetter and Dittert (1968), Euler et al. (1979), and Dean et al. (1985) suggest that the precipitation patterns described by Jorde may, in fact, extend back in time to approximately A.D. 400, the beginning of the Basketmaker III period.

Research by Lewis R. Binford (1980) has led to the identification of the empirical pattern that hunting and gathering population densities tend to be greater in environmental situations where quantities of precipitation either decrease or become erratic. The period between A.D. 400 and 1049, with its greater variance in year-to-year precipitation, is of particular interest, because it encompasses the transition from Archaic to established Anasazi adaptations.

The shift to precipitation patterns described by Jorde (1977) for the period between A.D. 750 and 1049 also occurs during a time that is generally characterized by degradation of floodplains, low effective moisture, and low spatial variability in climate (Dean et al. 1985). The trend of stream degradation is particularly severe in the period between A.D. 750 and 950; after this time a cycle of floodplain aggradation occurred. Dean et al. (1985:540) characterize major drops in the groundwater variability curve as indicative of arroyo cutting and resulting soil development on the newly formed terrace surfaces. These climatic characteristics would have placed some local groups in considerable subsistence risk because quantities of economically important rainfall to be received in any given year would not have been predictable. The combination of unreliable precipitation with growing regional population densities would have destabilized the Anasazi cultural system through increased competition for limited subsistence resources and reduced group mobility. In addition, Dean et al. (1985:543) suggest that low spatial variability in climate would have inhibited interaction among groups. Because most local populations would have suffered qualitatively similar adverse affects from a regional drought cycle and would have attempted to conserve limited subsistence resources for themselves, I believe that the trend toward reduced interaction among local groups reported by Dean et al. (1985) only serves to reflect heightened regional competition.

Human populations most severely threatened by the above changes would have been those occupying the lower elevations of the central San Juan Basin, which is characterized as a relatively dry, featureless plain with low natural productivity and diversity (Beirei 1977). Not only do the lower elevations typically receive less moisture than their upland counterparts because of the orographic phenomenon described by Bailey (1913), the lowlands would also have been more severely affected by floodplain degradation, which would have lowered regional water tables. The situation faced by groups in these local settings may be described as one of high population density relative to the carrying capacity of the natural environment and the level of the late Archaic/early Anasazi technological assemblage.

Intensified agricultural efforts would necessarily have been focused along floodplains of major drainages where the water table was closest to the surface regardless of short-term climatic conditions. Low terraces along the large permanent or seasonal streams and alluvial fans from lateral ravines, which could have been farmed like the Hopi *akchin* fields (Hack 1942; Bradfield 1971), may have been preferred field locations, although other runoff irrigation technologies may have also been important. Floodplain and runoff irrigated field locations, however, are susceptible to damage during heavy downpours, which may cause stream beds and arroyos to fill with high velocity runoff.

The beginning of aggradation after A.D. 950 would have enhanced the reliability and productivity of these settings because the water table would have risen. Love (1977, 1980) has also argued that braided channels in unentrenched streams would have watered a wider floodplain and provided a rougher surface area to reduce the risk of crop damage due to high velocity runoff. In addition, stream aggradation would also have resulted in the deposition of a 30-60 cm thick layer of sand in the bottoms of washes that would have buffered plants from earlier alkaline alluvial sediments and functioned as a mulch that held moisture within root zones and inhibited evaporation.

Upland areas, in comparison, would have offered productive arable lands for dry farm and simple water control agricultural technologies, such as slope wash and small scale runoff diversion, during cycles of greater than mean precipitation. Upland areas are also economically important for their comparatively diverse hunting and gathering resources. During drought cycles, the suitability of upland areas for agricultural production may have been greatly diminished if the existing water control technologies could not insure the delivery and conservation of moisture to crops.

Subsistence Risk and Adaptive Processes

The early Anasazi populations facing subsistence risk essentially had two options. First, they could have employed social mechanisms to reduce their population in an attempt to mitigate the effects of localized population-resource imbalances. Second, they could have intensified their agricultural practices to buffer against shortfalls in local productivity (Jorde 1977). (See Boserup [1965] and Sanders and Webster [1978] for an examination of the variables conditioning agricultural intensification; also, see Athens [1977] for a concise critique of Boserup's arguments when applied to groups residing in semiarid environments.) On another level of analysis, however, a short-term, unilateral decision by one local group to reduce its population in the face of growing regional population densities could result in the loss of the group's ability to effectively compete over the long term. The first option is thus not a viable alternative given the constraint of an increasingly competitive regional cultural environment. The second option is more viable because it does not sacrifice the group's ability to compete; nonetheless, it entails tremendous long-term social costs to the human population. These costs can be examined in terms of labor and group mobility.

Larger amounts of labor are needed to bring land under intensive cultivation than to practice low-level, incipient horticulture. Preparation of fields for planting is necessary to create soil textures appropriate for the proposed crop. Care needs to be taken to ensure that the plants have sufficient soil nutrients and moisture to allow their growth and maturation. Labor requirements also include the planting and the nearly continuous maintenance of the young plants until they become well established. The latter energy expenditure consists of the frequent shallow hoeing of the fields to prevent the growth of deep rooted competitor weeds, the thinning of the crops to enhance the productivity of a smaller number of plants, and the regular inspection of the plants for predators, such as cutworms, so protective action can be taken before significant damage is inflicted. The ripened produce must be harvested within a narrow time period to prevent spoilage and to minimize predation, and the foodstuffs must then be prepared for storage. Construction of substantial and durable storage facilities also requires additional labor investment. The stored foodstuffs must be regularly checked to inhibit further losses through spoilage and predation.

Loss of group mobility is closely related to the increased labor requirements for agricultural intensification. The labor requirements outlined above necessitate that various segments of the population be kept from large-scale hunting and gathering at different times of the year. The members recruited to a labor party involved in the preparation of the fields may be very different than those charged with the care of the stored foodstuffs. While the agriculturally related activities do not necessarily prevent an individual from participating in hunting and gathering activities, the net result is that the individual's hunting and gathering time is reduced as the group increasingly focuses its subsistence activities toward agricultural production. More time is spent at and within the vicinity of residential settlements, which are used for longer periods of time by most segments of the society.

The unpredictability of precipitation under a regime of high variance in year-to-year rainfall selects against subsistence specialization, such as that described for the intensification of agriculture (Jorde 1977). Canal irrigation and other intensive water control systems, which function to increase agricultural reliability and to help stabilize long-term production, evidently were not viable large-scale technological strategies in the Anasazi Southwest during the A.D. 750 to 1049 time period, judging from the paucity of these features in the archaeological record (Dean et al. 1985, table 1). Although dry farming and simple runoff control agricultural technologies may have produced sizable harvests during short-term cycles of greater than mean precipitation, there is little likelihood that a group pursuing such a subsistence strategy would have enjoyed long-term success in meeting its storage needs for overwintering or as a buffer against periodic shortfalls in local productivity during periods of reduced rainfall. To rely exclusively on agriculture under these circumstances would have entailed the acceptance of unnecessary subsistence risk. Simply, agricultural intensification, such as the development of water and soil conservation technologies, could not fully dampen the effects of high frequency cycles of rainfall periodicity and high year-to-year variance in effective moisture. Although Anasazi populations continued to have intensified their agricultural efforts between A.D. 750 and 1049 (Plog 1979), I argue that it was also necessary for local groups to have retained access to a wide geographic area to fulfill their long-term subsistence requirements.

On one level, a group's perceptions of the likelihood of plentiful yields in the upland portions of their home territories may have resulted in the adoption of more land-extensive, and possibly less labor-intensive, farming strategies (Kirkby 1974). Although these lands might not have been planted most years given the prevailing precipitation regime described by Jorde (1977) for the time span between A.D. 750 and 1049, the sporadically arable upland settings would have assumed considerable importance as backup field locations as local and regional population densities continued to grow. Seasonal, and perhaps semipermanent, agricultural settlements may have been occupied intermittently in upland areas when conditions permitted.

Following the Valley of Oaxaca study (Kirkby 1974), the simple dry farming of comparatively marginal agricultural lands should not be viewed as a desire to completely shift food production from one environmental setting to another. Rather, it reflects the wish, or need, to farm the marginal lands whenever feasible. The planting of the marginal lands by an individual or group legitimizes and maintains either informal or formal claims to its use-rights. In addition, this strategy constitutes the means through which a farmer may reduce his labor investment in crop production by temporarily reducing his dependence on the more intensive technologies used in the floodplains.

Kirkby (1974:125) contends that Oaxacan farmers try to maximize their returns by literally gambling their seed stock on the basis of their perceptions of changing productivity among environmental settings. I would argue that the early Anasazi apparently faced a coercive element in making the decision to plant in the upland settings. Given the high year-to-year variability in regional precipitation patterns prior to the mid-eleventh century (Jorde 1977) and the positive correlation between increased elevation and precipitation (Bailey 1913), it is probable that the years perceived as good for agricultural production in the piedmont zones may have also been the years in which the productivity of the floodplains may have been reduced or riskier. That is, if regional rainfall was significantly greater than the mean, about two standard deviations (Dean and Robinson 1977), then the major floodplains may have been inundated by prolonged spring runoff and the risk of violent flooding by minor streams, ravines, and washes during heavy summer storms may have increased.

While simple water control systems could have served to divert runoff to floodplain fields in years of average precipitation, cycles of lower than mean regional precipitation would have necessitated the elaboration of the water control facilities to ensure that they would capture the reduced levels of runoff from a larger watershed. In contrast, the features would also have to be periodically remodeled during cycles of greater than mean precipitation to protect fields from the potential affects of too much water. Clearly, the frequent modification of these water control systems would have necessitated high labor expenditures. I argue that a less labor-intensive strategy would have been for the lowland Anasazi farmers to disperse into the upland settings to dry farm whenever possible and forego the intensive remodeling of water control features to prevent flooding. The uplands, therefore, might have served as important agricultural backup outlets during the times that the floodplains were under moisture stress.

On another level, the agriculturally marginal upland areas would have also been economically important for the procurement of wild plants and game animals. During years of high agricultural productivity in the floodplain environments, it is likely that hunted and gathered foodstuffs still comprised a significant proportion of the total annual diet, even among Puebloan populations heavily committed to farming (Richard I. Ford, pers. comm., 1975; Ortiz 1969:176). The contribution of agriculture to the annual Anasazi diet has traditionally been overemphasized by archaeologists, who have tended to abuse ethnographic analogy in reference to the territorially constrained modern Pueblos (Cordell 1979a, 1979b). While agricultural production assumes tremendous importance in meeting the overwintering needs of a group, the role that it played in the diet of the Anasazi from late spring to late fall, which is the time that a succession of wild resources is available, should be questioned. Intensified hunting and gathering activities could have formed another important, albeit short term, backup strategy when a group failed to harvest sufficient agricultural foodstuffs from either their floodplain or upland fields.

Two major implications of the continued importance of a hunting and gathering section in the Anasazi subsistence economy remain to be examined. First, not all hunted and gathered resources are equally available across geographic space. Because the territory required to support the hunting and gathering subsistence base is of low overall productivity, the need to have access to a wide geographical area is reinforced. Although the weight or perishability of many raw foodstuffs are constraints prohibiting their regular long-distance transport in large quantities (Lightfoot 1979), some items, such as meat or salt (Flannery 1976; Lange 1959), are deemed so important that exceptionally long distances may be covered for their procurement. The concept of nested resource catchment areas (Flannery 1976) is important in that it conveys the varying distances individuals will travel for the direct procurement of selected resources.

Second, wild plant and animal resources are not equally available throughout the annual cycle. Many of these resources are accessible only during narrowly delimited time periods. This characteristic has been termed seasonality (Flannery 1968). This factor is of benefit to populations dependent upon agriculture, especially since some wild foodstuffs become available during the spring when stored surpluses may begin to run low. However, the strictly delimited accessibility of certain economically important resources may serve to aggravate existing labor shortages. For example, juniper seeds, cholla and prickly pear fruits, saltbush seeds, Cheno-Am seeds, grama and dropseed grass seeds, and purslane seeds become available in large quantities during late summer and early fall at roughly the same time that agricultural crops need to be harvested and processed for storage. Scheduling decisions would have necessitated that some resources would have been neglected, "but it is assumed that time will be spent on those resources which are most productive" (Cordell 1979b:28).

Other subtle labor demands are implicit in the continued importance of hunting and gathering. To efficiently schedule the exploitation of wild seasonal resources, some of which may have marked variation in distribution or productivity from year-to-year, time regularly needs to be spent away from the agricultural fields to monitor a wide geographic area for the location, relative yield, and stage of development of economically important plants and animals. Although hunting and gathering task groups go out "seeking to procure specific resources in specific contexts" (Binford 1980:10), they can largely fulfill the monitoring requirements by taking note of the areas they pass through and conveying this information to other members of the community. Nonetheless, the need to have intimate knowledge of the changing conditions of the surrounding environs reinforces the necessity that potential agricultural laborers spend time away from the fields throughout the growing season, as well as throughout much of the annual cycle.

The bidirectional pulls confronting the early Anasazi in the northern Southwest, i.e., the need to intensify agricultural production and storage versus the need to hunt and gather across a wide geographic area, resulted in acute seasonal labor shortages. To provide the labor necessary to meet their subsistence needs at a time of increasing regional population densities and competition for limited resources, a number of groups were forced to undertake demographic power drives (Athens 1977; Jorde 1977; Stuart 1982; Stuart and Gauthier 1981).

The theoretical arguments explaining the mechanisms for how a power drive is initiated and integrated within a society is currently the subject of dispute (Athens 1977:366; Stuart 1982; Stuart and Gauthier 1981). Binford and Chasko (1976) have argued that increased birth rates may be related to sedentism. They further suggest (also, see Frisch [1975] and Santley and Rose [1979:200]) that the consumption of larger quantities of carbohydrates, such as in diets in which maize is a staple, would enhance female fertility by reducing the amount of time needed for women to replenish critical stores of body fat and decreasing the period of postpartum amenorrhea. Whatever the causes, the society's new members may be employed to ease the extant labor shortages inherent in subsistence economies heavily dependent upon both agriculture and hunting and gathering.

The end result of the demographic power drive in the long run, however, is the formation of a positive feedback relation, and the need for additional manpower amplifies. The success of the power drive strategy is dependent upon the population's ability to continually intensify its cultural buffering mechanisms to reduce agricultural risk and to retain access to extensive hunting and gathering territories.

The Increasing Size of Habitation Sites

As discussed previously, the increasing size of habitation settlements in the Anasazi Southwest through time indicates that socio-organizational changes were occurring. On the one hand, these changes might have been a response to growing conditions of social circumscription (Chagnon 1968a). That is, groups living along the major drainages had become bounded in space by daughter communities that had settled the adjacent upland settings. If excess populations could no longer be fissioned into adjoining territories, then social mechanisms had to be created to maintain intragroup integration. On the other hand, the trend toward increasing village size may also be viewed as an organizational strategy that is closely linked to the demographic power drive. Simply, increasing group size served to ensure that a sufficient labor force remained intact to support the intensified agricultural practices and storage (Jorde 1977). Larger group size is also necessary to maintain a competitive stature with respect to ever growing regional population densities. A local group needed enough manpower to protect its arable lands and hunting and gathering territories from encroachment by other human populations. If these conditions were not met, the group's continued long-term viability would have been threatened.

Early Anasazi Social Organization and Interregional Interaction

Although the demographic power drive is argued to have accompanied the establishment of Anasazi adaptations in the northern Southwest, the time span encompassing the Basketmaker II and the early Pueblo I periods is nonetheless characterized by relatively low, albeit increasing, regional population densities (Dean et al. 1985, fig. 1). With low regional populations, group mobility remained a viable option and competition for critical subsistence resources would have been minimal. Competition that did exist most likely would have taken the form of a nonaggressive scramble (Nicholson 1954; Wilson 1968). Scramble competition typically occurs when two or more populations attempt to use a given resource that is in short supply. Nicholson (1954:20) notes that the success enjoyed by the rival populations is characteristically incomplete and that the resources secured from a single locale by these groups may not even be sufficient to sustain the respective populations. The nutritional value of the foodstuffs is dissipated by individuals, who do not obtain sufficient quantities for their maintenance. Given the relatively low level of the Anasazi technological assemblage until after ca. A.D. 1050, the low annual productivity of the natural environment, and the patchy distribution of resources, it is unlikely that overt territoriality would have evolved for the direct control of subsistence resources. Most of the resources exploited during the early Anasazi periods are not readily defensible because they are either dispersed across space or are highly mobile (Pianka 1974:106). Agricultural lands, which may yield localized and highly aggregated crops, are notable exceptions to this generalization.

Under conditions of low regional population densities, elaborate and highly developed socio-integrative alliance mechanisms are unnecessary (Acklen 1980). Acklen persuasively argues that trade and exchange has important adaptive functions through the creation and maintenance of social bonds. The medium of exchange, whether it is marriage partners, small quantities of food, or items of material culture, are symbols of an integrative alliance network. Through a system of reciprocal exchange obligations, an effective mechanism is created that expedites the transmittal of information about subsistence resources across geographic space. Not only did potentially competitive groups learn where critical subsistence resources were and were not, information on the quantities available, the predicted time of its accessibility, and the intent of one group or another to exploit a given resource could have also been exchanged.

Through this system of reciprocal exchange obligations, the early Anasazi populations were further able to fulfill their need of maintaining access to a broad geographic area, thereby minimizing subsistence risk within any given localized setting. If any group was expecting shortfalls within their home territory while another group anticipated surpluses beyond their own subsistence needs, then the socio-integrative alliance networks could have provided the avenue through which individuals from the area with shortages could have been moved to a setting with surpluses.

The movement of people across space as part of a regional population's subsistence rounds, as the response of a group to localized population-resource imbalances, or as marriage partners would have been one factor selecting for the great ceramic stylistic homogeneity observed in the Anasazi Southwest until the mid-ninth century. A second factor would have been the actual exchange of material items between groups as symbols of the regional integrative network.

Following McAnany (1980:7-12), any notable stylistic variation present prior to late Pueblo I probably reflects differences in how groups exploited the resources in their home territories and should not necessarily be interpreted as evidence of ethnic or social boundaries. McAnany (1980:6-14) defines this form of stylistic variation as the reflexive mode, i.e., the energy residual of the subsistence system. The reflexive mode of style is conditioned by the changing structure of the natural environment and the changing use of the natural environment by human populations.

The Social Implications of Ceramic Stylistic Diversity

As productive technologies were intensified and competition for limited subsistence resources heightened, increasing variability in regional ceramic data during late Pueblo I suggest that social networks were undergoing a major reorganization. I believe that local groups in relatively rich resource habitats were attempting to establish overt ownership of tracts of land as competition for food heightened. In other words, local Anasazi populations, which were acting in their own short-term self interest, had begun the trend toward increasingly territorial behavior.

The end result of this process was the segmentation of the natural and cultural landscapes into increasingly discrete units. This segmentation is partly reflected by the proliferation of locally manufactured ceramic types, many of which were not widely distributed through trade.

Ceramic data, therefore, suggest that some local exchange mechanisms were deliberately not being maintained. However, the continued wide distribution of certain pottery types, for example, the Cibola series white wares, indicates that other social mechanisms were being redefined to counteract the emerging trend toward territoriality.

With increasing regional population densities, mobility was no longer a viable option for most groups, particularly those residing along the major drainages in the lower elevations that were more densely occupied relative to the carrying capacity of the natural environment. Competition for limited subsistence resources correspondingly became greater and more aggressive. The nonaggressive scrambles described previously would thus have given way to direct interaction competition, such as contests and territoriality (Nicholson 1954; Wilson 1968; Pianka 1974). Nicholson (1954:20) characterizes contests as competition between rivals for an amount of favorable space, which an individual or population can then appropriate for itself. Territoriality is not only defined as an overt action on the part of an individual or population against intruders of the same species, the concept also includes the degree to which a unit of space is used exclusively by its occupant (Wilson 1968:194).

The preconditions for territoriality stipulate that a resource be defensible and in short supply (Pianka 1974:106). Farm lands under intensified cultivation appear to meet these preconditions. First, under conditions of increasing regional population densities, agricultural lands would have become premium resources. Second, agricultural lands, which are localized resources and which may yield aggregated crops, may be defensible. This is particularly true of the lands along the major drainages, which contain the potentially most productive and well-watered soils. The reduction of short-term risk during favorable precipitation cycles would have encouraged the human populations to more closely guard their agricultural holdings.

The elaboration of the ceramic assemblage late Pueblo I suggests that the reflexive mode of stylistic variation was being replaced by a dynamic mode, which is attributable to the organizational strategies of the human populations (McAnany 1980:13-14). McAnany argues that a group's organization is encoded in the stylistic properties and distribution of artifacts. This is, in turn, believed to imply that there are "properties of style which are a codification of symbols referring to access, alliance, power, or control over resources" (McAnany 1980:14). Finally, McAnany notes that there is a positive correlation between the emergence of the dynamic mode of stylistic variation and increasing regional population densities.

Long-Term Productive and Social Instability

During late Pueblo I, I believe the Anasazi passed a critical regional population-resource threshold, and the extant regional climatic, productive, and socio-organizational variables had placed the cultural system in long-term risk. That is, the Anasazi, by segmenting their natural and cultural landscapes into increasingly discrete units, had left themselves susceptible to the effects of periodic droughts that lasted two or three years (Jorde 1977) or localized climatic perturbations, such as storm or frost damage. The intensification of agricultural technologies and storage buffers had been undertaken, as discussed previously, at the expense of a wide network of informal exchange and alliance relationships. While Anasazi populations were able to dampen the effects of short-term environmental perturbations through their intensified agricultural storage efforts, periods of prolonged drought would have created severe economic and social stress since the existing network of ties was not sufficiently broad to resolve the problem of localized productive imbalances. Social mechanisms simply did not exist to allow a large segment of the regional Anasazi population access to a wide geographic area. Alliance networks in particular had been so short-circuited in the face of increasing regional population densities that individuals in areas of productive shortfalls could not invoke social obligations among real or fictive kinsmen in other subregions to reliably gain their assistance.

Summary

Patterns of short-term (high frequency) cycles of precipitation periodicity and relatively great, unpredictable year-to-year variance in rainfall persisted through the mid-A.D. 1000s (Jorde 1977). Within the limitations of this precipitation regime, early Anasazi populations were able to sustain themselves through a combination of greater dependency on agricultural production, the increased storage of foodstuffs, and a continued reliance on broad-spectrum hunting and gathering. However, the energetic demands of this diversified subsistence base resulted in ever-greater labor shortages. As the early Anasazi populations attempted to offset their manpower problems by participating in a regional demographic power drive, they were confronted with the problem of maintaining intragroup cohesion in face of large coresident populations. Local populations might have fissioned into spatially separate but socially connected units in response to real or potential conflict accompanying increased group size (Cordell 1979b). As this process evolved, the uplands, particularly those bordering the west side of the Chuska Valley, were increasingly settled. This patterning implies that regional population densities and concomitant competition for limited subsistence resources had not yet become so severe in the higher elevations that the large-scale intensification of agricultural technologies and other cultural buffering mechanisms was necessary in the lowlands.

The Elaboration of Anasazi Adaptations: The Pueblo II and Pueblo III Periods

The climatic cycles described by Jorde (1977) and Dean and others (1985) persisted through the Pueblo II period (ca. A.D. 1050). Within the parameters of unpredictable precipitation and low spatial variability in climatic conditions, regional population densities continued to expand through a demographic power drive. Because this adaptive strategy pushes the productive capabilities of the natural environment, the Anasazi had severely destabilized their ecosystem by the beginning of Pueblo II. By definition, a power drive can only succeed with the continuous growth of the subsistence economy (Stuart 1982; Stuart and Gauthier 1981). Increased competition for limited resources placed local groups, especially those occupying the featureless plains of the central San Juan Basin, in risk. Cultural buffering mechanisms were intensified to mitigate this heightened risk, but rainfall unpredictably placed finite limitations on the ability of the Anasazi to further increase their agricultural technologies and storage capacities (Jorde 1977). In addition, the trend toward overt territoriality, which was initiated during late Pueblo I, continued to develop. This trend threatened to further destabilize the regional cultural system by reducing a local group's mobility and access to a broad range of resources across a wide geographic area.

The Emergence of Chaco Canyon as a Regional Center

The construction of the well-known Chaco "town" sites began between A.D. 900 and 960 and are presumed to reflect local population increases (Lekson 1984, 1986). Powers and others

(1983:302) argue that the relatively poor physical environment of Chaco Canyon, with its poorly drained soils that are susceptible to alkalinity build-up, could not support expanding local populations within the regional climatic constraints. They further contend that the development of the outlier and road network was the social mechanism that allowed the Chaco populations access to resources not available within their local area (Powers et al. 1983; Powers 1984). The outlier and road network, which was started on a modest scale during early Pueblo II (A.D. 900-975), reached out to the peripheral areas of the San Juan Basin that are characterized by greater and more diversified natural productivity. The presence of outliers is defined on the basis of a number of Chaco architectural attributes in the construction of the central or Great House. Outliers may or may not be associated with clusters of small non-Chaco sites, which form "communities" (Powers et al. 1983) around the Great House. Because many of these communities were in place prior to the construction of the Chaco Great House, it is clear that the Chaco populations were establishing ties with previously existing local social systems. Sebastian (1983:451) states,

> The Great House is built on a particular plan and is accompanied by one or more great kivas, but as far as we can tell from the limited information available, the general material culture from the outlier is more similar to the material from local community sites than to material from distant outliers. The outlier is basically a local site with an overlay of traits and some material items from a larger exchange system.

During early Pueblo II, eleven outliers are believed to have been founded (Table 1). This time span is characterized by above-mean annual precipitation during the A.D. 910s and all of the period between A.D. 930 and 970, except for a brief decline in the A.D. 950s (Robinson and Rose 1979). Drier summer conditions are represented during the A.D. 920s and 940s. Therefore, with the possible exception of the A.D. 920s-940s, the Chaco outlier system was initiated during a time that short-term productivity may have been somewhat greater and more predictable than was usual under the prevailing rainfall regime described by Jorde (1977).

This initial outlier network emphasized ties with areas south of Chaco Canyon, and three sites are located within the Red Mesa Valley of the Cibola heartland (Table 1). Nine sites are associated with limited settlements or actual community clusters occupied by indigenous local groups. Of the sites with estimated rooms counts, Kin Bineola was the largest with 230; the others averaged 37 rooms. (It should be added that tree-ring data from Kin Bineola [Bannister 1964; Bannister et al. 1970] indicate that much of this outlier's construction dates to early Pueblo III.) The outlier at the southern end of the Chuska Valley northwest of Chaco Canyon, Skunk Springs with its estimated 45 rooms, also has an associated small community. However, Powers and others (1983:247) note that the early Pueblo II component at the Chaco structure is tenuous because it is based on the presence of a small number of early Pueblo II sherds. The two outliers in the northern San Juan drainage, Sterling and Wallace, are found near scattered contemporaneous local sites, but the available settlement data are not sufficient to allow the determination of whether these local villages form communities with the Great House (Powers et al. 1983). These outliers have an estimated 25 and 73 rooms, respectively.

Construction of another 20 Chaco outliers began during late Pueblo II (A.D. 975-1050) to raise the total number of sites within the outlier network to 31 (Table 1). The dendroclimatological reconstruction for this period (Robinson and Rose 1979) indicates a severe drought cycle in the late A.D. 970s and early 980s. This is followed by above-mean annual

Table 1. Inventory of Known Chaco Outliers

Outlier Names	Early Pueblo II	Late Pueblo II	Early Pueblo III	Associated Community (?)	Estimated No. of Chacoan Rooms
Basin Floor					
Bee Burrow			X	Y	11
Bis sa'ani			X	Y	37
Casa Abajo	X	X	X	Y	
Casa Cielo		X	X	Y	
Casa del Rio			X	N	
Great Bend		X	X	Y	
Greenlee's Ruin		X	X	P	15
Grey Hill Springs		X	X	Y	
Halfway House			X	N	12
Kin Bineola	X	X	X	P	230
Kin Klizhin			X	Y	18
Lake Valley			X	N	
Padilla Well			X	P	
Pierre's Site			X	Y	46
Pueblo Pintado		X	X	Y	135
Upper Kin Klizhin		X	X	P	25
Whirlwind House		X	X	Y	
Chuska Valley					
Newcomb			X	Y	
Sanostee	?	X	X	Y	
Skunk Springs		X	X	Y	45
Tocito			X	Y	
Eastern Arizona					
Allantown		X	X	P	100
Houck			X	P	9
Rio Puerco					
Guadalupe	X	X	X	Y	25
Red Mesa Valley					
Andrews Community	?	X	X	Y	

Table 1. Continued.

Outlier Names	Early Pueblo II	Late Pueblo II	Early Pueblo III	Associated Community (?)	Estimated No. of Chacoan Rooms
Casamero		X	X	Y	26
Coolidge Pueblo	X	X	X	Y	
Coyotes Sing Here		X	X	N	
El Rito	X	X	X	Y	55
Fort Wingate			X	Y	
Haystack Community			X	Y	26
Iyanbito			X	Y	
Kin Nizhoni		X	X	Y	
Las Ventanas		X	X	Y	
San Mateo		X	X	Y	
South Chuska Slope					
Blue Water Spring			X	N	
Casa de Estrella			X	N	
Crownpoint District			X	Y	
Dalton Pass		X	X	P	20
Grey Ridge			X	P	
Heaton Canyon			X	N	
Kin Ya'a		X	X	Y	44
Muddy Water		X	X	Y	54
Peach Springs	X	X	X	Y	30
Standing Rock		X	X	Y	35
Toh La Kai		X	X	N	
San Juan Drainage					
Aztec			X	Y	405
Chimney Rock			X	Y	55
Hogback		X	X	Y	10
Jacques			X	N	
LA 8619			X	N	
Morris 39			X	Y	40
Morris 41			X	Y	75
Salmon Ruins			X	N	175
Squaw Springs	X	X	X	Y	

Table 1. Continued.

Outlier Names	Early Pueblo II	Late Pueblo II	Early Pueblo III	Associated Community (?)	Estimated No. of Chacoan Rooms
Sterling	X	X	X	N	25
Twin Angels			X	N	17
Southwestern Colorado					
Escalante			X	N	25
Ida Jean			X	N	55
Lowry			X	N	34
Wallace	X	X	X	N	73
Yucca House			X	N	
Zuni					
Village of the Great Kivas			X	N	18

Key: Y = yes; N = no; P = probable
After Marshall et al. 1979; Powers et al. 1983

precipitation in the late A.D. 980s and 990s, including the two greatest positive deviations in rainfall represented in the 400-year record. These peaks are not represented in the summer precipitation reconstruction, however. Annual rainfall totals for all of the eleventh century are slightly below the mean with exception of peaks in the A.D. 1020s and 1060s (Robinson and Rose 1979). In contrast, the summer reconstruction shows a prolonged cycle of lower than mean precipitation between A.D. 1030-1060, which is the span encompassed by the transition from Pueblo II to Pueblo III adaptations in the San Juan Basin.

Fourteen of the new Chaco structures were placed within indigenous local communities, and another four were situated near scattered indigenous settlements, which are believed to represent community associations. With the exception of Pueblo Pintado, which has an estimated 135 rooms, these 18 new outliers range in size from 10 to 54 rooms, with a mean of 34. (Again, tree-ring evidence [Bannister 1964; Bannister et al. 1970] indicates that much of the construction of Pueblo Pintado dates to early Pueblo III.) The four remaining outliers do not have certain associated indigenous sites. The two isolated Chaco structures with estimated room counts, Allantown and Upper Kin Klizhin, also reveal great size variability (Table 1).

The emphasis of this expansion continued to focus primarily along the southern periphery of the San Juan Basin. Construction at Skunk Springs and Hogback, both of which are associated with indigenous community clusters, suggest the increasing importance of the northern and western portions of the basin. These sites are in the southern Chuska Valley and the San Juan Valley, respectively. The Wallace and Sterling outliers, however, remained isolated Chaco structures and were never associated with settlement clusters.

Various researchers (Grebinger 1973; Altschul 1978; Judge 1979; Schelberg 1982) have proposed economic redistribution models to explain the development of the Chaco cultural system. The formalized exchange network represented by the outliers and roads, they argue, served to moderate the severity of local and regional shortages in subsistence resources through the movement of large quantities of food between areas enjoying surpluses and those suffering shortages. However, as Sebastian (1983:449) points out, an underlying problem with these economic redistribution models is that they assume the movement of large quantities of food could have been or must have been the social solution to differential productivity between local areas. Also implicit in these arguments is the assumption that the development of an administrative hierarchy would have then been necessary to coordinate the movement of food and the mobilization of labor necessary for the massive construction projects associated with the Chaco system. Because there currently is no evidence to suggest that Pueblo II Anasazi populations possessed either market-based economies or politically centralized systems, the applicability of economic redistribution arguments should be questioned (Sebastian 1983:449).

Sebastian, following Eastern Pueblo ethnographic accounts (Ford 1972a, 1972b) and other general anthropological arguments (Sahlins 1972), alternatively suggests that generalized reciprocal exchanges, which were underlain and were required by local kin networks, could have functioned to even out random crop failures experienced within the local San Juan Basin Anasazi communities. Sebastian (1983:451) contends that if the exchange system was extended beyond the local group, then risk of crop failure could be further buffered through balanced reciprocal exchanges (Sahlins 1972) among populations once the structure of the exchanges was adapted to accommodate an asymmetry of obligation. Rather than to be strictly obligated to return equivalent quantities and kinds of foodstuffs within a narrowly delimited time (such an obligation would have been tenuous at best given the relatively unpredictable nature of agriculture up to A.D. 1050), it would benefit a local group experiencing productive shortfalls to offer labor or other services to a population with surpluses.

Sebastian further suggests that it would have been to the obvious advantage of the group with repeated shortfalls to maintain these exchange relationships even at the social cost of subordinating themselves to their benefactors to form patron-client relationships (Flannery 1972). Sebastian (1983:451) then argues that as these asymmetrical obligations became institutionalized, a bounded network exchange system could emerge. Winter (1980:505, after Smith 1976a, 1976b) defines bounded network exchange as noncommercial, hierarchical, and partially closed systems of local units, which are linked to centers that are controlled by elites. The elites, who possess preferential access to one or more critical resources, also control the means of exchange. Using the argument that the Anasazi could have only stored food for a short time without it spoiling, Sebastian (1983:451) asserts that surplus foodstuffs approaching their storage limit must be converted into durable goods or used to engender obligations if it was not to be lost. (Sebastian unfortunately does not specify the limitations of Anasazi storage.) Exotic, durable goods of high economic or symbolic value, besides serving as banking mechanisms to buffer against local crop failures (Bettinger and King 1971; Flannery and Schoenwetter 1970; Upham 1982), may be used by elites to maintain social ties between local settings through alliances and reciprocal obligations. Sebastian then suggests that exchange among elites could account for the overlay of a small number Chaco traits at outlier communities that otherwise resemble the material culture of the local indigenous populations.

Sebastian uses the results of a study of Chuska, Cibola, and San Juan ceramic distributions at sites in Chaco Canyon and at Chaco outliers (Draper 1981) to argue that the formalized exchange systems may have actually been less bounded than Winter's model implies. Draper reports that the distributions of the Chuska and Cibola ceramics, which dominate the Pueblo II and early Pueblo III assemblages in Chaco Canyon, generally follow a linear fall-off in abundance with distance from its source. The only major deviation in this gravity model occurs at sites within Chaco Canyon proper where there is an anomalous high frequency of

Chuska Wares and a corresponding low for Cibola ceramics. When Draper plotted the percentages of ceramic categories as isopleths on a map, he discovered that the Chuska Wares were probably produced in a localized area between the Captain Tom and Sanostee washes in the Chuska Valley northwest of Chaco Canyon. In contrast, the analysis indicates that the Cibola Wares were obtained from a regional area ranging from 50 to 70 km south of the canyon.

The San Juan ceramics, which were evidently procured from a large area, have a curvilinear fall-off, with frequencies at first declining from the source of manufacture and then rising again within Chaco Canyon (Draper 1981). Sebastian (1983:446) views this pattern as the result of a major shift in the regional economic network at the end of the twelfth century. During the time span of the dominance of the Chaco system, Sebastian expects that the San Juan ceramics would have had a simple linear fall-off with distance from its source of manufacture. Sebastian (following Toll et al. 1980) argues that the increased frequencies of San Juan ceramics at sites within Chaco Canyon would have occurred after A.D. 1200 as the importance of Chaco Canyon was supplanted by the emergence of the Mesa Verde system. (The discussion of the Mesa Verde system is presented later in this chapter.)

I agree with Sebastian's (1983:451) contention that much of what we see in ceramic distribution and outlier settlement patterns in the San Juan Basin may be accounted for through reciprocal exchange. The linear fall-off of Cibola and Pueblo II San Juan ceramics with distance from their source does not support market-based models of economic redistribution. In addition, the generally small size of the early Chaco outliers (Tables 1 and 2) does not seem to support the argument for the large-scale redistribution of foodstuffs. I simply do not believe that the organization of either the individual outlier structures or the outlier network as a whole had the capacity to store and to regularly move large quantities of food across the San Juan Basin (the Inca road system with its evenly spaced stations and massive storehouse complexes). For one thing, the energetic limitations of foot transport inhibits the efficient movement of corn beyond a radius of about 30 km (Athens 1977; Lightfoot 1979).

I also concur with Sebastian (1983:451) that bounded network exchange mechanisms may account for the directional distribution of durable exotic items and certain ceramics, such as the Chuska Wares that were produced by specialists (Toll et al. 1980; Toll 1984). Interestingly, there is also a directional distribution of Washington Pass chert, which is found only in the Chuska Mountains (Cameron 1984). Because bounded network exchange mechanisms overlie the reciprocal exchange relationships fundamental to the cultural system and, by definition, are controlled by elites, the Chaco outlier network may best be described as a multitiered system of exchange obligations that reflect existing social hierarchies.

I suggest that the apparently directional distribution of Chuska ceramics linked sets of community clusters, and I agree with Upham (1980, 1982) that Anasazi ceramic exchange data are best understood from the perspective of alliance formation. Upham interprets the structure of alliances in terms of the highest levels of decision-making in the society, and he infers that these social ties might have facilitated the transmission of esoteric knowledge used to manage increasingly aggregated and localized human populations. Within this interpretative perspective, the Chaco adaptation appears to have been a means to formally reestablish broad-reaching socio-integrative ties to override the developing trend of territorialism. The expanding network of Chaco outliers, most of which were placed in the vicinity of indigenous local communities (Powers et al. 1983), effectively permitted the central San Juan Basin access to its peripheral areas.

Table 2. Estimated Size of Chaco Structures by Number of Rooms

Outliers	n	minimum	maximum	mean	sd
Early Pueblo II (including Kin Bineola)	7	25	230	69	73.1
Early Pueblo II (excluding Kin Bineola)*	6	25	73	42.2	19.3
Late Pueblo II (including Kin Bineola and Pueblo Pintado)	16	10	230	58.3	73.1
Late Pueblo II (excluding Kin Bineola and Pueblo Pintado)*	14	10	100	36.4	22.9
Early Pueblo III	35	1	405	57.3	77.1
Early Pueblo III (Chaco Canyon Bonito Phase Towns)	12	50	695	232.5	200.6

* Most of Kin Bineola's 230 rooms and Pueblo Pintado's 135 rooms were built during early Pueblo III
Chaco Canyon Bonito Phase Towns and number of rooms: Casa Chiquita, 80; Chetro Ketl, 580; Hungo Pavi, 150; Kin Kletso, 135; New Alto, 50; Peñasco Blanco, 215; Pueblo Alto, 130; Pueblo Bonito, 695; Pueblo del Arroyo, 290; Tsin Kletsin, 115; Una Vida 160; Wijiji, 190.

It is significant that whereas most San Juan Basin Anasazi communities could have manufactured their own pottery, many relied on the exchange networks to obtain both their utilitarian and decorated ceramics. This situation is similar to that described by Chagnon (1968a, 1968b) for the Yanomamö Indians of southern Venezuela and adjacent portions of northern Brazil. Each Yanomamö village is largely capable of economic self-sufficiency; however, pottery is subject to specialized production and trade (Chagnon 1968b:100). The Yanomamö villages that do not produce pottery have essentially created artificial shortages of the item, thereby making them dependent upon an ally for its procurement. The explanation for this productive specialization, therefore, is in the socio-integrative aspects of alliance formation, and Chagnon (1968b:100) argues,

> Trade functions as the social catalyst, the 'starting mechanism,' through which mutually suspicious allies are repeatedly brought together in direct confrontation. Without these frequent contacts with neighbors, alliances would be much slower in formation and would be even more unstable once formed.

The exchange of pottery and other trade items among the Yanomamö thus serves to initiate the exchange of critical social and subsistence information and contributes toward the maintenance of socio-integrative alliances.

The ceramics traded among the Pueblo II Anasazi certainly had some utilitarian functions, such as storage and cooking. Although Snow (1981) has noted that prehistoric Anasazi pottery served as containers for the shipment of other items, he contends that there is no direct evidence that large quantities of perishables or other goods were transported in ceramics. Given the apparent differential access to Chuska ceramics based on status position and residence within a settlement cluster (Draper 1981) and the generally low rates of consumption for decorated pottery

(Upham 1980, 1982:150-155), I argue that the movement of the specialized Chuska wares among Anasazi populations was far more important as symbols of the underlying regional alliance network than as the exchange of some basic household item. In other words, Chuska wares, like turquoise and other exotic items, were primarily nonutilitarian in nature. As markers of socio-integrative alliances, the Chuska ceramics would have served to initiate the exchange of critical information, much like the situation described for the Yanomamö. Because the kinds of information exchanged were likely unequal, for example, one community was experiencing severe agricultural shortfalls versus another enjoying surpluses, the trade of the specialized ceramics, like other exchange markers, would have maintained information flow and, in turn, the alliance network (Wright and Zeder 1977). Because of their apparent status differentiation, the Chuska ceramics would have formed the highest tier of the exchange hierarchy. Furthermore, the directional distribution of the Chuska ceramics further suggests that the highest tier of exchange obligations in the San Juan Basin might have been structured to emphasize close relations between local groups that were not immediate neighbors.

Spielmann (1982:59-65) has examined exchange and mobility patterns among ethnographically documented agricultural societies. Within her sample, which includes the Enga of New Guinea (Waddell 1975), the Tonga of Zambia (Colson 1958; Scudder 1962), the Bemba of Rhodesia (Richards 1932), and the aboriginal horticulturalists of the Missouri River Valley (Blakeslee 1975), Spielmann has found that the socio-integrative ties among these groups are widely dispersed. Each individual has an extensive kin network, which is invoked for assistance in times of serious local crop failure. While intracommunity exchange for food among these societies is an option when localized crop failures occur, the pattern commonly exhibited in the case of persistent drought or severe frost is the segmentation of the community into its composite nuclear or extended family units. Each of these smaller groups uses its kin network to move to other communities where subsistence stress is less (Spielmann 1982:60).

The Bemba maintain kin ties over an area up to 160 km in diameter (Richards 1932). The Fringe Enga of the highlands, when faced with a series of killing frosts every one to three decades, may abandon entire villages and move in with their Central Enga kinsmen, who inhabit lower elevations. Individual families might remain with their hosts for as little as six months or as long as three years (Waddell 1975:263). Mechanisms that allow the permanent incorporation of some of the immigrants into the Central Enga communities also exist. Cordell (1979b:101) reports similar migrations among the historic Pueblos, including the Pecos move to Jemez and the Tano relocation to Hopi.

Spielmann concludes that "under conditions of both persistent and periodic low subsistence resource productivity, dispersal in order to forage locally, or to forage and farm...in other areas is necessary" since most local groups "are not generally capable of absorbing a large portion of the subsistence needs of another population" (1982:65).

During Pueblo II, the Chaco system focused primarily on the widening and maintenance of strong alliance networks to allow the dispersal of people among their real or fictive kinsmen in areas not effected by contemporaneous productive shortfalls due to either crop failure or the depletion of agricultural soils. Such a regional adaptation could have accommodated both local and regional crop failures by effectively spreading agricultural risk across the entire Anasazi population participating in the alliance network. As I have argued previously, reciprocal exchanges could have functioned to even out resource imbalances within a local community. Although integrative ties undoubtedly existed among neighboring local groups, I contend that the relationships between elites that allowed the fragmentation of a community and the legitimized emigration of some of its component parts would have been the strongest among populations that were geographically removed from each other. The alliance network, which has been previously described as being composed of a number of tiers that reflect existing social hierarchical organization, thus appears to also have a number of level of reciprocal obligations that were determined by the geographic distance between partners. In sum, I agree with Sebastian that given a natural landscape characterized by differential productivity, a social landscape defined by a relatively simple hierarchy of social alliances, and a dependency on foot transportation, the movement of people to areas with surpluses is the most energetically viable solution to resource imbalances. Because of differential productivity within a given locality on a year-to-year basis, this cultural adaptation benefits its participants by reducing long-term risk. An area that enjoys surpluses one year, may be hurt the following year by some local environmental perturbation. Nonetheless, I argue that regional demographic pressures, and the related rise of territorialism, could not be completely overridden, thereby preventing the large-scale emigration of population to more favorable (but already occupied) settings during Pueblo II.

I suggest that Chaco Canyon, which occupies the resource-poor central portion of the San Juan Basin, was able to temporarily ascend to the predominant position within the regional hierarchy by controlling the flow of critical subsistence information between local groups, which is reflected, in part, by Chaco Canyon's dominance in the distribution of certain classes of ceramic and lithic artifacts. The relationship between Chaco Canyon and the Chuska Valley is particularly important in this regard since their relationship is the best illustrated in the archaeological record. Windes (1984b) has reconsidered population estimates for Chaco Canyon, and he has suggested that the large towns actually had relatively low populations and that they may have been seasonally occupied. Ceramic (Toll 1984) and lithic (Cameron 1984) data from Pueblo Alto offer some support for this supposition. Toll (1984:132) states, "It is hard to resist attributing the possibility of large gatherings to ceremonial functions." If large seasonal influxes into the canyon in fact did occur, then I believe that a major activity within this controlled setting would have been the exchange of information about critical subsistence resources among representatives of the various local areas.

The Attempted Consolidation, Stagnation, and Fall of Chaco Canyon

The localized superimposition of a number of favorable climatic cycles between A.D. 1050 and 1150 within a regional shift in precipitation patterns fueled the development of the Chaco cultural system as the dominant regional center in northwestern New Mexico and, in the process, actually served to undermine the long-term resiliency of the Anasazi populations to environmental flux. With the slow unraveling of the favorable climatic conditions after A.D. 1150, the regional Anasazi cultural system, which was still locked into a cultural trajectory predicated on continued economic expansion with a limited technological base, underwent a series of regional social upheavals as populations attempted to establish a new equilibrium within their ecosystem. The importance of Chaco Canyon, which had begun to stagnate even under conditions for optimal growth, was supplanted by the emergence of Mesa Verde.

A.D. 1050 to 1300 Precipitation Patterns. The precipitation regime across the Anasazi Southwest underwent a significant shift between A.D. 1050 and 1100 (Jorde 1977; Euler et al. 1979; Dean et al. 1985). These changes consisted of a lengthening of periodicity cycles to a pattern of longer-term (low frequency) oscillations and a decrease in the year-to-year variance in rainfall. Jorde (1977:393) notes that a lengthening of the periodicity cycle increases the probability of two or more sequential dry years. The Anasazi populations confronted with this change would have had to have responded with more elaborate cultural buffering mechanisms to insure their continued survival. These buffers are believed to have included further increases in the quantities and duration of food storage, intensified agricultural practices, such as the construction of more elaborate water and soil control devices, and the aggregation of population along major drainages (Jorde 1977:385).

Jorde further contends that the decrease in year-to-year variance in rainfall would have positively influenced the development of an economy more dependent on agriculture, because precipitation would have been more predictable in the short-term. Labor demands concomitant with the intensification of cultural buffers reinforced the power drive adaptation, while greater energy demands placed on the environment by the expanding regional population further destabilized the ecosystem (Jorde 1977:393). Because the changes in regional demography and the intensification of cultural buffers threatened to outstrip the society's productive and socio-integrative capabilities even during times of relative productive stability in the natural environment, the Anasazi cultural system was subjected to severe stress when a number of exceptionally dry years occurred in succession.

Other climatic variables also fluctuated during this period. Dean and others (1985; also Love 1977, 1980) report that the trends of floodplain aggradation and rising water tables, which began in early Pueblo II times, continued until the end of Pueblo III. The groundwater curve is uninterrupted except for a short cycle of downcutting during the mid-twelfth century that was accompanied by prolonged drought conditions. Pollen evidence indicates that effective moisture increased between A.D. 850 and 1125 or 1150, after which time it began a significant and prolonged decline (Dean et al. 1985). Peterson (1981) has argued that the observed increase in available moisture relates to the northward movement of monsoons, which brought warmer temperatures and heavier summer rains to the region. Following A.D. 1150, the monsoons once again moved south to restore cooler and drier climatic conditions. The time span between A.D. 1000 and 1150 was further characterized by high spatial variability in climatic conditions, as indicated by local dendroclimatological reconstructions (Dean et al. 1985). The period between A.D. 1150 and 1300 marked the return to low regional climatic variability.

Hogan (1983:60) suggests that the superimposition of cycles of increased precipitation, more reliable spring and summer rainfall, and favorable geomorphic conditions accompanying stream aggradation would have increased the range of settings that could be successfully farmed. However, Dean and others note that these favorable conditions were not equally enjoyed across the northern Southwest, and they contend that the high spatial variability in climatic conditions between A.D. 1050 and 1150 "would have favored if not stimulated increased interaction among the populations of the southern Colorado Plateaus" (1985:543). It is under these conditions that the Chaco system flourished, expanded into the northern periphery of the San Juan Basin, and then stagnated.

The Pueblo III Chaco Outlier Network. Thirty-two outliers are known to have been established during early Pueblo III to bring the number of documented outliers in the Chaco system to 63 (Table 2). Thirty-six of the Chaco structures are associated with indigenous communities, and another eight are found near scattered local settlements that are believed to compose community clusters.

The dendroclimatological reconstruction for the San Juan Basin by Robinson and Rose (1979) indicates that the latter half of the eleventh century, the during which most of this construction is believed to have occurred, was characterized by slightly below-mean annual precipitation, and a significant drought period is represented in the summer curve during the A.D. 1090s. The early twelfth century had generally above-mean annual values until A.D. 1130, and the summer rainfall reconstruction shows above-mean values for 23 of the 29 years between 1100 and 1128. This prolonged favorable cycle is followed by below annual mean values in the 1130s, the late 1140s, and the late 1150s, the time that the Chaco system slowly fell.

Whereas all areas around the San Juan Basin except the Rio Puerco Valley saw continued outlier construction, it is significant that the northern periphery was focus of the greatest increases (Table 2). During late Pueblo II there were two outlier communities and an isolated Chaco structure in the San Juan drainage and only one isolated outlier in southwestern Colorado. After A.D. 1050, the San Juan drainage featured 11 Chaco outliers, six of which were supported by community clusters. The Chaco presence in southwestern Colorado increased to five isolated structures. In addition, the number of outlier communities on the Chuska Valley doubled (from two to four). These three areas account for 43.8 percent of all new outlier construction.

The shifting focus to the northern basin periphery during early Pueblo III is also evident in the size of two new outliers along the San Juan River. Aztec is estimated to have had 405 rooms, Salmon Ruins is believed to have had 175 rooms. Salmon Ruins is larger than 7 of the 12 Bonito phase towns within Chaco Canyon proper (Powers et al. 1983). Furthermore, Kin Bineola, with its estimated 230 rooms, is the only other outlier larger than Salmon Ruins. It should be noted, however, that Kin Bineola is located on the basin floor near Chaco Canyon. Aztec, on the other hand, is surpassed in size only by Pueblo Bonito (695 rooms) and Chetro Ketl (580 rooms) (see Tables 1 and 2). The establishment of two residential communities along the floodplain of the largest permanent drainage in the Four Corners area suggests that the Chaco system was undergoing a significant organizational shift.

As discussed previously, the rise of the Chaco system during Pueblo II was an adaptive response to short-term and long-term subsistence risk. Following Dean and others (1985), I believe the elaboration of the Chaco system during early Pueblo III is attributable, in part, to the pattern of relatively high spatial variability in regional climatic conditions. But demographic dynamics, the existing social organization, and the changing patterns of rainfall described by Jorde (1977) are other critical variables that need to be considered.

As before, Chaco Canyon was centered in a relatively poor setting for farming, hunting, and gathering in comparison to areas along the periphery of the San Juan Basin. In addition, the dendroclimatological reconstruction for the central San Juan Basin (Robinson and Rose 1977) indicates that Chaco was suffering the effects of slightly below mean annual precipitation throughout the last half of the eleventh century. In other words, it seems that Chaco Canyon was one of the local areas that was hurting even though there was a generally regionwide superimposition of favorable climatic cycles. We know that agricultural technologies in the canyon were greatly intensified during early Pueblo III, as evidenced by the construction of grid bordered fields, terraces, dams, reservoirs, and canals (Vivian 1972, 1974), to cope with the increased subsistence risk caused by continuing local and regional population growth. However, I argue (after Cordell 1979a:140) that these efforts could not fulfill the needs of the local canyon population and that the limitations of agricultural intensification in an arid environment were soon reached.

Increasing regional population densities during this period would have heightened competition for limited resources in general. A greater reliance on intensified agricultural production, which places a premium on arable lands and provides an aggregated resource, would have contributed to the underlying trend for territoriality in particular. Whereas the network of social alliances controlled by the Chaco system in Pueblo II was partially able to override the developing trend for territorialism to permit the emigration of components of local communities that were suffering productive shortfalls, it apparently could not legitimize large-scale population relocations. I believe that the Chaco Anasazi had to develop more powerful institutionalized social mechanisms to offset the variety of social and natural factors selecting for further territorial behavior in areas of good agricultural production. Given the tremendous subsistence short- and long-term risk confronting the groups within the central San Juan Basin, the Chaco system needed the means to allow the greater movement of population from areas with productive shortages to those with surpluses. The San Juan River system, with its permanent streams, high water tables, and productive alluvial soils, would have been particularly important to the Chaco system in the late eleventh century. The integrative mechanisms that the Chaco populations used to allow their increased presence in the San Juan drainage are explored below.

During Pueblo II, the Chaco system seemed to be based on the manipulation of mutual exchange obligations between the elites of the local groups participating in the regional alliance network and the control of critical subsistence information. With the preplanned construction of the Salmon and Aztec outliers in the San Juan drainage and the apparent large-scale additions to Kin Bineola and Pueblo Pintado (Bannister 1964; Bannister et al. 1970) in the central basin, the Chaco populations appear to have formalized their involvement in lower level, day-to-day reciprocal exchange relationships with other local groups to help legitimize the larger-scale movement of people across the region. The archaeological data recovered from Salmon Ruins is particularly interesting in this regard.

Irwin-Williams (1980, 1983a) reports that the primary occupation at Salmon was apparently organized around Chaco craft specialization, and she cites the planned character of the ruins (and other Pueblo III Chaco structures), the formal attributes and craftsmanship of the masonry, and the relative lack of random variation among projectile points, ornaments, grinding tools, and bone tools as support. Irwin-Williams (1980:166-169) also notes that the ceramic data, although not entirely conclusive, suggest some degree of dual organization within the community and that Salmon was occupied by both intrusive Chaco and indigenous San Juan populations. Most room ceramic assemblages that are high in either Chaco or Cibola series wares occur only on the western residence units or in the special activity areas, including the tower kiva, milling rooms, milling stone production and maintenance localities, special food production locations, the possible butchering area, and the "atypical" large square rooms adjacent to the tower kiva. Many of the residential units on the east side of the community, in contrast, were dominated by local San Juan wares. The great kiva, the only other kiva during the Chaco occupation of the site, contained both "average" frequencies of Cibola and San Juan ceramics, and Irwin-Williams (1980:171) suggests that this patterning reflects the structure's function in maintaining the integration of two distinctly different Puebloan populations in the community.

On the basis of these patterns, Irwin-Williams (1983a) argues that Salmon is representative of the internal centralization or nucleation of all components of the economy by a few elites. Although Irwin-Williams does not explicitly state what role local San Juan populations residing at Salmon Ruins contributed to the maintenance of the community, it is simple to infer that they must have provided much of the labor for the basic extractive activities, such as farming. Even in these activities, the Chaco groups seems to have had a great deal of control: the Chaco occupation is characterized by a greater dependency on corn than the thirteenth century component and the early Pueblo III component has a narrower range of wild plant species. The corn produced during early Pueblo III was larger and typically had more rows. This may have been a result of what Irwin-Williams claims to have been the Chaco's continued reliance on hard flint corns, which have better storage capabilities, at the time most other Anasazi populations were switching to softer flour varieties (Irwin-Williams 1980:149).

The most interesting aspect of the Chaco phenomenon is that it evolved without being the center of surplus agricultural production. In contrast to Sebastian's (1983) argument that populations suffering subsistence stress would find it advantageous to have allied--and even have subordinated--themselves with groups with surpluses, the Chaco peoples placed themselves in control of the flow of critical subsistence information and were able to position themselves in the highest tiers of the exchange network. Given the continuing growth of regional population densities, the long-term success of the system was based on Chaco's ability to continually expand the alliance network to spread agricultural risk across an ever-wider geographic area. As I have argued previously, it was beneficial to local groups to participate in the alliance system because local, seasonal, and annual variability in productivity almost certainly would mean that there would have been periods that their local communities were stressed. With the relatively high degree of regional variability in climatic conditions, the system could potentially flourish, because at any point in time some groups would have enjoyed bountiful harvests while others suffered shortfalls.

The lack of new construction at outliers after the mid-A.D. 1120s (Powers et al. 1983) and only sporadic building at the Bonito phase towns in Chaco Canyon between the mid-A.D. 1120s and mid-1130s suggest that the Chaco alliance system was internally unstable even during prolonged cycles of above mean precipitation. The above construction data suggest that the Chaco alliance network had reached its productive and socio-integrative limits prior to the onset of the mid-A.D. 1130s to 1179 spring and summer drought cycle that marks the end of the early Pueblo III period and the regional dominance of Chaco Canyon.

I believe that the energetic constraints imposed by foot transportation (Athens 1977; Lightfoot 1979), combined with a lack of overt political authority, may have been a crucial limiting factor in the regional expansion and consolidation of the Chaco system. Because the long-term success of the Pueblo II and early Pueblo III alliance network was dependent upon the Chacoan population's ability to effectively move an increasing number of people across an ever wider geographic area in accordance with differential productivity between local settings, a loss of efficiency in the maintenance of upper-level reciprocal obligations, which could interfere with the transmittal of critical information among the elites, would be detrimental to the system. Although the development of large residential outliers, such as Aztec and Salmon ruins, may have improved some the lower level social interactions, the distance (about 70 km) between Chaco Canyon and its northern periphery may have been too great an obstacle over the period of several generations. I suggest that the loss of efficiency translated into the stagnation of the alliance network. The concept of stagnation implies that the alliance network could not continue its necessary outward expansion to fulfill the needs of its still expanding demographic base. As subsistence risk could no longer be successfully mitigated by the regional system, the underlying forces selecting for territoriality could have again arisen as local groups more openly competed with one another for the control of limited subsistence resources. The regional cultural system, which had become dependent upon the ability of local populations to relocate themselves in time of stress, was placed in long-term risk.

The stagnation of the Chaco system is indicated by the remodeling data from Salmon Ruins. Irwin-Williams (1980, 1983a) views the massive construction episode of A.D. 1105-1106 to be entirely Chacoan in character, which she interprets as evidence of continued close affiliations between Chaco Canyon and the San Juan drainage. However, a number of building modifications took place between A.D. 1116 and 1130 that totally altered the function and connectivity of rooms (Irwin-Williams 1980, 1983b). These changes included the addition of kiva-like features within the large square rooms of the tower kiva complex that opened toward the plaza. Irwin-Williams (1980:185) believes that these architectural data indicate the breakdown in the centralized or administratively nucleated Chacoan control over the outlier community prior to the advent of the spring and summer drought cycle that dominated the middle twelfth century.

The effects of the extended drought cycle of A.D. 1135 to 1179 are reflected, in part, by the lack of new major construction at the Bonito phase towns in Chaco Canyon (Lekson 1984, 1986) and the Chaco outliers (Powers et al. 1983). An A.D. 1132 tree-ring cutting date recovered from Pueblo Alto is the last date known from a Bonito phase pueblo in Chaco Canyon (Lekson et al. 1982). Tree-ring dates from the A.D. 1250s and 1260s have been recovered at the Salmon Ruins, Aztec, and Guadalupe outliers; however, they reflect the modification of the existing Chaco structures rather than new large-scale construction.

The building sequences imply that the mid-twelfth century drought subjected the unwieldy Chaco system to sufficient stress that its strained productive and socio-integrative mechanisms completely broke down and the system could no longer maintain itself even in a stagnant state. We know that the population of Chaco Canyon was greatly reduced by the late 1100s (Hayes 1981) and that outliers like Salmon Ruins were either partly or completely abandoned as the Chaco system finally fell (Irwin-Williams 1976). The degree of turmoil that occurred during this time period as the Anasazi populations struggled to cope with the changes in their cultural and natural environments is best illustrated by the appearance of defensive sites in many localities across the northern Southwest (Dean et al. 1985, table 1). Although site and areal abandonments also intensified during this time, I believe that the character of these demographic shifts was very different than that previously. Stuart and Gauthier (1981:42) suggest that the inhabitants of the central San Juan Basin began to move into the Rio Grande, the Zuni highlands, the Chuska Valley, and possibly even briefly into Mesa Verde.

The Rise of Mesa Verde as a Regional Center. The Mesa Verde system expanded to fill the organizational vacuum in the San Juan region left by the stagnation and collapse of the Chaco alliance network. While it is probable that the Mesa Verde system was based on reciprocal obligations, it was structurally different from its predecessor, i.e., it lacked the clearly defined administrative nucleation that characterized the Chacoan network (Irwin-Williams 1980, 1983a).

The paleoenvironmental reconstruction for the northern Southwest (Dean et al. 1985) in general and the dendroclimatological sequence developed for the San Juan Basin (Robinson and Rose 1979) in particular indicate that the late Pueblo III Anasazi populations faced subtly different climatic conditions, which, I suggest, helped influence the organizational structure of the Mesa Verde system. On the one hand, the general rainfall regime continued to be characterized by relatively low periodicity and low year-to-year variability (Jorde 1977) and the major floodplains generally continued to aggrade until the late thirteenth century (Dean et al. 1985). On the other hand, effective moisture was progressively reduced and climatic conditions had relatively low regional variability.

The San Juan Basin annual and spring rainfall reconstructions (Robinson and Rose 1979) indicate that the extensive drought period of A.D. 1135-1179 was followed by mean to slightly above-mean values that lasted to A.D. 1214 (Robinson and Rose 1979). It is during this time that the Mesa Verde system expanded to include the San Juan drainage. Below-mean annual values dominated from the late A.D. 1210s to 1230, with the period between A.D. 1215 and 1220 expressed as the most severe drought cycle recorded in the Pueblo occupation of the San Juan Basin between 900 and 1200. Above-mean annual values returned from A.D. 1231 to 1245, and the last half of the thirteenth century is characterized by predominantly below-mean annual precipitation, although brief positive peaks occur in the late A.D. 1260s and early 1290s. The reconstructed summer precipitation curve reveals near mean values for most of the first half of the century, followed by slightly above-mean values between A.D. 1245 and the early 1270s. Between 1272 and 1295, roughly the period of the Great Drought, summer precipitation is marked by slightly below-mean values. Robinson and Rose note that the departures from the summer mean are less during the A.D. 1200s than the preceding three centuries. The spring precipitation curve begins with above-mean values at the beginning of the century. This moisture cycle is followed by a short but severe drought, which is reflected in the annual reconstruction, in the late A.D. 1210s. Precipitation values are near average for the middle portion of the century, while the Great Drought of the A.D. 1270s through 1290s are predominantly subaverage. Dean and others (1985:546) argue,

> The coincidence during the A.D. 1250-1300 interval of a primary hydrologic-aggradation minimum with a major drought would have had important adaptive consequences for Anasazi populations still adjusting to the sociocultural ramifications of their responses to the twelfth century environmental stresses.

Despite the suggestion by Dean and others (1985:546) that a return to reduced spatial variability in climatic conditions would have selected against large-scale trade as an effective response to subsistence stress, ceramic data (Toll et al. 1980) indicate that Mesa Verde assumed an important role in the regional exchange system. This system appears to have operated to legitimize the emigration of population from Mesa Verde into the San Juan drainage and possibly even into Chaco Canyon (Hayes 1981). Dendrochronological evidence from the former Chaco outliers of Aztec, Salmon Ruins, and Guadalupe are associated with substantial remodeling in the 1250s and 1260s by populations participating in the Mesa Verde system (Powers et al. 1983). Although there is some debate whether the appearance of Mesa Verde material culture in Chaco Canyon represents the actual immigration of populations (Hayes 1981) or shifts in social affiliation (Toll et al. 1980; Cordell 1979a). Regardless of the interpretative scenario, the Mesa Verde component at Chaco Canyon follows a period in which the canyon's population densities were greatly reduced and were still declining (Hayes 1981).

The Mesa Verde system, like that of Chaco Canyon, was internally unstable. Because it lacked the nucleated administrative hierarchy of its predecessors (Irwin-Williams 1980, 1983a) and was faced with relatively low spatial variability in climatic conditions, I do not believe that Mesa Verde was afforded the option of moving populations across geographic space to balance differential local, seasonal, and annual productivity. Rather, the most viable short-term option available to the Mesa Verde system was to develop social mechanisms to allow the aggregation of populations along the regional floodplains. Thus, the Mesa Verde system superficially resembled the early Pueblo III Chaco attempt to permanently relocate populations in the major drainages even though it lacked the well-coordinated regional integrative network that served as the foundation of the Chaco system. As a result, the Mesa Verde system would have actually emphasized the factors for territorialism that Chaco had tried to subdue.

The process of aggregation along the major floodplains would have had the net result of exacerbating the trend toward increased settlement size and the concomitant changes in the socio-organizational complexity identified previously. The San Juan drainage populations, however, might have actually welcomed the emigres from Mesa Verde and the central portions of the San Juan Basin. Given the factors of high regional population densities and heightened competition for increasingly limited subsistence resources, the acceptance of emigres might have offered a local group a temporary competitive advantage by providing the labor pool necessary for further agricultural intensification and the maintenance of territorial boundaries.

Clearly, the Mesa Verde strategy was at best a short-term resolution that could only succeed as long as the floodplains of the Four Corners area continued to be productive. However, with the superimposition of the Great Drought of the late thirteenth century with a severe cycle of floodplain downcutting, the Mesa Verde system was thrown into complete turmoil and the final abandonment of the San Juan Basin proceeded and was completed by ca. A.D. 1300.

Summary. The Chaco alliance network emerged on a modest scale in early Pueblo II to counteract the trend toward increasingly overt territoriality among local groups that threatened to further destabilize the regional cultural system. From early to late Pueblo II, elites of the various local groups were linked by a system of mutual exchange relationships that was coordinated by the upper status individuals in Chaco Canyon. The existence of this exchange system is reflected by the construction of the Chaco outliers and their associated roads, which often linked Chaco Canyon with other indigenous community clusters, and the directional exchange of Chuska ceramics and raw lithic materials. The alliance network primarily functioned to allow the movement of people from areas suffering shortages to areas enjoying surpluses. Through the manipulation of this exchange system, the Chaco Canyon elites, who resided in the relatively homogeneous and resource-poor central San Juan Basin, were able to control the flow of critical subsistence information and to ascend to the predominant position within the regional social hierarchy.

The lengthening of precipitation periodicity cycles, a decrease in the year-to-year variance in rainfall, and the localized superimposition of favorable climatic conditions fueled the elaboration of the Chaco alliance network in early Pueblo III. Although mutual exchange obligations among elites continued to form the basis of the regional integrative system, the residents of Chaco Canyon, which was one of the localized settings that was environmentally stressed even though most areas were enjoying the favorable climatic conditions, had to develop more powerful institutionalized exchange mechanisms to offset further territorial behavior among groups with more reliable, productive agricultural bases. The Chaco system, therefore, emphasized the emigration of population from the central canyon to outlying areas, particularly those along the San Juan drainage. This large-scale movement of people was legitimized by the Chaco population's formalized involvement in low level, day-to-day reciprocal exchange relationships, such as those evidenced at Salmon Ruins.

The Chaco integrative network appears to have begun to stagnate, as indicated by the lack of major construction episodes within Chaco Canyon and at the outliers, even during the period of generally favorable regional climatic conditions. This stagnation, I argue, resulted from Chaco's lack of overt political authority and its dependence on foot transportation to maintain the flow of critical subsistence information at the time that the social system required the responsive movement of increasing numbers of people across a wider geographic area. With the unraveling of favorable climatic cycles and a return to reduced regional variability in environmental conditions at the end of the early Pueblo III period, the unwieldy Chaco system was subjected to sufficient stress that its strained productive and socio-integrative mechanisms completely broke down and the stagnating system finally fell.

The Mesa Verde system responded to fill the organizational vacuum left by the collapse of the Chaco alliance network. It continued to emphasize the aggregation of population along the permanent regional drainages. Although Mesa Verde cultural manifestation was likely based on a system of mutual exchange obligations, it was structurally different from its Chaco Canyon predecessor because it lacked a clearly defined administrative hierarchy that could effectively link the various local areas encompassed by the regional system. Given its organizational limitations, the Mesa Verde system may have actually emphasized the factors selecting for territoriality that Chaco had attempted to subdue by increasing its dependency upon intensified agricultural efforts within a highly constrained environmental setting. The Mesa Verde strategy was successful only for as long as the major floodplains remained productive. The superimposition of the Great Drought of the late thirteenth century with a cycle of severe floodplain downcutting resulted in the collapse of the Mesa Verde system and the abandonment of the San Juan Basin by Anasazi populations by approximately A.D. 1300.

EXCAVATIONS AT LA 50337

Bradley J. Vierra

Field Methodology

LA 50337 can be divided into six separate proveniences based on the location of various features and strata within the site. These include the north trench, south trench, room block and surrounding plaza, Room 13 and plaza, north plaza, and pit structure area (Fig. 2).

Subsurface cultural deposits were first exposed by the trenching activities of the utility company in the north trench on the east side of the road. Work on the site began here. Several alluvial deposits, a trash deposit (Stratum 1), a pit feature (Feature 1), and an ash/charcoal lens (Stratum 4) were visible in the west profile of the trench. These were drawn (Profile 1) and samples of the strata were excavated and screened through a ¼-inch mesh. The remaining portion of the pit feature was totally excavated. A backhoe trench (.50 by 3 by 1.5 m deep) was dug on the west side of the road, opposite the north trench. No cultural remains were observed in this trench. Finally, a surface reconnaissance of the site area was made. A light lithic and ceramic scatter was observed in lots to the east of the right-of-way and on the slope along the western edge of the right-of-way in front of the A-Z Autos Parts building.

A datum with an elevation of 10.0 m was situated at station 66+27.47 along the east edge of the right-of-way. This datum system works the same as topographic elevation--the higher the elevation, the greater the number and the lower the elevation, the smaller the number. To find the depth below present ground surface, one must subtract the elevation from 10 m.

Trenching activities continued further to the south where more cultural deposits and two wall stubs were exposed in the north trench, and a plaza surface, hearth feature, and trash deposit in the south trench. Figueroh Avenue divides the north trench from the south trench. Because the hearth feature was in the greatest danger of being further disturbed, work shifted to this area. The east wall of the south trench was profiled and samples of the plaza surface were excavated (Stratum 8). Test Pits 1-4 were placed over the hearth feature (Feature 2), consisting of four contiguous 1 by 1 m grids, and the feature was excavated. A small trash deposit (Stratum 12) situated at the south end of the south trench was also mapped and excavated.

The west wall of the north trench, where cultural strata were exposed, was drawn and samples were taken. The bottom of the backhoe trench was then cleaned in the area surrounding the two exposed wall stubs. Test Pits 5-10 were situated from south to north over the area. These were roughly 1 by .70 m in size and were bounded by the west wall of the trench on one side and a water-main pipe on the east side. The excavation revealed the presence of a large kiva with a bench on its north side and a bench and pilaster on its south side. A portion of the burned roof was found on the floor of the kiva. Since the kiva was situated below the proposed road zone, only the area within and below the backhoe trench was excavated.

An attempt was made to link up the north trench with the south trench under Figueroh Avenue. However, the junction of the main water pipeline was situated in this area. It and a couple of old arroyo channels had severely disturbed and segmented the stratigraphy.

A grader exposed the corners of at least three rooms on the west side of the road opposite the south trench. A 100N/100E datum for a 1 by 1 m magnetic north grid system was placed in the graded area north of the room block. Work began by first uncovering and delineating the top of the room block walls. This produced a series of walls that may have represented about twelve rooms. Next, the graded area was cleaned. A hearth and occupational surface were excavated just west of Room 1. Room 1 was then excavated, followed by Room 2, Room 3, and Room 4. Only a very small portion of the northwest corner of Room 3 was present. Room fill was removed in natural stratigraphic units. This included a post-occupational fill stratum overlying a floor, which was underlain by several other layers of fill between successive floors. A stratum was defined as a distinct depositional unit. Floors were mapped and photographed; all the artifacts were point provenienced and collected. Features were excavated and the appropriate samples taken. Pollen and flotation samples were taken from various locations on the floor. A subfloor test pit was excavated beneath the final floor.

Upon excavation of Rooms 5 and 6, it was determined that these were not rooms, but were part of exterior plaza activity areas. Again, strata were excavated in natural units with plaza surfaces treated the same as floors. Rooms 7 and 8 were enclosed rooms, while Rooms 9-12 were actually part of a plaza that had been partitioned by small wall segments. Three plaza levels were excavated along the southern side of the room block in the area of Rooms 10-12.

A series of seven 1 by 2 m test pits were dug along the slope north of the room block to determine the presence of any other subsurface cultural deposits. These were placed 5 m apart, with four between the room block and a driveway to A-Z Auto Parts, and three north of the driveway. Test Pits 11 (106N/97-98E) and 12 (101N/98-99E) contained trash strata overlying a plaza surface. Test Pit 13 (117N/98-99E) exposed a feature. Test Pit 14 (111N/98-99E) contained some mixed deposits because it was situated in an area partially disturbed by a water main. Test Pits 15 (136N/99-100E) and 17 (146N/99-100E) contained no intact cultural deposits, while Test Pit 16 (141N/99-100E) uncovered a possible wall segment and a layer of trash.

A profile was drawn of the exposed grader cut north of Room 1, where Test Pits 11 and 12 had exposed a plaza surface. Then, grids 95N/97E, 96N/96-97E, and 96-100N/98E to the north of Room 1 were excavated down to the plaza surface.

While the site was being excavated, the water-main pipe was replaced, running east-west across the road from the south end of the north trench to between Test Pits 11 and 14. The north wall of the trench was a clean cut, allowing us to view the stratigraphy under the road. A plaza surface was observed along the eastern end of the trench, but it could be followed for only about 5 m. This surface was about the same level as the kiva in the north trench. On the west end of the trench, a hearth feature was exposed. It was situated about 1.1 m below the level of the plaza surface to the north of the room block.

The area around Test Pit 13 was excavated in order to define the exposed feature. Work revealed the presence of a milling bin that was situated in a plaza, lying just to the south of another room (Room 13). Room 13 was then excavated and subfloored. A backhoe trench (10 by .50 by 1.6 m deep) was placed immediately north of Room 13 to determine if any other rooms were present. The west wall of the trench was drawn (Profile 16). No rooms were found, but two hearths, a plaza surface associated with Room 13, and a much older surface were exposed.

Grids 139-140N/99-100E were excavated to the south of Test Pit 16 to determine the nature and extent of the exposed trash deposit and possible wall stub. The wall stub turned out

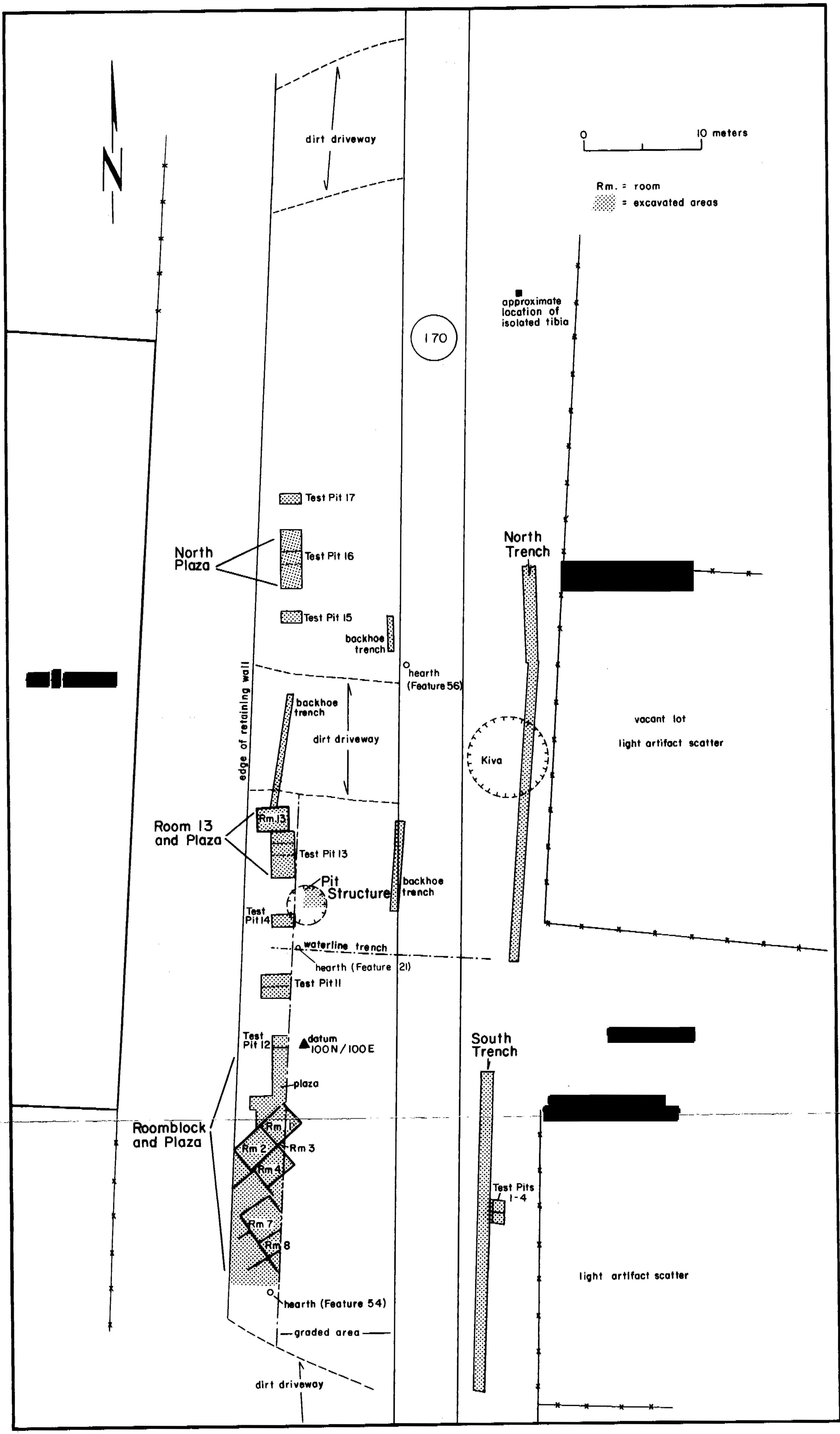


Figure 2. Site plan, LA 50337.

to be an isolated wall fragment. The trash was situated below the wall stub in a pit. Grids 139-140N/99E were then excavated to a level below the feature. Here the top of an upright sandstone slab was uncovered. The excavation then moved into grids 139-140N/100E and 141-143N/99-200E as it became apparent that the upright slab was part of a milling bin associated with a plaza surface and four hearths. All the features were excavated. The plaza surface was only definable in the area of the features, with loose sand present on the northern and southern ends of the trench.

After all the work had been completed, the utility company was allowed to dig a trench in the graded area adjacent to the road. This would give us a look at the subsurface stratigraphy along the west side of the road the entire length of the site. Because a ditch-witch was used to lay the cable, only the back dirt could be checked for cultural material. The trench was cut about 1.5 m deep. Only one place exhibited signs of subsurface cultural deposits consisting of a darkened soil with chunks of charcoal situated just northeast of Test Pit 14. A backhoe was brought in to widen and remove the fill from the trench. The trench had cut through the edge of a room 1.36 m below the present surface. The overburden was removed from above a portion of the room, down to the top of the walls, by the backhoe. Roughly one-quarter of the structure was excavated within grids 111-112N/100-120E including post-occupational fill, a burned roof, and floor. It appeared to be a pit structure with a central hearth and surrounding bench. Since the room was below the proposed road construction zone, only the area that was partially disturbed by the utility cable trench was excavated.

After the excavation of the pit structure, the highway construction company was allowed to begin working in this area of the site. A hearth (Feature 54) was exposed about 80 cm below the third plaza level south of the room block, and an isolated child burial was unearthed about 1-1.5 m below Room 1.

Roughly three months after work had been completed at LA 50337, the asphalt paving of the road was removed exposing cultural deposits and a hearth (Feature 56) in the area east of the pit structure and Room 13. A backhoe trench was dug through what was defined as an isolated trash deposit.

Stratigraphy

A total of 121 strata were defined during the excavation of LA 50337. These are listed and described by site provenience in Table 3.

Table 3. List of Strata by Provenience

Provenience	Stratum	Description
North Trench		
Profile 1	1	Redeposited Trash
	2	Laminated sand w/ gravel and charcoal
	3	Laminated sand w/ gravel and charcoal
	4	Ash/charcoal lens

Table 3. Continued.

Provenience	Stratum	Description
	5	Feature 1, pit fill
	6	Laminated sand w/ gravel and charcoal
	7	Laminated sand w/ gravel and charcoal
Profile 3	13	Laminated sand w/ gravel and charcoal
Kiva	14	Laminated sand w/ gravel and charcoal
Profile 3	15	Laminated sand w/ gravel and charcoal
	16	Laminated sand w/ gravel and charcoal
	17	Laminated sand w/ gravel and charcoal
Kiva	18	Wall and roof fall
	19	Roof fall
	21	Floor
South Trench		
Profile 2	6	Laminated sand w/ gravel and charcoal
	8	Plaza surface
	9	Laminated sand w/ gravel and charcoal
	10	Feature 2, roasting pit fill
	11	Feature 3, hearth fill
Profile 4	12	Trash
Room Block		
96-97N/100E	20	Feature 4, hearth fill
Room 1	22	post-occupational fill/wall fall
	23	post-occupational fill
	25	Floor 1
	26	Feature 5, hearth fill, Floor 1
	27	post-occupational fill
	28	Floor 2
Subfloor	29	wall fall/fill
	33	occupational surface?
Room 2	22	post-occupational fill/wall fall
	38	post-occupational fill

Table 3. Continued.

Provenience	Stratum	Description
	40	Floor 1
	43/48	Feature 17, pit fill, Floor 1
	45	Feature 19, pit fill, Floor 1
Subfloor	50	Laminated sand w/ gravel
	52	occupational surface?
	55	Laminated sand w/ gravel
Room 3	22	Post-occupational fill
Room 4	22	Post-occupational fill
	31	Floor 1
	32	Post-occupational fill/wall fall
	34/39	Floor 2
	41	Feature 13, hearth fill, Floor 2
	42	Floor 3
	46	Feature 15, hearth fill, Floor 3
	47	Feature 16, pit fill, Floor 3
	50	Laminated sand
Room 7	22	post-occupational fill
	53	Floor 1
	54	Feature 22, hearth fill, Floor 1
Room 8	59	Feature 24, hearth fill
Room 8, Subfloor	61	trash
Plaza Around Room Block (Areas 5, 6, 8, 9, 10, 11, 12)		
Area 5	22	post-occupational fill
Area 6	22	post-occupational fill
Area 9	22	post-occupational fill
Area 10	22	post-occupational fill
Area 5	35	exterior occupational surface
	37	Feature 12, hearth fill, Floor 1
	36	fill beneath Floor 1
Area 9	62	trash

Table 3. Continued.

Provenience	Stratum	Description
Plaza 1, Area 5	44	ramada (on Floor 2)
	49	surface
Plaza 1, Area 6	65	surface
	30	Feature 9, hearth fill
	51	Feature 20, hearth fill
Plaza 1, Area 9	63	surface
Plaza 1, Area 10	70	Feature 31, hearth fill
	71	surface
Plaza 1, Area 11 (80-83N/95-98E)	65	surface
Plaza 1 (83N/97E)	66	Feature 26, pit fill
	67	Feature 27, post hole
	68	Feature 28, hearth fill
Fill below Plaza 1, Area 5	57	sand w/ gravel and charcoal
Fill below Plaza 1, Area 10	73	fill between strata 71 and 72
Plaza 2, Room 10 (82-83N/95-96E)	72	surface and fill
	77	Feature 35, hearth fill
	83	Feature 37, pit fill
Plaza 3, Area 5	58	Feature 23, hearth fill
Plaza 3, Room 7, subfloor	60	Feature 25, hearth fill
Plaza 3, Room 8 (Floor 1, subfloor)	64	surface
Plaza 3 (83N/97E)	74	surface
Plaza 3 (82-83N/97-98E)	84	Feature 38, hearth fill
Plaza 3 (85N/98E)	107	Feature 44, pit below Room 7
Under room block	50	laminated sand
Plaza 4 north of room block (96N/96-97E, 96-100N/98E)	78	trash on plaza
Plaza 4 north of room block (105N/97-98E)	79	trash in plaza (same as 78?)
	85	laminated sand between 79 and 80
	80	trash in plaza

Table 3. Continued.

Provenience	Stratum	Description
Plaza 4 north of room block (96N/96-97E, 96-100N/98E)	88	surface
Room 13 and Plaza		
Room 13	22	post-occupational fill
	97	roof fall
	100	post-occupational fill
	101	Floor 1
	105	Floor 2
	108	Feature 45, hearth warming pit, Floor 2
	109	Feature 46, hearth warming pit, Floor 2
118N/99E, subfloor	103	redeposited trash
	104	building debris?
north of Room 13	121	Feature 53, hearth fill (Profile 16)
Plaza and South of Room 13		
TP 13 (115-117N/97-99E)	22	post-occupational fill
	75	plaza surface
	76	trash between 75 and 82/86
	81	wall, fill
	82/86	Feature 36, ramada
	87/94	Plaza surface
	90	Feature 39, milling bin fill
	91	Feature 39, milling bin floor
116N/97E	93	trash fill below Feature 39 floor
	96	Feature 40, hearth fill (Level 1)
	98	Feature 42, pit fill
117N/99-100E	99	Feature 43, hearth fill
116-117N/98E	102	Feature 40, hearth fill (Level 2)
North Plaza		
139-143N/99-100E	22	post-occupational fill
139-140N/99-100E	89	redeposited trash

Table 3. Continued.

Provenience	Stratum	Description
	92	laminated sand w/ charcoal
140N/99-100E	95	Feature 41, pit fill (trash)
139-143N/99-100E	106	laminated sand w/ charcoal
	110	surface
140N/100-101E	115	Feature 47, pit fill (milling bin)
141N/100E	111	Feature 48, pit fill (assoc. w/ milling bin)
	114	Feature 51, hearth fill
142N/100E	112	Feature 49, hearth fill
142N/100-101E	113	Feature 50, hearth fill
Pit Structure 1		
111-112N/100-102E	116	mixed roof, fill
	117	roof
	118	post-occupational fill
	119	floor and bench
112N/101E	120	hearth fill
109N/98-100E	69	Feature 21, hearth fill, found in backhoe trench south of Pit Structure 1

Features

The discussion on features will be organized in respect to the site proveniences. Refer to later sections for more specific information on ceramics, lithics, floral remains, and faunal remains.

The North Trench

The north trench (34 by 1 m) is where the excavation of LA 50337 was first initiated (Fig. 2). Profile 1 (Fig. 3) shows the west wall at the northern end of the trench. Here a redeposited trash layer (Stratum 1) is situated at the top of the profile. It is an unconsolidated charcoal-stained sandy clay loam soil. The stratum contains bits of charcoal, sherds, lithic artifacts, large mammal bone, and some gravel. The pottery present included Kiatuthlanna Black-on-white, Cortez Black-on-white, Mancos Black-on-white, Chuska Black-on-white, and Mancos Corrugated. A pollen [2] and flotation [3] sample were analyzed. The pollen sample included evidence of pinyon, sagebrash, and maize. The flotation contained burned corn with juniper, cottonwood, saltbush, and sagebrush charcoal. A scattered C-14 sample [6] produced a date of A.D. 724 ±

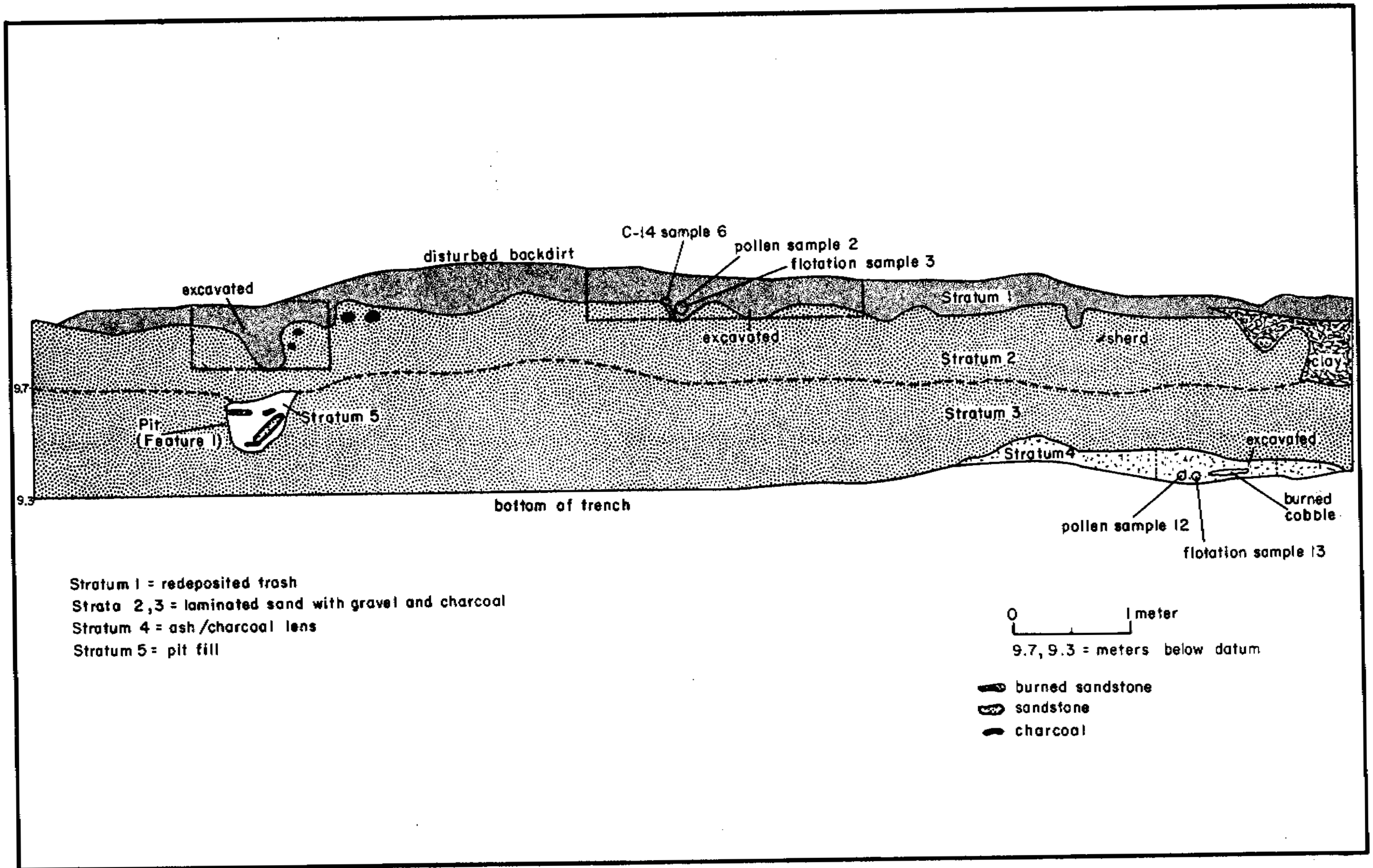


Figure 3. Profile, west wall of northern end of north trench.

130 (Beta-13292). Underlying the trash are two laminated sand deposits with gravel and some bits of charcoal (Strata 2 and 3). Stratum 3 generally has a higher clay content that Stratum 2.

A pit (Feature 1) appears to have been dug into Stratum 3 at an elevation of 9.7 m. The feature is an unlined bell-shaped pit hat had been partially cut through by the backhoe trench. It was filled with laminated trash similar to Stratum 1, with five large and two small tabular pieces of sandstone, two small tabular cobbles, and a large circular-shaped sandstone slab. Two burned sandstone slabs were situated horizontally across the top of the pit, the large, shaped slab was lying upright near the north side of the feature and two slabs were lying horizontally near the bottom of the pit. The feature may have been partially lined at one time, eventually collapsing and filling with waterlain trash. Alternatively, the contents may have simply been discarded there. Because the walls of the pit were not oxidized, the burned slabs must have been heated somewhere else. Also the large shaped slab looks like it could have acted as a cover for the pit. The feature probably represents a storage pit of some kind. Pollen [8] and flotation [10] samples were analyzed from the fill. The pollen sample included evidence of Cheno-ams, maize, and cholla. The flotation sample contained goosefoot, globemallow, saltbush, Indian ricegrass, pigweed, purslane, nightshade, and tobacco seeds. Burned corn and juniper and rabbitbrush charcoal were also present.

Stratum 4 is situated on the bottom of the trench at an elevation of 9.3 m. It consists of an ash lens mixed with charcoal, burned soil, and some laminated sand and gravel. Two flakes, four Sambrito Brown Ware jar sherds, a burned corn cob, and some fire-cracked gravels were recovered from the stratum. One small and two large burned cobbles were found lying on top of the ash layer. The soil underlying the ash was not oxidized, and it appears that the layer was not burned in situ, but was discarded in this location. Charcoal collected from Stratum 4 yielded a date of A.D. 487 $\pm$ 100 (Beta-13293). A pollen [12] and flotation [13] sample were analyzed. The pollen sample included evidence of Cheno-ams and maize. The flotation sample mainly consisted of nightshade seeds with some pigweed, hedgehog cactus, and globemallow.

Kiva 1 is situated roughly in the center of the north trench. The top of the outer two wall segments were exposed in the bottom of the backhoe trench. These were overlain by multiple strata that were sectioned along the west wall of the trench. Figure 4 shows the cross section of this stratigraphy and the kiva. Strata 13-17 are alluvial deposits consisting of laminated sand mixed with varying amounts of charcoal, artifacts, and gravel. Excavation began between the two exposed wall segments, within the backhoe trench (6 m by 70 cm area). Stratum 14 was removed, exposing the top of a bench next to the north wall and a pilaster and bench along the south wall. Deposits dipped towards the center of the kiva. A whole Cortez Black-on-white pitcher was recovered from Stratum 14. A pollen sample was taken from the pitcher and it yielded evidence of Cheno-ams and maize from both the fill and sides of the vessel. Stratum 18 consists of a mixed roof and wall debris level, lying below the benches. The fill contains laminated sand with cobbles, sandstone blocks, chunks of charcoal, small burned twigs, burned adobe, Cortez Black-on-white, Mancos Black-on-white, Mancos Corrugated, debitage, cores, ground stone, and bone. The bone includes cottontail, mule deer, jackrabbit, pocket gopher, and skunk. After partially excavating Stratum 18, the depth of the trench had begun to reach an unsafe level, more than 2 m below the surface and another meter or so of backdirt piled on top of this. Therefore, a decision was made to only complete the excavation of the northern half of the kiva. The roof (Stratum 19) had burned and collapsed onto the floor. Most of it had piled up against the north bench, thinning out towards the center of the kiva (Fig. 5). It consists of charcoal, burned beams, and adobe casts. Sherds recovered from this level include Mancos Black-on-white and Mancos Corrugated. The kiva floor (Stratum 21) is unprepared, consisting of compacted burned sand.

The kiva is 5.75 m across in the exposed area of the backhoe trench. However, the trench is situated near the eastern edge of the structure. Therefore, the kiva may have a total diameter of roughly 7 m. Dimensions for the north wall, south wall, benches, and pilaster are given in Table 4. The north wall and bench is constructed of a single course of cobble and sandstone block masonry. The bench contains much more adobe mortar than the wall. No upright posts were present on the bench, however, a burned cottonwood post was found lying on the bench (dendro #69, Fig. 6). The wall and bench had been covered with a layer of adobe about 1 cm thick, over which at least two coats of plaster (<2 mm) were placed. The edge of the bench was rounded off and the bottom of the bench was coped with adobe, connecting it with the floor.

Table 4. Kiva Wall, Bench, and Pilaster Dimensions

	North Wall	South Wall
wall thickness	26-29 cm	38 cm
wall height above bench	70-77 cm	76 cm
bench width	23-27 cm	39-43 cm
bench height	89-93 cm	---
pilaster width	---	36-39 cm
pilaster height	---	28-31 cm

The construction of the south wall, bench, and pilaster were similar to that found in the north, except that a larger number of cobbles were used. Two upright posts were present in the pilaster (Fig. 5). They are about 5-8 cm wide; the post holes were 24 cm deep. One cottonwood post (dendro #82) was present in the west wall of the trench and about 44 cm high. Another cottonwood upright post (dendro #83) was situated on the bench, 25 cm to the east of the pilaster. It was about 15 cm high and had been coped with adobe to the wall (Fig. 7). A small portion of unconsolidated roof fall was present on the bench. A pollen sample [77] was analyzed from where the pilaster, bench, and wall intersect. It yielded evidence of Cheno-ams and maize.

Only the northern half of the roof was excavated within the kiva (Fig. 5). It is difficult to determine the nature of the roof from such a small sample. The beams were 6-12 cm in diameter, with some running roughly east-west and others north-south. Dendro samples 96, 97, 98, 99, and 100 were taken from the burned beams found on the floor in Test Pits 9-10 and dendro sample 80 and C-14 sample 81 from a beam near the top of the roof stratum in Test Pit 6. All the dendro samples were cottonwood, except for dendro sample 80, which was juniper. The radiocarbon sample (Beta-14246) dated A.D. 879 ± 60. One beam was covered with adobe and juniper bark. Two samples (72 and 87) of roofing material were comprised of saltbush and cottonwood/willow, with a single corn stem. Fifty-four burned corn kernels were also recovered from the top of the roof fill. This was dated by C-14 to A.D. 786 ± 90 (Beta-15430). The roof appears to have been composed of at least two components. The first includes the main body of the central roof, which was found on the floor of the kiva, and the second of small upright posts, which were situated in the pilasters and benches.

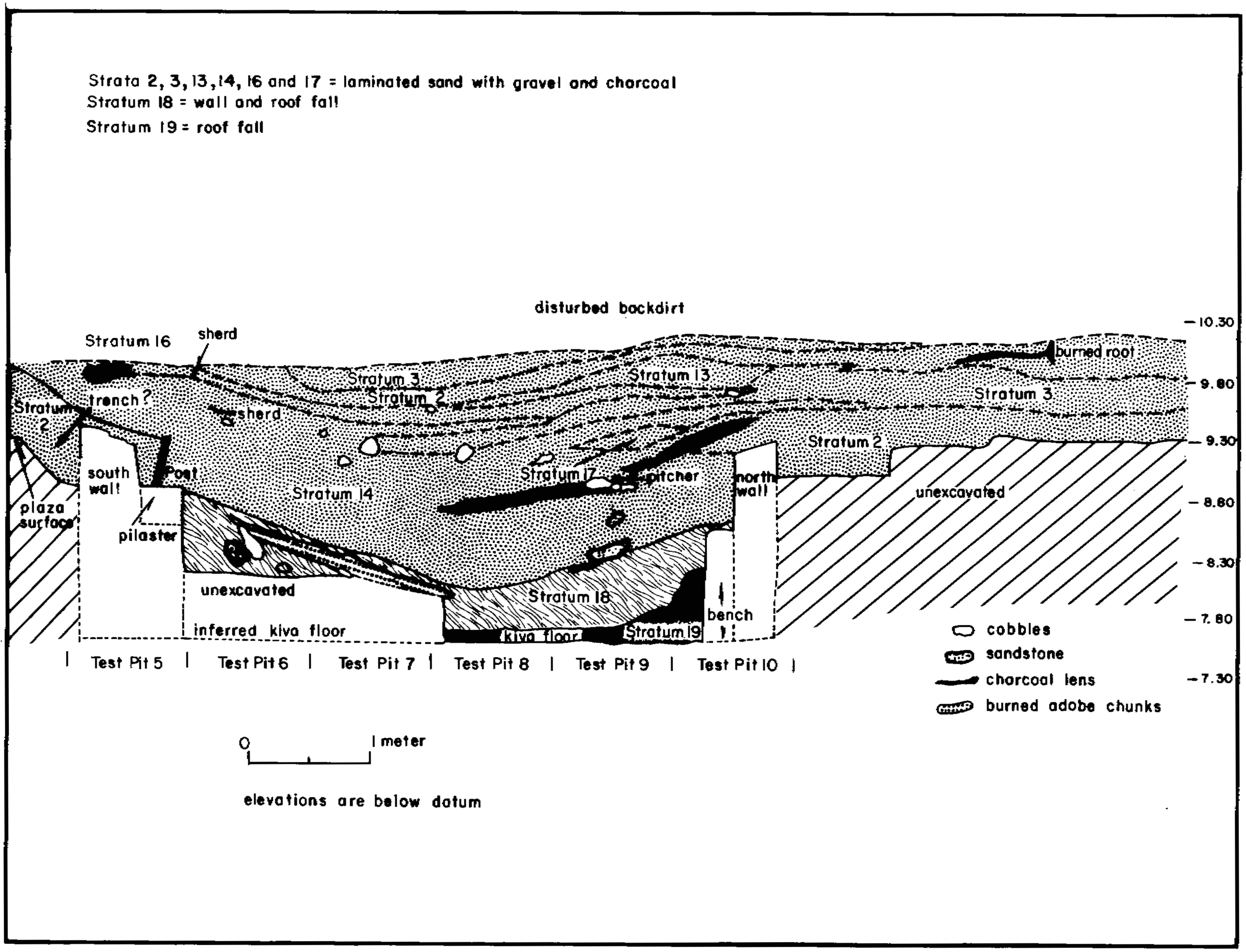


Figure 4. Kiva 1, profile.

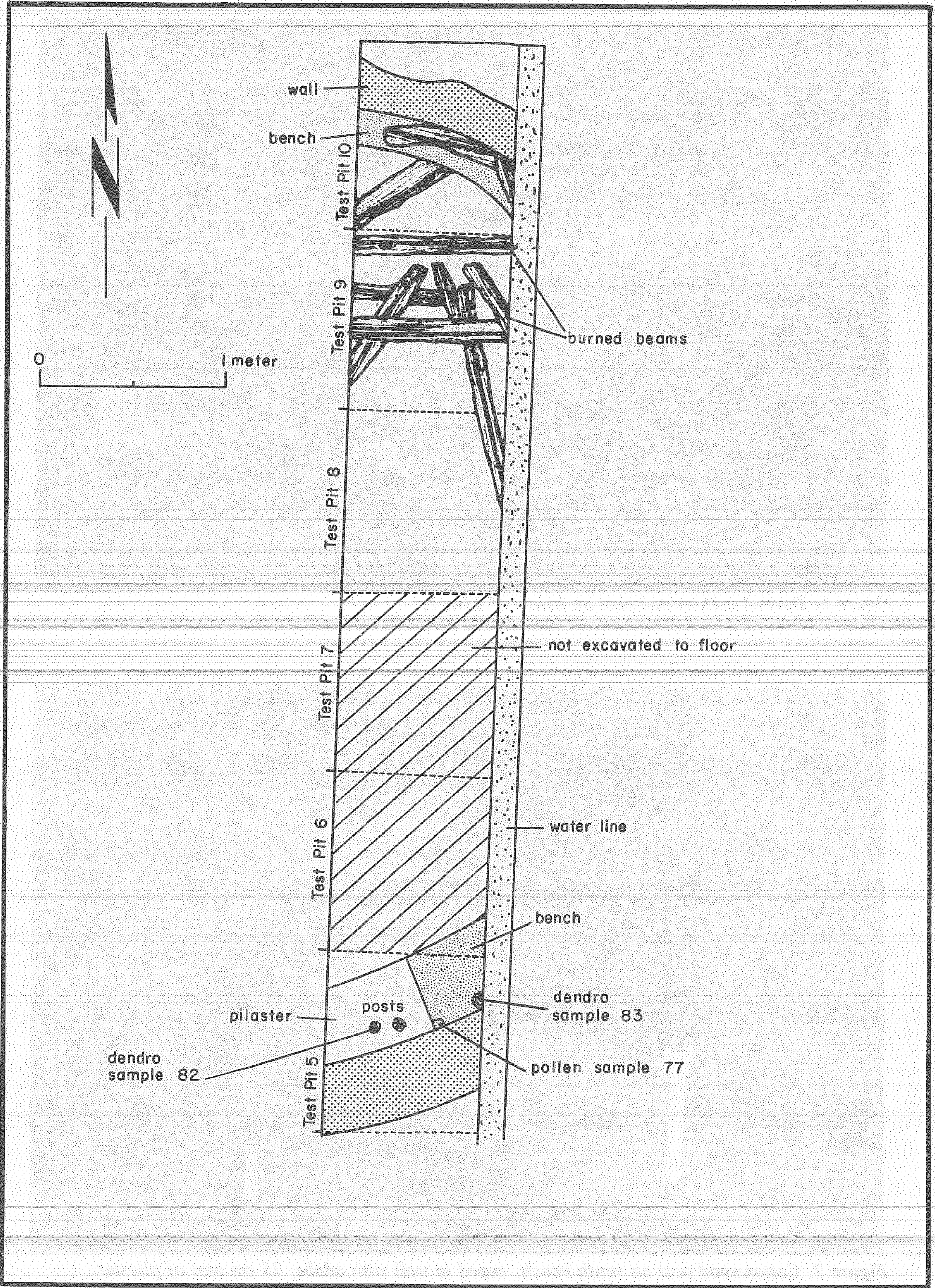


Figure 5. Kiva 1, roof in plan.

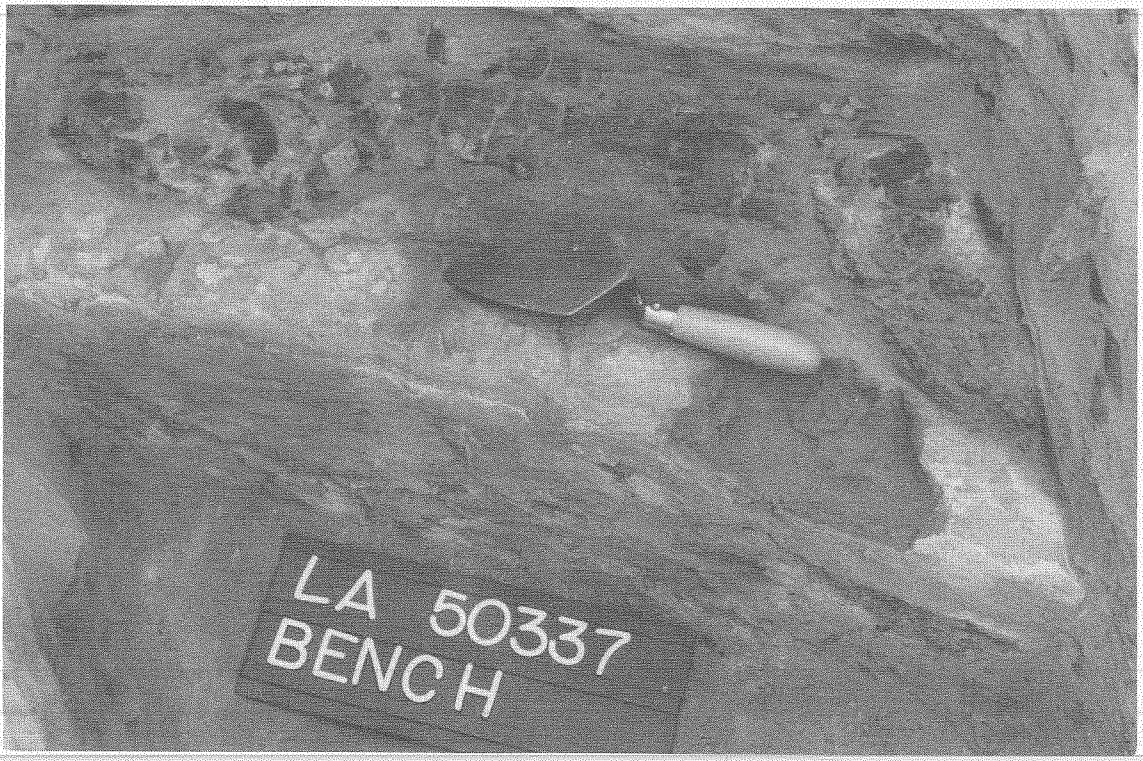


Figure 6. Burned cottonwood post on bench of Kiva 1.

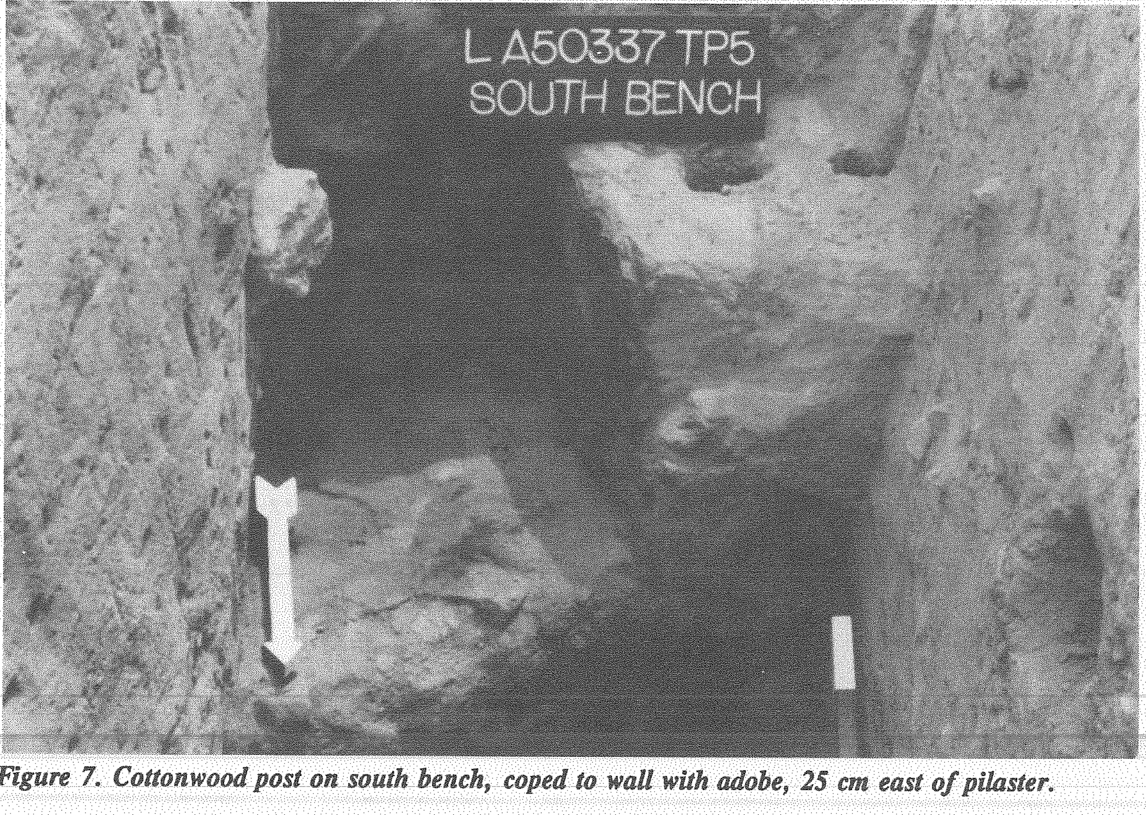


Figure 7. Cottonwood post on south bench, coped to wall with adobe, 25 cm east of pilaster.

No features or artifacts were observed on the floor. It was composed of compacted sand that had been burned by the collapsed roof. Pollen [94] and flotation [95] samples were analyzed from the surface. The pollen sample yielded evidence of Cheno-ams, maize, *Pinus* sp., cholla, and prickly pear. The flotation sample only contained two prickly pear and nightshade seeds, and some juniper and cottonwood charcoal.

A plaza surface associated with the kiva was exposed on the south side of the structure. It was situated at an elevation of 9.3 m and continued south in the profile for several meters. A trench that may have been associated with the construction of the kiva was present between the plaza and the south wall. It was 55 cm wide and 45 cm deep.

A water-line trench was dug from near the southern end of the north trench across the road to the west. Another plaza surface was observed in the north wall near the east end of the trench. It was about 4 m long and rose from an elevation of 9.74 m on the east to 9.93 m on its western end. It could not be directly tied to the surface associated with the kiva in the north trench. They did, however, look similar, but there was a difference of about 40 cm in elevation between the two surfaces.

The South Trench

The south trench (27 by 1 m) was situated 9 m south of the north trench, separated by Figueroh Avenue. A profile (Fig. 8) was drawn of the east trench wall. Strata 6-10 were defined here. Strata 6 and 7 are laminated sand with some gravel and charcoal. Stratum 8 is a plaza surface that extends for 11.5 m from the north end to near the south end of the trench. It consists of a charcoal-stained sandy clay loam, about 15 cm thick, which contains bits of charcoal, gravel, caliche, a Sambrito Brown Ware sherd, debitage, and some oxidized soil. The top of the stratum undulates from an elevation of 9.28-9.48 m with a mean elevation of 9.38 m. Pollen [17] and flotation [18] samples were analyzed from the plaza surface stratum. The pollen sample yielded evidence of Cheno-ams and maize. The flotation sample mainly contained Indian ricegrass seeds, with some hedgehog cactus, goosefoot, pinyon, and Russian thistle. The presence of Russian thistle certainly indicates some form of modern contamination. Burned corn and juniper and saltbush charcoal were also present. Again, this surface could not be directly connected to the plaza surface in the north trench, but is appears similar to it and was situated at the same elevation. What is interesting is that Stratum 8 rises to the west--15 cm higher in the west wall of the trench than in the east wall. The plaza surface observed in the water-line trench also sloped up toward the west.

Feature 2 was exposed along the east wall of the trench (Fig. 9). Stratigraphically, it lies above the plaza surface articulating with the top of Stratum 6 (9.6 m). The feature is a large pit (1.3 by 1.3 by .44 m). The sides of the pit are unlined, and the bottom is covered with river cobbles. The total outline of the pit is defined by a 6 cm thick oxidized layer of sand. The feature fill (Stratum 10) was excavated in four levels (Fig. 10). The first level was mainly composed of charcoal with some sand and burned soil. The second level consisted of sand mixed with ash and charcoal. The third level was oxidized soil mixed with some charcoal, sand, and pockets of ash. A portion of the north wall of the feature had collapsed, constituting most of the oxidized soil in this level. The last level was composed of large chunks of charcoal mixed with burned soil and ash. This level was situated on the cobbles that lined the bottom of the pit. Figure 10 shows plan and cross-section views of the final excavation. The feature probably

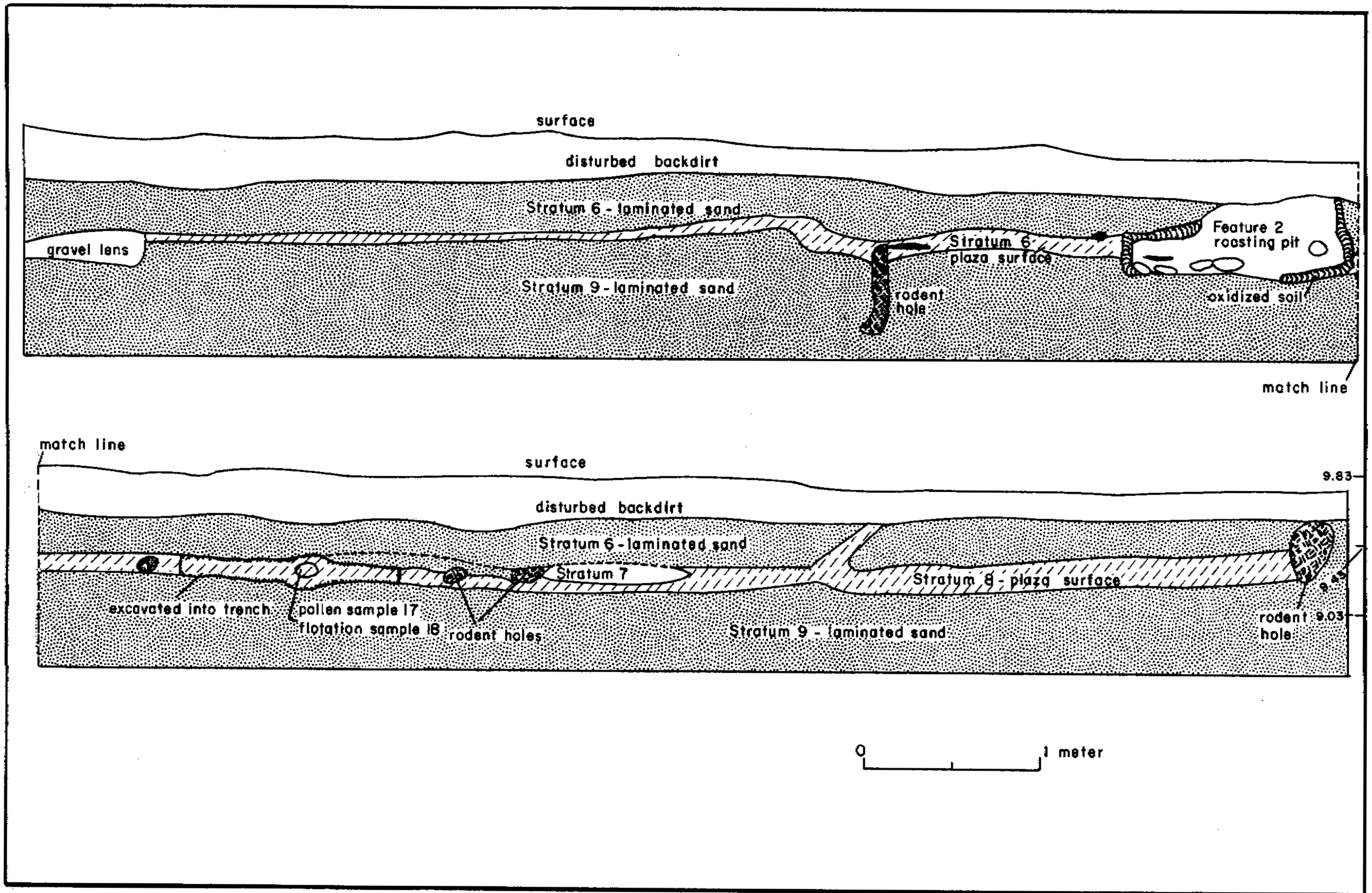


Figure 8. Profile 2, east wall, south trench.

represents a large roasting pit. Pollen [35] and flotation [37] samples were analyzed from the lower portion of the feature fill. The pollen sample yielded evidence of Cheno-am and maize. The flotation sample contained 130 saltbush seeds, with some saltbush charcoal. Burned grass and a corn cob fragment and shank were also recovered from the fill. Additionally, evidence of burned and unburned prairie dog, cottontail, jackrabbit, turkey, pocket gopher, and wood rat bones were recovered. A C-14 [34] and eight dendro samples were analyzed. The dendro samples consisted of four juniper, three pinyon, and one piece of cottonwood, none of which was datable. The radiocarbon sample (Beta-14245) provided a date of A.D. 992 ± 60. Pottery from the feature fill included Bluff Black-on-red, Mancos Black-on-white, McElmo Black-on-white, Mancos Gray, Mancos Corrugated, and Mesa Verde Corrugated. An attempt was made to refit the sherds from different levels within the feature to determine if they represented mixed deposits or distinct layers due to reuse. Some sherds could be refitted within a level, but could not between levels. Therefore, the layers within the feature appear to be the result of repeated use. Most of the sherds and some of the bones were not burned, indicating that they had been tossed into the feature after each use episode.

A small trash deposit (Stratum 12) was exposed on the southern end of the south trench along the west wall. It was about 1.14 m long, 8 cm high, and 10 cm deep. The stratum consisted of a charcoal stained sandy clay loam, with bits of charcoal and burned soil, gravel, caliche, a gray ware sherd, and debitage. It was situated at about the same elevation as Feature 2 and was probably associated with this occupational level.

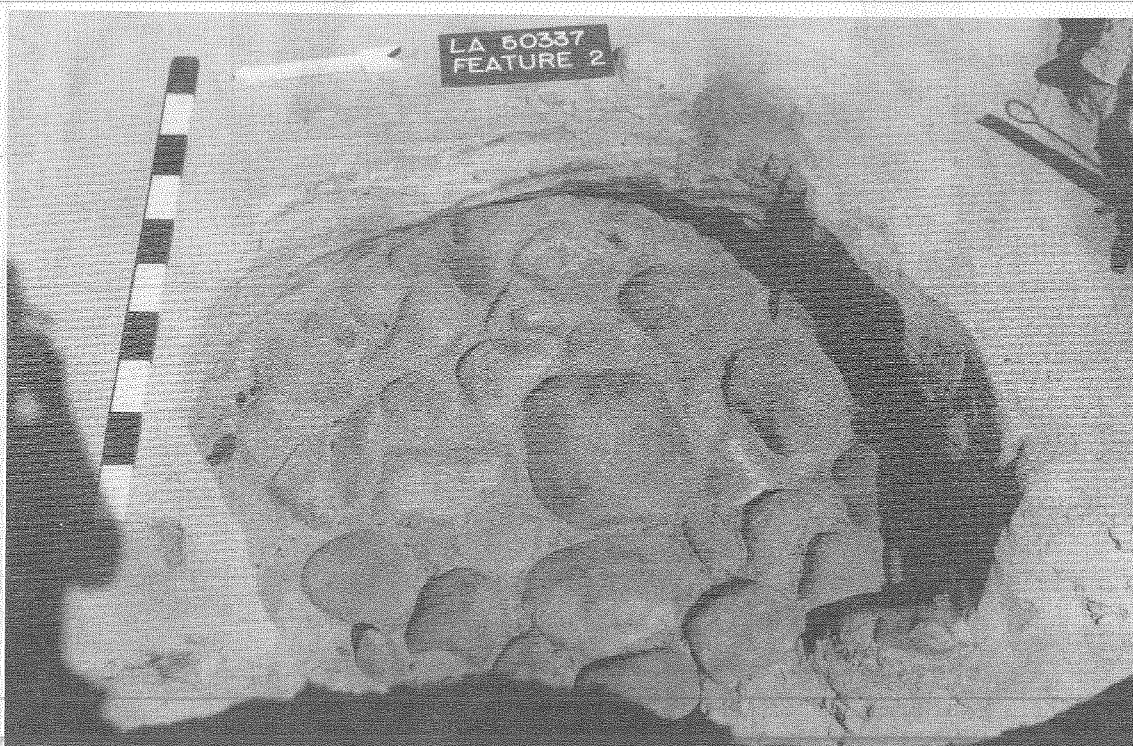


Figure 9. Feature 2, cobble-floored pit.

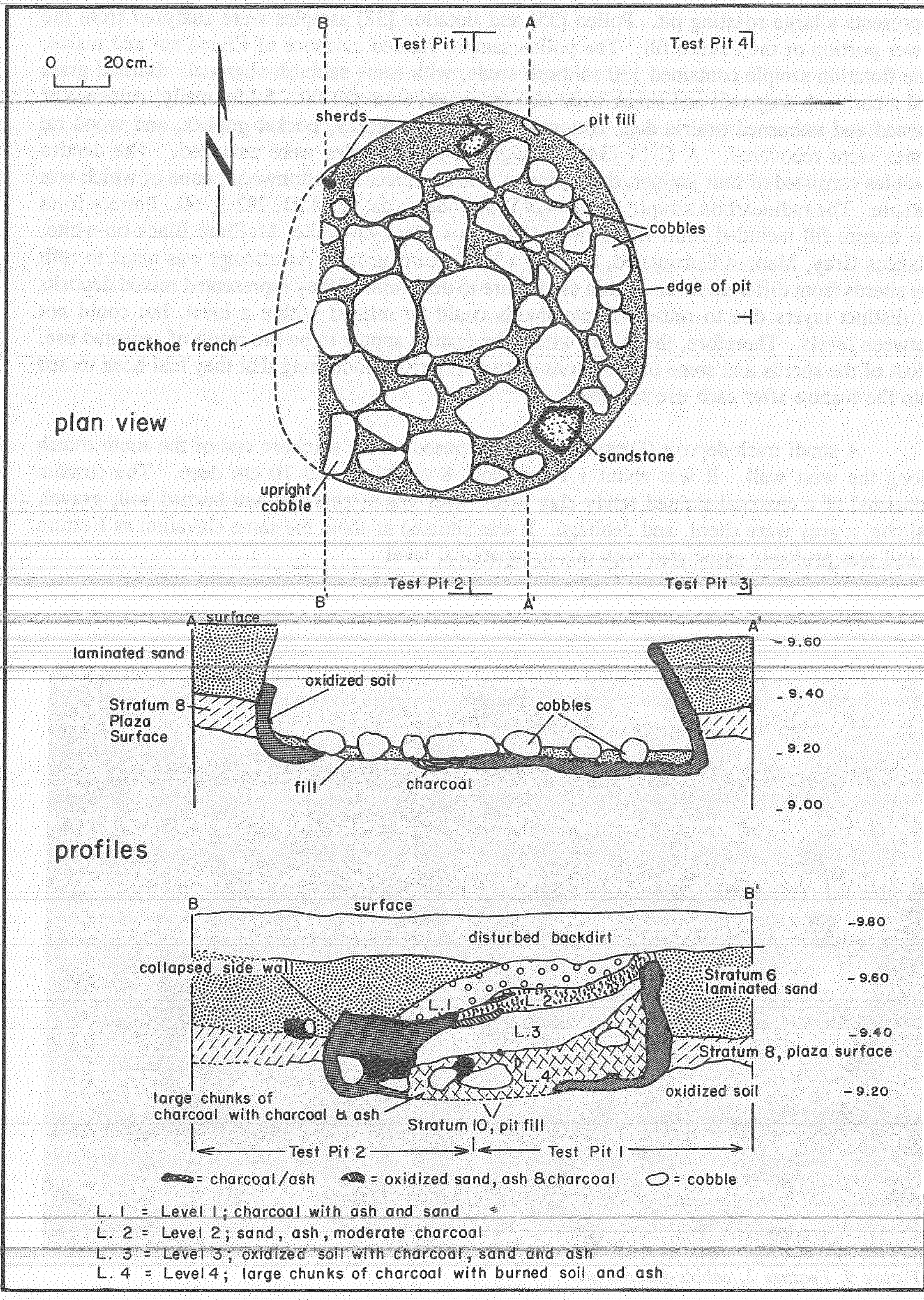


Figure 10. South trench, Feature 2.

Room Block and Surrounding Plaza

Room 1. As previously noted, work began in the area of the room block by first defining the top of the wall segments. Twelve possible rooms were isolated. The top of the walls were already missing indicating that the area had been partially disturbed at some time in the past. Room 1 was situated on the northeast corner of the room block and had been cut in half by the grader. It was a rectangular masonry room, approximately 3 m (east-west) by 2.3 m (north-south) in size. Present wall height ranged from 22-82 cm and wall width from 20-50 cm. Post-occupational fill and wall fall (Stratum 22), including sandstone blocks and river cobbles, were removed in the first 40 cm level. This covered another post-occupational fill level (Stratum 23), which was 20 cm thick and included ceramics, debitage, a small mammal long bone fragment, caliche, charcoal, and very little wall fall. Mesa Verde Black-on-white and Mancos Corrugated pottery was recovered from Stratum 22 and Cortez Black-on-white, Mancos Black-on-white, and Mancos Corrugated from Stratum 23.

Floor 1 (Stratum 25) was an irregular surface, best preserved around a hearth (Feature 5) in the southwest corner of the room (Fig. 11). The hearth consists of a shallow adobe-lined depression set about 1 cm into the floor. The edges of the feature do not have a formal lip. The pit contained an ashy fill that had burned in situ because the bottom of feature was oxidized. Pollen [103] and flotation [109] samples were analyzed from the fill. The pollen sample included evidence of Cheno-ams, pinyon, greasewood, and maize. The flotation sample contained saltbush, prickly pear, and pigweed seeds with some saltbush/greasewood charcoal. A black-on-white jar sherd was also recovered from the fill. The floor was situated at an elevation of 11.07-11.17 m and the hearth at 11.07 m. Elsewhere in the room, the surface was not well preserved. Concentrations of caliche often defined it. In the north half of the room, Floor 1 undulated over lumps of adobe. A sandstone two-hand mano fragment and a small tabular cobble with two ground surfaces were present on the floor.

A 7-13 cm layer of post-occupational fill (Stratum 27), similar to Stratum 23, separated Floor 1 from Floor 2. It contained a few Mancos Corrugated sherds, debitage, and ground stone. At an elevation of 11.11 m, a low adobe wing wall was defined near the center of the room. After the wall was exposed, the room was subdivided into Room 1a, including the larger southwest portion of the room, and 1b, the smaller northeastern area. Therefore, Stratum 27 was excavated separately within the room subdivision.

Floor 2 (Stratum 28) was a compact, well-defined surface that was easily exposed under Stratum 27 (Fig. 11). The floor was uniform across the room (11.0-11.04 m elevation), consisting of a 1-1.5 cm thick layer of adobe. The adobe also continued from the floor up onto the surrounding walls for a height of 10-15 cm. The wing wall (Feature 8) appears to have been constructed at the same time as the floor, as the floor plaster and wing wall are continuous and are made of the same material. The wing wall is composed of solid adobe 9 cm wide, 8 cm high, and 86 cm long. It is rounded in cross section and curves slightly to the southwest. The wall may have fully bisected the room, or it could have made a right angle turn to the east, partitioning off the northeastern portion of the room.

The floor in Room 1a to the west of the wing wall contained a hearth (Feature 7), a shaped sandstone slab, a tchamajia fragment, and a Mancos Black-on-white sherd. The hearth was situated near the wing wall and was cut in half by the grader. The remaining pit was 62 by 21 by 10 cm deep (Fig. 12). The sides of the feature were lined with upright sandstone slabs. Adobe was applied to the bottom of the pit and continued up 10 cm onto the slabs. The

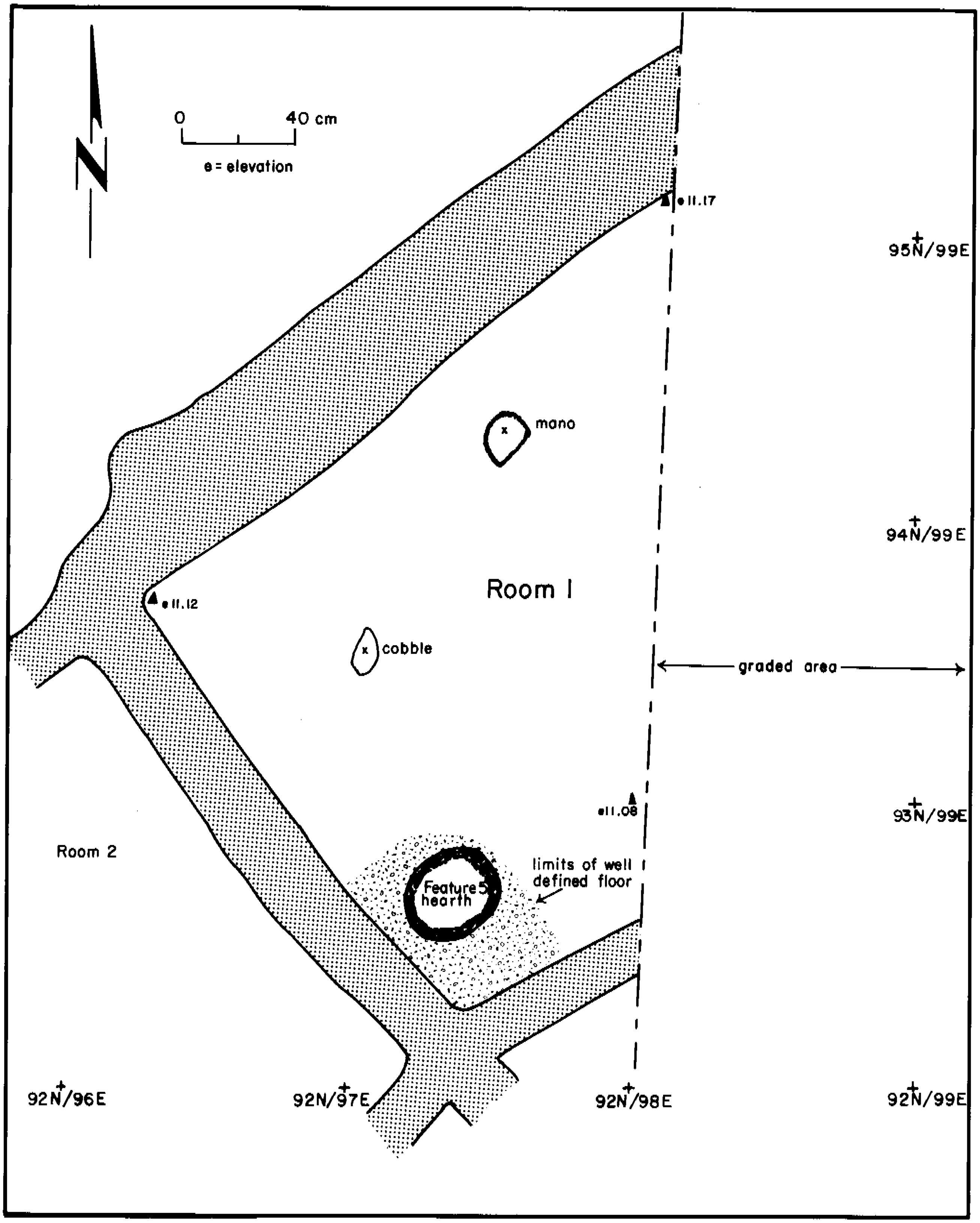


Figure 11. Room 1, Floor 1.

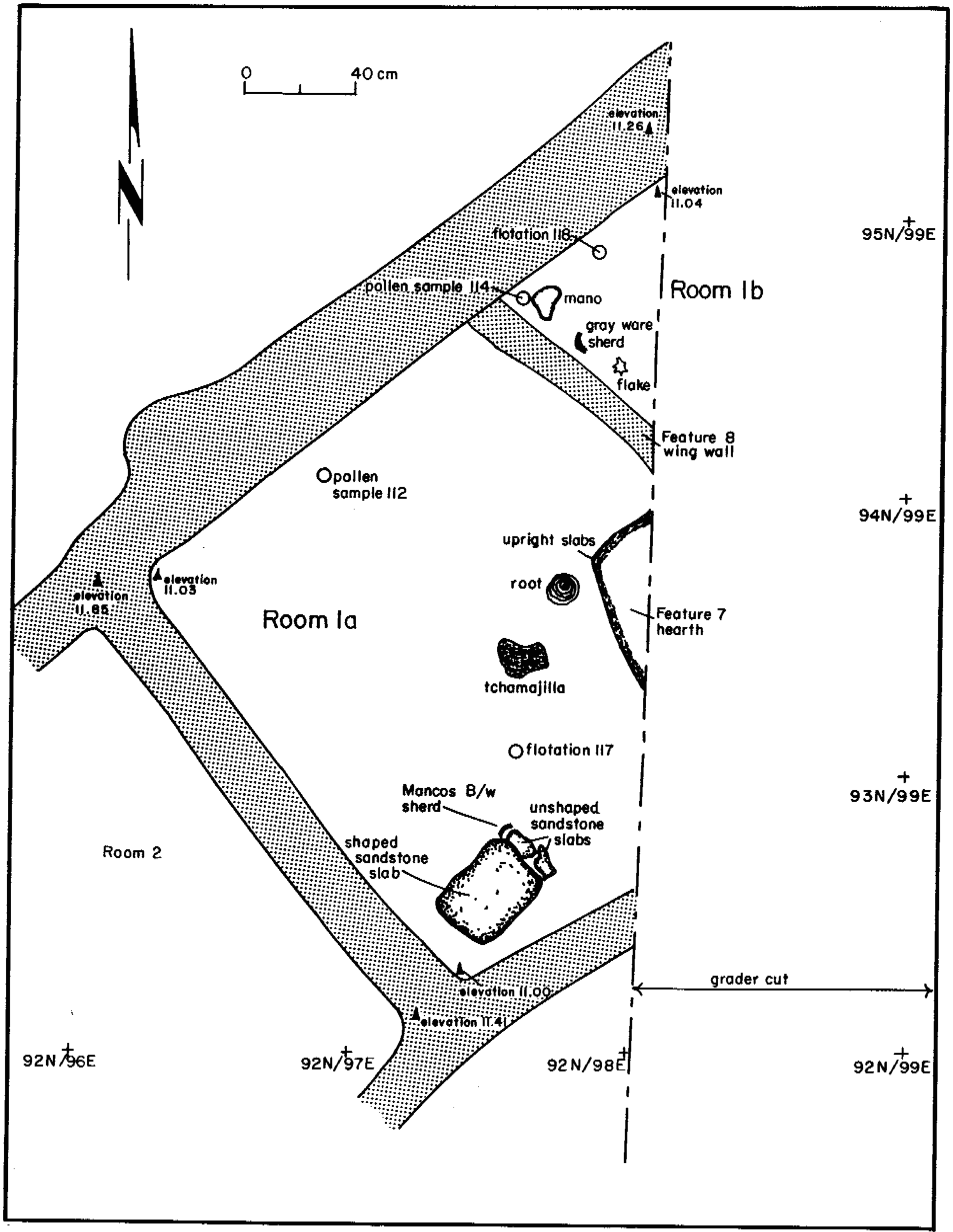


Figure 12. Room 1a and 1b, Floor 2.

sandstone was heavily oxidized. Because there were no definable breaks between the hearth and the floor, the hearth appears to have been installed when the floor was constructed. A C-14 sample [111] was taken from the hearth that only contained a little of its ashy fill. This sample (Beta-14247) yielded a date of A.D. 1177 ± 100. A flotation sample [106] was taken from what fill remained. It contained a goosefoot seed and some juniper, saltbush, and cottonwood charcoal. A tchamajia fragment was situated about 15 cm southwest of the hearth. It consists of a tabular piece of siltstone that is finely ground on both sides, bidirectionally retouched on one end, and broken in half where it would have been hafted. A shaped piece of tabular sandstone (315 by 275 by 15 mm) was laid into the floor in the southwest corner of the room and the floor was plastered around it. The surface of the slab is ground. Two other fragmentary pieces of unshaped sandstone slabs were present just to the east of the larger ground slab, as was a Mancos Black-on-white sherd. A pollen sample [112] was analyzed from the floor along the north masonry wall of the room. It yielded evidence of Cheno-ams, pinyon, and maize. This side of the room contained more pinyon pollen than 1b. A flotation sample [117] was analyzed from the floor to the north of the shaped sandstone slab. It contained pigweed, winged pigweed, globemallow, and prickly pear seeds.

There is only a small remnant of Room 1b situated to the east of the wing wall. A sandstone mano fragment, a gray ware sherd, and a silicified wood secondary cortical core reduction flake were present on the floor. A pollen sample [114] was analyzed from the corner between the wing wall and the north masonry wall and a flotation sample [118] was analyzed from next to the north wall. The pollen sample yielded evidence of Cheno-ams and maize, more maize pollen than in the 1a side of the room. Adams (1983:49) notes that granaries were defined at Walpi by the presence of a clay ridge (5-10 cm high) that ran parallel to a wall and served as the base of cribs for the storage of corn. Because most of this side of the room is missing, it is difficult to determine the exact nature of the wing-wall feature. The dominance of maize pollen in this area may indicate that corn was being stored or processed here. The flotation sample contained pigweed, winged pigweed, saltbush, and a trace of burned juniper.

Floor 2 was laid on top of a 6-9 cm thick sandy stratum (29) that contained burned sandstone fragments, wall fall, including unshaped sandstone blocks and river cobbles, and some Cortez Black-on-white and Mancos Corrugated sherds and lithics. This fill undercut the surrounding masonry walls and appears to represent a pre-Room 1 occupation. The top of an L-shaped alignment made of a single course of unshaped tabular sandstone and river cobbles was uncovered at an elevation of about 10.96 m. Just northeast of the alignment is a hearth (Feature 10) that is bounded by an unprepared but compacted surface at an elevation of 1,092 m (Stratum 33). The hearth consists of a shallow adobe-lined basin, 21 cm in diameter and 4 cm deep. The sides of the feature were oxidized. No fill was present and the hearth had been partially disturbed. A one-hand mano and a mano fragment were situated about 30 cm northeast of the hearth. Both of these were burned.

A Mancos Corrugated sherd and a piece of debitage were recovered from an otherwise sterile laminated sand stratum (50) lying below this occupational surface. However, a backhoe unearthed a child burial (Feature 55) situated about 90 cm further down. This burial included a cranium, a mandible, both humeri, a radius, ribs, a femur, a tibia, and a fibula. Several artifacts were also recovered that may be associated with this burial. These are a bone bead/whistle, a Cortez Black-on-white sherd and a Newcomb Black-on-white sherd, a side-notched chert arrow point with a broken base, a silicified wood biface base fragment, and a chert secondary cortical core reduction flake.

Room 1 reflects at least four separate occupation episodes. The first occupation is associated with the interment of the child burial. The second occupation is represented by the hearth and L-shaped rock alignment. The shallowness of the hearth and the lack of a prepared surface seems to indicate that this level represents a temporary occupation of some type. The wall debris found above this level may be from the L-shaped alignment, or it may have been deposited here from somewhere else on the site. The location was then vacated and Room 1 was later constructed on top of this debris. The area was leveled, sandstone masonry walls built, and the adobe floor with wing wall and hearth placed into the room. The walls were constructed of a single course (20-24 cm thick) of roughly shaped sandstone blocks with liberal quantities of adobe mortar. A 20-cm-deep trench filled with adobe was used as a foundation for the walls. The presence of a hearth, a ground sandstone slab plastered into the floor, and the wing wall indicate that the room was used as a residence.

Eventually, the room was no longer used and later it was remodeled by the occupants of Floor 1. Floor 1 was a poorly defined surface with a simple hearth situated in the southern corner of the room. The north wall of the room was reinforced at this time, with a new course of sandstone blocks and cobbles placed on top of the old wall and a new course constructed on the outside of the wall. This increased the width of the wall to about 50 cm. The ephemeral nature of Floor 1 may indicate a much shorter occupation of the room, and possibly a different room function than that of the Floor 2 occupants. After Floor 1 was abandoned, the walls collapsed and the room was never reused. No evidence of roof fall was ever encountered; therefore, it must have been scavenged and removed from the room after its final occupation phase. There were no indications of a doorway in any of the walls.

An attempt was made to refit sherds from the different strata within Room 1. Although some sherds could be put together within a level, none could be refitted between levels.

Room 2

Room 2 is situated immediately west of Room 1. It is a rectangular masonry room measuring about 3 m (east-west) by 2 m (north-south). Present wall height ranges from .68-1.1 m and wall width from 18-25 cm consisting of a single course of roughly shaped sandstone blocks with adobe mortar. Stratum 22 was removed in a 40-56 cm level consisting of wall fall. This included unshaped pieces of tabular sandstone, roughly shaped tabular sandstone blocks (15 by 35 by 3 cm), slabs (15 by 35 by 8 cm), and river cobbles. Much of the building debris was burned. Overall, Room 2 contained much more wall fall than Rooms 1, 4, and 7. Relatively large quantities of ceramics, with lesser amounts of debitage, ground stone, turkey bone, jackrabbit bone, and large mammal bone were recovered from this level. The pottery present included Cortez Black-on-white, Mancos Black-on-white, Crumbled House Black-on-white, McElmo Black-on-white, Mesa Verde Black-on-white, Mancos Gray, and Mancos Corrugated. Stratum 22 was underlain by another 20-31 cm thick post-occupational fill level (Stratum 38). The break between these two strata was not marked, but the lower level appeared to contain a more clayey soil matrix with lesser amounts of wall debris. Floor 1 was beneath Stratum 38; it was thicker in the eastern area of the room and thinner on the western side. Several human bones including portions of a clavicle, atlas, axis, three cervical vertebra, eight lumbar vertebra, manubrium, sacrum, right radius, right and left ulna, left tibia, left calcaneus, and left and right rib fragments were recovered from the last 10 cm of fill above the floor. Portions of an unfired Cortez Black-on-white jar were also recovered in this level.

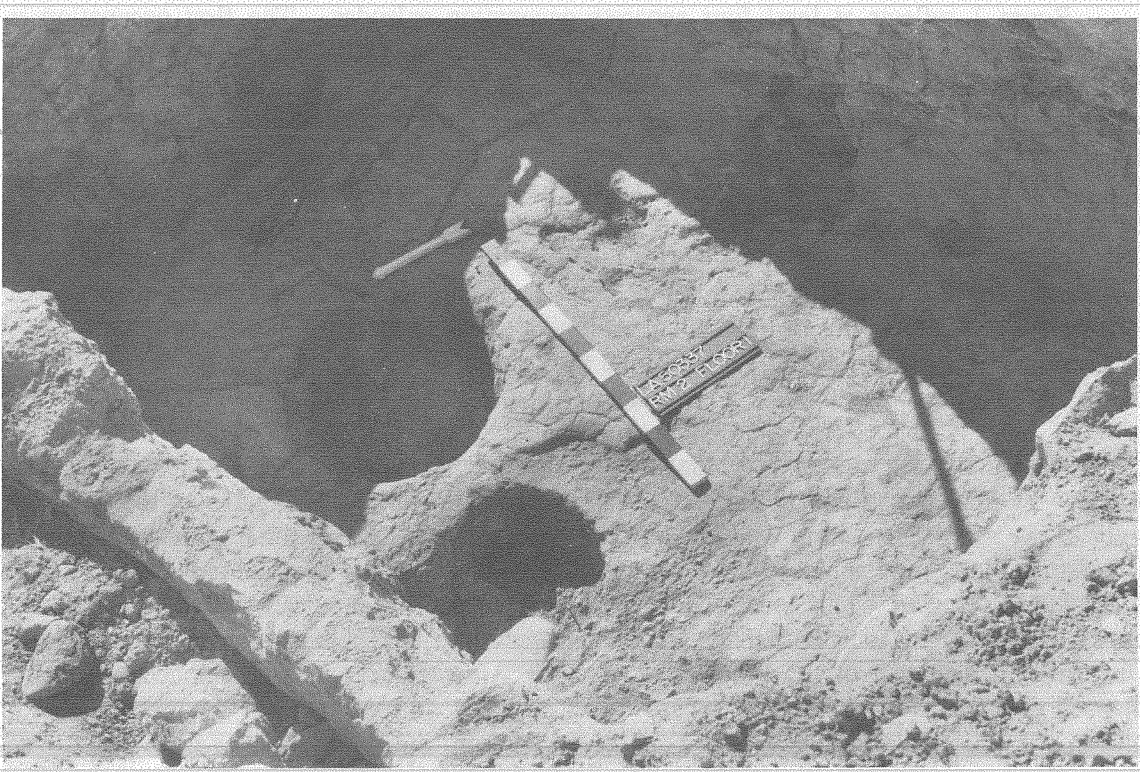


Figure 13. Room 2, Floor 1.

Floor 1 (Stratum 40) was a well-prepared adobe floor, situated at an elevation of 10.77-10.84 m (Fig. 13). It was best preserved in the eastern area of the room and less well defined in the western portion of the room where it appears that the wall collapsed directly on it. The intersection of the floor and walls were coped with a thick layer of adobe that continued up the sides of the walls. The floor in the southwestern corner of the room was lightly oxidized, but no formal outline was defined. Three features were located on the floor, including a pit (Feature 17), a shallow basin hearth (Feature 18), and a large pit (Feature 19). Surrounding these features, scattered across the floor, were the remains of a disarticulated human skeleton (Figs. 14 and 15).

Feature 17 is a partially adobe-lined pit approximately 63 by 37 by 15-19 cm deep. The pit fill consisted of chunks of adobe, charcoal, ash, a burned corn cob, and a few sherds and lithic artifacts mixed with sand. The sides of the pit were not oxidized, indicating that the charcoal, ash, and corn cob had not been burned in situ. The feature had been disturbed by rodent activity, but river cobbles and adobe still partially lined the bottom of the pit. A river cobble was situated on the floor immediately north of the pit. Pollen [161] and flotation [149] samples were analyzed. The pollen sample yielded evidence of Cheno-ams, pinyon, cholla, prickly pear, and maize. The flotation sample contained gramineae, maize, pigweed, and beeweed seeds, with some juniper, saltbush, and cottonwood/willow charcoal.

Feature 18 is a shallow basin hearth about 18 by 21 by 1 cm deep. The sides of the pit were oxidized, but no fill was present.

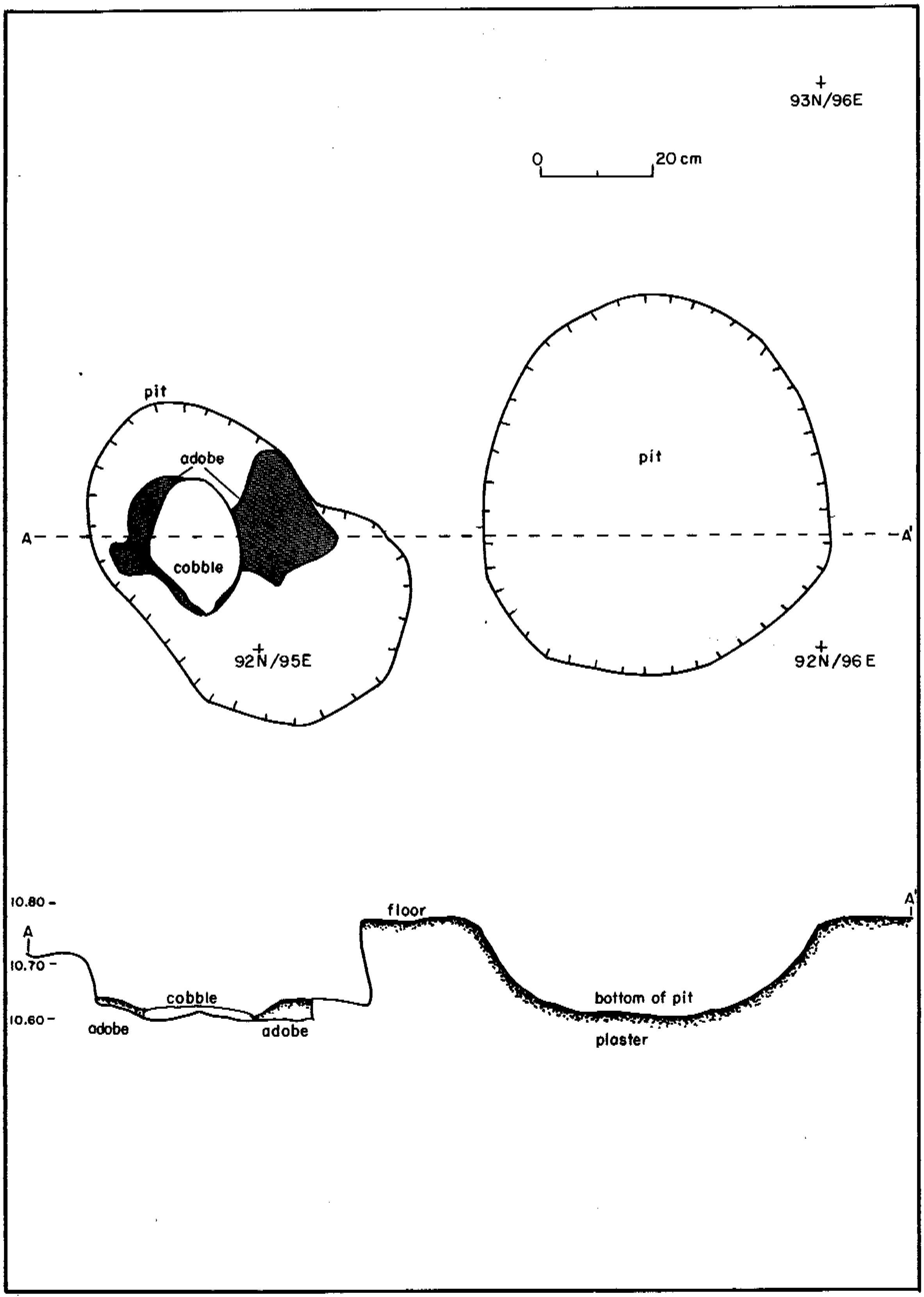


Figure 14. Room 2, profile and plan view of Features 17 and 19.

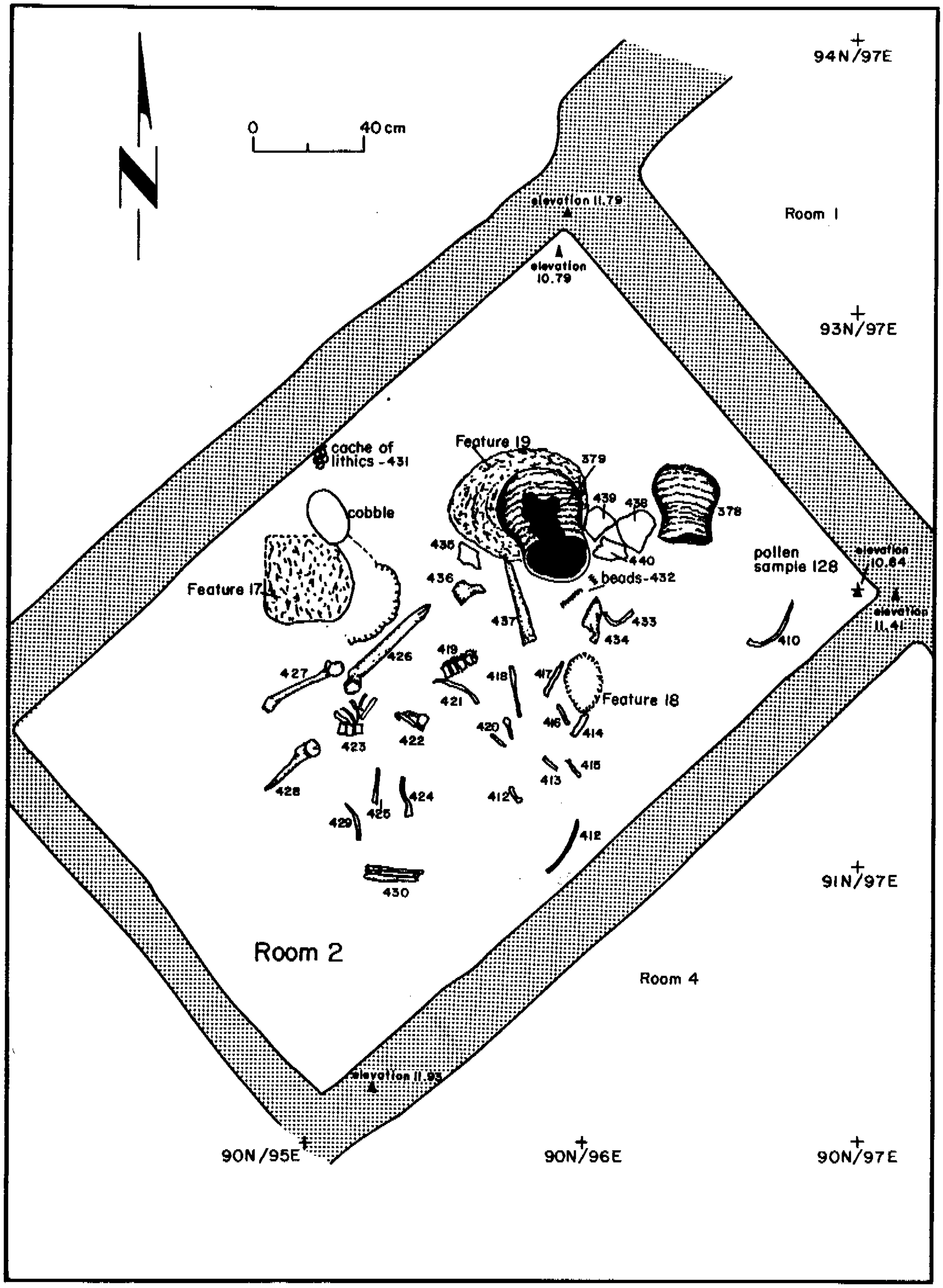


Figure 15. Room 2, Floor 1. KEY: 378 corrugated vessel; 379 corrugated vessel; 410 right rib; 411 right rib; 412 metatarsal; 413 nonhuman bone(?); 414 rib fragment; 415 rib fragment; 416 rib fragment; 417 fibula fragment; 418 fibula fragment; 419 last cervicle and 1st and 3rd thoracic vertebra; 420 two metatarsals; 421 left rib; 422 two ribs, one vertebra; 423 five rib fragments, two thoracic(?) bodies; 424 right clavicle; 425 rib; 426 right femur; 427 right humerus; 428 left femur; 429 right rib; 430 left radius and ulna; 431 cache of lithics; 432 beads; 433 left rib; 434 right scapula; 435 sherd; 436 left scapula; 437 right tibia; 438 sherd; 439 ground stone; 440 sherd.

Feature 19 is a large pit measuring 66 by 68 by 13-19 cm deep. The sides of the pit were plastered, and there was only slight evidence of oxidation observed on the bottom of the pit. The ashy fill, with very little charcoal, was similar to that found in Feature 17, which is only located 12 cm to the west. Only one flake and a few sherds were recovered from the fill. However, human bone was present at the top of the fill surrounding a large Mancos Corrugated jar, the bottom of which protruded about 5 cm down into the fill (Fig. 16). The corrugated jar appears to have been placed into the pit, presumably at the time the body was left in the room. It has a height of 370 mm, width of 285 mm, and an opening diameter of 225 mm. The jar has a capacity of about 15,200 cc, although the bottom of the vessel was missing. Bones recovered from the fill included portions of a left clavicle, left humerus, seven ribs (mostly right), four articulated thoracic and one lumbar vertebrae, left femur, left tibia, left fibula, right calcaneus, and right cuboid. The remainder of the skeleton was scattered across the central portion of the room (Fig. 15). Missing from this assemblage are the skull, mandible, hand bones, innominates, and most of the foot bones. Also situated around Feature 19 was a tabular sandstone two-hand mano fragment, six Cortez and Mancos Black-on-white bowl sherds, siltstone beads from a necklace (Fig. 17) and the broken remains of another large Mancos Corrugated jar (Fig. 16). The corrugated jar has a height of 295 mm, width of 230 mm, and an opening diameter of 221 mm. The capacity of the vessel is about 9,100 cc, although the bottom of this jar was missing also. A cache of 15 pieces of debitage was recovered from against the wall, just north of Feature 17. These were mainly secondary cortical core reduction flakes made of chert, quartzite, and siltstone. None of these exhibited any damaged or utilized edges. A pollen sample [128] was analyzed from the floor in the eastern corner of the room. It yielded evidence of Cheno-ams, greasewood, cholla, prickly pear, squash, and maize.

A possible occupation surface (Stratum 52) was identified about 30 cm below the floor at an elevation of 10.53 m. It was a compacted surface with charcoal embedded in it, and two localized oxidized areas. It appeared to continue under the west, south, and east walls of the room, although it was not identified below Room 1. A Mancos Black-on-white sherd was found at this level.

The area of Room 2 appears to represent at least two occupation episodes. The first occupation is associated with the subfloor surface situated at a depth of 10.53 m. The exact nature of the occupation is not understood. It was not definable below Room 1, but is about 40 cm lower and presumably predates the hearth and rock alignment below Room 1.

Since the north and south walls of Rooms 1 and 2 are continuous, and the central partitioning wall is bonded to these walls, it would appear that these two rooms were built at the same time. Both are made of the same style of masonry, consisting of a single course of horizontally laid roughly shaped sandstone slabs with adobe mortar. The slabs were generally two sizes, with some 25-45 by 18-25 by 6-12 cm and others 10-15 cm long and 2-3 cm thick. Floor 1 in Room 2 and Floor 2 in Room 1 must also have initially been contemporaneous, as they were built at the same time.

The presence of a hearth and ash pit indicate that the room was originally used as a residence. Once it was vacated, an individual, a female less than 25 years old, was entombed there, probably in the area near Feature 19 where most of the bones, a bead necklace, and two corrugated jars were located. The bones appear not to have been exposed to intense weathering (see Appendix 3), which would make sense if the body was left in a covered room. However, since no evidence of the roof was recovered from the room fill, it was presumably removed at some time before the walls collapsed, and after the burial was interred and covered with Stratum

Figure 16. Mancos Corrugated jar and the remainder of a burial, Room 2, Floor 1.

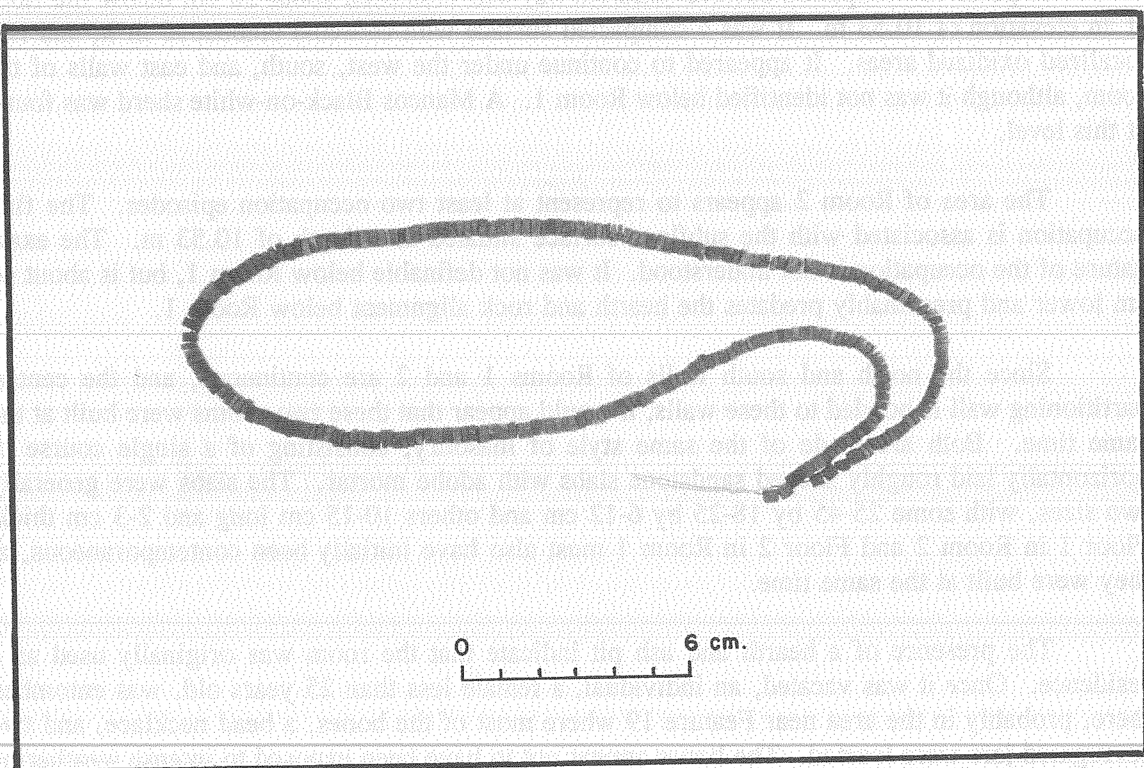


Figure 17. Siltstone bead necklace, Room 2, Floor 1.

38. Several factors including natural decomposition, rodent activity, carnivore activity, and possibly human intervention resulted in the present horizontal and vertical displacement of the skeletal elements. However, the absence of a skull, mandible, innominates, hand bones, and most of the foot bones is still not understood. See Appendixes 3 and 4 for more indepth analyses of this burial. No indications of a doorway were found in the walls of Room 2.

Room 3. Room 3 is situated immediately south of Room 1, however only the northwest corner of the room (about 60 by 90 cm) remained. Thirty centimeters of post-occupational fill (Stratum 22) was removed from the room fill. It consisted of a sandy clay loam fill with Mancos Black-and-white and Mancos Corrugated sherds, debitage, cottontail bones, jackrabbit bones, large mammal bone, a carbonized corn shank, and some small pieces of burned sandstone. No wall fall was present in this level, but it had probably been removed, along with the upper portion of the walls, at some time in the recent past.

Floor 1 was uncovered along the north wall at an elevation of 11.04 m. It consisted of a well-prepared adobe surface that was only definable for about 10 cm out from the wall (Fig. 18). Underlying this floor was about 20 cm of laminated sand mixed with gravel, a few pieces of debitage, and bits of charcoal. A possible surface was uncovered at an elevation of 10.85 m, which included some compacted sand and a possible post hole.

There appears to be at least two occupational episodes in the area of Room 3. The first occupation is represented by the compacted surface and post hole. These are situated about 10 cm lower than the hearth and rock alignment under Room 1 and 30 cm higher than the surface found under Room 2. Later, Room 3 was built. Since the north wall of Room 3 is the same as the south wall of Room 1 and the east wall of Room 3 is bonded to Room 1, it appears that Room 3 was constructed at the same time as Rooms 1 and 2. Floor 1 is also situated at the same level as Floor 2 in Room 1. Therefore these floors were presumably also built at the same time and represent at least partially contemporaneous occupations. Since no features were found on Floor 1, the exact function of the room is undetermined.

Room 4. Room 4 is located immediately south of Room 2 and west of Room 3. It is a rectangular masonry room measuring 2.1 m (east-west) and 1.9 m (north-south). Only the foundations remain of the southeastern portion of the room. Present wall height ranges from .43-1.01 m and wall width from .30-.50 m. A 12-19 cm level of post-occupational fill (Stratum 22) was removed from the room. It consisted of a sandy loam mixed with wall fall, Mancos Black-on-white, McElmo Black-on-white, and Mancos Corrugated sherds, debitage, and bits of charcoal. Floor 1 (Stratum 31) was defined in the western half of the room at an elevation of 11.24-11.28 m (Fig. 19). It consists of a prepared adobe surface that is coped to the surrounding walls. Two post holes were found in the western and southern corners of the room. Two Cortez Black-on-white and a Mancos Corrugated sherd were also present on the floor. A pollen sample [121] was analyzed from the western corner of the floor. It yielded evidence of Cheno-ams, greasewood, pinyon, and maize.

Underlying Floor 1 was a 17-20 cm layer of sandy clay loam mixed with wall fall, a few Mancos Black-on-white, Mesa Verde Black-on-white, and Mancos Corrugated sherds and debitage. The wall fall appeared to be resting directly on Floor 2. Floor 2 (Stratum 39) consisted of a prepared adobe surface situated at an elevation of 11.07-11.08. The adobe was coped to the surrounding walls. The south wall associated with Floor 1 was removed and another wall was uncovered about 20 cm further south (Fig. 20).

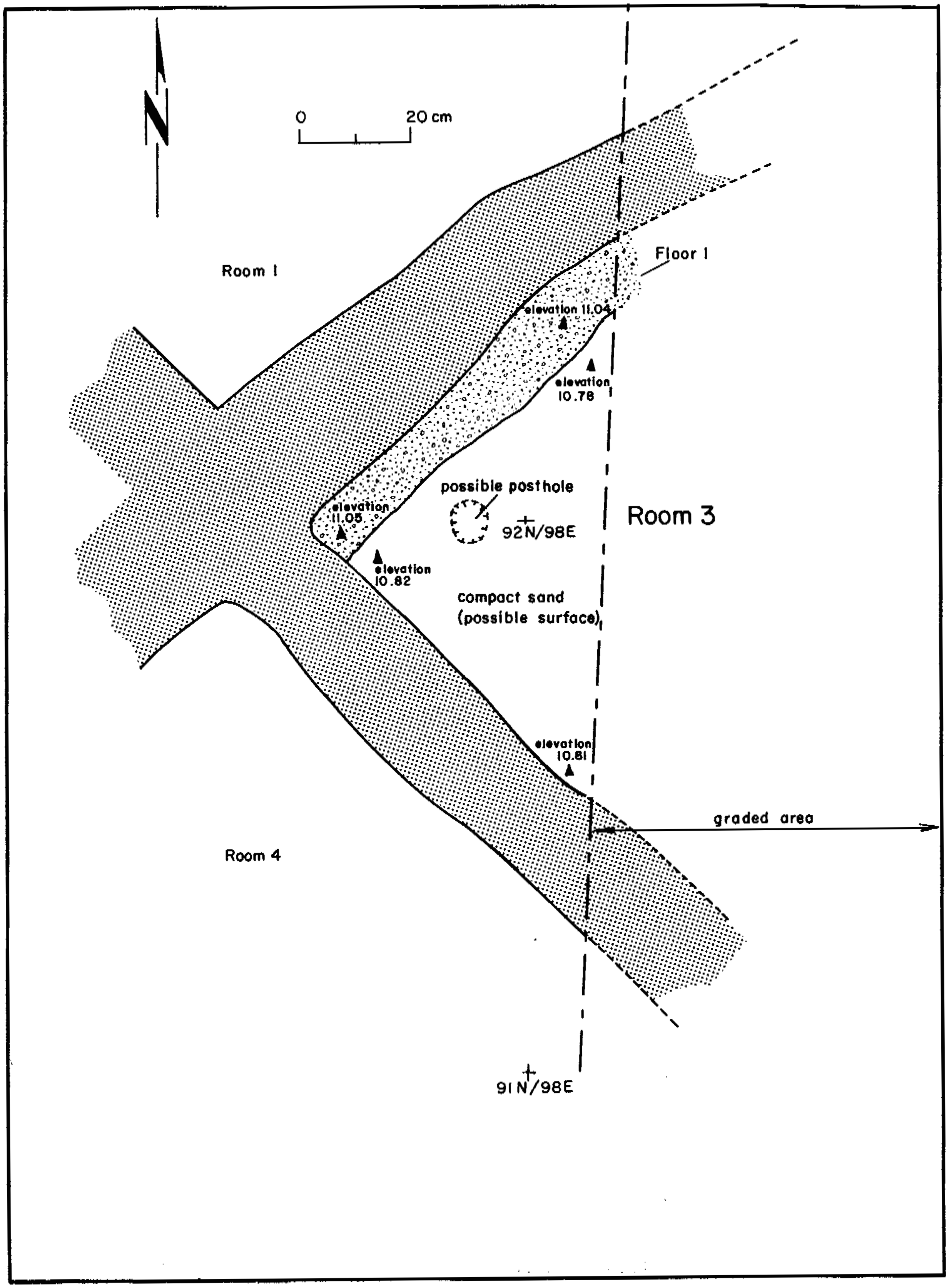


Figure 18. Room 3, plan view.

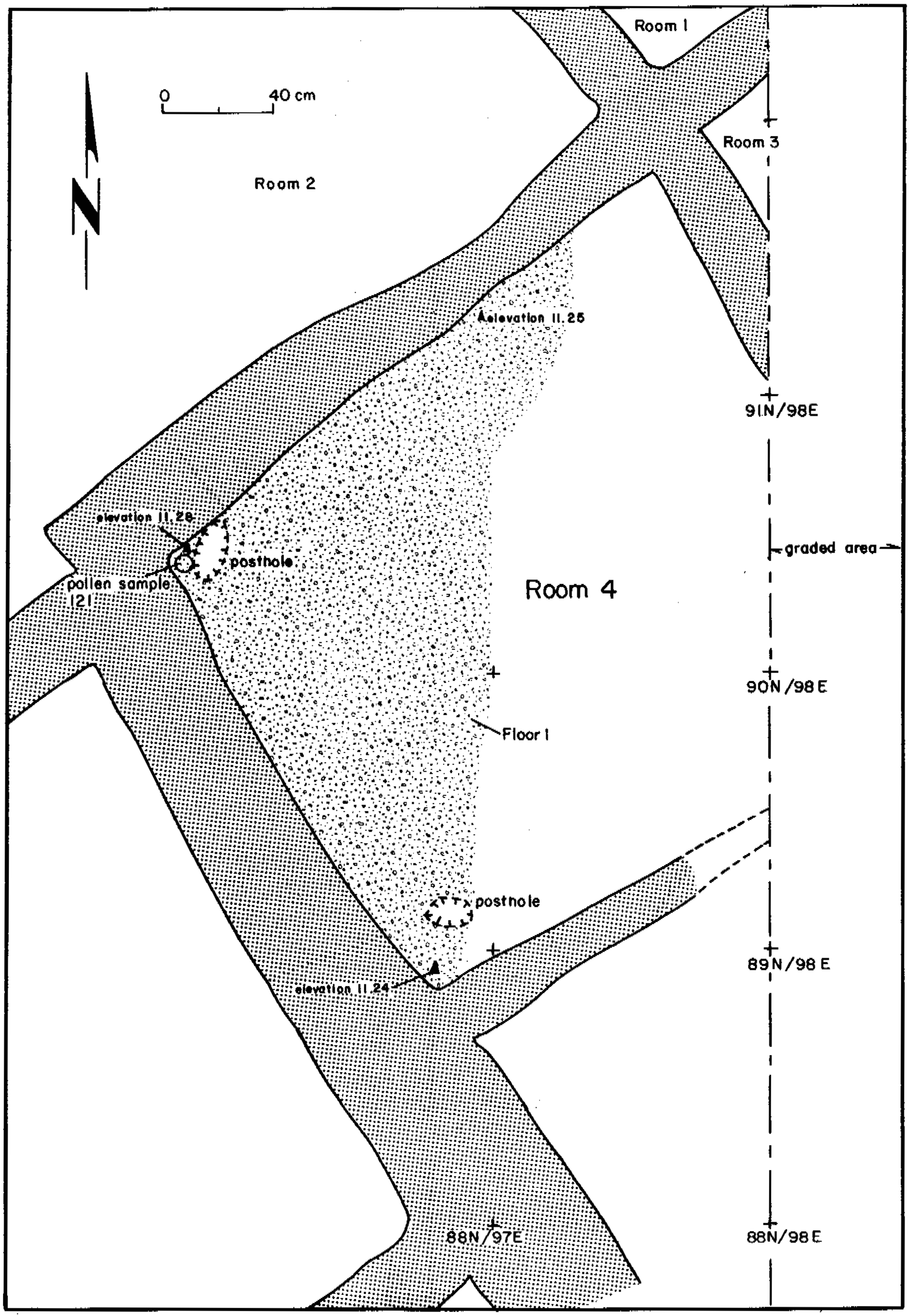


Figure 19. Room 4, Floor 1, plan view.

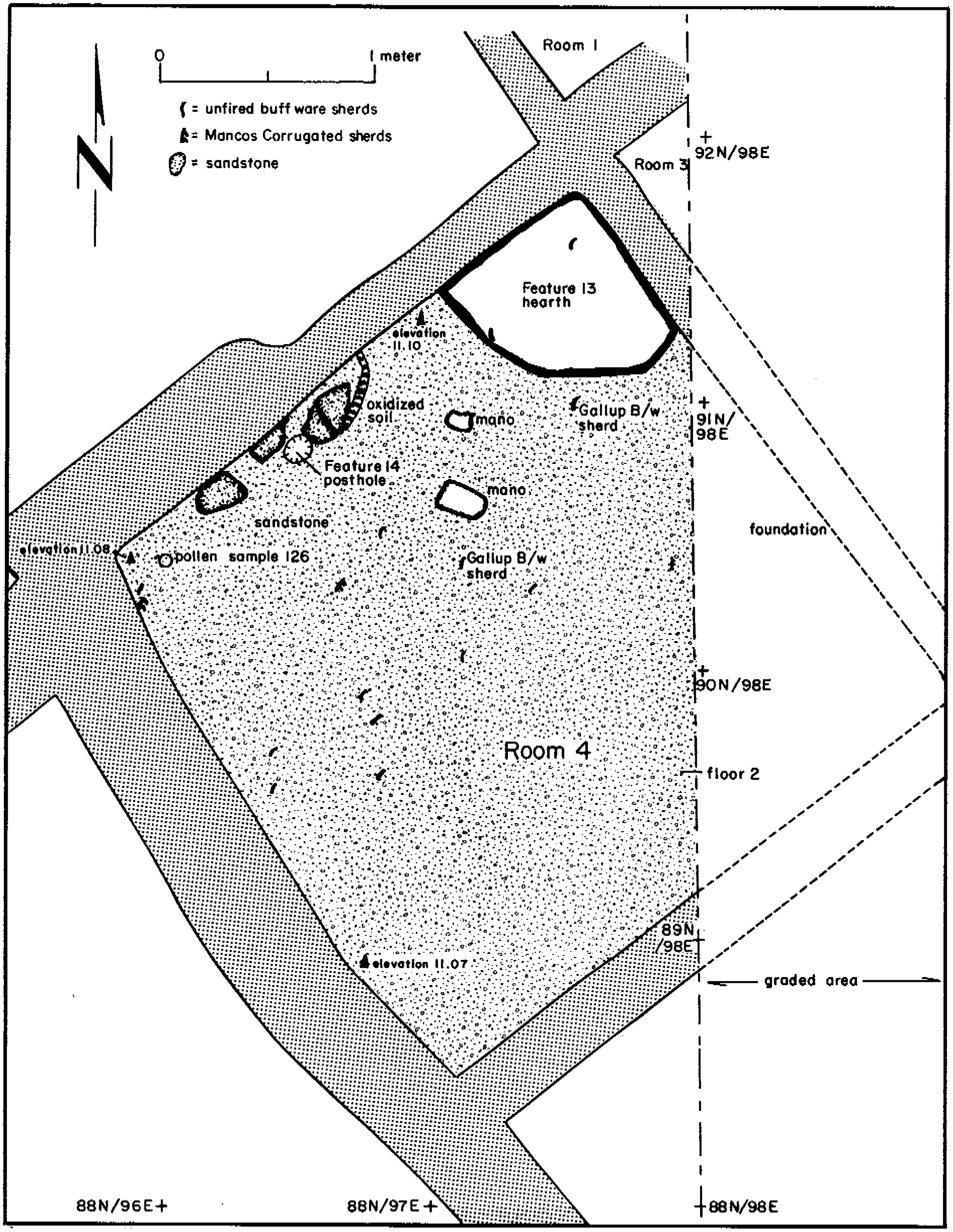


Figure 20. Room 4, Floor 2, plan view.

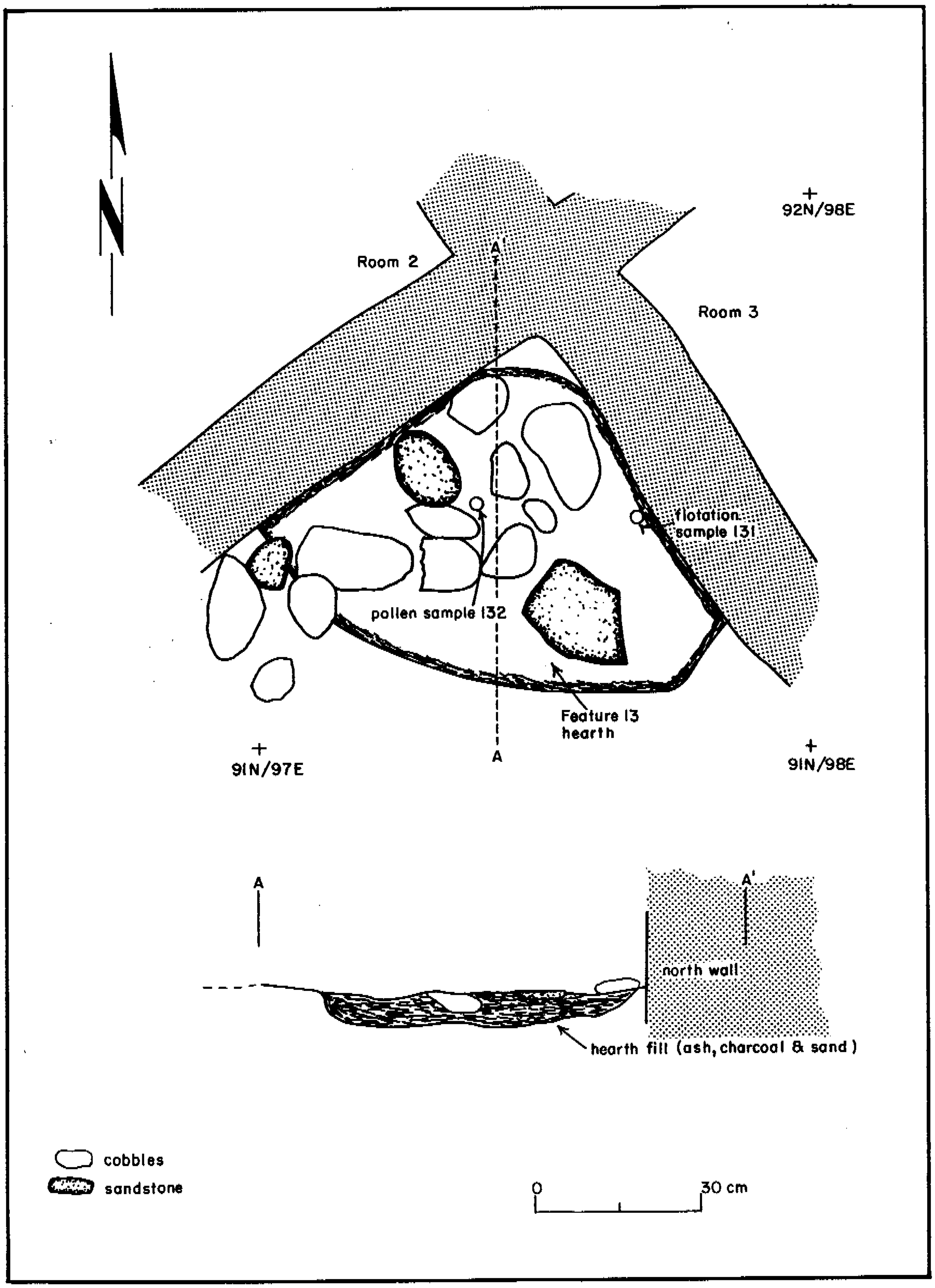


Figure 21. Room 4, Feature 13, plan view and cross section.

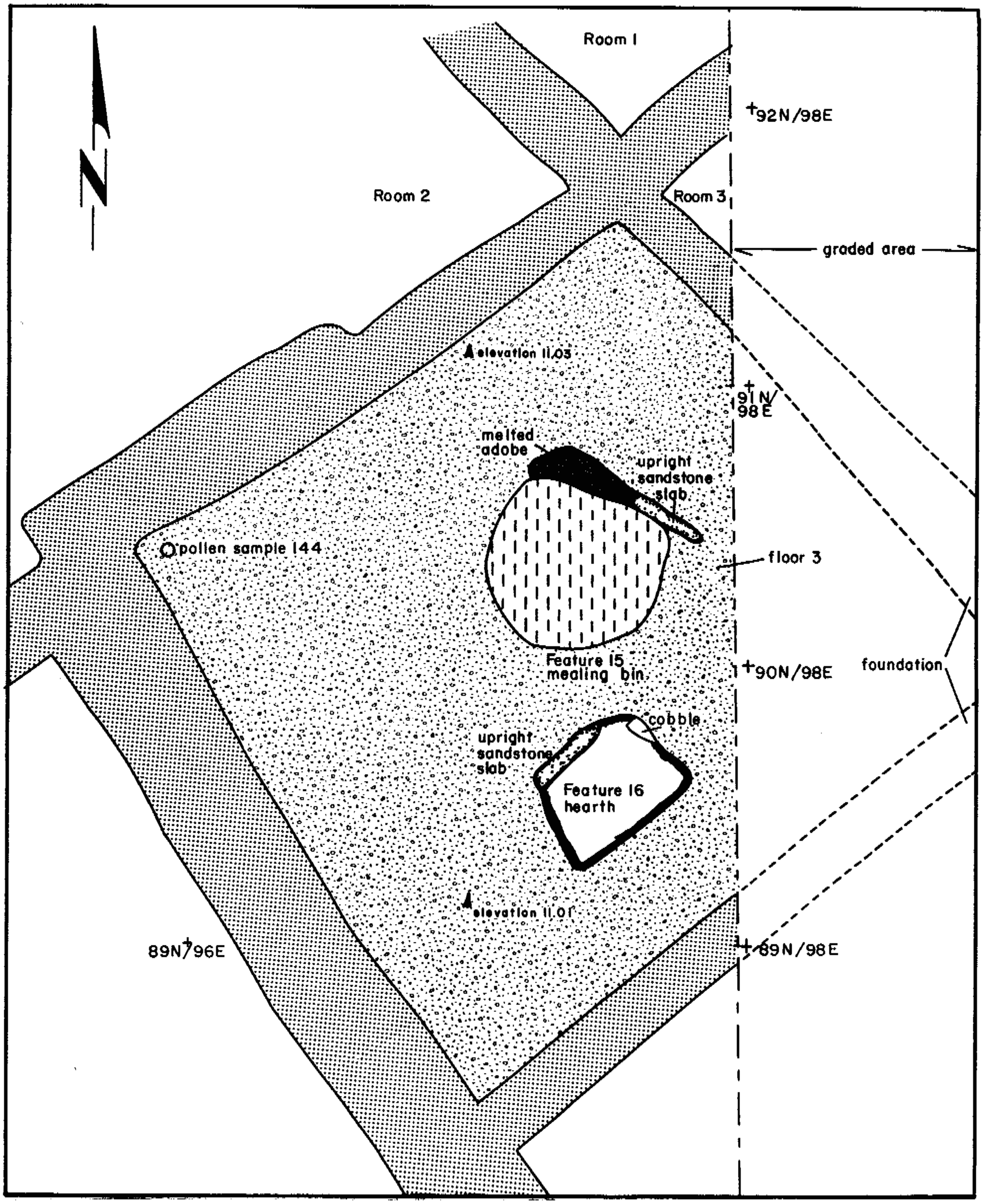


Figure 22. Room 4, Floor 3, plan view.

Two features were present on the floor. Feature 13 is a hearth situated in the northeast corner of the room (Fig. 21). It consists of a shallow unlined basin (60 by 84 by 6 cm), with oxidized sides. The fill is a uniform mixture of ash, charcoal, and sand. Pollen [132] and flotation [130] samples were analyzed from the fill. The pollen sample yielded evidence of Cheno-ams, cholla, squash, and maize. More maize pollen was present in this context than that recovered from the floor. The flotation sample contained juniper, saltbush, greasewood, cottonwood, and corn charcoal. Several burned and unburned cobbles and tabular pieces of sandstone were situated on top of and slightly protruding down into the pit fill. The walls of the room above the hearth were also blackened and oxidized. Feature 14 is a post hole located adjacent to the north wall. Four small sandstone blocks were around the hole and may be associated with the feature. A unidirectional core was also present in this area.

Forty-one sherds, a two-hand mano (coarse-grained sandstone), a burned mano fragment (fine-grained sandstone), and a bidirectional chert core were distributed across Floor 2. The pottery included 2 Gallup Black-on-white worked sherds, 9 pieces from 2 Mancos Corrugated jars, and 26 pieces of 2 unfired Cortez Black-on-white(?) "buff ware" jars. An attempt was made to refit sherds from these unfired vessels to those from the unfired Cortez Black-on-white jar in Room 2, but none fit. A pollen sample [126] was analyzed from the western corner of the room. It yielded evidence of Cheno-ams, pinyon, cholla, prickly pear, squash, and maize.

There was 8-10 cm of wall fall between Floors 2 and 3, within which a two-hand sandstone mano was recovered. Floor 3 (Stratum 42) was below this wall fall at an elevation of 10.97-11.00 m. This floor had a prepared adobe surface similar to Floor 2. Although the present north, east, and south walls articulate with Floor 3, the west wall bottoms out at Floor 2. A milling bin and a hearth articulated with the floor (Fig. 22). A pollen sample [144] was analyzed from the floor in the western corner of the room. It yielded evidence of Cheno-ams, pinyon, cholla, and maize.

Feature 15 is a milling bin with metate rest. It consists of an adobe-lined pit (74 by 71 by 16 cm), with three two-hand manos set into the bottom of the pit, one upright and two horizontal (Figs. 23 and 24). These presumably acted to support a metate. An upright slab was situated against the northeastern edge of the pit and another is located about 15 cm further away from the pit. Both are connected by some melted adobe. A pollen sample [150] was analyzed from the top of the mano in the metate rest. It yielded evidence of Cheno-ams, greasewood, pinyon, squash, and maize.

Feature 16 is a hearth 40 by 35 by 16 cm in size. The sides of the pit are oxidized. Two upright slabs partially line the pit on its north and east side. The pit fill consisted of a mixture of charcoal and sand. A pollen [147] and flotation [140] sample were taken from the fill. The pollen sample included Cheno-ams, greasewood, pinyon, cholla, squash, and maize. The flotation sample only contained three pigweed and saltbush seeds, with some burned corn. A radiocarbon sample (Beta-14248) yielded a date of A.D. 704 ± 100.

Sterile laminated sand mixed with gravel (Stratum 50) was exposed beneath Floor 3. The bottom of the walls were located about 20 cm below Floor 3.

At least three occupations are represented within Room 4. The first occupation is associated with Floor 3, when the room was originally constructed. Portions of the north, east, and south walls still remain. They mainly consist of a single course of roughly shaped sandstone blocks with adobe mortar 20 cm wide. The east wall is bonded to the north wall, but only

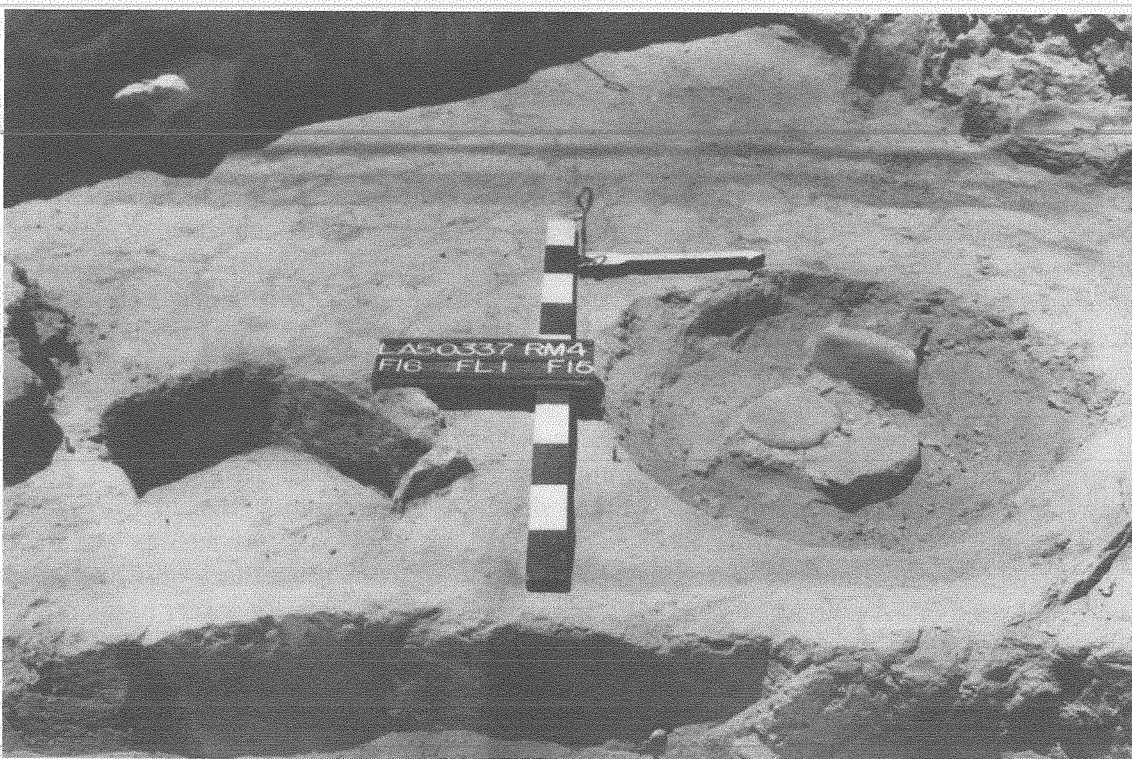


Figure 23. Room 4, Features 15 and 16.

foundations are left in the southeastern corner of the room connecting the east wall to the south wall. Room 4 appears to have been built at the same time as Rooms 1-3; however, there was no west wall present at the level of Floor 3. This area was disturbed, and it could be that a wall was built, which later collapsed and was dismantled. Floor 3 did not extend into Room 5 to the west, but a poorly defined plaza surface was exposed at this level. The presence of a hearth and milling bin on Floor 3 indicates that the room was used as a residence.

The room was abandoned until Floor 2 was constructed on top of the debris overlying Floor 3. At this time a new west wall was built. It was larger than the other walls--40 cm wide and constructed of one to three courses of roughly shaped sandstone blocks with adobe mortar. It also abutted the north wall about 30 cm east of the southwestern corner of Room 2. This created an offset corner between the rooms where a large buttress consisting mainly of adobe with a few large unshaped sandstone blocks was built. The west wall then continued about 60 cm further to the south of the existing south wall. This southwestern corner of the room did not abut the northeastern corner of Room 7. The room was presumably reused as a residence with a corner fireplace.

The room was vacated again and Floor 1 overlaid some of the older wall debris. A new south wall was built about 20 cm into the center of the room, decreasing the overall size of the room. New courses of sandstone and river cobble masonry were added to the west wall. The function of the room might also have changed, although it is difficult to determine as only the west half of the floor remained. There were however, only two post holes on the floor, one in the northwest corner and another in the southwest corner of the room.

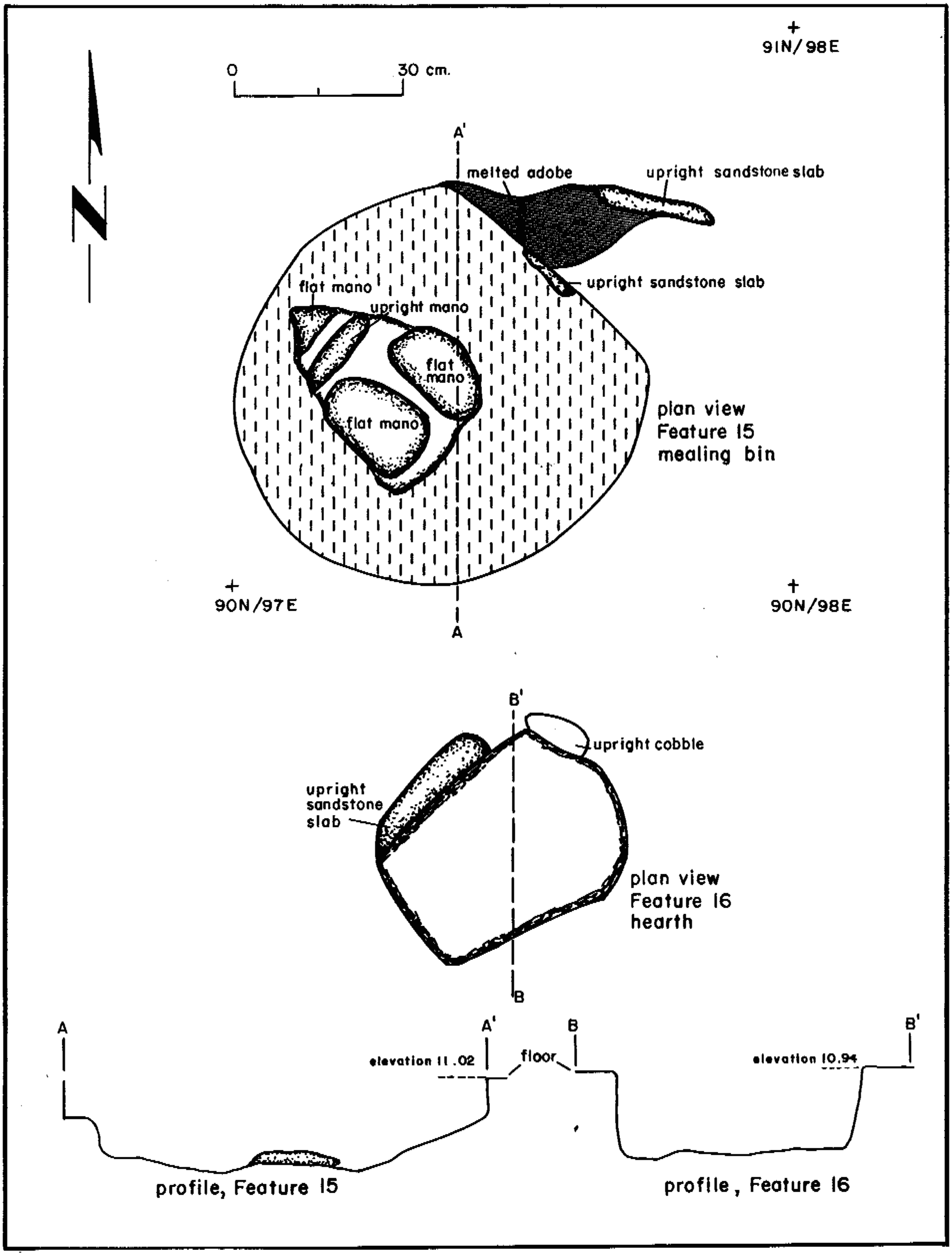


Figure 24. Room 4, Features 15 and 16, plan view and cross section.

After the Floor 1 occupation, the room was never reused. No roof fall was ever encountered; it had to have been removed before the walls collapsed in on the room. No indications of a doorway were present in the walls of the room.

An attempt was made to refit the sherds from the different strata within the room. Like Room 1, some sherds did fit together within a level, but not between levels. This strategy was also used between Rooms 1 and 4 in the hope of isolating contemporaneous occupations in the two rooms. However, no sherds from Room 1 could be fitted to those from Room 4.

Room 7. Room 7 was located to the southwest of Room 4. It was a square masonry room measuring 2.16 m (east-west) by 2.25 m (north-south). The southeastern corner of the room had been graded through. Wall height ranged from 15 cm to 45 cm and width ranged from 25 cm to 30 cm. About 15-30 cm of post-occupational fill (Stratum 22) was removed. It consisted of sandstone blocks and cobble wall fall with some lithic artifacts, ceramics, and ground stone present. The pottery included Kiatuthlanna Black-on-white, Cortez Black-on-white, Mancos Black-on-white, Mancos Gray, and Mancos Corrugated. Floor 1 was a prepared adobe surface about 2-4 cm thick, situated at an elevation of 10.96-11.10 m (Stratum 53). The floor was coped to the walls, which were also covered with plaster. Two sandstone slabs with adobe mortar were offset from the wall in the northeastern corner of the room (Fig. 25). They were situated about 34 cm above the floor. It is unclear whether they were part of the wall masonry or represent some type of internal room feature. Five river cobbles were into the adobe floor along the west wall. These had also been covered with plaster. Three sandstone slabs were the only artifacts present on the floor. A pollen [164] and flotation sample [165] were analyzed from the central area of the floor. The pollen sample yielded evidence of Cheno-ams, *Pinus* sp., cholla, squash, and maize. The flotation sample contained only a single goosefoot seed.

Feature 22 was a hearth situated in the north-central area of the room. It consists of a 33 by 40 by 12 cm oblong pit, divided into two compartments. An upright sandstone slab separates the eastern burned half from the western unburned half. Both sides are adobe lined and an upright cobble was placed along the western side of the pit. The fill consisted of a mixture of sand, charcoal, and one burned corn cob fragment. A flotation sample [168] was analyzed from the fill and contained a goosefoot seed and three pigweed seeds. A radiocarbon sample (Beta-14250) yielded a date of A.D. 745 $\pm$ 60.

A shallow basin hearth (Feature 25) was exposed about 10 cm below the south-central area of the floor at an elevation of 10.9 m. This is below the walls of Room 7. No definable surface or artifacts were found in association with this feature. It consisted of a 25 by 37 by 4 cm pit with oxidized sides, containing a mixture of sand, ash, charcoal, and a couple of small cobbles.

There are at least two occupations represented in the area of Room 7. The first is associated with an isolated hearth (Feature 25). The nature of this occupation is not understood. Later, Room 7 was built as a separate room block from Rooms 1-4. The wall construction looks the same as the initial building phases of Rooms 1-4, consisting of a single course of sandstone slabs with adobe mortar. The foundations in Room 7 were masonry and were situated about 20 cm below the floor. The elevation of Floor 1 is roughly the same as that for Floor 2 in Room 1, Floor 1 in Room 3, and Floors 2 and 3 in Room 4. All of these had adobe floors coped to the surrounding walls. Similarities in room construction, floor elevation, ceramics, and radiocarbon dates indicated that Room 7 was at least partially contemporaneous with these occupations. The room presumably functioned as a residence, since it contained a central hearth.

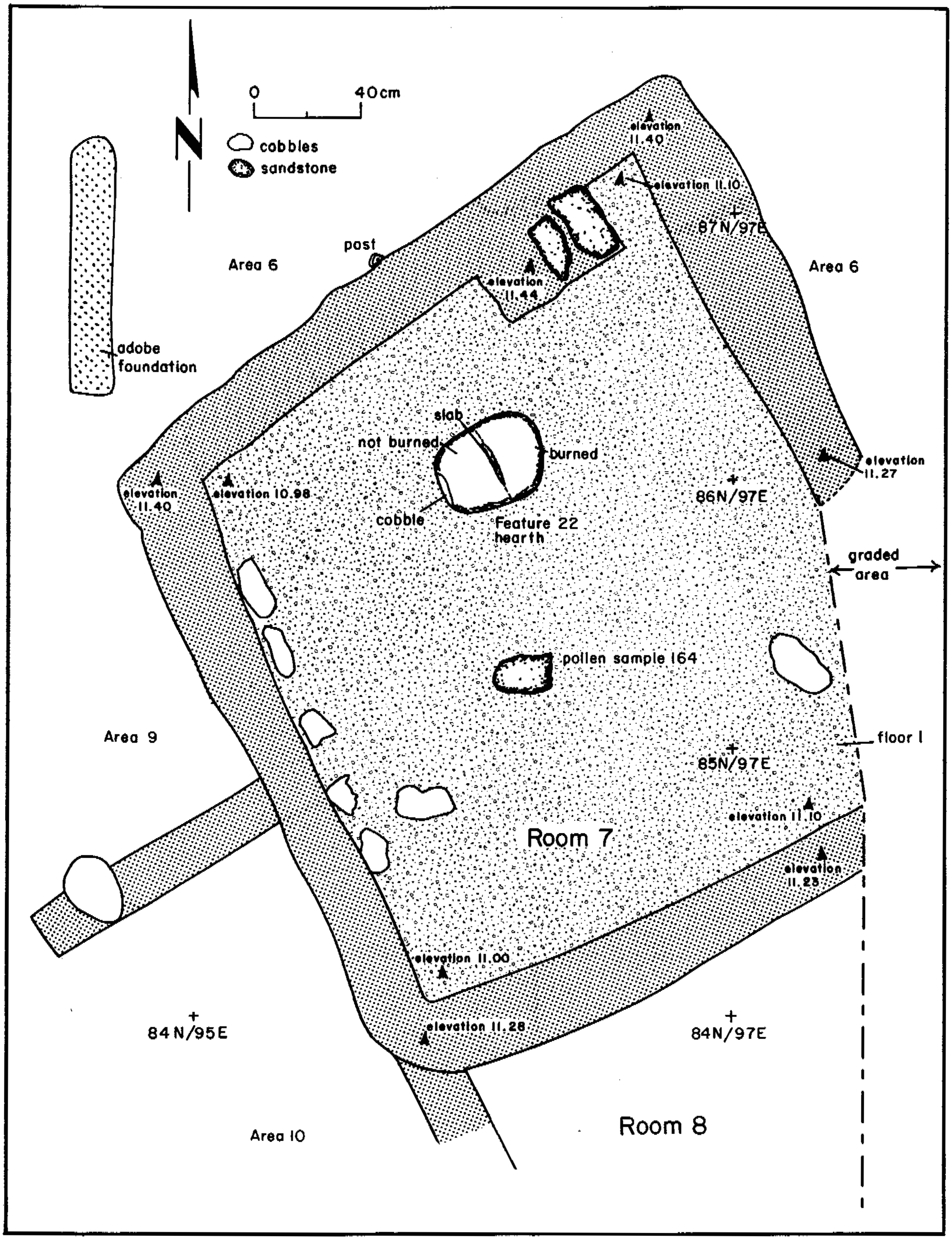


Figure 25. Room 7, Floor 1.

As was the case with all the other rooms, there were no indications of a doorway, nor were any roof remains found. The roof must have been removed before the walls collapsed and after the room was abandoned.

Room 8. Room 8 was situated immediately south of Room 7 (Figs. 25, 26). It is a small rectangular masonry room approximately 1.17 m (east-west) by 1.70 m (north-south) in size. The east wall of the room was missing. The wall height ranged from 20 to 28 cm and width from 18 to 28 cm. Most of the wall had already been removed. As with the rest of the rooms, the disturbed overburden was removed until the walls were defined. However, very little remained of the walls in Room 8. A hearth was exposed after the overburden was removed. It was situated near the base of the walls at an elevation of 11.0 m. The feature was a shallow, unlined basin hearth measuring 40 by 38 by 7 cm. It was filled with a mixture of adobe, burned soil, charcoal, and seven small cobbles. A flotation sample [175] was analyzed from this fill. It contained saltbush, winged pigweed, and corn seeds, with some juniper, saltbush, cottonwood, and corn cob charcoal. A radiocarbon sample (Beta-14251) yielded a date of A.D. 693 $\pm$ 70. No surface was ever defined associated with this hearth. This may be partially due to modern disturbance in the area.

Underlying Feature 24 and the bottom of the walls in Room 8 was a 19-28 cm thick layer of trash (Stratum 61). It was made up of a sandy clay mixed with charcoal, sherds, debitage, prairie dog bone, cottontail bone, mule deer bone, and six burned corn cob fragments. Ceramics present include Kiatuthlanna Black-on-white, Cortez Black-on-white, Mancos Black-on-white, Mancos Gray, and Mancos Corrugated. Some of the sherds were burned, but the level was not. The stratum had been disturbed by rodents.

This layer of trash was deposited on top of an occupational surface (Stratum 64). It was a compacted surface, stained with charcoal flecks. A hearth (Feature 30), a full-grooved quartzite maul, a large primary flake from a chert hammerstone, and some eggshells were found on the surface. The feature consists of an unlined basin hearth measuring 38 by 24 by 8 cm. The sides of the pit were oxidized and it was filled with dark ash. The hearth and artifacts were situated at an elevation of about 10.7 m.

At least three occupation episodes are represented in the area of Room 8. The first is reflected by the hearth and associated artifacts found on an exterior surface. Later trash was deposited in this area, although none was observed below Room 7. Next, Room 7 was built. Room 8 was probably a later addition to Room 7 because the south wall of Room 7 is the north wall of Room 8. This wall was made of roughly shaped sandstone blocks, one course wide, with adobe mortar, and is the same masonry as the original occupations of Rooms 1-4. In contrast, the west and south walls of Room 8 are constructed of sandstone and cobble masonry one course wide. The addition of cobbles to the masonry is similar to the later wall additions found in Rooms 1 and 4. Also, the west wall abuts the north wall. This indicates that Room 8 was added to Room 7. The function of Room 8 is unclear. There was a hearth present in the room at about the same elevation as Floor 1 in Room 7, but no actual floor was ever defined. Room 8 probably represents another habitation room that was added to Room 7.

Plaza Surrounding the Room Block

During the initial clearing of the room block, the tops of walls were defined and seemed to indicate the presence of 12 rooms. Upon excavation it became apparent that Rooms 5, 6, 9, 10,

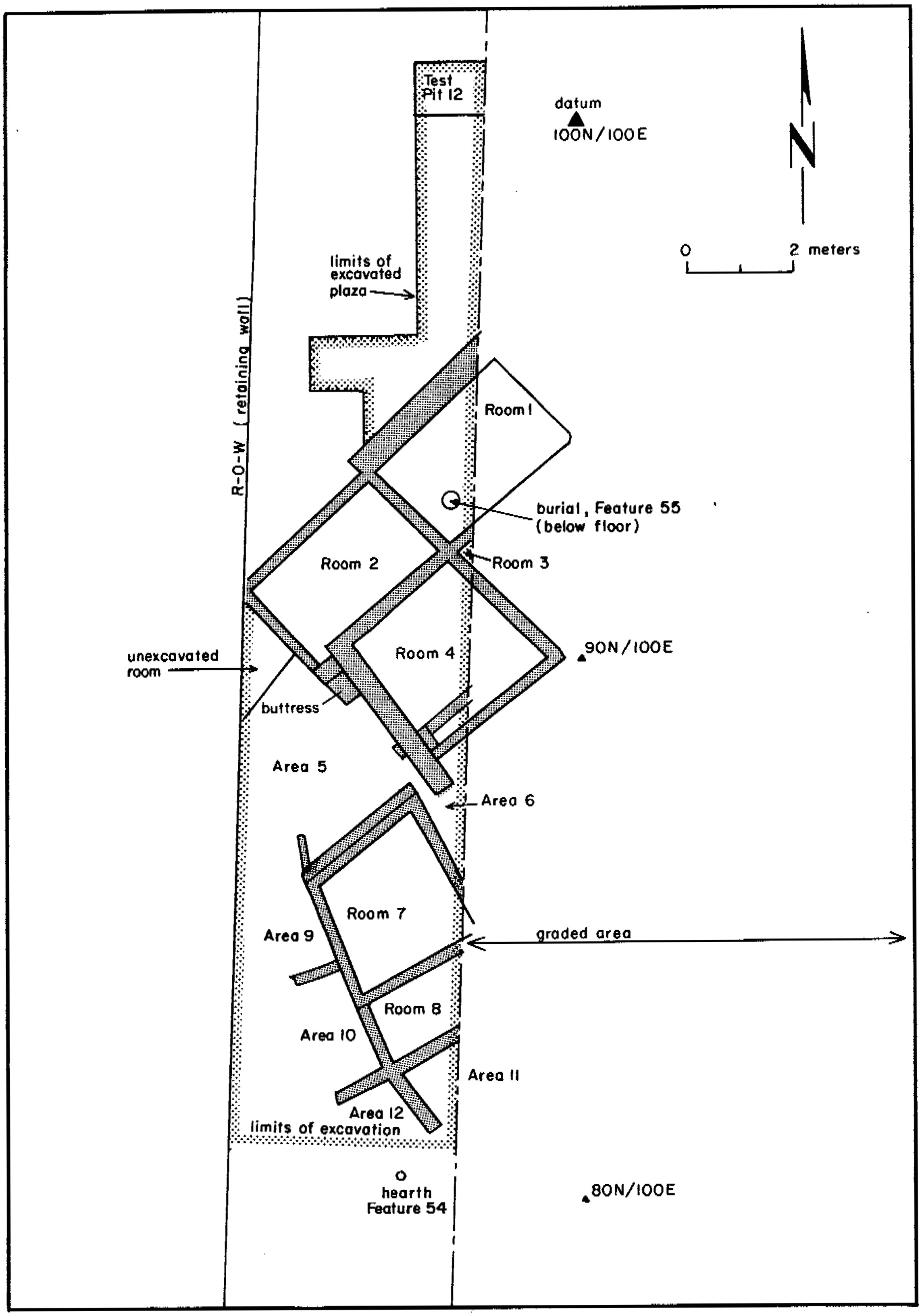


Figure 26. Room block.

11, and 12 were not interior rooms, but were outside plaza areas that had in part been partitioned by small wall segments. Therefore, they will be referred to as Areas 5, 6, 9, 10, 11, and 12 (Fig. 26). At least four separate plaza/occupation surfaces were defined, including Plazas 1, 2, 3, and 4. The fill lying above these surfaces will be described on an area-by-area basis. Then, the contemporaneous surfaces will be discussed together. Area 5 was the first of these proveniences to be excavated.

Area 5 was the area situated west of Room 4, north of Room 7, and south of an unexcavated room (Fig. 27). It included grids 87-90N/95-97E. The first layer to be removed from the area consisted of a 15 to 36 cm level of post-occupational fill (Stratum 22). It included wall fall (sandstone blocks and cobbles), sherds, debitage, a two-hand mano fragment, a metate fragment, jackrabbit bone, a burned corn cob fragment, and charcoal. The pottery included Cortez Black-on-white, Mancos Black-on-white, McElmo Black-on-white, La Plata Black-on-red (superseded by Deadman's Black-on-red), and Mancos Corrugated.

An occupational surface (Stratum 35) was exposed under the fill at an elevation of 11.38-11.41 m. It consisted of a compacted surface that was mainly definable in the area around a hearth (Feature 12). The hearth is composed of a shallow unlined pit measuring 36 by 36 by 8 cm. The sides of the pit were oxidized and the fill included a mixture of ash and charcoal. A pollen [124] and flotation [125] sample were analyzed from the fill. Gramineae was the only pollen present. The flotation sample contained pigweed, saltbush, Indian ricegrass, goosefoot, purslane, and nightshade seeds, with some juniper, cottonwood, and corn charcoal. Surrounding the hearth were four pieces of burned and unburned sandstone, two small cobbles, three sherds, and a possible post hole. A single course cobble wall, which was associated with this occupation, was present along the outside of the north wall of Room 7. A large shaped sandstone slab (47 by 28 by 26 cm) was found lying flat, near an opening between the eastern end of this wall and the west wall of Room 4.

Underlying this occupational surface was a 27-37 cm thick post-occupational fill level (Stratum 36). This included wall fall (sandstone blocks and river cobbles), sherds, debitage, two cobble bifaces, six granite and sandstone mano fragments (one- and two-hand), a sandstone metate fragment, a granite mortar, five burned corn cob fragments, turkey eggshell, cottontail bone, jackrabbit bone, prairie dog bone, and mule deer bone. The pottery included Cortez Black-on-white, Mancos Black-on-white, Wetherill Black-on-white, La Plata Black-on-red, Mancos Gray, and Mancos Corrugated. Below this, numerous chunks of charcoal began to appear in the fill. This defined the top of Stratum 44. The upper 2-6 cm of this stratum contained some wall debris (burned and unburned sandstone blocks and cobbles), sherds, debitage, turkey eggshell, three side-notched arrow points, and two basalt unidirectional cores. The lower 1-6 cm exposed the remains of a possible ramada situated against the north wall of the area. The burned ramada, along with several other artifacts were lying on an irregular occupational surface (Stratum 49). This surface was Plaza 1, situated at an elevation of about 11.00 m.

Area 6 was an outside area bounded on the west by Room 7 and north by Room 4 and included grids 87-89N/98E. The eastern side of the area was cut through by the grader. Fifteen centimeters of disturbed fill (Stratum 22) was removed. It contained some Cortez Black-on-white and Mancos Corrugated sherds, debitage, small to medium mammal bone, and a burned cob fragment. This fill occurred over an occupational surface (Stratum 65) that was associated with two hearths (Features 9 and 20). The southern extension of the western wall of Room 4 was built on top of Feature 9. The hearths and surface were situated at an elevation of 10.93-11.04 m and presumably were related to the Plaza 1 occupation.

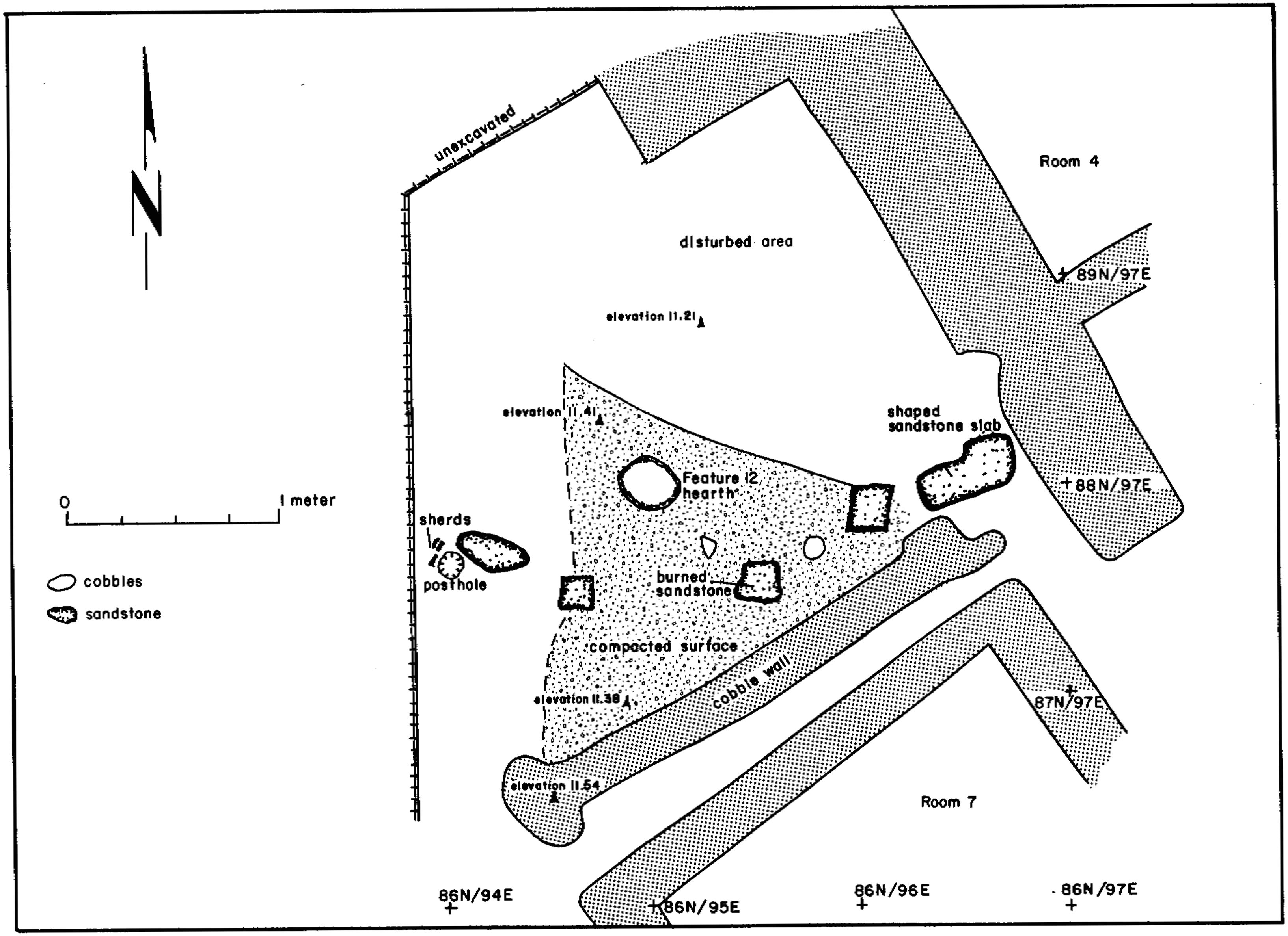


Figure 27. Area 5, occupational surface.

Area 9 was situated to the west of Room 7 and included grids 85-86N/94-95E. It was bounded by the wall of Room 7 to the east and a small two-course high sandstone and cobble wall to the south. An 11-26 cm level of wall fall underlain by trash (Strata 22/62) was removed. It contained Cortez Black-on-white, Naschitti Black-on-white, and Mancos Corrugated sherds, debitage, prairie dog bone, turkey eggshell, a burned corn cob, and a trough metate fragment. This material covered an occupational surface (Stratum 63), associated with a milling bin, post hole, two manos, and a metate fragment. This surface was a continuation of Plaza 1 from Area 5 and was situated at an elevation of 10.95-11.01 m.

Area 10 was the area located west of Rooms 7 and 8 and south of Area 9 (83-85N/95-96E). It is bounded by small two-course high sandstone and cobble walls to the north and south, and the walls of Rooms 7 and 8 to the east. From 1 to 9 cm of fill was removed from the area including some wall fall, Cortez Black-on-white and Mancos Corrugated sherds and debitage. This exposed an occupational surface (Stratum 71), which was situated at an elevation of 10.95-10.99 m. A hearth (Feature 31), a large cobble metate, and a mano were associated with this Plaza 1 surface.

Area 11 was immediately south of Room 8 and included grids 82-83N/96-97E. It was bounded by a cobble and sandstone masonry wall to the north, a single course of cobbles with adobe wall to the west and the grader cut to the east. A slab-lined hearth (Feature 28) had already been exposed in the profile of the grader cut. About 10 cm of fill (Stratum 22) was removed from the area. It contained McElmo Black-on-white sherds, debitage, and flecks of charcoal. This uncovered the Plaza 1 surface (Stratum 65) at an elevation of about 10.82 m. Associated with this surface were the hearth, two post holes, and the top of a buried corrugated jar.

Area 12 was south of Area 10 and west of Room 11 and included grids 81-83N/95-96E. The area was bounded by a two-course high sandstone block with adobe masonry wall to the north and a single course of cobbles to the east. The first 10 cm level removed consisted of a post-occupational clay and sand fill with some wall fall (large cobbles and sandstone blocks), bits of charcoal, sherds, debitage, and ground stone. The pottery included Mancos Black-on-white, Snowflake Black-on-white, Mesa Verde Black-on-white, and Mancos Corrugated. An ash stain and a post hole were exposed at a 10.96 m elevation. This was the Plaza 1 surface (Stratum 65).

Plaza 1. Plaza 1 surfaces were defined in Areas 5, 6, 9, 10, 11, and 12. They appear to be associated with the occupation of the room block (Fig. 28). In Area 5, a ramada had burned and collapsed on top of the surface. It consisted of five burned, latilla-sized cottonwood poles that were partly covered with juniper, twigs, and adobe. A flotation sample analyzed from the ramada contained seeds from the sedge family, amaranth, mentzelia, nightshade, Indian ricegrass, and prickly pear, with burned juniper twigs and cottonwood charcoal. Also present in this level were isolated chunks of charcoal, two side-notched points, two turquoise pendants, four pieces of malachite and azurite pigment, burned mano fragments, a burned tabular piece of sandstone (28 by 18 by 1 cm) with a ground surface, a quartzite cobble biface, sherds, bone, and a bone awl. The pottery included Cortez Black-on-white, Mancos Black-on-white, and Chuska Black-on-white.

Portions of the Cortez Black-on-white seed jar were recovered from both levels of Stratum 44. It could be that the points, pendants, and pigments were the contents of the seed jar (although the bottom of the seed jar was never recovered) because they were all found in the area of the burned ramada. Four of the five points are made of the same chalcedony, while the

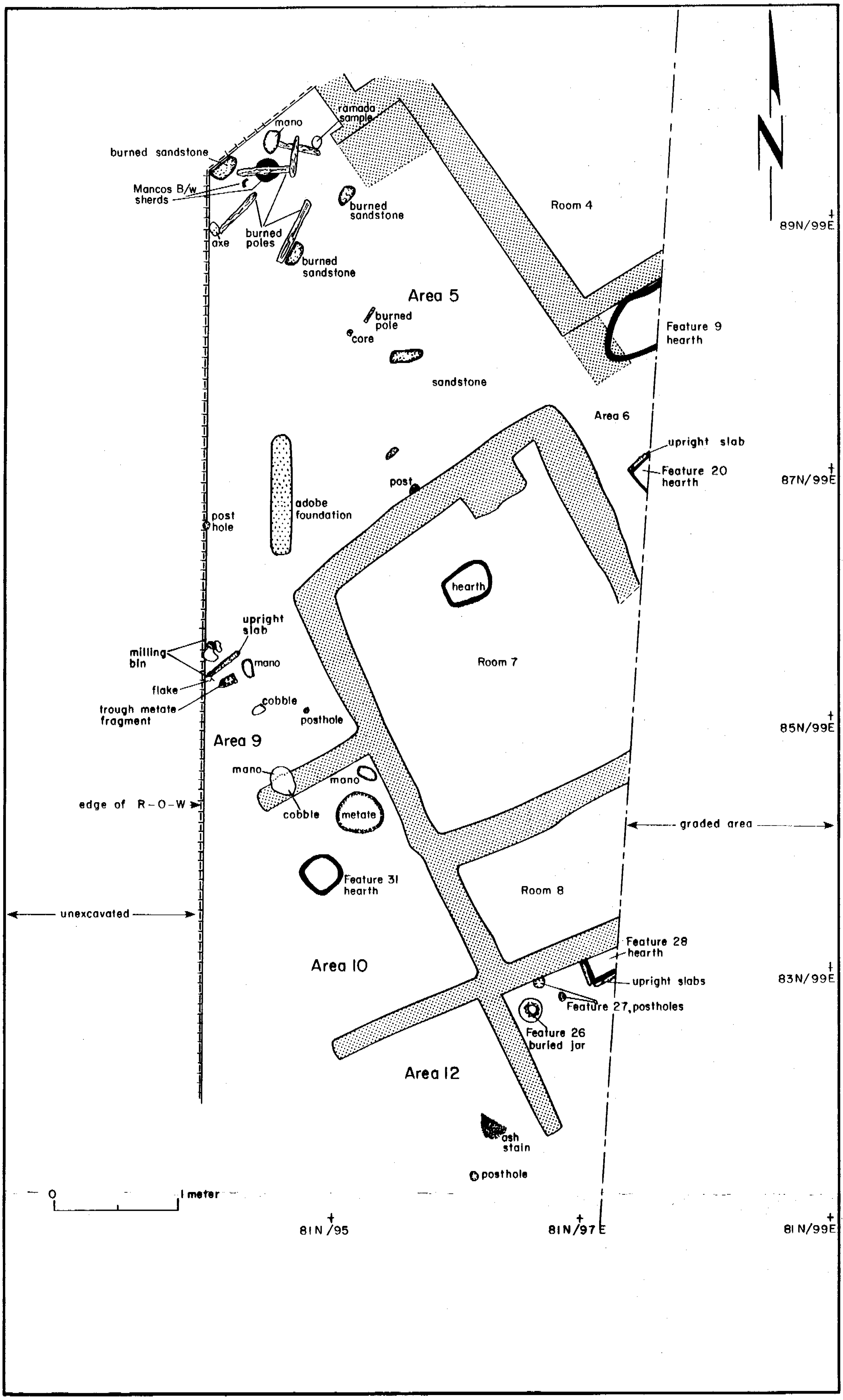


Figure 28. Room block, Plaza 1.

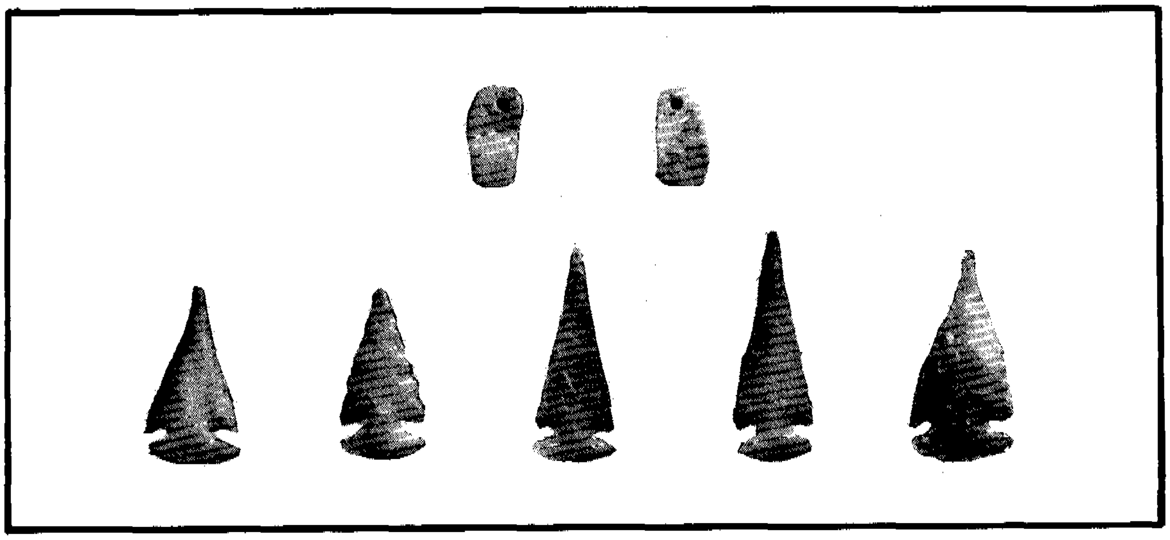


Figure 29. Projectile points and pendants.

remaining one is made of chert. Use-wear and discoloration on the tips of four of these points indicate that they were used as drills. These drill tips fit the holes in the two pendants (Fig. 29). It is possible that the points, pendants, and pigment represent some kind of jewelry kit.

The presence of the ramada and other artifacts at the same level (11.0 m) is what predominantly distinguished the surface. Otherwise, it was unprepared and irregular, compacted in some areas and loose sand in others. Most of the artifacts were recovered from under the remains of the burned ramada. This included an andesite grooved axe, a two-hand quartzite cobble mano, and part of a Mancos Black-on-white bowl. A pollen sample [163] was analyzed from under the mano. It yielded Cheno-ams, cholla, and maize pollen. Two of the poles from the ramada were submitted for dendrochronological analysis. They both were identified as *Populus* sp., probably cottonwood, and could not be dated (Robinson, pers. comm., 1985). A radiocarbon sample (Beta-14249) yielded a date of A.D. 827 $\pm$ 80. Other than a couple of pieces of tabular sandstone, a multifaceted quartzite core with a battered edge was the only other artifact found on the surface. There were, however, an adobe foundation and two post holes present. The adobe foundation was situated just to the northwest of Room 7. It was 1 m long, 20 cm wide, and about 2 cm high. The feature may represent the footing for a jacal wall, although its function is difficult to determine. A small upright post was found against the north wall of Room 7 and a post hole was found at the edge of the excavation west of the adobe foundation.

There was no definable surface that connected Plaza 1 in Area 5 with Area 6. Most of the area near the west wall of Room 4 was disturbed. However, the two large hearths uncovered in Area 6 are presumed to be associated with the occupational surface in Area 5 because they were situated at a similar elevation (10.93-11.04 m). Feature 9 was a large unlined pit with burned sides abutting the south wall of Room 4. Partial dimensions for the hearth are 90 by 55 by 15 cm. The pit fill consisted of several overlying layers, including laminated sand, then a mixture of ash and sand, and finally some charcoal on the bottom of the pit (Stratum 30). Several pieces of burned and unburned tabular sandstone were present in the fill, one of which was ground. Also present were a few burned cobble fragments, Mancos Corrugated sherds, debitage, a chert core, small mammal bone, and 13 burned corn cob fragments. These cobs were C-14 dated to A.D. 941 $\pm$ 90 (Beta-15431).

Another hearth (Feature 20) was located about 75 cm south of Feature 9. It was cross-sectioned in the grader cut so that the remaining pit was about 80 cm wide and 16 cm deep. The feature is mostly unlined, although there were three burned upright cobbles situated along part of its perimeter. The sides of the pit were oxidized and the fill consisted of an upper layer of mixed oxidized soil with a separate layer of ash and charcoal on the bottom of the feature (Stratum 51). A pollen [184] and flotation [183] sample were analyzed from the ash/charcoal lens. The pollen sample yielded evidence of Cheno-ams and maize. The flotation sample contained pigweed, beeweed, and nightshade seeds, with some juniper, cottonwood, saltbush, and corn charcoal. Also present in this lens was a burned corn cob fragment.

Like Area 6, no definite surface linked Plaza 1 in Area 5 to Area 9. However, the profile of the west wall along the right-of-way shows a continuous stratum between the two areas. The presence of features and artifacts at about the same elevation (10.95-11.01 m) also supports this relationship. Area 9 was a small area situated outside the northwest corner of Room 7. A portion of a milling bin with metate rest was excavated. It was constructed from an upright sandstone slab with two cobbles and a piece of sandstone set into adobe north of the upright. This presumably acted as a pedestal to rest the metate on, which was about 10 cm above the plaza surface. A core reduction flake, granite trough metate fragment, and granite two-hand mano were located just south of the milling bin. Another trough metate fragment was found in the fill above this level, which was probably part of the same metate. A pollen sample [178] analyzed from under the mano contained Cheno-ams and maize pollen. Another two-hand granite mano with finger grips was present under a large cobble that protruded from the southern wall. Lastly, a small post hole was near the southeastern corner of the area.

Area 10 was located south of Area 9, separated by a small wall that abutted Room 7. A compacted surface (Stratum 71) was defined in the area around a hearth (Feature 31). This surface was situated at about the same elevation as the rest of Plaza 1 (10.96-10.99 m). The wall separating Area 9 from 10 was also associated with this surface. The hearth was located near the center of the excavated area. It consisted of a shallow unlined basin-shaped pit with burned sides. The pit was 30 by 30 by 4 cm in size and was filled with some charcoal. A flotation sample [189] contained winged pigweed, goosefoot, pigweed, globemallow, and saltbush, with some burned cottonwood, juniper, and corn. A very large cobble metate was only 30 cm northeast of the hearth. It was 42 by 35 by 19 cm in size and weighed 38,556 g. The metate had been overturned. The ground surface had a slight trough shape. The two-hand mano found adjacent to the wall in Area 9 appears to fit this ground surface. This would indicate that the two areas were used contemporaneously, if indeed the mano and metate are associated. A thin two-hand sandstone cobble mano was found between the metate and west wall of Room 7. But it does not fit the grinding surface on the cobble metate. A pollen sample [189] taken from under the mano yielded evidence of Cheno-ams, prickly pear, beeweed, squash, and maize.

The Plaza 1 surface in Area 11 appears to be lower than the other areas around the room block. It was associated with a slab-lined hearth (Feature 28), two post holes (Feature 27), and a buried jar (Feature 26) situated at an elevation of about 10.8 m. The bottom of both the west and north walls of the area also lie at this level. The hearth was cross-sectioned by the grader cut. The eastern half of the feature was destroyed. It was constructed of two burned upright sandstone slabs along the west and south sides of the pit and the burned exterior wall of Room 8 along its north side. This indicates that the feature was associated with the occupation of Room 8. Very little fill remained within the hearth, so only a pollen sample [186] was taken. It contained Cheno-ams, cholla, and maize. Next to the hearth were two post holes about 20 cm deep. Between the post holes and the west partitioning wall was the top of a Mancos Corrugated jar. The rim of the jar was situated at the level of the Plaza 1 surface, with the bottom of the pot buried another 30 cm down. The vessel was covered with soot and ash indicating that it may have been used for cooking at one time. The bottom of the pot was missing and it appears to have been broken and then reused as a storage vessel. The jar was filled with dirt and was sent to the pollen laboratory for analysis. The fill was situated against the sides of the vessel and contained a large amount of Cheno-am, greasewood, cholla, prickly pear, squash, and maize pollen. A sherd wash from the vessel also contained large amounts of Cheno-ams, greasewood, cholla, and maize pollen.

The bones of a six-year-old individual were found in the bottom of the jar (Burial 4). These include four teeth, both scapulae, five thoracic vertebrae, three ribs, a left clavicle, a left femur, a right tibia, a possible left fibula, a right humerus, part of the right ischium, and four metatarsals. See Appendix 3 for a more in depth discussion of the remains. Mesa Verde Black-on-white and Sosi-Dogoszhi Black-on-white bowl sherds were also present in the bottom of the vessel with the burial.

Area 12, west of Area 11, did not have a distinctive Plaza 1 surface. All that was present was an ash stain and a post hole at an elevation of 10.99 m.

The Plaza 1 surface appears to be associated with the occupation of the room block. It was generally situated at an elevation of about 11 m, which is similar to most of the floors within the rooms. It also contained Cortez Black-on-white and Mancos Black-on-white pottery. How the various features present on the plaza surface relate to the multiple floors within the rooms is not understood. Not all of the features on this surface are contemporaneous. For example, Feature 9 probably relates to the initial occupation of the room block because it abuts the earlier south wall of Room 4 and underlies the later addition to the west wall of the same room. The plaza in Areas 9, 10, 11, and 12 may relate to the later occupation of the room block. All of these areas are associated with later structural additions including Room 8 and the abutting sandstone and cobble wall segments. The ramada area on the plaza in Area 5 probably burned and collapsed near the end of the room block occupation or after it was abandoned. Otherwise, the materials would probably have been scavenged if it had burned while the room block was occupied. This would also place the use of the ramada during the later occupation.

Plaza 2. Plaza 2 (Stratum 72) was associated with two hearths situated to the west and southwest of Room 7 (Fig. 30). Feature 37 (85-85N/95-96E) consisted of a shallow unlined basin-shaped hearth 50 by 46 by 23 cm in size. It was filled with a mixture of sand, ash, charcoal, and a piece of large mammal bone (Stratum 83). A pollen [219] and flotation [220] sample were analyzed. The pollen sample yielded evidence of Cheno-ams and maize. The flotation sample contained pigweed, saltbush, winged pigweed, globemallow, Indian ricegrass, beeweed, and corn seeds, with some cottonwood, saltbush, pinyon, juniper, and rabbitbrush charcoal. The feature was located underneath the wall between Areas 9 and 10 at an elevation of 10.9 m. It abutted the west wall of Room 7. Therefore, it appears to be contemporaneous with the occupation of Room 7.

Feature 35 was situated 1.45 m south of Feature 37 (82-83N/95-96E). It also was beneath the Plaza 1 surface at an elevation of 10.9 m. The hearth was constructed of a shallow basin-shaped pit that was partially lined with cobbles and sandstone slabs. The pit was filled with a mixture of sand, charcoal, and ash (Stratum 77). A cobble uniface was found on top of the fill and three Mancos Black-on-white sherds, a possible McElmo Black-on-white sherd, a couple of flakes, a core, and a small mammal bone were recovered from the fill. A pollen sample [197]

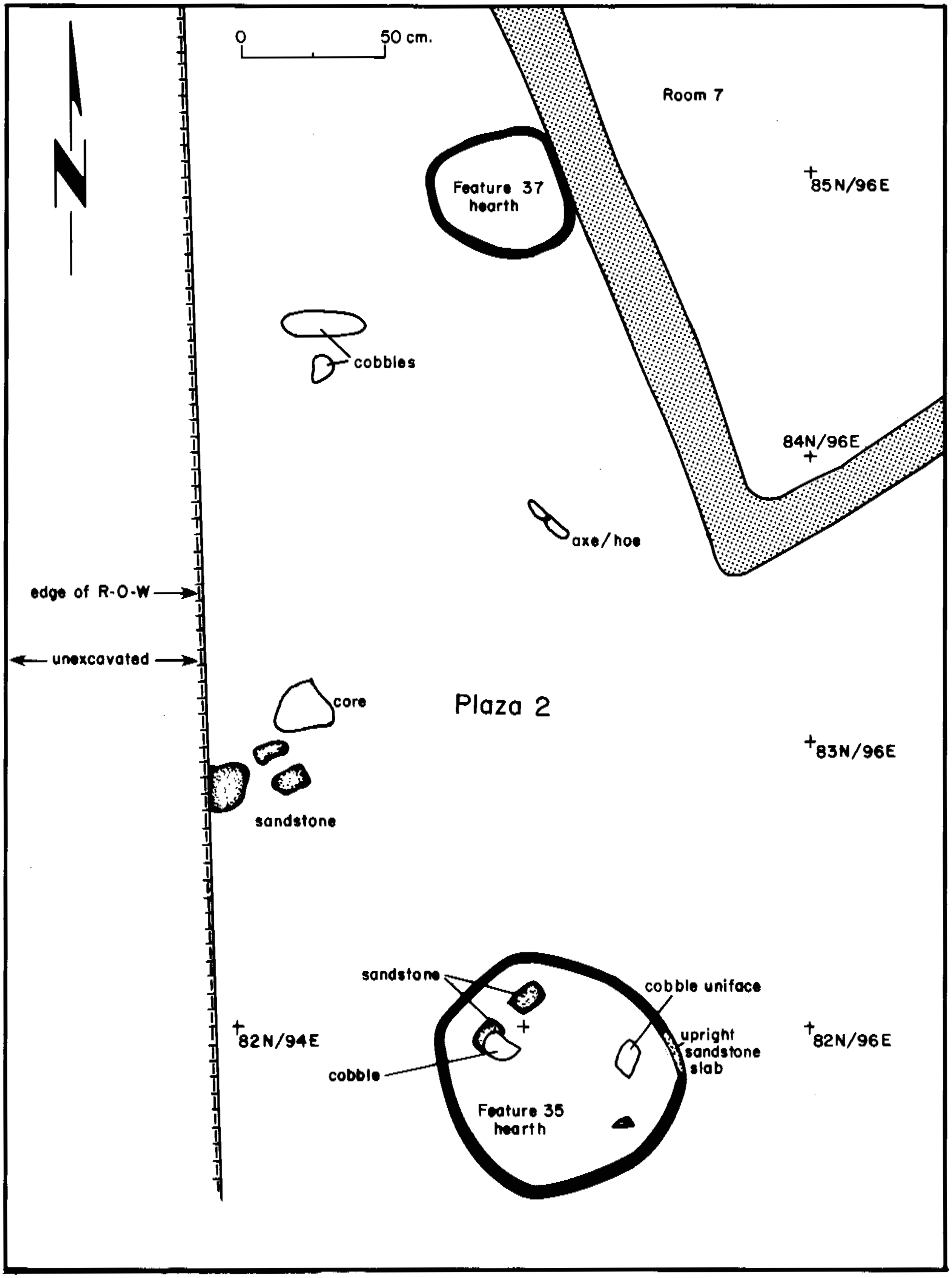


Figure 30. Room block, Plaza 2.

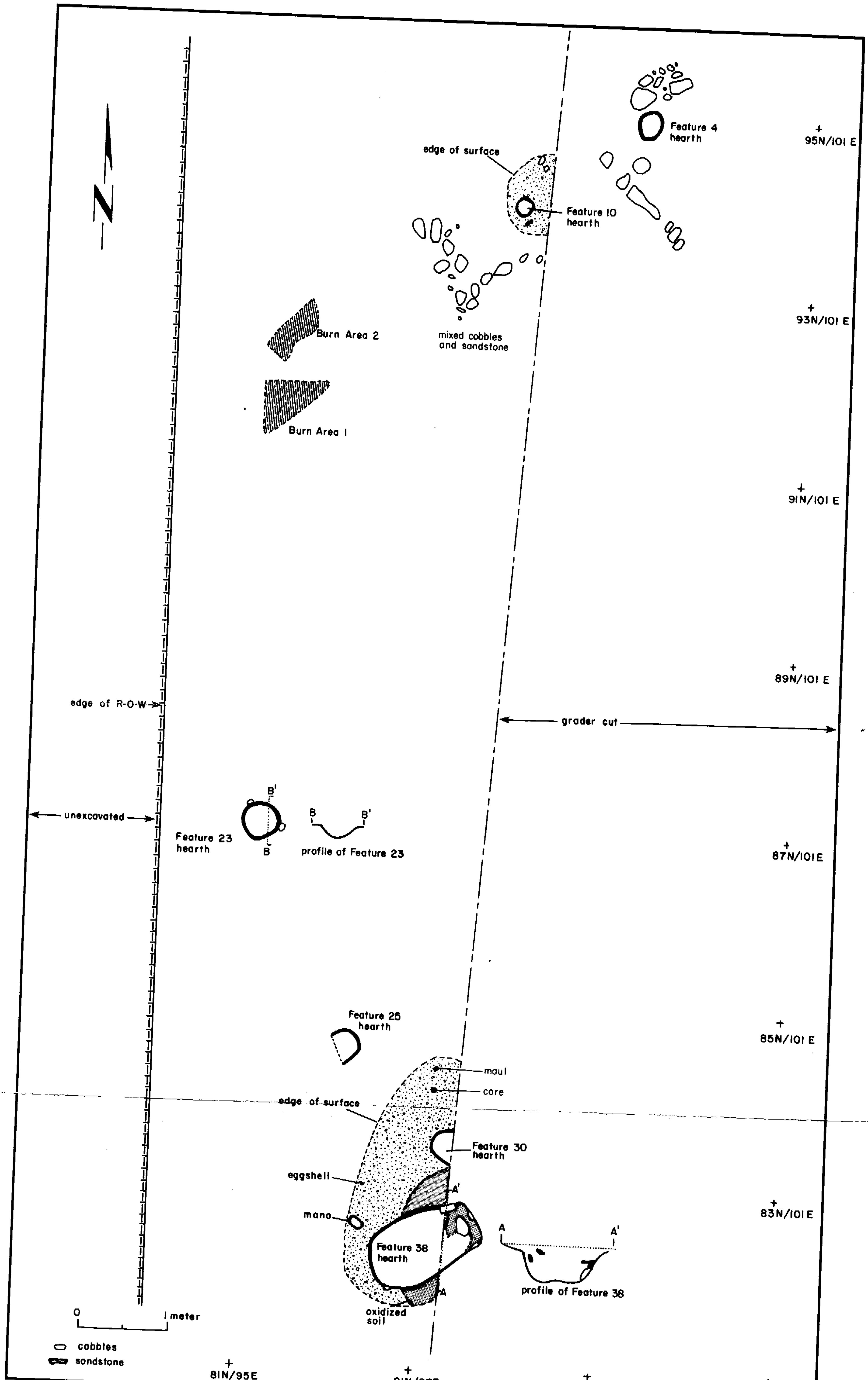


Figure 31. Room block, Plaza 3.

included evidence of Cheno-ams, greasewood, squash, and maize. A flotation sample [198] contained a saltbush and pigweed seed, with some burned juniper twigs and corn.

There was no compacted surface connecting the two features. However, a hafted axe/hoe blade and a core were located at the same elevation, between the two features. Other sherds found on this level included Cortez Black-on-white, Mancos Black-on-white, McElmo Black-on-white, and La Plata Black-on-white.

Plaza 2 appears to have been associated with the occupation of Room 7. Because both features underlie Plaza 1, on top of which the room was built, Room 8 postdates this occupation.

Plaza 3. Plaza 3 underlies and therefore predates the occupation of the room block. It was primarily associated with Features 30, 38, and the surrounding occupational surface. However, several other isolated features were also present below the room block (Fig. 31).

Features 30, 38, and the associated surface were situated below Room 8 and Area 12 in grids 82-85N/97-98E at an elevation of 10.70 m. Feature 38 was a very large oblong pit roughly 131 by 73 by 31 cm in size. Burning was only observed on the eastern end of the pit where three cobbles were set into the side of the feature and one into the bottom. The fill (Stratum 84) consisted of laminated sand mixed with charcoal, ash, Mancos Corrugated sherds, debitage, cottontail bone, mule deer bone, and prairie dog bone. A hafted axe was collected during the monitoring phase of the project, which may have also been from this pit fill. A pollen [200] and flotation [201] sample were analyzed. The pollen sample included evidence of Cheno-ams, cholla, and maize. The flotation only contained unburned Chenopodium seeds. A radiocarbon sample (Beta-14253) yielded a date of A.D. 735 ± 70. A compacted surface was defined around the immediate area of the feature, where it presumably was tamped down from extended use. A thin two-hand sandstone mano was found just to the west of the hearth and some eggshell was found to the northwest.

Feature 30 was located about 40 cm north of Feature 38. A scatter of charcoal connected the two features. Feature 30 was a shallow basin-shaped hearth about 38 by 24 by 8 cm in size. The pit was unlined with oxidized sides. It contained a darkened ashy stratum without any charcoal. Part of the pit had been disturbed by a rodent burrow. A maul and a core were found to the north of the hearth on a somewhat compacted and charcoal-stained surface surrounding the feature.

Five other features underlay the room block and were situated at roughly the same elevation as Features 30 and 38. These include Feature 4, 10, 23, 25, and Stratum 56. Features 10 and 25 and Stratum 56 have already been described; they were found directly under Rooms 1, 7, and 2. They include a hearth with an associated rock alignment (10.9 m), an isolated hearth (10.9 m), and a surface with two burned areas (10.63), respectively.

A hearth (Feature 23) was found about 15 cm below the Plaza 1 surface in Area 5 (87-88N/95-96E) at an elevation of 10.85 m. The hearth consisted of a shallow basin-shaped pit, 48 by 44 by 11 cm in size. The sides of the pit were oxidized and two cobbles were present along the edge of the pit. The fill included a fine gray ash with some charcoal (Stratum 58). A pollen [171] and flotation [172] sample were analyzed. The pollen sample included evidence of Cheno-ams and maize. The flotation sample contained goosefoot, pigweed, corn, purslane, stickleaf, nightshade, and tansy mustard, with some burned corn, juniper, and sagebrush.

Feature 4 was a hearth that had been partially exposed by the grader east of Room 1 and Feature 10 at an elevation of 10.80 m (96-97N/100E). It consisted of a shallow adobe-lined pit, 30 by 35 by 4 cm in size. The remaining hearth fill consisted of some ash and charcoal. Several cobbles and sandstone blocks were found around the hearth.

Since these features could not be stratigraphically linked, it is difficult to evaluate their relationship. Feature 25 was located near the Feature 30/38 surface, although it was 20 cm higher. Therefore, it was probably not associated with this occupation. Hearth Features 23 and 25 were situated at roughly the same level, 2 m apart. They may be related to a similar occupational level.

The Stratum 56 surface predates Feature 10 (hearth) because it was located 27 cm beneath it. Feature 10 was, however, present at about the same elevation as Features 23 and 25. The Feature 10 hearth, surface, and rock alignment may represent the remains of a structure. It is possible that the two hearths (Features 23 and 25) were associated with this occupational level.

Hearth Feature 4 was located just east and 20 cm lower than Feature 10. The area was impacted by the grader, but Feature 4 was probably earlier. It was situated at about the same elevation as the Stratum 56 surface and Features 30 and 38. Feature 4 and the associated rubble could represent a structure, with Stratum 56 and Features 30 and 38 present on the same occupational level.

Features Below Plaza 3. Three features were uncovered beneath Plaza 3, after the excavation of the room block had been completed. A burial (Feature 55) was exposed by a backhoe trench under Room 1 (93N/98E) at an elevation of about 10 m. This feature has already been described. Feature 44 was uncovered by a grader in grid 85N/98E below the southeastern corner of Room 7 at an elevation of 10.32 m. It consisted of an 80 by 20 by 3-7 cm layer of charcoal, ash, and burned gravel. This feature probably represents a discard pile as there was no evidence for in situ burning and the lens was thicker in the center and thinner toward the edges.

Feature 54 was exposed in grid 80N/97E at an elevation of 9.9 m. This was the earliest feature found in the area of the room block. Although it was partially destroyed by the grader, it consisted of a burned pit 50 by 60 cm in size, filled with a mixture of sand, charcoal, ash, and cobbles. It could not be determined whether the cobbles actually lined the pit or were simply part of the pit fill. A radiocarbon sample (Beta-14260) yielded a date of A.D. 621 $\pm$ 60, which corroborates the early use of the feature.

Plaza 4. Plaza 4 was exposed in grids 95-100N/96-98E north of Room 1 (Fig. 32). Stratum 22 was the first 30 cm level to be removed. It was comprised of laminated sand mixed with bits of charcoal, sherds, lithics, and mule deer bone. The pottery included Cortez Black-on-white, Mancos Black-on-white, Wetherill Black-on-white, Mancos Gray, and Mancos Corrugated. The next 25 cm level removed consisted of redeposited trash (Stratum 78). This was a charcoal-stained laminated sand, combined with pieces of charcoal, sherds, debitage, bone, and pieces of sandstone. The pottery includes Cortez Black-on-white, Kiatuthlanna Black-on-white, Mancos Black-on-white, Piedra Black-on-white, Naschitti Black-on-white, Newcomb Black-on-white, La Plata Black-on-red, Mancos Gray, and Mancos Corrugated. A pollen [221] and flotation [222] sample were analyzed from the trash in grid 96N/97E against the north wall of Room 1. The pollen sample yielded evidence of Cheno-ams, cholla, prickly pear, beeweed, and maize. The flotation sample contained nightshade, pigweed, winged pigweed, globemallow, goosefoot, sedge family, and hedgehog cactus, with some burned corn, cottonwood, and juniper.

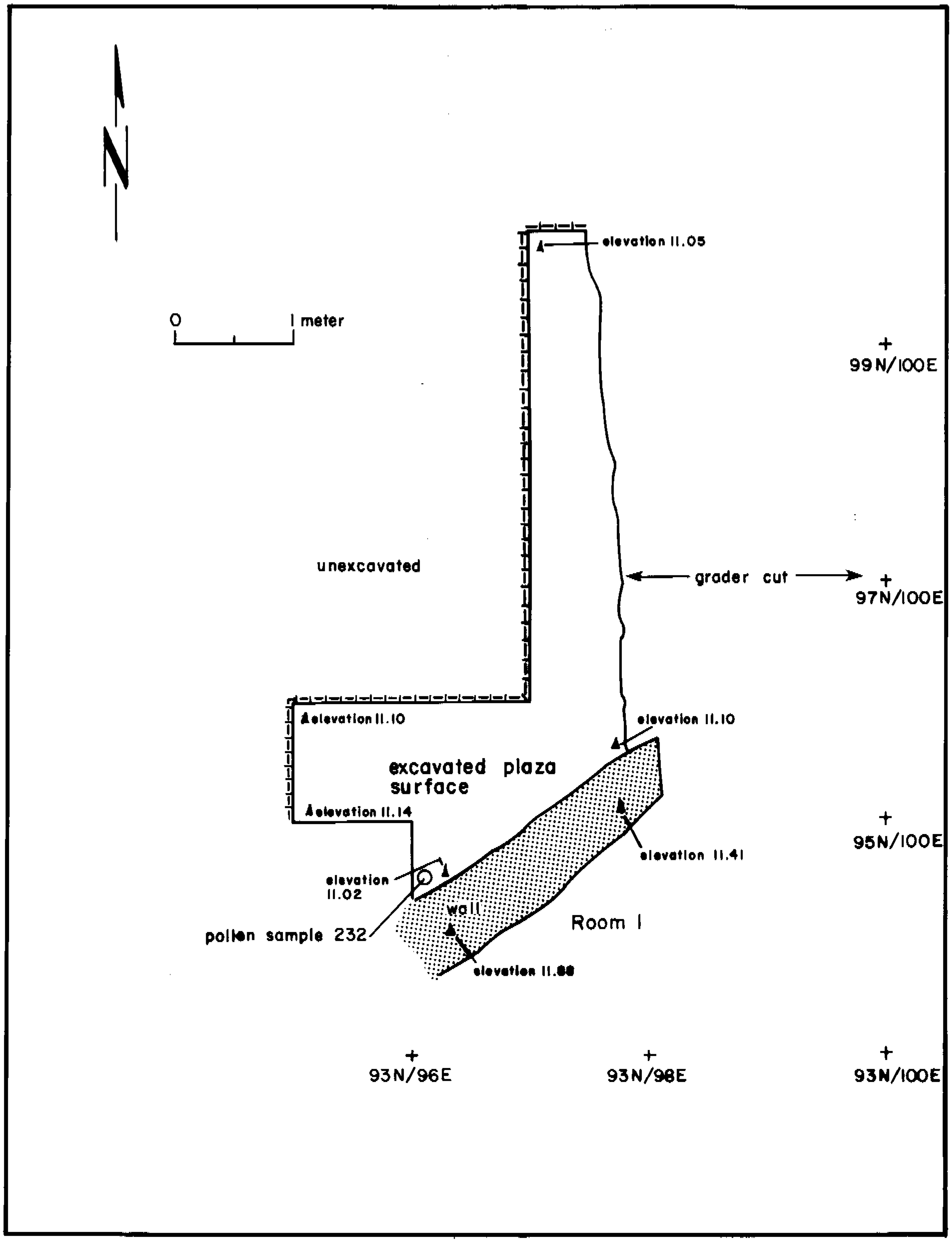


Figure 32. Room block, Plaza 4.

This trash was deposited on top of the Plaza 4 surface (Stratum 88). The plaza surface was better defined and compacted than the surfaces exposed to the south of the room block. However, Plaza 4 was more easily defined near Room 1 and less definable as one moved away from the room. Obviously, the area adjacent to the room was more heavily used. The plaza surface sloped up toward the west from an elevation of about 11.10 m to 11.22 m. This is similar to the plaza on the eastern side of the road. No features or artifacts were found on Plaza 4. A pollen [232] sample was analyzed from the surface in grid 95N/97E adjacent to the north wall of Room 1. It contained Cheno-ams, cholla, and maize.

Plaza 4 was probably associated with Plaza 1 and the occupation of the room block. It was situated at about the same elevation as Floor 2 in Room 1 (Fig. 33). If so, it shows that plaza space was differentially used. Plaza 1 to the west and south of the room block contained multiple activity areas, whereas Plaza 4 to the north exhibited none.

Room 13 and Plaza

Test Pit 13 (117N/98-99E) was situated 5 m north of Test Pit 14. It exposed a wall segment, corrugated jar, and some burned soil. The area of excavation was then expanded to include raids 115-117N/97-99E. The first 50 cm removed consisted of alluvial sediments mixed with charcoal, Mancos Black-on-white, and Mancos Corrugated sherds, and debitage (Stratum 22). This cleared the area around the remnants of the wall. The wall (Feature 34) was partially disarticulated, and included an east and south segment. The eastern section (125 by 30 by 22 cm) consisted of one vertical course of sandstone blocks with adobe mortar and a cobble foundation. The southern section (130 by 30 by 22 cm) consisted of two vertical courses of cobbles and sandstone blocks with adobe mortar and a cobble foundation. Two granite trough metate fragments had been incorporated into the foundation of the south wall segment.

An irregular compacted surface was present between the walls. Stratum 75 includes this surface and the fill immediately above, which contained the broken remains of half a Mancos Black-on-white bowl. The surface was situated at the base of the walls, above the foundation, at an elevation of 11.20 m. Approximately 14 cm of trash (Stratum 76) was removed from the area just outside (east and south) of the walls. It consisted of a charcoal and caliche mixed fill with Cortez Black-on-white, Moccasin Gray, and Mancos Corrugated sherds, debitage, a limestone cobble uniface, four burned corn cob fragments, prairie dog bone, and a piece of turquoise. The walls and surface were in such poor condition that it is difficult to determine what their function was.

Once the walls were removed, it was determined that they had been partially built over a milling room. The southern segment of the upper walls overlaid the southern wall of the milling room. The eastern segment of the upper walls were about 20-40 cm further east of the eastern wall of the milling room.

The next excavated level was composed of a 6-12 cm thick burned stratum east of the milling room. It consisted of oxidized soil, charcoal, ash, burned clay, and several pieces of burned poles or branches (Stratum 82/86). This appears to be the remains of a burned ramada that included at least three burned poles about 1.5 m long with some burned twigs and adobe chunks. Three dendro samples were determined to be cottonwood (Robinson, pers. comm.). A pollen sample taken from the ramada revealed the presence of a large amount of maize pollen. Also recovered from this level were Mancos Black-on-white and Mancos Corrugated sherds,

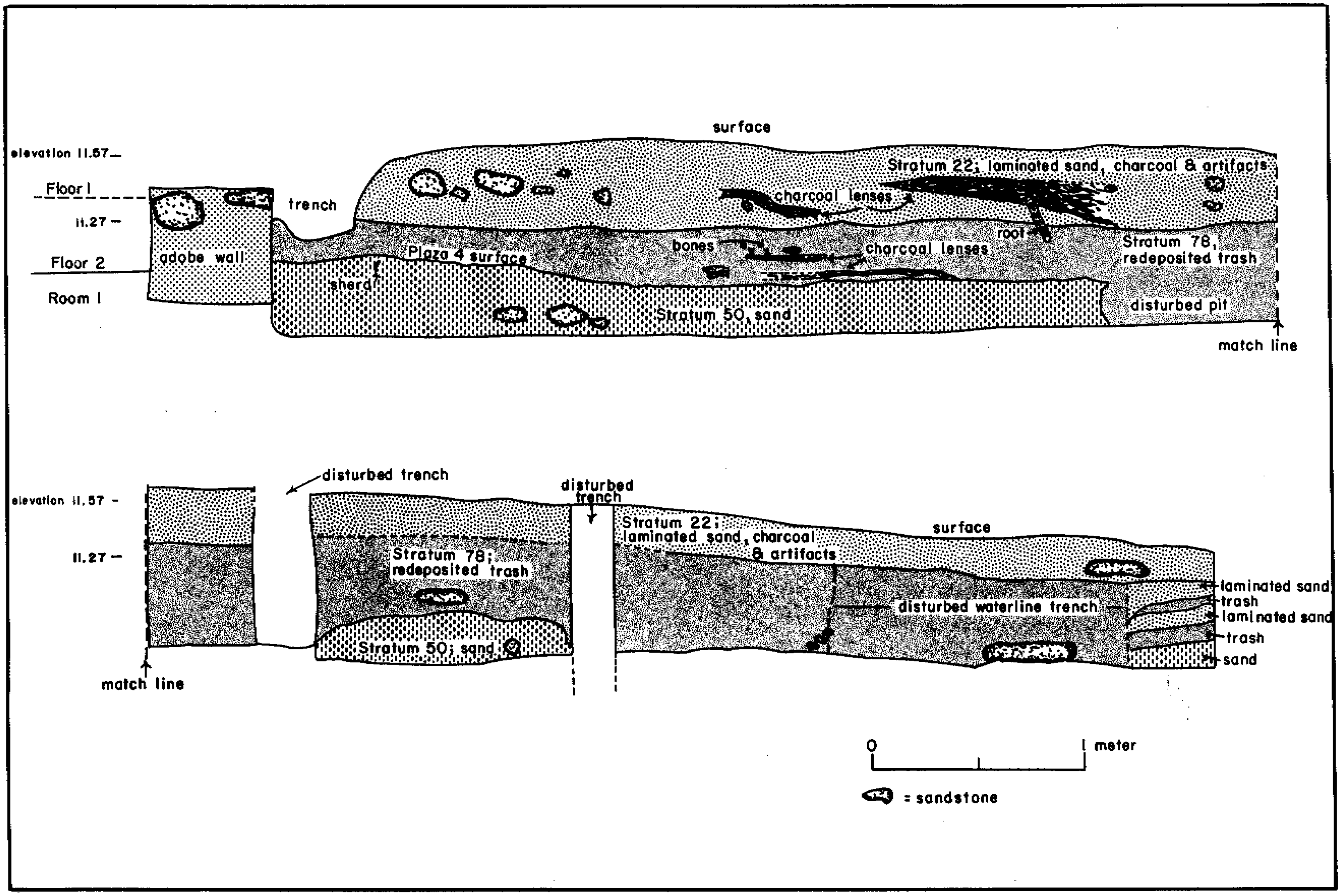


Figure 33. North of Room 1, profile.

debitage, two burned corn cob fragments, cottontail bone, large mammal bone, and two possible arrow shaft fragments. These arrow fragments were made of willow and an undetermined dicot shrub. A radiocarbon sample (Beta-14254) yielded a date of A.D. 477 $\pm$ 80. The ramada had burned and collapsed against the eastern wall of the milling room and onto a plaza surface, although there was a thin 1-2 cm layer of sand present between the ramada and plaza surface.

The plaza surface consisted of a slightly compacted sandy clay that was oxidized and stained by the burned ramada. The surface slopes down from an elevation of about 11.03 m on the west to 10.85 on the east. This is quite interesting in respect to the plaza surfaces observed in the eastern area of the site that also sloped down toward the east. A pollen sample taken from the surface included a large amount of maize with some Cheno-ams, cholla, and prickly pear. Several artifacts were present on the plaza including a Mancos Corrugated jar on a tabular piece of sandstone, a Mancos Black-on-white bowl sherd, a worked white ware sherd, a turquoise pendant fragment, five core reduction flakes, a basalt cobble biface, a basalt unidirectional core, a quartzite multifaceted core, three whole sandstone manos, and a couple of pieces of burned large mammal bone. The corrugated jar is 215 mm high, 195 mm wide, with an opening diameter of 140 mm and a capacity of 4,800 cc. Pollen samples taken from the fill and sherd wash of the jar contained high frequencies of maize pollen with some cholla. Two of the flakes were made of the same brown silicified wood, and an flake and core were of similar green chert, although probably not from the same nodule. Two of the manos were one-hand and wedge shaped in cross section, while the third was a two-hand mano with parallel grinding surfaces. Four features articulated with this plaza surface including a milling room (Feature 39), two hearths (Features 40 and 43), and a pit (Feature 42) (Fig. 34). The plaza also abuts the south wall of Room 13 and is presumably associated with the occupation of the room.

Because the milling room extended further to the west outside of the right-of-way, only a portion was excavated. It measured 1.45 m north-south by 90 cm east-west (partial dimension). The walls range from 20 to 28 cm high and 20 to 25 cm thick. They were constructed of adobe capped with tabular sandstone slabs, except for the south wall, which was made of seven whole and broken manos with adobe mortar. The room fill (Stratum 90) consisted of a sandy clay mixed with bits of charcoal, Mancos Black-on-white, and Mancos Corrugated sherds, debitage, a metate fragment, and a burned corn cob fragment.

The milling bin was situated in the southeast corner of the room. It was constructed of two upright sandstone slabs on the north and south sides and a trough metate fragment along its east side. A granite slab metate with a slightly concave grinding surface was set into the bottom of the bin at an elevation of 10.93 m. A pollen sample [249] analyzed from under the metate included Cheno-ams, cholla, and maize. The presence of maize pollen in this sample, as well as those taken from the ramada and adjacent plaza surface, indicate that corn was probably being processed in the milling bin. A split chert cobble tool was found resting on the metate and a mano fragment was situated just to the west of the slab metate. The total edge perimeter of the tool had been battered. It presumably was used to roughen the grinding surface of the metate. The first floor of the milling room (11.03 m elevation) was composed of a compacted clay and sand mixed with some charcoal. Four cobbles and two mano fragments were laid into the floor near the area where an individual would have kneeled while using the milling bin. A fine-grained sandstone two-hand mano was located on the floor above these cobbles. A coarse-grained two-hand mano with finger grips was situated between the east wall of the milling bin and the eastern wall of the room.

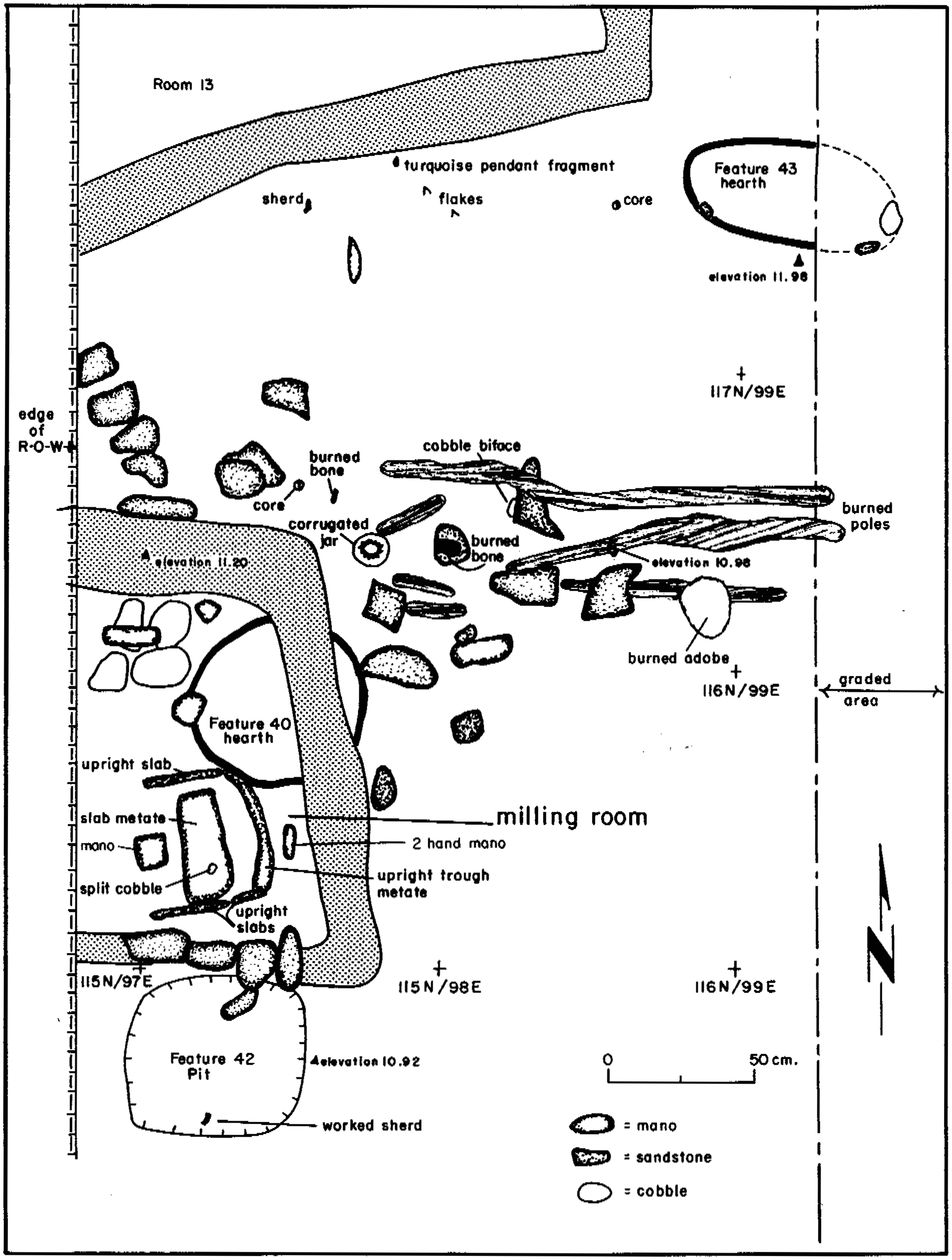


Figure 34. Plaza, south of Room 13.

The first floor was removed and 14 cm of trash (Stratum 93) was excavated including a mixture of clay, sand, charcoal, bits of adobe, sherds, debitage, and bone. This exposed a second floor (Stratum 94) in the milling room that consisted of compacted clay, situated at an elevation of 10.99 m. Two white ware bowl sherds and a hearth (Feature 40) were found on this surface. The eastern wall of the milling room was built on top of this feature. It appears that this hearth was associated with the plaza surface and was used before the construction of the overlying milling room.

Feature 40 consisted of a circular shallow basin hearth. The pit was unburned and adobe-lined. The hearth was reused as there were two separate fill levels. The first level (Stratum 96) contained yellow-brown soil mixed with bits of charcoal, while the second level (Stratum 102) was composed of a fine black soil. Pollen [247] and flotation [248] samples were analyzed from the upper fill of the feature. The pollen sample yielded evidence of Cheno-ams and maize. The flotation sample contained goosefoot, pigweed, Indian ricegrass, and tobacco seeds, with some burned juniper, corn, saltbush, greasewood, and cottonwood/willow.

Feature 42 was a shallow unlined pit measuring 74 by 53 by 13 cm. It slightly undercut the south wall of the milling bin at an elevation of 10.92 m. The sides of the pit were unburned and the fill consisted of a mixture of sand with some flecks of charcoal. This probably reflects post-abandonment fill of the feature.

Feature 43 consisted of a large oblong hearth that measured 90 by 46 by 15 cm. The edge of the pit was partially lined with a cobble and pieces of sandstone. The sides of the pit were oxidized and the fill (Stratum 99) included 13 sherds, debitage, and burned large mammal bone, with some burned sandstone and cobble fragments. Pollen [238] and flotation [237] samples were analyzed from the fill. The pollen included Cheno-ams and greasewood and the flotation contained only one nightshade seed with some cottonwood and ponderosa pine charcoal. The absence of maize pollen and the presence of ponderosa pine charcoal contrasts with other features in the area. This hearth could reflect a later occupation.

Room 13 was defined during the excavation of the milling room and surrounding plaza. It was a rectangular masonry room measuring approximately 1.9 m (east-west) by 2.65 m (north-south). The walls were constructed of a single course of shaped sandstone blocks with adobe mortar set on top of an adobe footing trench. They range in elevation from 11.34 to 11.37 m and width from 15 to 25 cm. The first level removed from the room consisted of 15-70 cm of post-occupational fill and wall fall (Stratum 22). It contained some Cortez Black-on-white, Kiatuthlanna Black-on-white, Burnham Black-on-white, and Mancos Corrugated sherds and debitage. Underlying this was a 2-7 cm thick level of possible roof fall (Stratum 97). It was mainly concentrated in the northeastern corner of the room, with some patches present in the remainder of the area. The inside walls of the room were also burned in this corner. The stratum consisted of a burned mixture of twigs, adobe, bits of charcoal, tabular sandstone slabs, cobbles, a two-hand sandstone mano fragment, a mule deer bone, and Mancos Black-on-white, McElmo Black-on-white, and Mancos Corrugated sherds. Below the roof fall was 10 cm of sandy fill with chunks of charcoal, more wall fall, and some Mancos Black-on-white, and Mancos Corrugated sherds and debitage (Stratum 100). This level exhibited a high degree of rodent disturbance.

Floor 1 (Stratum 101) was defined at an elevation of 11.10 m. There was no discernable prepared surface, rather the floor was defined by the presence of two metates and three mano fragments lying at the same level (Fig. 35). The manos included two sandstone fragments from

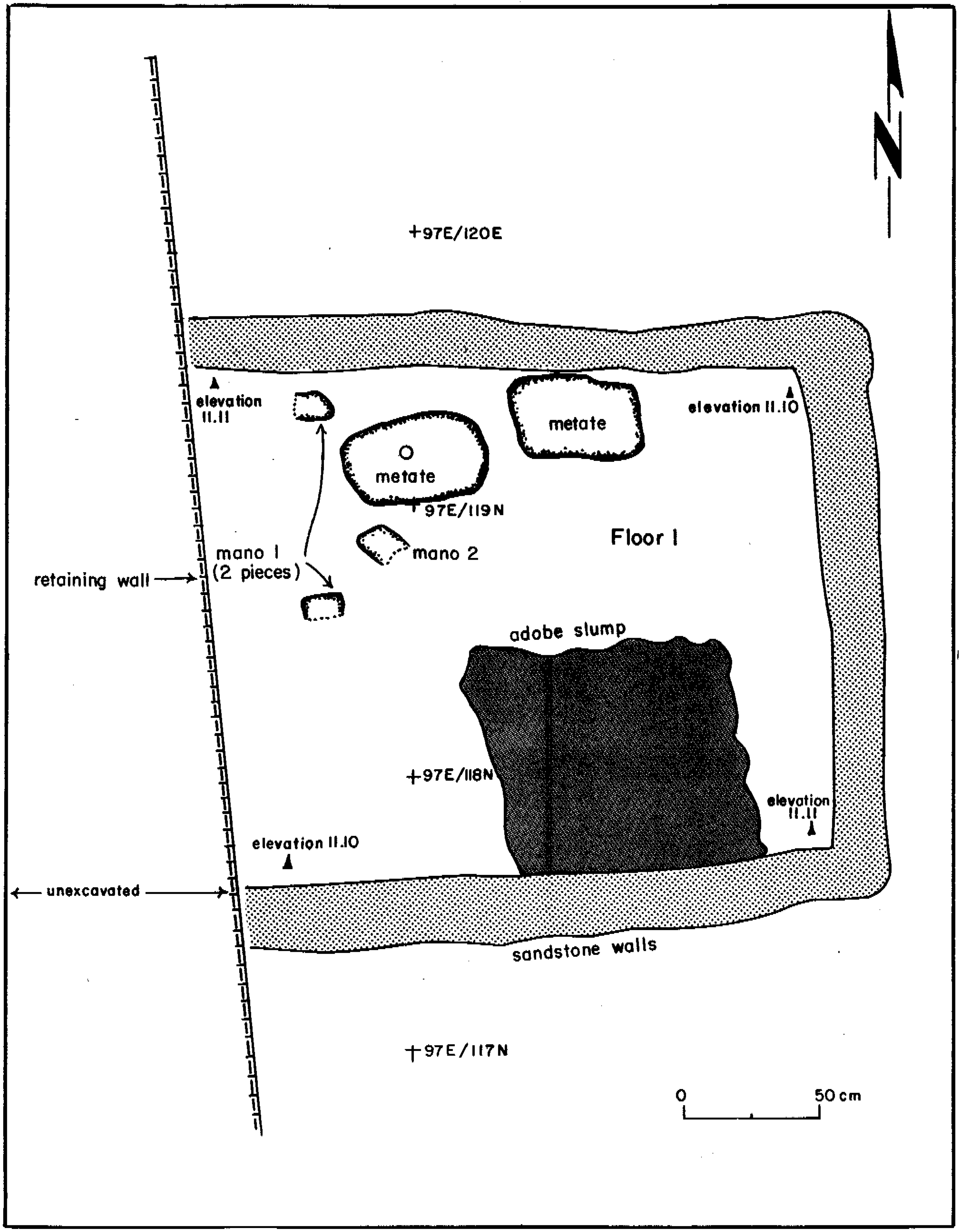


Figure 35. Room 13, Floor 1.

the same artifact (mano 1), and a granite two-hand fragment (mano 2). Both of the metates were very large, about 44 by 37 by 17 cm in size, and weighing about 46 kg. They were roughly shaped sandstone blocks, with a slightly ground surface on one side. The westernmost metate was found lying on a sandstone slab. A pollen sample [245] analyzed from under this metate included Cheno-ams, pinyon, and maize. A large mammal bone, 9 Mancos Black-on-white bowl sherds, 3 white ware sherds, 29 Mancos Corrugated jar sherds, and 1 Mancos Gray jar sherd were found at this level.

Beneath Floor 1 was a 10 cm sandy fill level with pieces of charcoal, chunks of adobe, tabular sandstone fragments, and small cobbles. This was lying on Floor 2 (Stratum 105), which was situated at an elevation of 10.96-11.02 m. The floor was constructed of adobe with multiple cobbles and sandstone slabs set into it (Fig. 36). A thin layer of plaster covered the cobbles and sandstone slabs. No artifacts were found on the surface, but a two-hand sandstone mano with finger grips was in the floor matrix. A pollen [255] and flotation [254] sample were analyzed from the floor near the south wall. The pollen sample included evidence of Cheno-ams, cholla, squash, and maize. The flotation sample contained pigweed, goosefoot, and burned corn.

Two hearth/warming pit features were present in the western (Feature 45) and eastern (Feature 46) sides of the room. Feature 45 was divided into two compartments. Both were adobe lined and upright sandstone slabs were situated along the southern edge of the pits. The uprights stood several centimeters above the floor surface. The western half of the feature was burned, including the sides of the pit and the upright sandstone slabs. This portion was 12 cm deeper than the eastern side of the feature. The eastern side was unburned and a large river cobble had been set into the floor of the pit. It would appear that the western half of the feature represents a hearth and the eastern half a warming pit. Fill from both sides of the feature consisted of a sandy loam with bits of charcoal, debitage, and Mancos Corrugated sherds. A flotation sample [262], wood sample [263], and C-14 sample [261] were analyzed from the hearth fill. The flotation sample contained pigweed, goosefoot, purslane, sedge family, globemallow seeds, some burned corn, saltbush, and cottonwood. The radiocarbon sample (Beta-14257) yielded a date of A.D. 1013 $\pm$ 60.

Feature 46 was also divided into two adobe-lined pits. The eastern side was partially oxidized and 6 cm deeper than the western side. The pit fill consisted of a sandy loam mixed with pieces of charcoal, ash, Mancos Black-on-white sherds, and debitage (Stratum 109). A small ash lens about 2 cm thick was present on the bottom of the pit. A pollen [265] and flotation [264] sample were analyzed from the ash lense. The pollen sample included Cheno-ams and maize and the flotation sample two saltbush and goosefoot seeds with some burned corn and saltbush. The western side of the feature was mostly unburned, although there was a small oxidized patch of soil in the southwestern corner of the pit. The fill included pieces of charcoal, Mancos Black-on-white sherds, and debitage. A pollen [267] and flotation [266] sample were also analyzed from this fill in contrast with the opposite side of the feature. The pollen sample included evidence of Cheno-ams and maize, and the flotation contained seven pigweed and three goosefoot seeds, with some saltbush, cottonwood, rabbitbrush, juniper, and pinyon charcoal. The eastern half of the feature was probably used as a hearth and the western half as a warming pit. It is interesting that a greater diversity of charcoal was found on the western side of the feature. This may be the result of ash from the hearth being systematically placed in the warming pit.

Grid 118N/99E was excavated as a subfloor test pit in the southeastern corner of Room 13. The first excavated level included about 45 cm of redeposited trash (Stratum 103). It consisted of a laminated sandy fill mixed with oxidized soil, chunks of charcoal, burned and

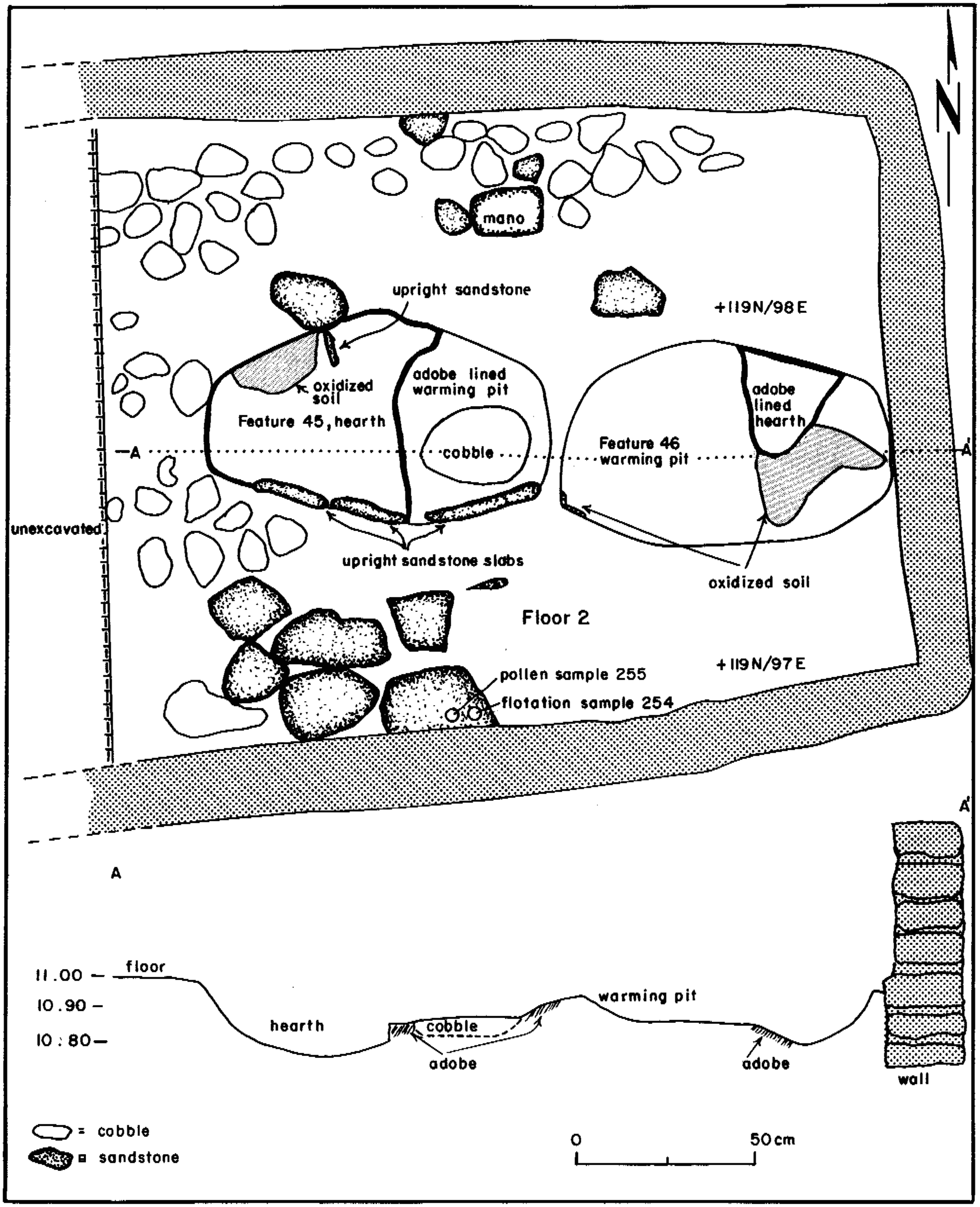


Figure 36. Room 13, Floor 2.

unburned adobe, cobbles, sandstone blocks, Cortez Black-on-white, Mancos Black-on-white, and Mancos Corrugated sherds, debitage, cottontail bone, large mammal bone, three two-hand sandstone mano fragments, and a large burned cobble that was used as an anvil. A radiocarbon sample (Beta-14255) yielded a date of A.D. 662 ± 70.

Underlying this redeposited trash was a 55 cm level of building debris (Stratum 104). It also consisted of a laminated sand matrix, but contained fewer artifacts than Stratum 103. The level was dominated by sandstone blocks and river cobbles, with pieces of charcoal, sherds, debitage, mule deer bone, a sandstone mano fragment, sandstone and cobble metate fragments, a ground piece of tabular sandstone and a quartzite cobble hammerstone. The pottery included Cortez Black-on-white, La Plata Black-on-red, and Mancos Corrugated. The discontinuous nature of the deposit and the absence of any rooms at this level in the area indicate that this stratum does not represent wall fall, but a discard pile of construction debris.

A backhoe trench was dug to the north of Room 13 to determine if there were any other rooms, features, or cultural deposits buried in the area (Fig. 37). The trench was 9.5 m long, 50 cm wide, and 1.75 m deep. There were no rooms present, but at least two hearths, some redeposited trash, and two surfaces were defined. Only remnants of the hearth located on the northern end of the profile remained. This included the oxidized edges of what probably was an unlined shallow basin pit situated at an elevation of about 11.75 m. A structurally similar hearth was exposed 10 cm lower (11.65 m) on the southern end of the profile (Feature 53). It consisted of an unlined shallow basin pit with oxidized sides, 50 cm wide and 10 cm deep. The pit was filled with ash charcoal (Stratum 121). One Cortez Black-on-white sherd was recovered from the fill. Pollen [319], flotation [320], and C-14 [321] samples were analyzed from the hearth. The pollen sample included evidence of cholla and maize. The flotation sample mainly contained saltbush seeds with some pigweed, winged pigweed, nightshade, Indian ricegrass, hedgehog cactus, prickly pear, goosefoot, and globemallow, with some burned corn, saltbush, rabbitbrush, and juniper. The radiocarbon sample (Beta-14259) yielded a date of A.D. 1291 ± 60. Although an occupational surface(s) must have been associated with these features, none was observed.

A plaza surface was defined in the profile at an elevation of about 11.25-11.35 m. This plaza may be associated with the isolated wall segments and surface located on the southern side of Room 13, which were situated at about the same elevation.

Another plaza surface was defined in the profile at an elevation of about 10.80 m, separated from the upper surface by laminated sand. This lower surface may be associated with the occupation of Room 13 and the plaza excavated on the southern side of the room. No cultural material was observed under this lower plaza surface, only laminated sand and a gravel lens were present.

There appear to be at least four occupation episodes in the area of Room 13. The first occupation was represented by the construction debris and trash strata underlying Room 13 and the plaza. The material was obviously discarded in this area from somewhere else on the site. It could be from the southern room block or the main room block located to the west underneath the A-Z Auto Parts building.

The major occupation was associated with the construction and use of Room 13 and the surrounding plaza surface. However, there are three remodeling episodes represented within Room 13 and two in the plaza. Room 13, Floor 2, and Feature 46 were constructed. Feature 46 was then abandoned and plastered over, with Feature 45 built and used for the same

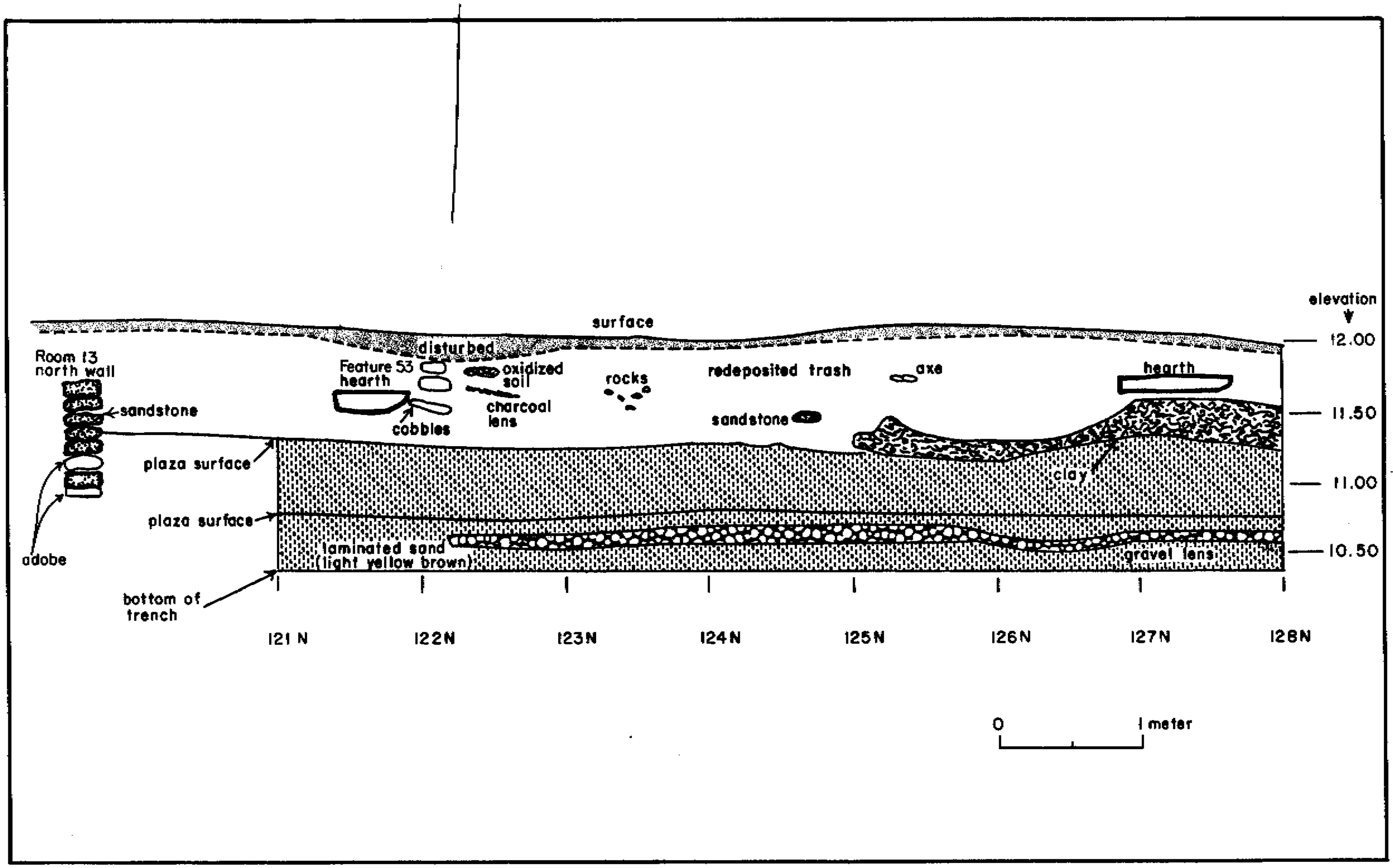


Figure 37. Profile of backhoe trench, north of Room 13.

hearth/warming pit function. It is unlikely that both features were used at the same time since together they would have taken up most of the available floor space. The room was vacated and then reused when Floor 1 was built. However, the function of the room may have changed from a residential one to possibly that of a storage or milling room. Floor 1 was not prepared like Floor 2, nor were there any features associated with Floor 1, except for two large metates.

The plaza area to the south of Room 13 also exhibited some remodeling. It is difficult to determine the contemporaneity among Features 40, 42, and 43, all of which are situated on the plaza surface. However, the milling room (Feature 39) was constructed on top of Features 40 and 42. Later the ramada burned and fell onto the plaza and the eastern wall of the milling room. It has not been determined how the addition of the milling room in the plaza is associated with the remodeling in Room 13. The radiocarbon date associated with the ramada appears to be much too early when compared with the ceramics and the date from Floor 2 of Room 13.

The third occupation was associated with the two isolated wall segments and associated surface situated to the south of Room 13 and a plaza surface situated to the north of the room. Although these two areas were not stratigraphically linked together, they both did lay at about the same elevation.

The last occupation was associated with the two hearths found in the west profile of the backhoe trench dug to the north of Room 13. These were about 55-65 cm higher than the floors in Room 13 and had a radiocarbon date about 200 years later.

North Plaza

The north plaza was situated about 20 m north of Room 13. Test Pit 16 (141N/99-100E) defined the presence of subsurface trash deposits in this area. Excavation then continued into grids 139-140N/99-100E. The first 15-45 cm removed consisted of disturbed and redeposited fill (Stratum 22). The second level excavated included about 7-15 cm of redeposited trash (Stratum 89). It was made up of laminated sand mixed with pockets of ash and charcoal, gravel, Cortez Black-on-white, La Plata Black-on-red, and Mancos Corrugated sherds, debitage, a ground piece of tabular sandstone, four burned corn cob fragments, jackrabbit bone, cottontail bone, and large mammal bone.

The next level to be excavated was similar to Stratum 89, except that it contained more laminated sand with only a few pockets of ash and charcoal (Stratum 92). These seemed to be the result of rodent disturbance. This stratum was 7-30 cm thick and included some gravel, burned adobe, burned and unburned sandstone, sherds, debitage, a basalt cobble biface, four one-hand and two-hand manos (whole and fragments), a ground piece of tabular sandstone, four burned corn cob fragments, and jackrabbit bone, mule deer bone, and cottontail bone. Cortez Black-on-white, Mancos Black-on-white, Red Mesa Black-on-white, Mancos Gray, and Mancos Corrugated were some of the pottery present. The outline of a large pit was defined at the bottom of this level.

The pit (Feature 41) was situated at an elevation of 10.87 m. It had been partially excavated through in Test Pit 16. The partial dimensions of the feature are 1.4 m (north-south) by 1.1 m (east-west), with a depth of 37 cm (Fig. 38). It was unlined and filled with an unconsolidated mixture of ash and charcoal with some laminated sand (Stratum 95). Since the sides of the pit were not oxidized, it would appear that the ash and charcoal fill was discarded

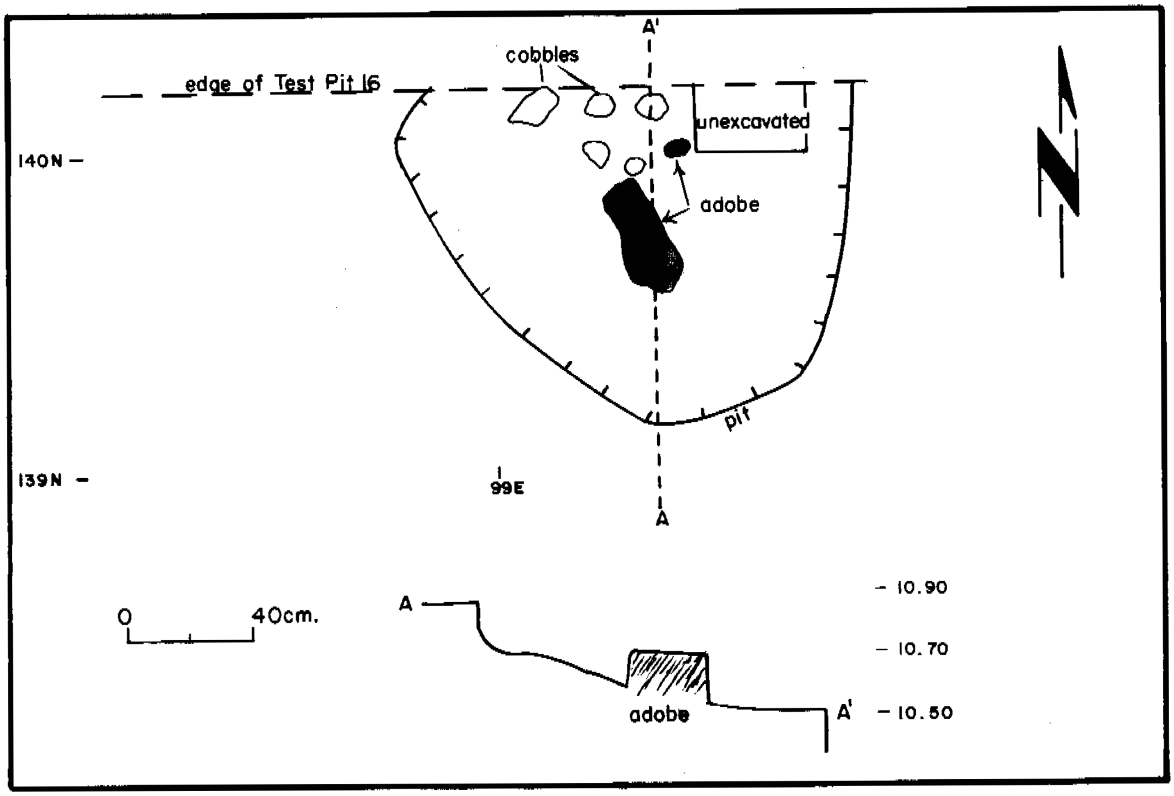


Figure 38. Feature 41, plan and profile.

here. A pollen [243] and flotation [244] sample were analyzed. The pollen sample yielded evidence of Cheno-ams, cholla, prickly pear, and maize. The flotation sample contained goosefoot, beeweed, sedge family, nightshade, and globemallow seeds, with some burned corn, cottonwood, juniper, ponderosa pine, saltbush, and rabbitbrush. The fill also included some gravel, burned and unburned cobbles, tabular sandstone, and chunks of adobe, along with sherds, debitage, four cores, a burned one-hand andesite mano fragment, a two-hand sandstone mano fragment, seven burned corn cob fragments, jackrabbit bone, and large mammal bone. Cortez Black-on-white, Newcomb Black-on-white, La Plata Black-on-red, Mancos Gray, and Mancos Corrugated sherds were present. All of this material may represent the contents of domestic hearths that were disposed of here. A large puddled adobe block was situated on the bottom of the pit along with several other smaller adobe chunks. This feature may have originally acted as a borrow pit or was used to mix adobe.

Excavations continued below the feature. This level was mainly composed of laminated sand and gravel with a few sherds (Red Mesa Black-on-white, Mancos Black-on-white, Bluff Black-on-red, La Plata Black-on-red, Mancos Gray, and Mancos Corrugated, debitage, and pieces of charcoal (Stratum 106). A mano and Cortez Black-on-white sherds were recovered at an elevation of 10.42 m. The top of an upright sandstone slab was also exposed at this elevation. The next level was excavated to about 10.22 m (Stratum 106). Here an occupation surface was defined, which was associated with the upright slab. This slab was then determined to be part of a milling bin. Very little cultural material was found in the level including a few Toadlena Black-on-white and Mancos Gray sherds, debitage, two cores, a burned corn cob fragment, cottontail bone, prairie dog bone, mule deer bone, and turkey eggshell. A 15 cm thick gravel lens was present about 10 cm above the occupation surface.

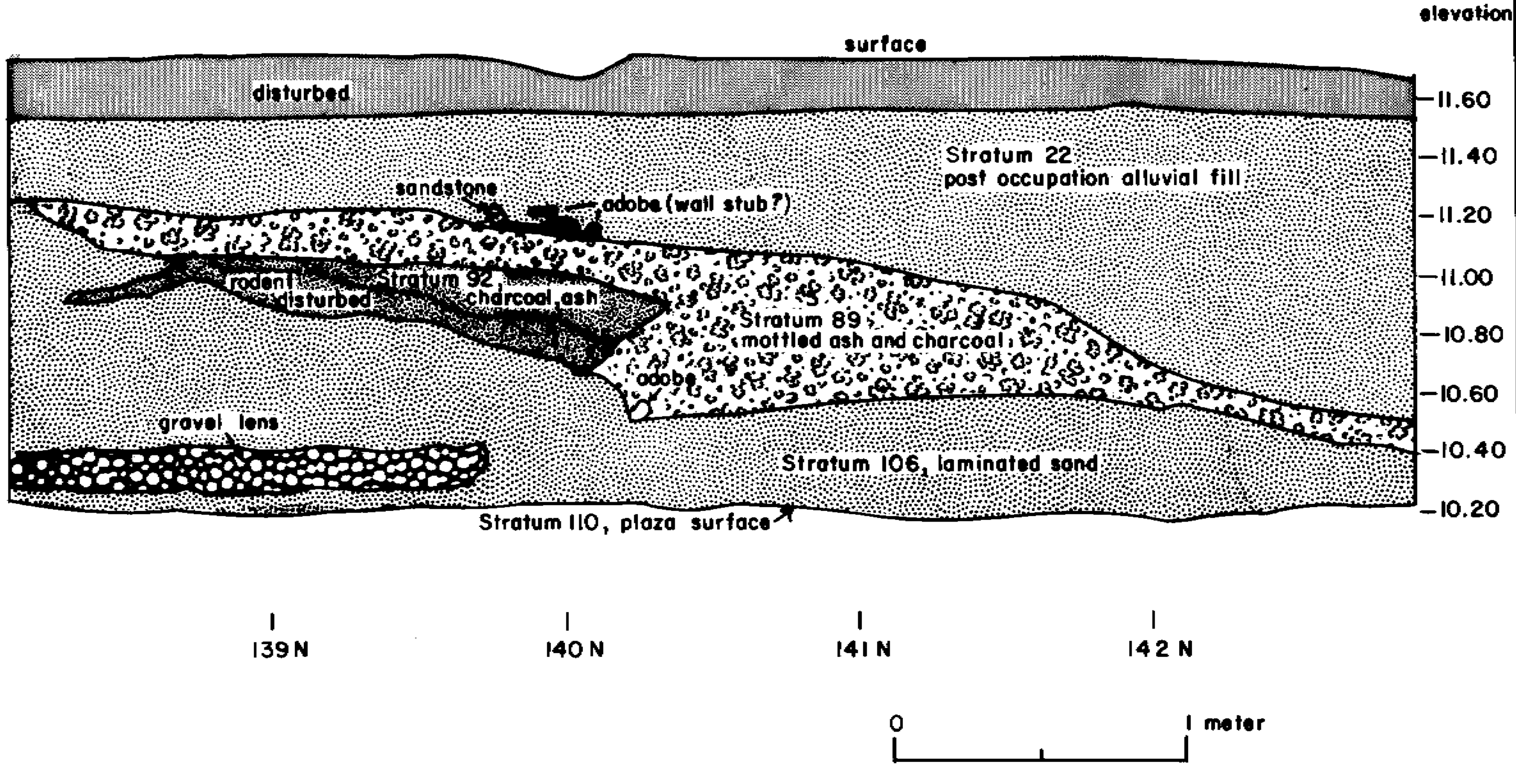


Figure 39. West profile of north plaza excavation.

Grids 141-143N/99-100E were then excavated down to the level associated with the milling bin. Figure 39 shows the west wall profile of the excavated area. The occupation surface (Stratum 110) was defined by the presence of a thin compacted layer of sand that had been trampled down in the immediate area surrounding several features. Other than the milling bin, three possible hearths and seven artifacts were exposed on the surface at an elevation of 10.19-10.22 m (Figs. 40, 41).

The milling bin (Feature 47/48) was located on the southern end of the area (140N/100E). It was composed of two upright sandstone slabs with an adobe-lined metate rest between them. The uprights were 20 cm above the floor of the bin. The feature opened to the west where another small upright was situated, although this one was flush with the floor of the bin. An adobe-lined pit was present at the opposite end of the feature. It had an adobe collar that also connected it with another adobe-lined pit immediately north. The fill of the bin and southern pit mainly consisted of melted adobe chunks with some laminated sand (Stratum 115). A quartzite cobble hammerstone was recovered from the fill of the southern pit. The northern pit contained laminated sand with a Mancos Gray sherd, a vertebra, a mano fragment, and a flake (Stratum 111). Pollen samples [261 and 270] were analyzed from the bottom of both pits. The southern pit contained a large amount of maize and some Cheno-ams. While the northern pit contained a large amount of maize pollen, with some Cheno-ams, it also exhibited evidence of cholla and prickly pear. The floor of the bin was situated at an elevation of 10.20 m and the bottom of the pits at 10.05 m. Altogether the feature was about 1.10 m (north-south) by 1.10 m (east-west). The milling bin floor where the metate would have rested was 60 by 50 cm in size and the pits about 40 by 45 cm. Some sort of container was probably placed in the pits to hold the ground flour.

A possible hearth (Feature 49) was situated on the northern end of the surface (142N/100-101E), about 80 cm north of the milling bin. It consists of a shallow unlined basin-shaped pit, 42 by 36 by 5 cm. The sides of the pit did not appear to be burned. It was filled with a mixture of stained soil, charcoal, some burned corn cob fragments, and a little gravel (Stratum 112). A pollen [258], flotation [259], and C-14 sample [260] were analyzed. The pollen sample included Cheno-ams and maize, while the flotation contained pigweed, sedge family, and corn seeds, with some burned corn, saltbush, sagebrush, rabbitbrush, juniper, and cottonwood/willow. The radiocarbon sample (Beta-14256) yielded a date of A.D. 798 ± 50. This fill may not have been burned in situ, but was discarded here from other nearby hearths.

Feature 50 was a small unlined basin-shaped pit (18 by 18 by 2 cm) situated about 40 cm southeast of Feature 49. The sides of the feature are oxidized and the pit is filled with stained soil and charcoal (Stratum 113). A similar hearth (Feature 51) was located about 40 cm south of Feature 50. It too is an unlined basin-shaped pit (28 by 23 by 2 cm) with oxidized sides. The fill consisted of stained soil mixed with charcoal (Stratum 114). Pollen samples [269 and 272] were analyzed from both hearths. They included evidence of Cheno-ams and maize.

Several artifacts were scattered on the surface and around the features. A wedge-shaped two-hand sandstone mano, a silicified wood core reduction flake, and quartzite cobble hammerstone were located 40 cm west of the milling bin. A large sandstone cobble two-hand mano was found about 20 cm northeast of Feature 51. A pollen sample [257] taken from under this mano yielded evidence of Cheno-ams, *Pinus* sp., prickly pear, and maize. A chert core, an Abajo Polychrome sherd, and a one-hand cobble mano/biface were just south of Feature 49.

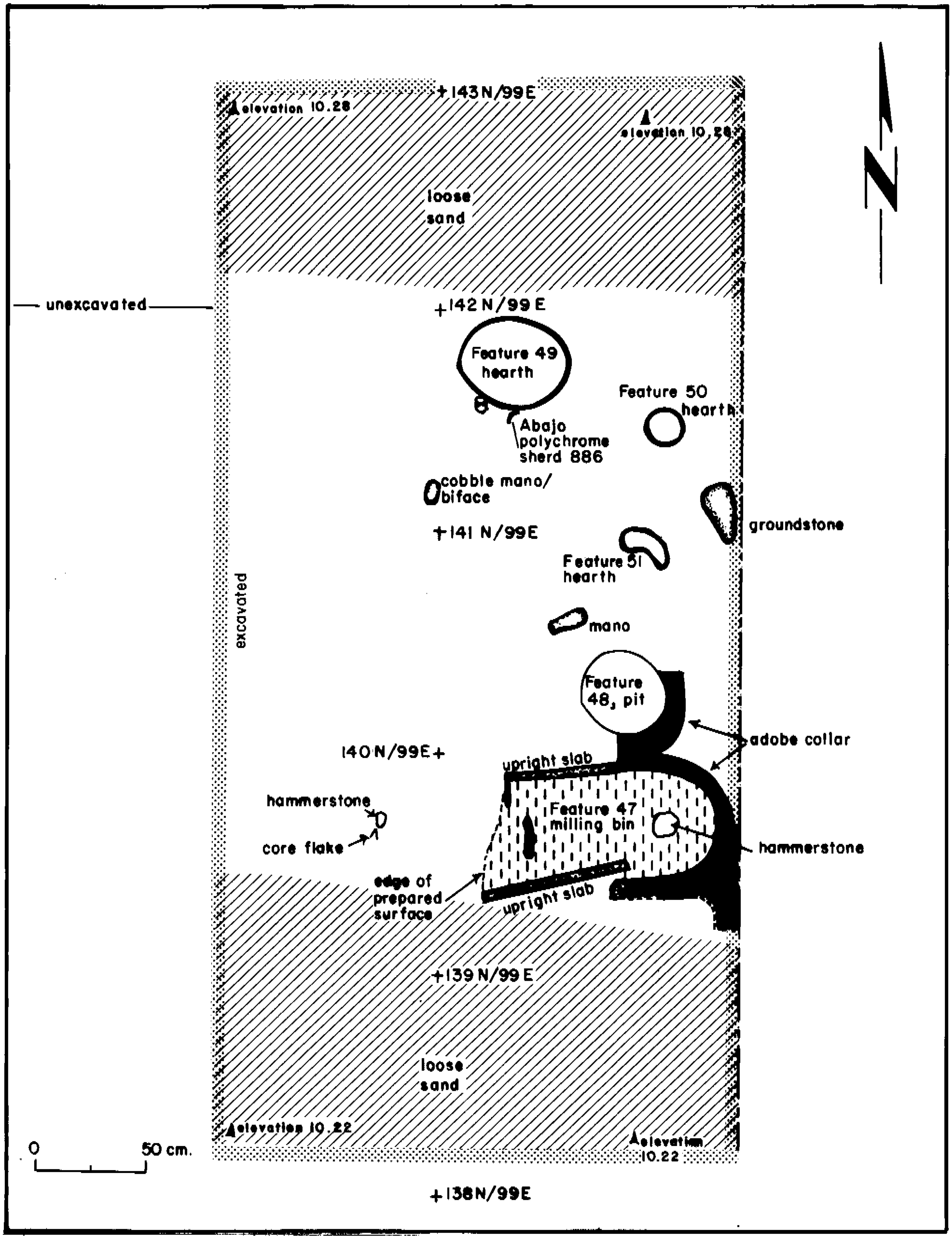


Figure 40. Stratum 110, occupational surface.

Figure 41. Stratum 110, Features 47-51.

The surface and features were probably part of an open-air activity area or plaza surface. There were no indications of these features located within any kind of enclosed space. Culturally sterile laminated sand (Stratum 50) occurred below the surface.

Pit Structure

Once the excavation of the area along the west side of the highway was completed, the utility company was allowed to lay their cable. This consisted of digging a narrow north-south trench over the length of the site, in the graded area between where the room block and test pits were located and the highway. Only one location exposed subsurface cultural deposits. This was between and just east of Test Pits 13 and 14. Upon examination, it was determined that the ditch-witch had cut through the eastern edge of a circular pit structure. About 1.6 m of overburden was removed to what appeared to be roof near the top of the structure's wall. This

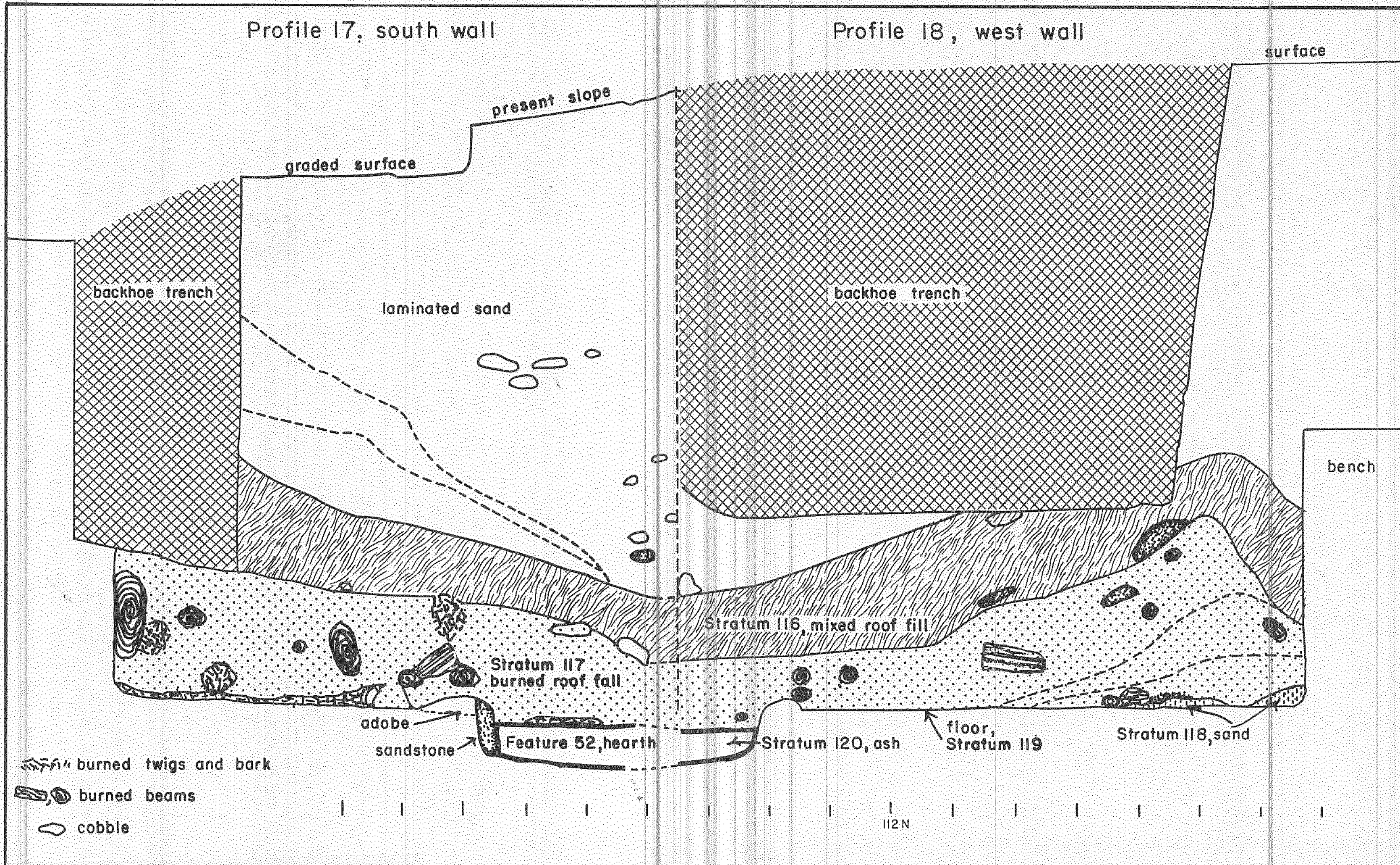


Figure 42. Pit structure profile.

layer consisted of laminated sands mixed with some artifacts and charcoal. Grids were laid out (111-112N/100-102E) and excavation began at an elevation of 9.41 m, about 30 cm below the top of the wall. Only the northeastern quarter of the structure was excavated. This was where the disturbance had occurred and no other impact on the structure was anticipated from the highway construction work.

The first 11-26 cm level excavated consisted of laminated sand mixed with burned and unburned adobe, charcoal, burned and unburned cobbles and sandstone blocks, sherds, debitage, cores, hammerstone, ground stone, a pestle, a retouched tool, jackrabbit bone, cottontail bone, pocket gopher bone, mule deer bone, skunk bone, a bone awl, and a corn shank (Stratum 116) (Fig. 42). The pottery from this level included Cortez Black-on-white, Kiatuthlanna Black-on-white, Red Mesa Black-on-white, Gallup Black-on-white, La Plata Black-on-red, Mancos Gray, Mancos Corrugated, and some brown ware sherds. Half of an incised Mancos Corrugated jar that had been badly burned was also recovered from this level. It is about 330 mm high, 300 mm wide, with an opening diameter of 170 mm. This probably represents a mixture of post-occupational fill, wall fall, and roof fall. The bottom of this level exposed several burned roof beams near the wall in the eastern area of the excavation, with burned and unburned soil in other areas.

The second 30-84 cm level consisted of the burned roof (Stratum 117). The roof was relatively intact and appeared to have burned and fallen partially onto the floor and a sandy fill. The roof can be divided into two major sections. One section consisted of about nine beams. These were situated adjacent to the wall and followed its curvature (Fig. 43). Three beams [283-285] were encased together with a mixture of clay, bark, and twigs. This could have acted to unite the beams into a single element. A fourth beam [289] was found directly beneath these beams, although it was not wrapped like the rest. Roofing material was present in the area of beams 280 and 282. Samples [276 and 277] of this material included saltbush mixed with corn leaves and corn stems.

The central portion of the roof was constructed of a series of poles laid across or perpendicular to each other. This was in contrast to the outside beams, which were laid parallel to each other. The roof consisted of two major sections. The outer section was built of about nine large beams, 8-15 cm in diameter. These may represent the remains of a modified cribbed form of roof construction. Several of the underlying beams could have been cribbed, with the top three beams forming a single element that was situated on top of the rest. If so, this larger element could then have articulated with the flat roof that was made of smaller (6-8 cm diameter) cross-hatched poles. A layer of twigs, bark, and corn-husk roofing material was then laid onto the framework, which was in turn covered with a layer of adobe (Fig. 44). The corn husks may simply have been on the roof and might not have been intentionally incorporated into it. A problem with this reconstruction is that the flat, top portion of the roof and the articulating main element could have needed support beams from the floor to hold them up. There was no evidence of any upright posts found on the floor. If there were four main support posts, then we should have found one in the quarter of the room we excavated. There was no evidence of upright posts found on the excavated portions of the bench.

Very few artifacts were recovered from the roof fill. These included some Cortez Black-on-white and Mancos Corrugated sherds, debitage, cottontail bone, jackrabbit bone, large mammal bone, and ten burned corn cob fragments. Burned corn cobs, corn husks, and cob stems were mixed in with the bark and twigs found around the beams. Burned adobe casts were also recovered. These were large fragments with latilla- and twig-size impressions, none of which

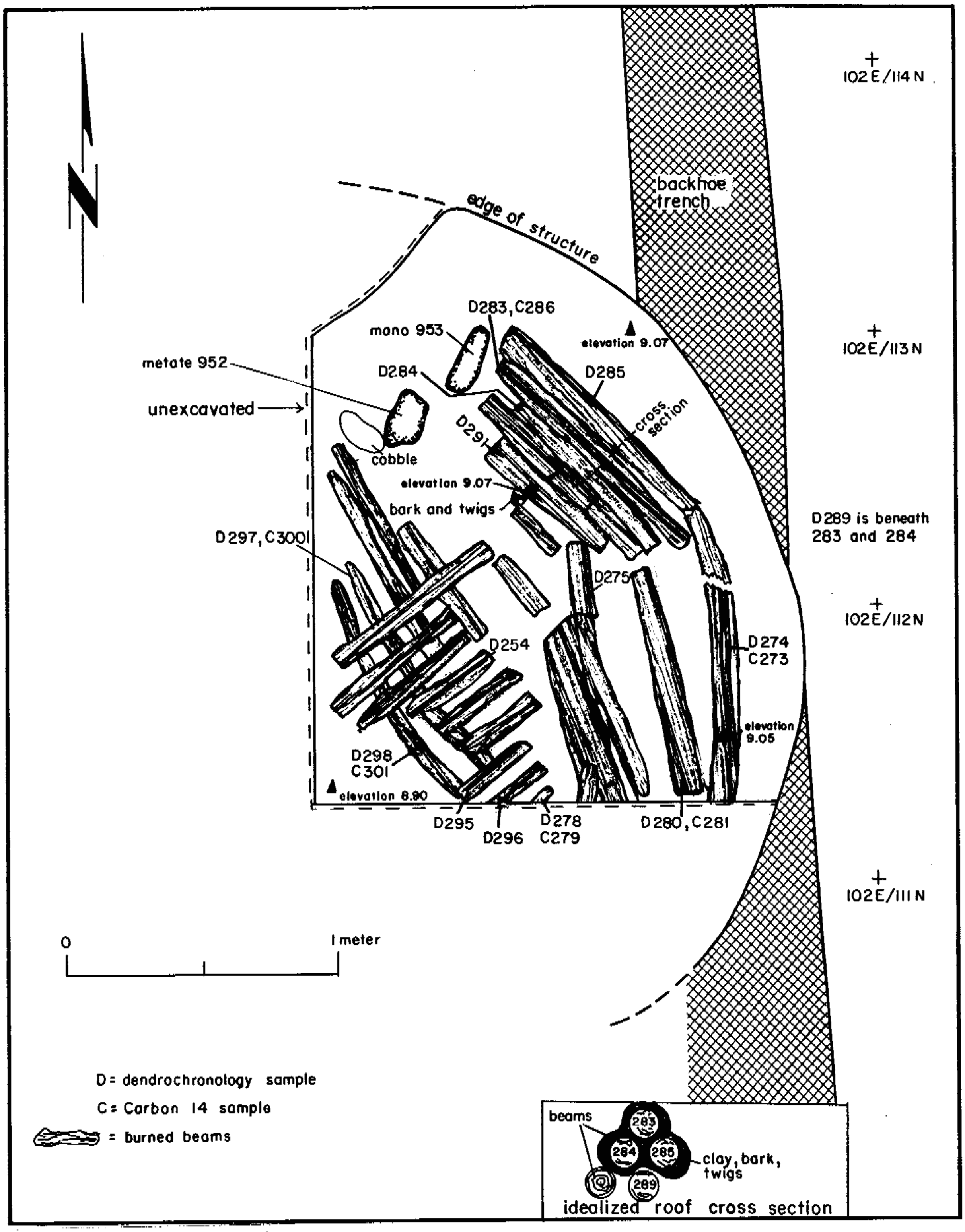


Figure 43. Pit structure roof.

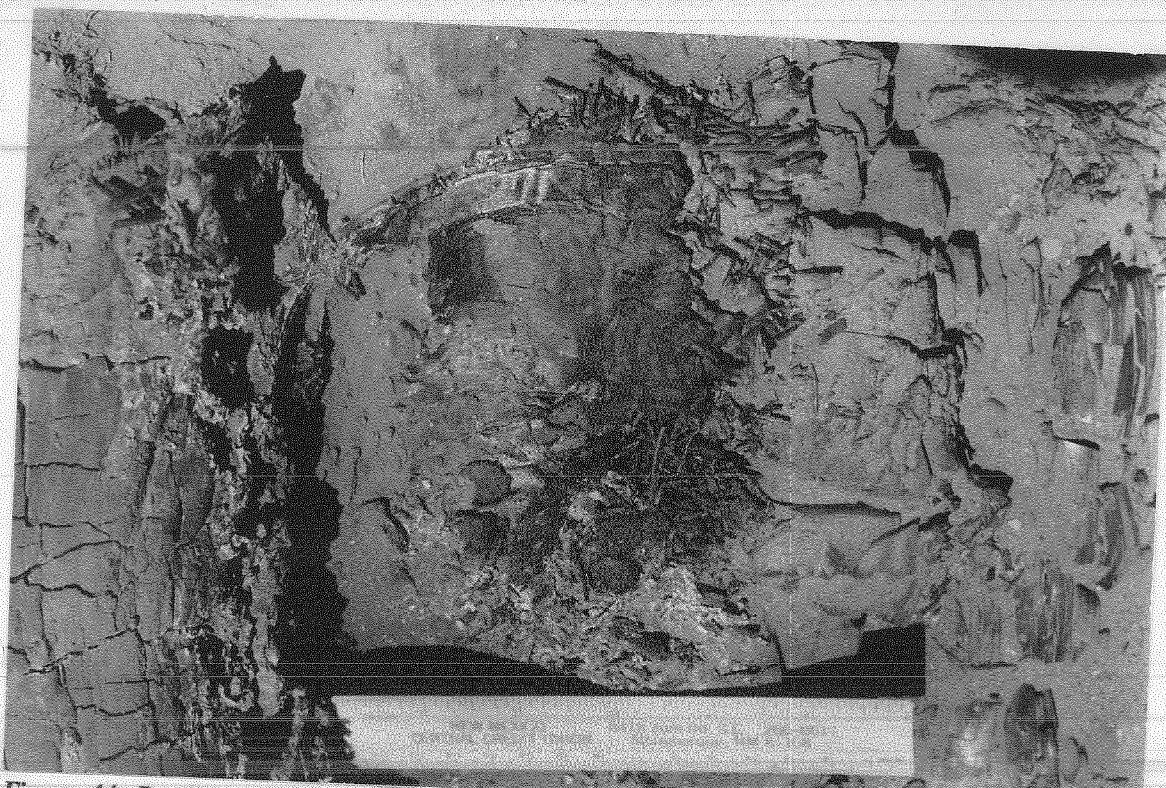


Figure 44. Roofing material: a layer of twigs, bark, and corn husks laid onto the framework, then covered with adobe.

still held any poles. A two-hand cobble mano and a metate fragment were found lying on the roof. They were probably in this context when the roof burned and collapsed as they too were burned.

Seventeen tree-ring samples were analyzed. None of these were datable because they consisted of *Populus* sp., probably cottonwood (Robinson, personal communication). One beam from the outside roof section was made of juniper. A C-14 sample (Beta-14258) was analyzed from beam 283). It yielded a date of A.D. 786 ± 60. The corn cobs from the roof dated A.D. 714 ± 60 (Beta-15041).

The structure had obviously been abandoned before the roof had burned and collapsed. A 3-15 cm layer of sand had blown into the room against the northern wall (Stratum 118). The roof had collapsed directly onto the central portion of the floor and this area was clear. Three artifact were found on the deposit of sand. One of these was a portion of a shaped wooden (cottonwood/willow) stick (15 by 5 by 2 cm), which could be the remains of a digging stick (Fig. 45). The second artifact was part of a Mancos Corrugated pitcher. A pollen sample [304] was analyzed from the pitcher and yielded evidence of Cheno-ams, cholla, prickly pear, and maize. The last item was a twill-plaited basket fragment made of flattened monocot stems (for example, sedges or rushes). The basket appears to have been lined with some minute aligned fibers (not grass) and the remainder of the contents was badly burned (Fig. 47). The contents were carbonized, leaving a bubbled and glazed appearance. A yucca knot was also present in the basket. A flotation sample [305] was analyzed from the area around the basket and contained five goosefoot, saltbush, pigweed, and globemallow seeds. A Mancos Corrugated jar/sherd was found in the southwestern area of the excavation partially on the floor and the sandy fill. Two

Figure 45. Shaped digging stick.

utilized Cortez Black-on-white sherds were also recovered from this level.

The floor of the pit structure (Stratum 119) consisted of a prepared plaster surface located at an elevation of about 8.80 m. It was about 1 cm thick and had been coped to the bottom of the surrounding walls. Most of it had been burned, except for the section covered by the sand. Only one artifact was found on the floor. This was a burned wooden object (Fig. 46a). It is 30 by 33 mm in size and 7 mm thick. The artifact has been notched or serrated along its perimeter and a hole has been drilled through it. The presence of this hole may indicate that the object was used as a pendant. Artifact similar to this one were described as scalloped discs by Vivian et al. (1978). A pollen [313] and a flotation [303] sample were analyzed from the north wall area on the floor. The pollen sample yielded evidence of *Pinus* sp., Cheno-ams, and maize. The flotation sample contained pigweed, saltbush, and goosefoot seeds with some burned corn, juniper, saltbush, and cottonwood.

A hearth (Feature 52) was located in the center of the floor, of which about one-half was excavated (Fig. 48). The feature had an adobe collar that was coped to the floor and partially continued into the pit. A sandstone block lined the eastern side of the pit. The fill (Stratum 120) consisted of ash and charcoal, with three core flakes. A pollen [314] and flotation [309] sample were analyzed. No pollen was recovered, however the flotation sample contained nightshade, goosefoot, and pigweed seeds, with burned juniper, corn, saltbush, rabbitbrush, and cottonwood/willow.

Portions of a bench were excavated along the northern and southern edges of the pit structure. The benches were situated 95 cm above the floor. The north bench was 50 cm wide, with the outside pit-wall rising up another 20 cm to meet the old ground surface. The southern bench was 84 cm wide and the outside pit wall was 34 cm high. The adobe facing on the inside

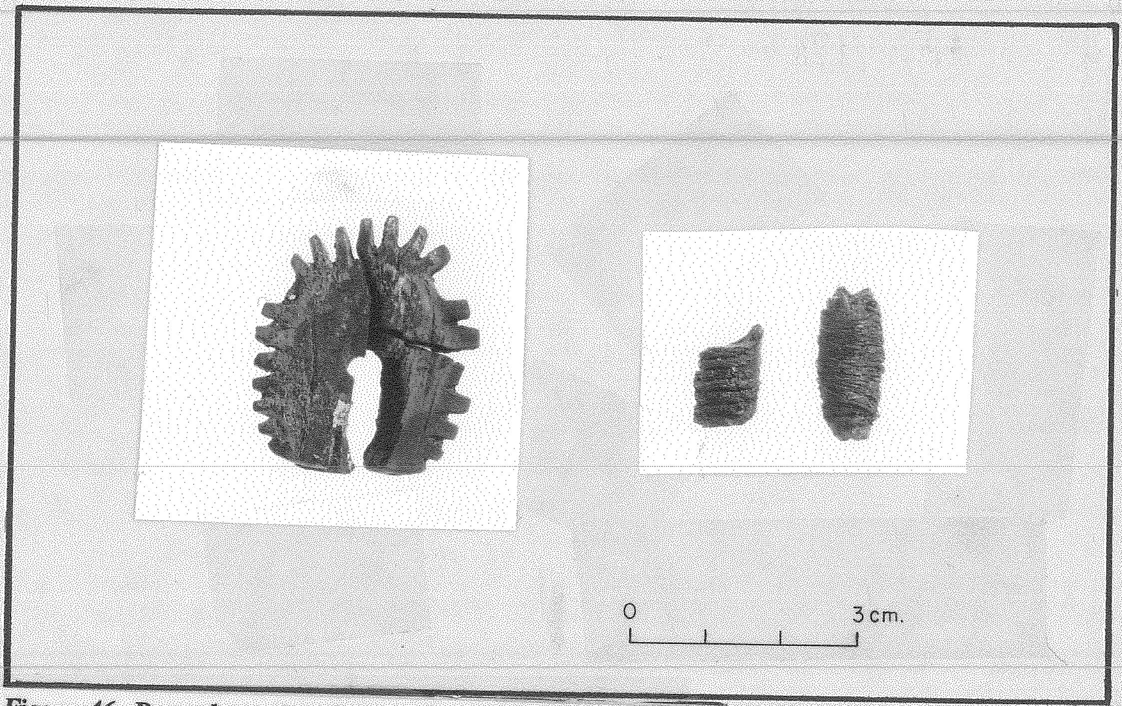


Figure 46. Burned wooden object and arrow shaft fragment.

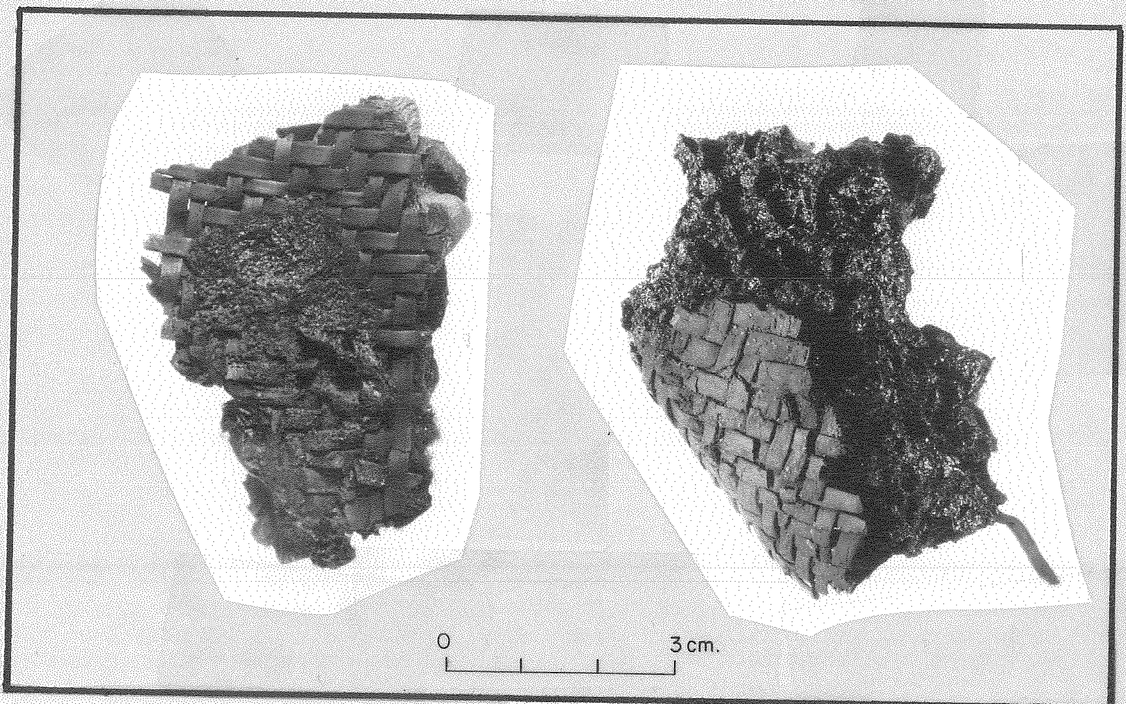


Figure 47. Twill-plaited basket fragment.

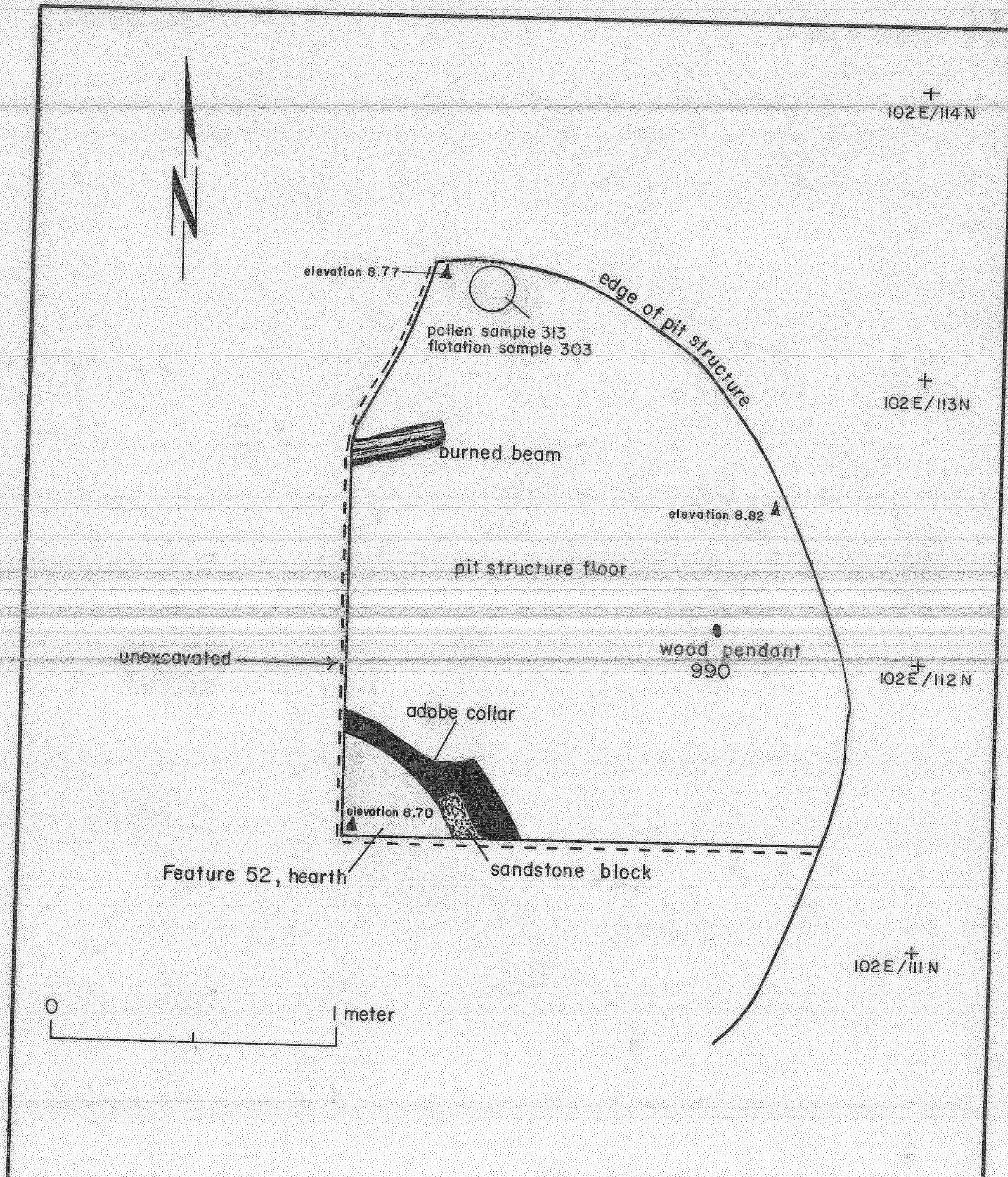


Figure 48. Pit structure floor.

pit wall curves over and copes the edge of the benches and continues onto the benches for about 14 cm. Otherwise, the benches were mainly unplastered, having simply been cut into the native soil. The bench surfaces were burned, with some burned twigs present. The only structural element found on the benches was a single latilla-size pole on the south bench. Four possible beans [317] were recovered from the north bench and a corn cob was visible in the backhoe trench profile of the east bench. This cob was later stolen from its in situ context and was not available for analysis. a large primary flake tool, a cottontail bone, and a Cortez Black-on-white and two Mancos Corrugated jar sherds were also recovered from the south bench. The north bench pollen sample included pinyon, Cheno-ams, and maize, while the south bench sample included Cheno-ams, buffalo gourd, and maize. The flotation sample contained saltbush and pigweed seeds with saltbush and cottonwood/willow charcoal.

The pit structure was determined to be about 2.5 m wide between the inside walls and 4 m wide including the benches. The top of the north wall above the bench was situated at an elevation of 9.86 m. This presumably represented the old ground surface. The pit structure was dug a total depth of about 1.3 m into sandy soils, with the main pit 95 cm below the benches. The bottom of the pit was lined with upright sandstone slabs, 30-40 cm high in some areas, and a mixture of adobe with a few corn cobs and pieces of sandstone in others. Above this pit was simply lined with adobe, which occasionally had some small sandstone blocks or cobbles set into it. Two to three layers of plaster were then placed over the face of the wall.

A hearth (Feature 21) was exposed in the water-line trench about 2 m south of the pit structure. The top of the hearth was situated at an elevation of 10.3 m. It consisted of a large unlined pit about 1.83 m wide and 33 cm deep. The sides of the pit were oxidized and the fill consisted of a mixture of laminated sand, oxidized soil, charcoal, and ash (Stratum 69). Four Cortez Black-on-white bowl sherds were recovered from the fill. a pollen [180] and flotation [179] sample were analyzed. The pollen sample included Cheno-ams, greasewood, and maize, while the flotation sample contained pigweed, globemallow, saltbush, and burned corn seeds with saltbush and cottonwood/willow charcoal. The hearth was probably associated with the occupation of the pit structure due to its proximity to the structure, the presence of Cortez Black-on-white and overlapping radiocarbon dates.

Features Exposed under the Highway

Two features were exposed when the pavement of the existing road was removed. A hearth (Feature 56) was uncovered northwest of the kiva. What remained of the feature included a 1 by 1 m area of charcoal-stained soil mixed with burned cobbles, sherds, and burned bone. The ceramics included Kiatuthlanna Black-on-white, Moccasin Gray, and Tseh So Corrugated. It was situated at an elevation of 9.98 m.

A trash deposit (Stratum 122) was also exposed northeast of the pit structure. A backhoe trench was used to define the nature and extent of the deposit. It consisted of charcoal-stained laminated sands mixed with pieces of charcoal, burned and unburned adobe, burned soil, sherds, debitage, a trough metate fragment, roughly shaped sandstone blocks, burned and unburned cobbles and cobble fragments, and some gravel. The ceramics included Cortez Black-on-white, Red Mesa Black-on-white, Mancos Black-on-white, Taylor Black-on-white, Moccasin Gray, Mancos Corrugated, and Tohatchi Banded. The deposit was about 8 m long and 15-40 cm deep. The top of the stratum was situated at an elevation of 9.87-9.97 m.

Both of these features were located at about the same elevation as the plaza surface associated with the kiva (as found in the north trench, south trench, and water-line trench). This and the presence of similar ceramic assemblages in these areas indicate that these features may be associated with the occupation of the kiva and nearby room blocks.

AN OCCUPATIONAL SEQUENCE FOR LA 50337

Bradley J. Vierra

At least five occupational episodes are present at LA 50337 evidenced by stratigraphic, ceramic, and radiocarbon dating methods. Forty-five specimens were submitted for dendrochronological analysis. However, most of these were *Populus* sp., probably cottonwood, and could not be dated (Robinson, pers. comm.). Table 5 provides the information on the radiocarbon dates from the site, while Figure 49 illustrates the distribution of these dates within one sigma. The series of dates from the site provide an overlapping curve.

Occupation	I	circa sixth century north trench, Stratum 4 Feature 53, below Plaza 3
Occupation	II	circa eighth century pit structure Feature 21, south of pit structure north plaza Plaza 3(?)
Occupation	III	circa tenth-eleventh century room block Room 1, Floors 1-2 Room 2, Floor 1 Room 3 Room 4, Floors 1-3 Room 7, Floor 1 Plaza 2 Room 8 Plaza 1 Plaza 4 trash below Room 13 kiva Room 13
Occupation	IV	circa twelfth century Feature 2, roasting pit Feature 12, Area 5(?)
Occupation	V	circa thirteenth century Feature 53, north of Room 13 Stratum 22

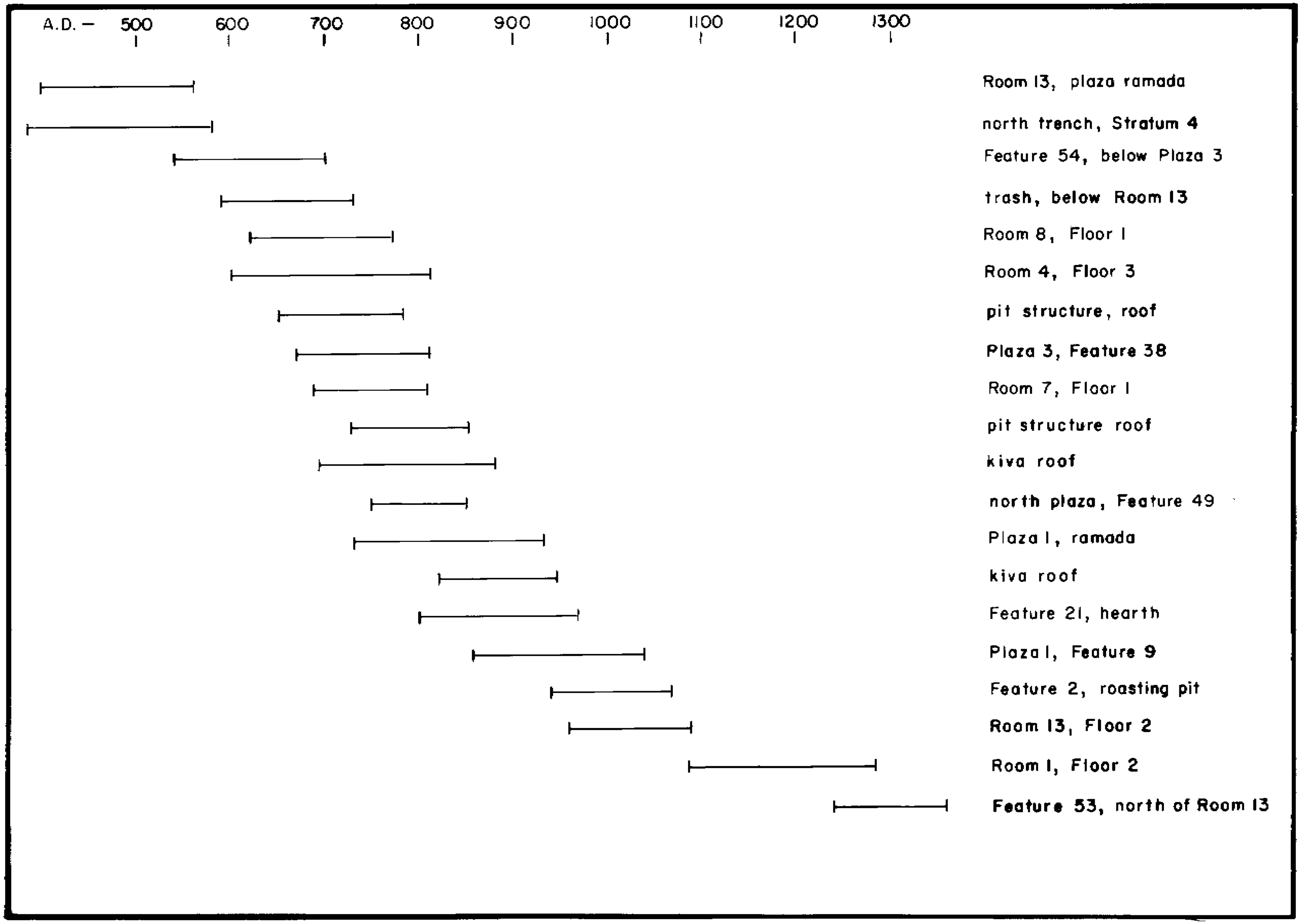


Figure 49. Distribution of uncalibrated C-14 dates.

Table 5. C-14 Sample List

Sample #	Beta #	Provenience	Feature	Type	C-14 Age B.P. ± 16*	Calibrated Date B.P.	C-14 Age A.D. ± 16	Calibrated Date A.D. (95% CI)**	
								Midpoint	Departure
6	13292	N. Trench, Stratum 1	trash	wood, shrub	1226 ± 130	1191	724 ± 130	825	99
16	13293	N. Trench, Stratum 4	charcoal lens	wood, shrub	1463 ± 100	1421	487 ± 100	603	116
34	14245	S. Trench, F.2, St.10	roasting pit	wood	958 ± 60	931	992 ± 60	1080	88
81	14246	Kiva, St. 19	roof	wood	1071 ± 60	1041	879 ± 60	1010	131
111	14247	Rm. 1, F. 7, Fl.2	hearth	shrub, wood	773 ± 100	751	1177 ± 100	1210	33
141	14248	Rm. 4, F. 16, Fl. 3	hearth	shrub	1246 ± 100	1211	704 ± 100	819	111
152	14249	Plaza 1, St. 44	ramada	wood	1123 ± 100	1091	827 ± 100	910	83
166	14250	Rm. 7, F. 22, Fl. 1	hearth	wood, shrub	1205 ± 60	1171	745 ± 60	785	40
175	14251	Rm. 8, F. 24	hearth	wood, shrub	1257 ± 70	1222	693 ± 70	765	72
180	14252	F. 21, St. 69	hearth	shrub	1071 ± 80	1041	879 ± 80	1003	124
199	14253	Plaza 3, F. 38	hearth		1215 ± 70	1181	735 ± 70	780	45
209	14254	Rm. 13, Plaza, F. 36	ramada	wood	1473 ± 80	1431	477 ± 80	598	121
251	14255	below Rm. 13	trash		1288 ± 70	1252	662 ± 70	799	93
260	14256	N. plaza, F. 49	hearth	shrub, wood	1154 ± 50	1121	796 ± 50	903	107
261	14257	Rm. 13, F. 45, Fl. 2	hearth		937 ± 60	911	1013 ± 60	1130	114
286	14258	Pit structure, St. 117	roof	wood	1164 ± 60	1131	786 ± 60	898	112
321	14259	F. 53, N. of Rm. 13	hearth	shrub, wood	659 ± 60	640	1291 ± 60	1330	39

Table 5. Continued.

Sample #	Beta #	Provenience	Feature	Type	C-14 Age B.P. ± 16*	Calibrated Date B.P.	C-14 Age A.D. ± 16	Calibrated Date A.D. (95% CI)**	
322	14260	F. 54, below Plaza 3	hearth		1329 ± 80	1291	621 ± 80	743	122
244	15430	Kiva, St. 19	roof	corn kernel	1164 ± 90	1131	786 ± 90	845	59
993	15041	Pit structure, St. 117	roof	corn cobs	1236 ± 60***	1201	714 ± 60	770	56
315	15431	Plaza 1, F. 9	hearth	corn cobs	1009 ± 90	981	941 ± 90	1060	119

*Libby half-life (5568 yrs) corrected to 5730 years
** Klein et al. 1982
*** C-13 adjusted C-14 age

Occupation I

The first occupation of the site occurred around the sixth century A.D. Stratum 4, an isolated ash/charcoal discard pile from the north trench, yielded a brown ware sherd and a radiocarbon date of A.D. 487 ± 100.

Also present at roughly this time was an isolated hearth (Feature 54) exposed underneath Plaza 3 and the room block. It dates to A.D. 621 ± 80. This date overlaps with the range for Stratum 4.

Occupation II

The second occupation at the site occurred around the eighth century A.D. and is associated with the presence of the pit structure, north plaza surface, and Plaza 3 below the room block.

The pit structure was situated about 1.2 m below Plaza 4 and the room block. Cortez Black-on-white and Mancos Corrugated were the dominant ceramic types (A.D. 900-950) recovered from the structure. While a radiocarbon sample taken from the roof yielded a date of A.D. 786 ± 60. A hearth (Feature 21) was exposed in a water line trench just south of the pit structure and was probably associated with this occupation. It was situated at about the same level as the pit structure, contained a Cortez Black-on-white bowl sherd, and has a C-14 date of A.D. 879 ± 80 that overlaps with the date from the pit structure.

The relationship between the pit structure and the north plaza surface (Stratum 110) is difficult to ascertain. The surface stratigraphically predates Room 13, as it underlies a gravel lens 10 cm below the plaza and associated with Room 13. An Abajo Polychrome sherd (A.D. 700-800) and a Mancos Gray sherd (A.D. 875-950) were found on the surface and in a milling bin pit. A C-14 sample from a hearth yielded a date of A.D. 796 ± 50. The sherds appear to be earlier than those found in the pit structure. However, the radiocarbon date is most similar to that from the pit structure, but it does overlap with the dates from the room block. It has not been determined if the north plaza surface is associated with the pit structure, the room block, or some other unexcavated portion of the site. It does seem to be most closely related to the pit structure based on the limited stratigraphic evidence and the radiocarbon date.

Plaza 3 obviously predates the room block because it is beneath the room block. The radiocarbon date from a hearth on this surface was A.D. 735 ± 70. Only Mancos Corrugated pottery was found on this surface. However, Cortez Black-on-white, Mancos Black-on-white, Brimhall Black-on-white, and La Plata Black-on-red were recovered from the fill between Plazas 1 and 3. How the Plaza 3 occupation relates to the use of the pit structure or the north plaza surface is undetermined. It may postdate the pit structure as it is located about 1 m above it.

Occupation III

The third occupation occurred around the tenth century and into the eleventh century A.D. It is during this time that most of the construction appears to have occurred including the room block, kiva, and Room 13.

There were at least two major occupational episodes represented within the room block. Rooms 1-4 were all built during the initial construction of the room block. Presumably, Room 7 was built somewhat later since it was not contiguous with the rest of the rooms. All of these rooms exhibited similar forms of sandstone masonry construction, with the first floors situated at an elevation of about 11 m. Room 1a, Floor 2, contained Mancos Black-on-white (A.D. 900-1150) with a radiocarbon date from a hearth of A.D. 1177 ± 100. Room 2, Floor 1, contained Cortez Black-on-white and Mancos Black-on-white (A.D. 900-1000). A charcoal sample from hearths in Rooms 4 (Floor 3) and 7 (Floor 1) dated to A.D. 704 ± 100 and A.D. 745 ± 60, respectively. The hearth dates from these rooms presumably indicate when the room block was initially vacated. However, they again appear to be much earlier than the associated ceramics.

The second major occupational episode was represented by the construction of new floors and the remodeling of Rooms 1 and 4, and the addition of Room 8 to Room 7. This time period could probably be subdivided into several separate occupations. The remodeling of the rooms included cobble and sandstone wall masonry and/or widening the walls to two horizontal courses. No ceramics were recovered from Floor 1 of Room 1, but the post-occupational fill stratum immediately above this level contained Cortez Black-on-white and Mancos Black-on-white. The northern wall of the room was widened to two courses with cobble and sandstone masonry. Room 4 had two new floors built into it. Gallup Black-on-white and Mancos Corrugated sherds were found on Floor 2. At this time the west wall was widened to two courses. Later, Floor 1 was built and the west wall was remodeled again. This time cobbles were added to the double-course sandstone masonry. Cortez Black-on-white and Mancos Corrugated sherds were recovered from the floor. Room 8 was a later addition to Room 7. The walls were constructed of a single course of sandstone and cobble masonry. A hearth on the floor yielded a date of A.D. 693 ± 70. Trash was found under this floor containing Mancos Black-on-white and Mancos Corrugated pottery. This trash could have been deposited by the occupants of an earlier occupation.

Plaza 1, which was associated with the occupation of Rooms 1-8, also contained Cortez Black-on-white, Mancos Black-on-white, and Mancos Corrugated. A ramada, which burned and collapsed onto the plaza, presumably represents one of the later occupations of the room block. A charcoal sample from this feature dated A.D. 827 ± 80.

All of the rooms and plazas are characterized by the presence of Cortez Black-on-white, Mancos Black-on-white, or Mancos Corrugated pottery. Three of the four radiocarbon dates place the occupation of the rooms during the eighth century A.D., with a range from A.D. 623 to A.D. 805 and one during the ninth century having a range of A.D. 727 to A.D. 927. One date, from Room 1, Floor 2 is A.D. 1177 ± 100. This date seems much too late when compared with the other room block dates and the date from Plaza 3. This was a very small sample (0.3 g). Although it was given an extended counting time, it may have been contaminated because a portion of the hearth was cut through by a grader. Reuse of the hearth during a much later occupation seems unlikely due to the presence of Floor 1.

The trash deposit (Stratum 103) situated under Room 13 obviously predates the room. It was also located about 30 cm higher, or roughly at the same elevation as the north plaza surface. It postdates the pit structure occupation because the surface was 60 cm higher. Cortez Black-on-white, Mancos Black-on-white, and Mancos Corrugated wares were present (A.D. 950-1000). This correlates with the presence of mainly Cortez Black-on-white. A charcoal sample taken from the trash deposit dated A.D. 662 ± 70. This date overlaps with the ones from the room block. Therefore, the trash deposit may be associated with the room block or another temporally similar occupation on the site.

The room block and the trash deposit below Room 13 contain the same types of ceramics (i.e., Cortez Black-on-white and Mancos Black-on-white) and the radiocarbon dates overlap. What is perplexing is that the radiocarbon samples from the room block and the trash deposit consistently date circa A.D. 700, while the pit structure and north plaza surface are in the late A.D. 700s. Obviously, there is some overlap in the date ranges between these areas, with the pit structure constructed as early as A.D. 726 and the initial occupants of the room block leaving as late as A.D. 805. The last occupation of the room block, which presumably was associated with the construction of the ramada, may be as late as A.D. 927. Overall, the C-14 dates for these areas seem to be much earlier than the age range traditionally given for the ceramics (see Breternitz et al. 1974).

No ceramics were found on the floor of the kiva, but the pottery from the roof stratum included Mancos Black-on-white and Mancos Corrugated. A radiocarbon date of A.D. 879 $\pm$ 60 from a roof beam supports this later assemblage. Presumably a kiva of this size would have been built at the same time as the large pueblo underlying the A-Z Auto Parts building. Twenty sherds were collected by Gene Walker from the large room block during the construction of his auto parts store. These include three Cortez Black-on-white, one Mancos Black-on-white, seven Wetherill Black-on-white, four white wares, one gray ware, and four Mancos Corrugated sherds.

It is difficult to estimate the size of the large pueblo. LA 50337 may have already been recorded as LA 1910 by Nusbaum in 1935. If so, the rubble mound recorded by him was roughly 7 by 20 m in size. This might include about 30 rooms for a single-story pueblo. Mr. Walker did state that a large room block was exposed under his building when the area was leveled by a grader. In fact, it was so difficult to remove these masonry walls that he decided to cover the pueblo with fill dirt, level the dirt, and then construct his building on top of it. Therefore, a substantial portion of the pueblo should be left intact under the auto parts building. If one stands back and looks at the building, it is easy to see that it was built on a large mound that rises a couple of meters above the surrounding area. How much of this is fill and how much is pueblo is again difficult to determine.

Like the kiva, Room 13 contained Mancos Black-on-white and Mancos Corrugated pottery. The C-14 date from the hearth on Floor 2 shows that it was used last about A.D. 1013 $\pm$ 60. This date, in conjunction with the presence of two floors in Room 13, indicates that the room represents a later addition that was subsequently vacated and then reused. The radiocarbon sample of the ramada associated with Room 13 yielded a date of A.D. 477 $\pm$ 60. This seems much too early for the construction of this feature because it does not correlate with the stratigraphy, ceramics or C-14 dates from Room 13 or the underlying deposits. This date may be related to the use of scavenged old wood. However, it was taken from what appeared to be the branches of a cottonwood tree, and the possibility of dating the older interior of a log would not seem to be a problem in this case. Otherwise, the date may simply be unreliable.

Occupation IV

There appears to be a marked decrease in the use of the site during the twelfth century. Feature 2 was the large roasting pit located in the south trench. It appears to postdate the occupation of the kiva because it was situated above the plaza surface interpreted as being associated with the kiva. The presence of Mancos Black-on-white, McElmo Black-on-white, Mesa Verde Corrugated, and a C-14 date of A.D. 992 $\pm$ 60 also supports the late use of this feature. This date overlaps with the occupation of Room 13. However, the presence of the late McElmo Black-on-white and Mesa Verde Corrugated ceramics (A.D. 1100-1300) in Feature 2 and their absence from Room 13, probably indicates that the feature was used later than the room.

The occupational surface associated with Feature 12 in Area 5 lies about 30 cm about Plaza 1 and therefore postdates the occupation of the room block. Cortez Black-on-white and Mancos Black-on-white ceramics were recovered from the fill beneath the surface. Along with McElmo Black-on-white, these were recovered from the fill immediately above the surface. How this occupation might relate to the use of Feature 2 is undetermined.

Occupation V

The last occupation of the site is associated with the use of an isolated hearth (Feature 53), found in the profile north of Room 13. It obviously postdates the room because it was situated about 60 cm higher than the floors in Room 13, and yielded a C-14 date of A.D. 1291 $\pm$ 60. The presence of some Mesa Verde Black-on-white in the upper post-occupational fill levels of the excavated room block also indicates that at least some sporadic use of the pueblo and site area was occurring during the thirteenth and fourteenth centuries.

Discussion

The Radiocarbon Dating Process

A simple comparison of the data presented in the previous section shows that there are some discrepancies among the dating methods. The stratigraphic and ceramic evidence seems to correspond; Cortez Black-on-white is found in the pit structure, Cortez and Mancos Black-on-white are found in the room block, Mancos Black-on-white is found in the kiva and Room 13, and McElmo Black-on-white and Mesa Verde Corrugated are found in Feature 2. The general curve of the radiocarbon dates also seems to follow this pattern, although sometimes dating somewhat earlier than the associated ceramic assemblages. This is probably most evident in the early radiocarbon dates recovered from the room block. The range for these dates tend to be much earlier than that for the pit structure, which is stratigraphically older in age. These dates are also over a hundred years earlier than the dates traditionally associated with Cortez Black-on-white and Mancos Black-on-white pottery. Beal (1984) noted a similar discrepancy of greater than 200 years on sites located to the northwest of LA 50337 in the San Juan Coal Lease. He simply dismissed them as being "inappropriate temporal indicators for these sites" (Beal 1984:366).

Recent attention has focused on the "old wood" problem involving the scavenging of dead surface wood for use in cultural contexts. In California, Ferguson (1969:14) dated a bristlecone pine fragment found in a surface context to 9000 B.P., and Schiffer (1982:325) identified a piece of ironwood collected near Libertad, Sonora, as 1,500 years old. The ramification of someone using these pieces of wood in a cultural context is obvious. One example of this problem was the determination of a 1400 B.P. date for a piece of juniper from a 20-year-old Navajo corral on Black Mesa, Arizona (Christenson and Parry 1985; see also Smiley 1985).

Dean (1978) was one of the first archaeologists to stress the importance of explicitly defining a methodology for using and interpreting chronometric dating techniques. This involves arguments of relevance, that is, statements that link the static archaeological record to a dynamic cultural system (also referred to as Middle Range Theory). Obviously, archaeologists are interested in dating a specific event that occurred some time in the past (for example, the last use of a hearth). What is sometimes forgotten is that the event that is actually being dated is usually the death of the organism, although it is often assumed that the two incidents coincided. A more accurate statement of this relationship is presented by Dean (1978:226-228) who offers a set of terms to delineate the events associated with independent dates. The *dated event* refers to the age of the radiocarbon sample as determined by the radiocarbon laboratory. The *reference event* is the actual date when the organism from which the sample was taken died. The *target event* is the event that the archaeologist is interested in dating, for example when a hearth was used. The dated event is most closely related to the reference event, but they do not necessarily coincide with the target event.

Smiley (1985:38-45) discusses a number of sources that could produce errors in the radiocarbon dating process: (1) Field sampling error. This might involve the misidentification of provenience information, or sampling mixed strata or disturbed context; (2) Built-in age. This is the old wood problem where dead surface wood is used. Here the reference event occurred in advance of the target event, therefore producing an overestimation of the target event; (3) Cross-section effect. As pointed of by Long et al. (1979), samples taken from the inside of a log will produce older dates than from the outer ring of the log. Therefore, the sample will estimate the age of the sampled rings (the dated event), not the death of the organism (the reference event). This is a problem when there is a mixture of younger outer rings and older inner rings for a sample. This can produce an overestimation of the reference event and possible target event; (4) Libby half-life error. An underestimation of the age of a sample can occur if the calculation of the Libby half-life of 5568 years is not adjusted to the more accurate figure of 5730 years. This is done by multiplying the Libby half-life date by 1.03. The dates from LA 50337 ranged from 30 to 60 years older after adjusting them to the more accurate figure; (5) Contamination. Contamination can affect a sample by under- or overestimating its age. Rootlets are often a source of contamination that can help underestimate the samples' age; (6) Calibration error. It has been determined that the amount of C-14 in the atmosphere fluctuated through time. The amount of this fluctuation and its effect on radiocarbon dating was identified by comparing samples with known dendrochronologically derived dates (Damon et al. 1974; Olsson 1970; Stuiver and Suess 1966). Klein et al. (1982) presents a series of calibration tables from which the radiocarbon B.P. dates can be corrected within a specific calendric date ranges and the departure or difference between the corrected and uncorrected dates. The mean difference for the LA 50337 dates is an underestimation of the age for these samples by about 90 years, ranging from 33 to 131. Berry (1982:11-13) argues that dates younger than 3000 years B.P. do not need to be corrected. Smiley (1985:94-96) reports a mean underestimation of his Basketmaker dates (400 B.C.-A.D. 200) of only 25 years, and agrees with Berry that for this time period calibration of the dates is not a necessity; (7) Counting error. Counting error generally increases as sample size decreases and as age of the sample increases. Smaller sample (<2-3 g) should have extended counting times; (8) Lab bias. It has been shown (Klein et al. 1982) that the analysis of the same sample by different laboratories can produce variable results; (9) Isotopic fractionation. This refers to the differential metabolism of C-14, C-13, and C-12 isotopes by the various plant species. Plants that discriminate against the heavier C-14 isotope utilize the C-3 pathway, in contrast to plants that are biased towards metabolizing C-14, which utilize a C-4 pathway (trees). Radiocarbon dates from C-3 pathway plants do not need to be corrected for isotope fractionation, however C-4 pathway plants (maize), which are enriched with C-14, do need to be corrected (Browman 1981). As much as 200 to 250 years could be added to the date (Bender 1968; Lowden 1969). Therefore, isotope fractionation may act to underestimate the age of a sample if not corrected.

Material quality refers to the expected degree of disparity between the dated event and the target event (Smiley 1985:68). Smiley (1985:71-72) provides a list of radiocarbon datable materials which he considers to have highest to lowest material quality. This scheme can be used in evaluating the dating potential of possible samples.

1. Annual subsistence materials, for example cultigens or charred wild seeds;
2. Samples from structural logs retaining their outer rings;
3. Sticks, twigs, or small branches;
4. Large cross-sectional pieces from beams or fuel that lacks outside rings;
5. Scattered charcoal from undisturbed contexts, such as hearth fill;
6. Scattered charcoal from excavational strata or levels;
7. Unprovenienced charcoal samples.

Sources of Error in the LA 50337 Radiocarbon Samples

There are at least three major sources of error that could be affecting the radiocarbon samples from the site. These include built-in age, the cross-section effect, and isotopic fractionation.

Smiley states that:

> one way to approach the problem is to attempt to determine the probabilities for built-in age and cross-section effect as *general* phenomena. Such estimates will depend upon the *wood age distribution* in a given environmental setting and upon the *wood use behavior* of the cultural groups involved (1985:98).

Through the use of ethnoarchaeological and computer simulation studies of dendrochronologically dated Navajo sites on Black Mesa, Smiley (1985) proposed what the general results of these problems might be on his radiocarbon samples. He found that the built-in age effect of using old pinyon and juniper wood created an overestimation of about 100 years due to the arid environment on Black Mesa. One recent Navajo site even had a sample that was 829 years old. He also found that old wood was differentially selected. Major seasonal sites exhibited a mean age of 68 years in contrast to minor seasonal sites of 145 years. Dwellings exhibited a mean age of 70 years, whereas temporary shelters exhibited 115 years (Smiley 1985:185). Obviously, more old wood was put to use on the shorter term seasonal sites and on temporary structures. He suggests that dead wood would probably have been more highly selected for use in cooking and heating context (as fuel) than in structural contexts (see also Schiffer 1982:324-327).

It was determined that the average cross-section value for pinyon and juniper was 50 years when based on the assumption that the material represents a random sample of a log. Together, built-in age and cross-section effect could help to overestimate the age of a site by 150 years. In addition to this, if you take into account the various natural and cultural processes that act to destroy the outer portions of these elements, the overestimation of site age might be as much as 200-300 years (Smiley 1985:253-254). Smiley reiterates that the dates used in his study were derived from the structural elements on various Navajo sites. He expects that his overestimation figure should be used as a conservative one when dealing with fuel wood.

Evaluation of the LA 50337 Radiocarbon Samples

We can start by evaluating the LA 50337 radiocarbon samples in terms of Smiley's (1985:171-172) material quality classes and how they might be affected by the suspected sources of error. Samples 81 and 286 were taken from cottonwood roof beams in the kiva and pit structure, respectively. The quality of these samples rank as either 2 or 4, depending on whether the outside rings of the beams were present and included in the sample. It is unlikely that scavenged surface wood was used to construct the roof of these structures, so built-in age is probably not a problem. Outer portions of the beams were used for the radiocarbon samples, however, it is unclear whether this actually represented the original exterior of the logs. They had been burned and presumably were left exposed so that the outside of the beams could have been destroyed. If so, the dates could be an overestimation of the age of the samples. Since the samples are made of wood, isotopic fractionation is not a problem.

The ramadas on Plaza 1 and the plaza south of Room 13 were constructed of cottonwood branches. Branches fall into class 3. Due to their small diameter, cross-section effect is probably not a problem, however they could have been in part scavenged from dead wood. Again, since the samples are made of wood, isotope fractionation is not a source of error. Sample 209 from the plaza associated with Room 13 does seem to be much too old when compared with the radiocarbon, ceramic, and stratigraphic evidence. If the sample represents the use of dead wood, then this could explain the roughly 500-year disparity between it and the other temporal evidence.

Radiocarbon samples were analyzed from ten hearths (see Table 5). These samples rank within material quality group 5. Half of these hearths are from the room block area. These room block dates also seem to be early when compared with the ceramic and stratigraphic evidence. As pointed out by Smiley (1985:131), materials used for fuel may represent scavenged dead wood, thereby overestimating the target event. Cross-section effect could also add to the overestimation of the date by including various portions of a specimen(s) within the sample. An analysis of flotation materials from the hearths (see Toll, this volume) indicates that both wood (juniper) and shrubs (saltbush and greasewood) were used as fuel and therefore may have been included within the samples. Saltbush is a C-4 pathway plant (Downton 1975). Since isotopic fractionation was not corrected, the date for these samples may be underestimated. A mixture of these three sources of error could be affecting the dates from the hearth radiocarbon samples. However, what is interesting is that the dates from samples 141, 166, 174, and 199 of the room block all cluster within about 50 years. This should lend support for the accuracy of dates, or at least for the argument that there may be some consistent error affecting all the samples (e.g., scavenging from the same fuel source).

Two other features had radiocarbon samples submitted for analysis. Stratum 4 consisted of an ash/charcoal lens in the north trench, which provided one of the earliest dates for the site. Juniper, saltbush, and cottonwood/willow charcoal were identified from the stratum. This radiocarbon sample ranks as a 6 on the material quality list. Built-in age, cross-section effect, and isotopic fractionation could all be sources of error in this sample. Feature 2 was a large roasting pit located in the south trench. It ranks as a 5. Charcoal identified from this feature includes pinyon, juniper, cottonwood, and saltbush. The large chunks used for the radiocarbon sample were probably made of wood not saltbush. Therefore, built-in age or cross-section effect could be sources of error in this sample.

The question is, how do we determine the amount that built-in age, the cross-section effect, and isotopic fractionation play in the age determination of the radiocarbon samples? One way to evaluate the reliability of these dates is to use cultigens. Cultigens rank 1 on Smiley's material quality list. They are produced annually and are used within a short period of time. They are not subject to sources of error like built-in age or the cross-section effect. However, since they are a C-4 pathway plant, the sample does need to be corrected for isotopic fractionation. Corn, most often recovered as burned cobs, were found throughout the site.

Three samples were selected for radiocarbon analysis based on the following criteria: (1) they were present in sufficient quantities for analysis; (2) they were associated with a previously dated sample; and (3) they were situated in separate locations relative to the occupational sequence of the site. Sample 993 consists of burned corn cobs recovered from the roof of the pit structure. It is one of the earlier occupations on the site, associated with Cortez Black-on-white and a date of A.D. 786 ± 60 from a roof beam. Sample 351 also consists of burned corn cobs that were used as fuel in a hearth (Feature 9) located on Plaza 1. This hearth stratigraphically correlates with the floor hearths dated within the room block. These dates range from A.D. 693 to A.D. 745 ± 100. However, they appear to be much too early when compared with the stratigraphy or the presence of Cortez and Mancos Black-on-white pottery. Sample 244 is burned corn kernels found mixed in the roof of the kiva. Ceramics from this context are mainly Mancos Black-on-white, with a beam from the roof yielding a date of A.D. 879 ± 60.

The corn cobs from the pit structure dated A.D. 714 ± 60. This overlaps with the previous beam date of A.D. 786 ± 60. A mean date for the pit structure would therefore be about A.D. 750 ± 60. It would appear that the beam sample represented a close estimate of the cutting date. This date is still much earlier than the time period generally associated with the use of Cortez Black-on-white (Breternitz et al. 1974).

The corn cobs from Feature 9 on Plaza 1 provided a radiocarbon date of A.D. 941 ± 90. This is quite later than the date range of A.D. 693 to 745 ± 100 for the other floor hearths. It would appear from this evidence that the fuel used in the floor hearths represented scavenged old surface wood or driftwood dating 200 to 250 years earlier. This is within the range of overestimation predicted by Smiley (1985:253-254). This new date correlates with the stratigraphic and ceramic data.

The corn kernels recovered from the roof of the kiva dated A.D. 786 ± 90. This overlaps with the date of A.D. 879 ± 60 for the roof of the kiva. Again, the radiocarbon sample taken from a structural beam appears to have provided a close approximation of the cutting date. A mean date for these two samples would be about A.D. 833 ± 90.

Lastly, the results of the radiocarbon dates from the room block indicate that other hearths on the site may actually date up to 250 years later due to the old wood problem.

THE POTTERY OF LA 50337

A. H. Warren

Introduction

Approximately 3,500 potsherds were recovered during the partial excavation of LA 50337, a prehistoric pueblo within the lower La Plata River drainage near Farmington, New Mexico. The potsherds, which include a few partially and completely restorable vessels, range in date from A.D. 700 to 1300 (from Pueblo I to Pueblo III).

Although only a portion of the site was excavated, the potsherds provide information about the relative dates of the components that were uncovered. The results of the ceramic analyses indicate the local production of pottery, most notably Cortez Black-on-white and Mancos Corrugated. Examination of specific ceramic attributes also identified the presence of a small number of intrusive wares, which were obtained from the Cibola region 125-150 km (78-94 mi) to the south and west, the Chuska Valley 20-100 km (13-63 mi) to the southwest, and the Four Corners area of southeastern Utah 65 km (41 mi) to the northwest. In addition, a small number of nonlocal brown wares was recovered. We believe that these wares were obtained from populations residing in the Navajo Reservoir District 50 km (31 mi) to the east.

The major objectives of these pottery studies are to describe the composition and variability of the LA 50337 ceramic assemblage, to establish an occupational history for the site as a whole, and to determine the relative dates of use for each of the architectural and nonstructural proveniences exposed during the excavations. Comparative background data, including descriptive summaries of tree-ring dated pottery, were obtained from a review of available archaeological publications relating to the Anasazi occupation of the San Juan drainage, the Mesa Verde region, the Four Corners area, the Navajo Reservoir District, and other nearby locales.

Pottery Classification in the San Juan Drainage

As part of his archaeological investigations of the Basketmaker III to Pueblo III occupation of La Plata Valley in the northern San Juan drainage, Morris (1919, 1939) hired Anna O. Shepard to conduct technological studies of the ceramics and to locate the sources of raw materials in the area. As an archaeologist and ceramicist, Shepard (1939) analyzed clay deposits, firing methods, tempering materials, and paint pigments. She also carried out extensive field investigations to determine the variability among locally manufactured wares in northwestern New Mexico. Her work emphasized the need to distinguish environmental factors, such as differences in locally available clays, tempering materials, and paint pigments, from cultural determinants, such as vessel form and design motif, in the study of archaeological materials. One of the most important accomplishments of her work was the refutation of the suggestion that Anasazi potters were able to control the firing atmosphere of their ceramics under primitive conditions (Shepard 1939, 1953, 1956). Shepard demonstrated that the amount of iron and other impurities in clays determined the vessel's color. In other words, if a potter wanted a red pot, red-firing clays or slips would be used in the vessel's manufacture.

Although most archaeological research in the San Juan drainage continues to consist primarily of simple sherd identification and description, there recently has been an acknowledgment that these basic analyses offer great potential in the interpretation of the structure of Anasazi cultural systems. An example of this growing awareness is provided by Lancaster and Snow (1983) in their research proposal for the mitigation of 24 sites in the La Plata Valley that are endangered by highway construction. They argue that because pottery, like lithic artifacts, is functionally specific, "observation of the frequency and distribution of vessel forms and their context is expected to inform on the role(s) of ceramics in the subsistence strategy" (Lancaster 1983:85).

Other research problems to be considered in ceramic analyses involve the reconciliation of pottery classification in the San Juan drainage with those from adjoining archaeological localities, including the Chuska Valley, Four Corners area, Navajo Reservoir District, and the Cibola region. If interregional comparisons are to be undertaken, definitional criteria must be standardized within the classificatory systems used to assign ceramic types. A regional perspective is needed to more accurately identify the degree to which variability in ceramic types is attributable to design motif longevity, differences in local raw materials, and possible population migrations.

Laboratory Procedures

No pottery classificatory scheme for the prehistoric Southwest has been sufficiently exacting to fully describe the variability in stylistic, chronological, and technological attributes exhibited among ceramic types through the periods of their manufacture or across their geographical distributions. The ceramic typology for the San Juan Valley is no exception.

Definitions are lacking to the extent that there is generally no single attribute that can be used to specifically separate one pottery type from another. For example, definition of pottery types on the basis of design is one of several methods of classification available to the archaeologist. However, because design is considered to be a cultural concept, pottery types based on this criterion may extend through many centuries. On the other hand, pottery classes based upon the use of raw materials that are available only within the local environment may overlook the cultural concepts of the ceramic technology.

In discussing the theoretical concepts of classification, Hargrave (1963) reviewed the classificatory problems of the Cibola wares and recognized that design styles may persist for long periods of time and, therefore, may be of little use in correlating pottery dates. Brew (1946) has warned us that objectivity in pottery classification is rarely possible and that flexible, nonprecise techniques may actually be more useful and "scientific" than a static scheme.

Previously established ceramic classificatory schemes were used to order the pottery of LA 50337 into typological and chronological groups. The use of existing definitional typologies also satisfies the need to follow a standardized regional classificatory system. Design style, tempering materials, paint type and color, and vessel form, attributes most helpful in determining ceramic type, compose the basis for this analysis.

The chronological placement of the LA 50337 wares is possible through the extrapolation of tree-ring dates reported elsewhere in the Southwest for the same ceramic types. Dates for wares manufactured in the San Juan drainage were adapted from a variety of sources (Breternitz 1966; Breternitz et al. 1974; Hayes 1966; Hayes and Lancaster 1975). References for the dates of intrusive pottery types include Peckham and Wilson (1964) for the Chuska Valley, Olson and Wasley (1956) and Neller (1978) for the Cibola region, and Eddy (1966) for the Navajo Reservoir District.

Brief summaries of the distinguishing attributes and the estimated best dates for each of the defined diagnostic pottery types and varieties defined for LA 50337 are presented in Table 6.

Three additional analytical procedures governing the classification of the LA 50337 ceramics remain to be discussed. First, the attempt to classify all small sherd fragments may result in the misidentification of types, which then could lead to serious errors in the description of a ceramic assemblage recovered from an archaeological site. For instance, Mancos Black-on-white has been defined as having one overall design system, whereas Cortez Black-on-white features combinations of motifs that include that of the former ware. A small fragment of Mancos Black-on-white might easily be mistaken for Cortez Black-on-white if small sherds were to be classified. For this reason, sherds smaller than thumbnail size were generally excluded from these analyses. Second, the use of design as the sole classificatory criterion may result in the misidentification of mineral-painted wares, which are otherwise not readily distinguishable. In this analysis, the classification of mineral-painted sherds was based on the type of mineral pigment, surface polish, and shape of inclusiona in the paste. Third, we classified the Mancos Corrugated wares into five varieties on the basis of the style of surface corrugation exhibited on the sherds (Table 6).[1]

The basic descriptive classificatory analyses were then tabulated by the critical horizontal and vertical provenience units defined by the supervising archaeologist during excavation. This analysis was completed to facilitate the discussion of intrasite assemblage variability across the site and through time. In addition, it is useful in determining whether there were any strong associations among certain ceramic types. This exercise, therefore, provides the data needed to address the research problem identified by Lancaster and Snow (1983) in their research design for the La Plata Valley.

The Ceramic Groups at LA 50337

During the descriptive typological analysis, 11 major local San Juan pottery types and 29 intrusive trade wares were recognized (Table 6). The correlation of published dates and the ceramic distribution analysis for the local wares resulted in the identification of three major ceramic groups, which may be assigned to relatively distinct temporal periods and which are more or less correlated with specific architectural and stratigraphic units of the site. This classificatory system permits comparisons among the spatial and stratigraphic proveniences defined for LA 50337, and it allows the ordering of intrusive wares on a temporal basis.

[1] The terminology used to distinguish the five varieties of Mancos Corrugated is the author's own and does not necessarily correspond with the terms used previously within the San Juan region to describe the range of variability within this ware (Breternitz et al. 1974; Hayes 1964; Sciscenti and Greminger 1962).

Table 6. Pottery Types of LA 50337

Pottery Type	Dates (A.D.)	Distinguishing Attributes
Brown Ware		
Sambrito Brown	400-750	Polished; unslipped; brown-firing paste; crushed sandstone temper; rarely igneous rock temper; from the Gobernador and Navajo Reservoir areas.
Basketmaker Ware		
La Plata Black-on-white	400-750	White, cream, or light gray paste; coarse-grained sandstone temper; mineral paint designs; motifs open, ticked lines and frame dots; uneven surfaces; locally produced within the San Juan region.
Pueblo Black-on-white Wares, San Juan Region		
Piedra Black-on-white	750-900	White, light gray surfaces; mineral paint designs, including barbed lines, zig-zags, nested or cribbed motifs, pendant triangles, and hooks; surfaces smoothed and polished; crushed igneous rock temper.
Cortez Black-on-white	900-1000+	White, gray surfaces; mineral paint designs, including interlocking scorlls, barbed lines, multiple parallel lines, and scallop triangles; mainly crushed igneous rock temper.
Mancos Black-on-white	900-1150	Paste light to dark gray; large motifs common, including solids, checkerboards, framed hachures, ticked circles, and wide parallel lines; decorations similar to Red Mesa Black-on-white but poorly executed; crushed igneous rock temper common; also, sandstone and sherd temper.
Wetherill Black-on-white	1050-1125	Carbon paint designs similar to Mancos Black-on-white; igneous rock, crushed sherd, or sandstone temper.
McElmo Black-on-white	1100-1300	Paste white to gray; rim rounded or squared; carbon paint designs including wide bands, solid lines, and framed hachures; igneous rock, crushed sherd, or sandstone temper.
Mesa Verde Black-on-white	1100-1300	Polished slips; vessel surfaces often exhibit crazing; squared rims; carbon paint design bands with compact geometric motifs that encircle vessel; igneous rock, crushed sherd, or sandstone temper.
Red Wares, San Juan Region and Four Corners Area		
Abajo Polychrome	700-850	Surface light to dark red; usually polished; dark red to black mineral paint; large isolated designs, including rickrack, and framed squiggle hachures; crushed rock with black hornblende and fine-grained sand of rounded quartz common temper materials.
Bluff Black-on-red	750-900	Surface color pink to brick red; mineral paint designs, including geometric motifs and wide lines; crushed rock with black hornblende temper; sometimes crushed sherd temper also used.
La Plata Black-on-red	800-1000	Surface orange-red to red; mineral paint designs, including fine line hachures that may be framed by bolder lines; bands of parallel lines; zig-zags, and nested chevrons; temper usually hornblende dacite or andesite.
Utility Wares, San Juan Region		
Moccasin Gray	775-900	Surface unpolished; light to dark gray; concentric bands 8-18 mm wide around vessel neck; crushed rock temper.
Mancos Gray	875-950	Surface unpolished; light to dark gray; coils average 5 mm (range 3-9 mm); tooling and incising of coils common; plain base; crushed rock temper.

Table 6. Continued.

Pottery Type	Dates (A.D.)	Distinguishing Attributes
Mancos Corrugated	900-1200	Five styles of surface corrugation; oblique indentations; patterned and tooled texturing; ribbed (3-5 mm), smeared indentations; and Tseh So (wide deep indentations. Crushed igneous rock with flakes of gold biotite is the most common temper material, although sandstone and crushed sherd were also used.
Mesa Verde Corrugated	1100-1300	Indented coils; sharply everted rim; tempering materials include crushed igneous rock, sandstone, and sherd.
Pueblo Wares, Arizona		
Kana'a Gray	700-900	Clapboard corrugated; coils 8-14 mm thick; light to dark gray surfaces; sandstone temper.
Cibola Series Pueblo Wares		
Kiatuthlanna Black-on-white	700-900+	Black mineral paint on polished white surfaces; designs include framed squiggles, sawteeth, checkerboard, and chevrons; crushed sherd and sandstone temper.
Red Mesa Black-on-white	875-1050	White polished interior surface; mineral paint designs, including scrolls, pendant dots, triangles, and sawteeth; sherd plus sand or sandstone temper.
Gallup Black-on-white	800-1200	Mineral paint on white surfaces; unevenly polished; designs include framed straight line hachures; sherd and sandstone temper.
Snowflake Black-on-white	1100-1250	Black mineral paint, may be glazed, on white polished surfaces; designs include fret motifs, opposed triangles, broad lines, and checkerboards; sherd plus sandstone temper.
Tseh So Corrugated	890-1050	Wide, deeply indented coils; sandstone temper. Synonymous with Exuberant Corrugated and Newcomb Corrugated.
Tohatchi Banded	900-1000	Coils are 3-14 mm wide; may have tooled, incised, punctated, or ribbed patterns; sandstone temper. Synonymous with Mancos Gray and Captain Tom Corrugated.
Coolidge Corrugated	1000-1150	Overall indented corrugation; often zoned with undented coils; coils average coil width 7 mm or more; sandstone temper.
Tusayan Corrugated	950-1275	Indented corrugated exterior; coils are 2-5 mm or more wide; medium ot coarse-grained crushed sandstone temper.
Reserve Smudged[1]	1200-1300	Jar(?); interior smudged; white paste; medium-grained sherd and sandstone temper.
Chuska Series Pueblo Wares		
Drolet Black-on-white	825-900	Mineral paint with Kiatuthlanna and Red Mesa Black-on-white design motifs; temper is coarse-grained Chuska trachyte.
Naschitti Black-on-white	900-1000	Mineral paint with Red Mesa Black-on-white design styles; trachyte plus crushed sherd temper.
Brimhall Black-on-white	900-1075	Mineral paint; design motifs are framed hachures in Dogoszhi style; trachyte or trachyte plus crushed sherd temper.
Newcomb Black-on-white	875-1000	Carbon paint; Red Mesa Black-on-white design styles; trachyte temper.
Toadlena Black-on-white	975-1125	Carbon paint; Red Mesa Black-on-white design styles but poorly executed, similar to Mancos Black-on-white; trachyte plus sherd temper.
Taylor Black-on-white	1000-1100	Mineral paint; motifs similar to Mancos Black-on-white designs, incuding solid wide lines, solid traingles, and solid diamonds; trachyte temper with or without crushed sherd inclusions.

Table 6. Continued.

Pottery Type	Dates (A.D.)	Distinguishing Attributes
Chuska Black-on-white	1000-1100	Carbon paint, Dogoszhi design styles; trachyte temper.
Crumbled House Black-on-white	1150-1300	Carbon paint; Mesa Verde Black-on-white design motifs; sherd plus trachyte temper.
Gray Hills Banded	850-950	Neckbanded; concentric bands; trachyte temper. Synonymus, in part, with Moccasin Gray.
Newcomb Corrugated	875-950	Indented coils, Tseh So style; trachyte temper.
Captain Tom Corrugated	875-1000	Overall indented and unindented coils, Mancos Corrugated style; trachyte temper.
Blue Shale Corrugated	925-1150	Coils over entire vessel; indented corrugations with or without unindented coils; vertical and horizontal alignments of indentations; trachyte temper.
Hunter Corrugated	1150-1300	Coils indented and unindented; coils 3-10 mm in width; indentations may be patterned. Synonymous with Mesa Verde Corrugated.

[1] Although vessels with interior smudging may have been present in southwestern New Mexico and eastern Arizona as early as A.D. 300, Reserve Smudged wares were common intrusives in the Four Corners area between approximately A.D. 1250 and 1300 (Hayes and Lancaster 1975; Warren 1978).
Sources: Hayes 1964; Breternitz 1966; Breternitz et al. 1974.

Ceramic Group I

Seventy-two sherds (Table 7) were identified as Ceramic Group I wares, which roughly span the Basketmaker III and Pueblo I periods (A.D. 400-900). This association is composed of nine major types, three of which are locally made and the remaining six are believed to be trade wares. The locally made types include La Plata Black-on-white, Moccasin Gray, and Piedra Black-on-white. The intrusive wares include Abajo Black-on-red, Bluff Black-on-red, Kana'a Gray, Kiatuthlanna Black-on-white, La Plata Black-on-red ,and Sambrito Brown.

Undifferentiated La Plata Red Ware ceramics, which consist of ten sherds without traces of black paint, are believed to be nondiagnostic portions of other Four Corners red ware vessels. Seven sherds of indeterminate brown ware (Table 8) may, in fact, represent other Sambrito Brown vessels; however, because this classification remains uncertain, these sherds were not included in the Ceramic Group I counts.

Although Breternitz (1966; Breternitz et al. 1974) reports that red wares may be manufactured within the San Juan drainage, the sherds recovered from LA 50337 possess a paste that contains small laths of black hornblende. This paste characteristic suggests that these sherds were manufactured in the Four Corners area and were imported to LA 50337. However, there are numerous variations in the tempering materials of the red ware assemblage that have not yet been identified by a specific source in that area.

Ceramic Group I is comparable to the Mesa Verde area during the same general time period (Hayes 1965). The Mesa Verde Piedra phase (A.D. 700-900) plain gray utility wares resemble the Sambrito Brown sherds recovered from LA 50337; the main difference between these wares is the firing characteristics of the local clays used in their manufacture. The Ceramic Group I assemblage is also similar to that reported from the Navajo Reservoir district for the Rosa phase (A.D. 700-850). Eddy (1966) notes that Sambrito Brown is a major type during the first half of the phase (ca. A.D. 700-750) and the San Juan Red Wares persist as late as A.D. 850.

Table 7. Ceramic Group I by Major Excavation Provenience.

	N. Trench	S. Trench	Rm. 1	Rm. 1a	Rm. 1b	Rm. 2	Rm. 3	Rm. 4	Rm. 7	Rm. 8
Abajo Polychrome										
Bluff Black-on-red		1b								
Kana'a Gray										
Kiatuthlanna B/w	1j							1b	2b	6b
La Plata Black-on-red	1b									
La Plata Black-on-white										
La Plata Red Ware						1b		1j		
Moccasin Gray			1j							
Piedra Black-on-white										
Sambrito Brown	8j									
Total	1b,9j	1b	1j			1b		1j,1b	2b	6b

Table 7. Continued

	Plaza around rm block	Plaza 1	Plaza 2	Plaza 3	Plaza 4	Room 13	Plaza s. of Rm 13	N. Plaza	Pit structure	Misc.	Total	% of Ceramic Group I	% of total assem. (n = 3474
Abajo Polychrome								1b			1	1.4	.03
Bluff B/r								9j			10	13.9	.29
Kana'a Gray		1j									1	1.4	.03
Kiatuthlanna B/w					2b			2b	1b		15	20.1	.43
La Plata B/r	1b,2j		1b			8b,1j		4b,1j[a]			18	25.0	.51
La Plata B/w											1	1.4	.03
La Plata Red Ware		1b				1j	2b	2b	2b		10	13.4	.29
Moccasin Gray		1j			3j			1j			6	8.3	.17
Piedra B/w					1b						1	1.4	.03
Sambrito Brown	1j										9	12.5	.26
Total	1b,2j	1b,2j	1b		3b,3j	8b,2j	2b	9b,11j	3b		72	98.8	2.07

[a] = tecomate miniature; b = bowl; j = jar

Table 8. Other Wares by Major Excavation Provenience

	N. Trench	S. Trench	Rm. 1	Rm. 1a	Rm. 1b	Rm. 2	Rm. 3	Rm. 4	Rm. 7	Rm. 8
Indeterminate carbon white	6j	1b,1j								
Indeterminate mineral white	1b,5j	4b,4j								1j
Unspecified white ware	13b,54j,2o	2j	5j		1j		2[a]b,32j		1b,7j	1b,6j
Indeterminate brown ware		20j								
Indeterminate gray ware	2b,11j		6j		1j	1j	9j		10j	10j
Indeterminate red-brown ware										
Indeterminate unfired pot	2j									
Unspec. utility ware										
Total	16b,78j,2o	5b,27j	11j		2j	1j	2b,41j		1b,17j	1b,17j

Table 8. Continued

	Plaza around rm block	Plaza 1	Plaza 2	Plaza 3	Plaza 4	Room 13	Plaza s. of Rm 13	N. Plaza	Pit structure	Misc.	Total	% of Ceramic Group I	% of total assem. (n = 3474
Indeter. carbon white	1b,1j	1b,2j		1b						1j	13	1.78	0.37
Indeter. mineral white	2b,2j	1b,1j			2b,4j		1j	4j	1b		27	3.69	0.78
Unspec. white ware	3b,39j	11b,19j	6b,5j	4j	12b,14j	8b,22j	9b,29j	6b,19j	2b,3j	1b,4j	350	47.81	10.08
Indeter. brown ware									4j	1j	7	0.96	0.20
Indeter. gray ware	36j	28j	8j	4j	56j	16j	10j	85j	5j		326	44.54	9.38
Indeter. red-brown ware							1j				1	0.14	0.03
Indeter. unfired pot											2	0.27	0.06
Unspec. utility ware			3j				3j				6	0.82	0.17
Total	6b,78j	13b,50j	6b,16j	1b,8j	14b,74j	8b,38j	9b,44j	6b,108 j	3b,12j	1b,6j	732	100	21.07

a = includes one complete miniature jar; b = bowl; j = jar; o = other

Ceramic Group I wares were found in 15 of the 20 proveniences defined for this analysis (Tables 7 and 9). The north plaza has 18 sherds (25 percent) of the assemblage, the largest cluster of Group I ceramics on the site. The north trench and Room 13 each have ten sherds (13.9 percent); the remaining proveniences yielded only small numbers of these wares.

The locally manufactured La Plata Black-on-white, Moccasin Gray, and Piedra Black-on-white wares are represented by only eight sherds (11.1 percent of the Group I assemblage). The red wares from the Four Corners area, in contrast, comprise 39 sherds (54.2 percent), and Kiatuthlanna Black-on-white, which was produced in the Cibola region, is represented by 15 sherds (20.8 percent). Because Kiatuthlanna Black-on-white has a long production span (ca. A.D. 700-900+), it is possible that these sherds, in fact, date somewhat later than the other Group I wares. The nine Sambrito Brown sherds (12.5 percent) are believed to have come from the Navajo Reservoir District or the Gobernador region to the east. The single Kana'a Gray sherd (1.4 percent) is likely from eastern Arizona.

Table 9. Pottery Distributions by Ceramic Group and Provenience

Provenience	Group I n (%)	Group IIA n (%)	Group IIB n (%)	Group III n (%)	Other n (%)	Total n (%)
North trench	10 (3.3)	25 (8.2)	171 (56.4)	1 (0.3)	96 (31.7)	303 (99.9)
South trench	1 (1.0)	4 (3.9)	36 (35.3)	29 (28.4)	32 (31.2	102 (99.8)
Room 1	1 (2.1)	2 (4.2)	31 (66.0)	2 (4.2)	11 (23.4)	47 (99.9)
Room 1a	0	0	3 (60.0)	0	2 (40.0)	5 (100.0)
Room 1b	0	0	1 (50.0)	0	1 (50.0)	2 (100.0)
Room 2	1 (0.2)	141 (23.4)	410 (68.0)	8 (1.3)	43 (7.1)	603 (100.0)
Room 3	0	0	4 (100.0)	0	0	4 (100.0)
Room 4	2 (1.8)	29 (26.1)	58 (52.3)	4 (3.6)	18 (16.2)	111 (100.0)
Room 7	2 (4.3)	5 (10.9)	29 (63.0)	0	10 (21.7)	46 (99.9)
Room 8	6 (6.9)	3 (3.4)	60 (69.0)	0	18 (20.7)	87 (100.0)
Plaza around room block	4 (0.9)	29 (6.3)	325 (70.3)	20 (4.3)	84 (18.2)	462 (100.0)
Plaza I	3 (0.9)	19 (5.9)	200 (61.9)	38 (11.7)	63 (19.5)	323 (99.9)
Plaza II	1 (1.0)	3 (3.1)	66 (68.8)	4 (4.2)	22 (22.9)	96 (100.0)
Plaza III	0	2 (8.0)	14 (56.0)	0	9 (36.0)	25 (100.0)
Plaza IV	6 (2.3)	49 (19.1)	103 (40.1)	11 (4.3)	88 (34.2)	257 (100.0)
Room 13 and plaza	10 (3.5)	25 (8.7)	206 (71.5)	1 (0.3)	46 (16.0)	288 (100.0)
Plaza south of Room 13	2 (0.7)	8 (2.9)	214 (77.0)	1 (0.4)	53 (19.1)	278 (100.1)
North plaza	20 (9.0)	59 (26.7)	28 (12.7)	0	114 (51.6)	221 (100.0)
Pit structure	3 (1.7)	24 (13.7)	133 (76.0)	0	15 (8.6)	175 (100.0)
Misc.	0	9 (23.1)	16 (41.0)	7 (17.9)	7 (17.9)	39 (99.9)
Total	72 (2.1)	436 (12.6)	2108 (60.7)	126 (3.6)	732 (21.1)	3474 (100.0)

Ceramic Group II

Most of the sherds (n = 2,544; 73.2 percent of the total ceramic assemblage) recovered from LA 50337 are classified as Ceramic Group II wares, and they dominate the pottery assemblages within all spatial and stratigraphic proveniences (Tables 9 and 10). This association dates between ca. A.D. 900 and 1150 and roughly spans the Pueblo II and early Pueblo III periods as traditionally defined in the northern San Juan Basin.

This group is principally composed of four locally manufactured types: Cortez Black-on-white, Mancos Gray, Mancos Black-on-white, and Mancos Corrugated. Within these, a hybrid of Cortez and Mancos Black-on-white and five varieties of Mancos Corrugated may be defined. (The surface treatments that distinguish the Mancos Corrugated varieties are provided in Table 6.) Eighteen trade wares occur in small numbers.

Because one of the principal wares, Cortez Black-on-white, was produced only between ca. A.D. 900 and 1000 (Breternitz et al. 1974), Ceramic Group II was divided into two subgroups (Tables 9 and 10). The earlier, Ceramic Group IIA, is composed of Cortez Black-on-white, its Cortez-Mancos hybrid, and Mancos Gray. These wares comprise 90.0 percent (n = 388) of this subassemblage. Eleven trade wares are believed to be associated with this subgroup on the basis of published dates (Table 6). The Red Mesa Black-on-white, Tohatchi Banded, and Tseh So Corrugated wares (n=20; 4.6 percent) originated in the Cibola region. Brimhall Black-on-white, Burnham Black-on-white, Captain Tom Corrugated, Drolet Black-on-white, Gray Hills Banded, Naschitti Black-on-white, Newcomb Black-on-white, and Newcomb Corrugated (n=28; 6.4 percent) were produced in the Chuska Mountains.

Ceramic Group IIB, which dates from A.D. 1000-1150, consists of Mancos Black-on-white, Mancos Corrugated, and seven trade wares. The locally manufactured Mancos decorated and utility wares composed 97.2 percent of the subassemblage (n=2,049). The Cibola wares consist of Coolidge Corrugated and Gallup Black-on-white (n=6; 0.3 percent). Blue Shale Corrugated, Chuska Black-on-white, Taylor Black-on-white, and Toadlena Black-on-white are from the Chuska Valley (n=50; 2.4 percent). Tusayan Corrugated is an eastern Arizona ware (n=3; 0.1 percent).

Ceramic Group III

This pottery association, which dates to the Pueblo III period (A.D. 1150-1300), is represented by 126 sherds (Tables 10-12). The locally produced wares (n = 105; 83.3 percent) consist of McElmo Black-on-white, Mesa Verde Black-on-white, the McElmo-Mesa Verde Black-on-white hybrid, Mesa Verde Corrugated, and Wetherill Black-on-white. The latter is similar to Mancos Black-on-white; the major distinction between these wares is that Wetherill Black-on-white is decorated with carbon-based paints as opposed to the mineral-based paints of its predecessor (Hayes 1964). The trade wares (n = 21; 16.7 percent) consist of two types from the Chuska Valley, Crumbled House Black-on-white (n = 3) and Hunter Corrugated (n = 13), and two types from the Cibola region, Reserve Smudged (n = 4), and Snowflake Black-on-white (n = 1).

Ceramic Group III wares were found in 11 of the 20 proveniences used in this analysis (Table 12). The south trench (32 sherds; 25.4 percent), the plaza around the room block (20 sherds; 15.9 percent), the Plaza 1 (38 sherds; 30.2 percent) represent the three largest clusters of Ceramic Group III wares on the sites. Plaza 4 had another 11 sherds (9.2 percent), and the remaining 16 proveniences contributed only small numbers of these wares.

Table 10. Ceramic Group IIA by Major Provenience.

	N. Trench	S. Trench	Rm. 1	Rm. 1a	Rm. 1b	Rm. 2	Rm. 3	Rm. 4	Rm. 7	Rm. 8
Brimhall B/w										
Burnham B/w	1b									
Capt. Tom Corrugated									1j	
Cortez B/w	13b,6j,1o					14b,117j[a]		29j[b]	4b	1b,1j
Cortez/Mancos B/w			2j			5b				
Drolet B/w										
Gray Hills Banded	1j									
Mancos Gray		4j				2j				
Naschitti B/w										
Newcomb B/w										
Newcomb Corrugated						1j				
Red Mesa B/w	1b,1j									
Tohatchi Banded	1j					2j				
Tseh So Corrugated										1j
Total	15b,9j,1o	4j	2j			19b,122j		29j	4b,1j	1b,2j

Table 10. Continued

	Plaza around rm block	Plaza 1	Plaza 2	Plaza 3	Plaza 4	Room 13	Plaza s. of Rm 13	N. Plaza	Pit structure	Misc.	Total	% of Ceramic Group I	% of total assem. (n = 3474
Brimhall B/w		1b	1b								2	0.46	0.06
Burnham B/w		1b				1b					3	0.69	0.09
Capt. Tom Corrugated		3j			1j	1j				2b,3j	6	1.38	0.17
Cortez B/w	15b,5j	3b,8j[c]	2b		9b,3j	12b,11j	3b[d],4j	11b,8j	13j,8b		308	70.64	8.86
Cortez/Mancos B/w										1b	5	1.15	0.14
Drolet B/w											1	0.23	0.03
Gray Hills Banded					2j			1j		1j	4	0.92	0.12
Mancos Gray	5j	2j		2j	22j			36j	1j		75	17.20	2.16
Naschitti B/w	1b				1b					1j	2	0.46	0.06
Newcomb B/w	1j				1b,1j						4	0.92	0.12
Newcomb Corrugated	2j	1j						2j			6	1.38	0.17
Red Mesa B/w								1b	2j		5	1.15	0.14
Tohatchi Banded					9j		1j			1j	14	3.21	0.40
Tseh So Corrugated											1	0.23	0.03
Total	16b,13j	5b,14j	3b	2j	11b,38j	13b,12j	3b,5j	12b,47j	13b,11j	3b,6j	436	100	12.55

[a] 116 sherds from reconstructible vessel 3, and one complete ladle
[b] includes 26 unfired sherds from two different vessels
[c] includes five sherds for one Tecomate miniature
[d] includes one complete small pitcher

Table 11. Ceramic Group IIB by Major Provenience

	N. Trench	S. Trench	Rm. 1	Rm. 1a	Rm. 1b	Rm. 2	Rm. 3	Rm. 4	Rm. 7	Rm. 8
Blue Shale Corrugated	5j			3j		1j				
Chuska Black-on-white	2j							1b		
Coolidge Corrugated										1j
Gallup Black-on-white							1j	3j		
Mancos Black-on-white	29b,11j,1o	1b,1j		1b,1j		10b,5j	3j	6b,2j	2b	2b,4j
Mancos Corrugated Indeter.	2j	4j		15j		42j		24j	3j	48j
MC Oblique Indented	102j	30j		8j		261j[a]		21j	20j	
MC Patterned	3j					70j[b]				3j
MC Ribbed	4j					18j[c]			3j	
MC Smeared Indented	1j			2j	1j	3j		1j		
MC Tseh So style	5j									2j
Taylor Black-on-white										
Toadlena Black-on-white										
Tusayan Corrugated	1j			1j					1j	
Total	29b,141j,1o	1b,25j		1b,30j	1j	10b,400j	4j	7b,51j	2b,27j	2b,58j

Table 11. Continued

	Plaza around rm block	Plaza 1	Plaza 2	Plaza 3	Plaza 4	Room 13	Plaza s. of Rm 13	N. Plaza	Pit structure	Misc.	Total	% of Ceramic Group I	% of total assem. (n = 3474
Blue Shale Corr.		3j	1j		1j	20j		6j	1j		43	2.04	1.24
Chuska B/w		1b					2b				4	0.19	0.12
Coolidge Corr.											1	0.05	0.03
Gallup B/w									1b,1j		5	0.24	0.14
Mancos B/w	7b,3j	10b,19j	4b,2j		2b,4j	17b,10 j	25b,20j,1 o	1b,2j[c]	2b	2b,1j	220	10.44	6.33
Mancos Corr. Ind.	72j	63j	3j	4j	19j	49j	52j	1j	4j	9j	417	19.78	12.00
MC Oblique Ind.	190j	64j	54j	9j	43j	76j	99j	10j	95j	3j	1085	51.47	31.23
MC Patterned	12j				3j	1j	1j	1j	29j		123	5.83	3.54
MC Ribbed	3j	24j			24j	1j	2j	3j			87	4.13	2.50
MC Smeared Ind.	16j[d]	14j	2j	1j	2j	31j	2j			1j	79	3.75	2.27
MC Tseh So style	22j	2j			5j			2j			38	1.80	1.09
Taylor B/w						1b					1	0.05	0.03
Toadlena B/w								1b,1j			2	0.09	0.06
Tusayan Corr.											3	0.14	0.09
Total	7b,318j	11b,189j	4b,62j	14j	2b,101j	18b,18 8j	35b,178j, 1o	2b,26j	3b,130j	2b,14j	2108	100	60.68

[a] 140 sherds from reconstructible vessel 1
[b] 58 sherds from reconstructible vessel 2
[c] includes one complete miniature jar
[d] includes one small ladle

b = bowl; j = jar; o = other

Table 12. Ceramic Group III by Major Provenience

	N. Trench	S. Trench	Rm. 1	Rm. 1a	Rm. 1b	Rm. 2	Rm. 3	Rm. 4	Rm. 7	Rm. 8
Crumbled House B/w	1j					2j				
Hunter Corrugated										
McElmo B/w		1b,2j						2b,1j		
McElmo/Mesa Verde B/w			2j			1j				
Mesa Verde B/w						4b		1j		
Mesa Verde Corrugated		26j				1j				
Reserve Smudged										
Snowflake B/w										
Wetherill B/w										
Total	1j	1b, 28j	2j			4b,4j		3b,1j		

Table 12. Continued

	Plaza around rm block	Plaza 1	Plaza 2	Plaza 3	Plaza 4	Room 13	Plaza s. of Rm 13	N. Plaza	Pit structure	Misc.	Total	% of Ceramic Group I	% of total assem. (n = 3474
Crumbled House B/w											3	2.38	0.04
Hunter Corr.		9j									13	10.32	0.37
McElmo B/w	1b	7b	2b		4j	1b					18	14.29	0.52
McElmo/Mesa Verde B/w	1b	1j			1b						3	2.38	0.09
Mesa Verde B/w	2b	1b,6j									16	12.7	0.46
Mesa Verde Corr.	1j	10j			3j						41	32.54	1.18
Reserve Smudged		1b	2b				1j				4	3.17	0.12
Snowflake B/w	1b										1	0.79	0.03
Wetherill B/w	14j	3j			3j					7b	27	21.43	0.77
Total	5b,15j	9b,15j	4b		1b,10j	1b	1j			7b	126	100	3.63

b = bowl; j = jar; o = other

The Role of Temper in Ceramic Research

During the past half-century, the role of temper or constituent analysis in prehistoric creamics has been used to a limited extent during ceramic studies of archaeological materials. Methods are varied according to the scope and purpose of the investigation. Areas to which temper studies can be applied include (1) identification of manufacturing centers, (2) extent and direction of trade, (3) cultural relationships among groups, and (4) influence of environment upon pottery manufacture (Warren 1977).

A temper analysis of approximately 200 sherds of Cortez and Mancos Black-on-white sherds by design motif and temper type indicates that the potters making the two types commonly used similar temper materials (Table 13). For instance, 38 percent of Cortez Black-on-white sherds were tempered with crushed porphyry (3070), while Mancos Black-on-white contained 45 percent porphyry. The Mancos sherds contained 7 percent more crushed sherd than the Cortez Black-on-white sherds. Cortez, on the other hand, had 23 percent hornblende diorite (3240) in contrast to Mancos, which had only 10 percent. Except for the squiggle hachures, which were generally confined to Cortez Black-on-white, there did not appear to be any major differences between the design motifs of the two types.

The presence of at least one vessel at LA 50337, which was unfired and contained biotite porphyry (3070-13), indicates that this rock was used locally for temper material.

Temper analysis was also instrumental in identifying intrusive wares, particularly those from the Chuska Valley. Since crushed sherd and sandstone was an abundant temper type in the San Juan Valley, similar to the temper of the Cibola wares, it was frequently necessary to identify the pottery type on the basis of paint type and surface finish. Paint types in the San Juan were often fugitive, ranging from black to greenish black to brown and red-brown. Cibola paints are usually black mineral. Surface finish on the San Juan wares usually have a glossy surface due to the low percentage of clay shrinkage.

Analyses of the temper types of the potsherds from the room block were tabulated by the pottery types and ceramic groups as well as vessel form (Table 14). A minimum of 63 vessels with an average of 11 sherds per vessel were estimated within the 700 potsherds examined. Various methods of estimating the number of vessels at a site have been utilized in the past but were confined to relatively small ceramic assemblages of less than 2,000 sherds. The results indicated a range of 9 sherds per vessel for sites of Pueblo III time, circa A.D. 1000, to 13 sherds per vessel for early historic sites, and appear to be consistent with the results obtained from examination of the sherds from the room block at LA 50337.

Although the relatively high percentage (42 percent) in the room block of granitic porphyry (3070) as a local temper, the equal or higher percent of crushed sherd and sandstone suggests that these temper materials were of equal importance to the potters of the San Juan region.

Table 13. Cortez and Mancos Black-on-White Designs, Motifs and Temper

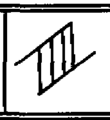
Motifs & Temper												Total	%
Cortez Black-on-white													
Crushed sherd	10	1	1	1	1			7	1			22	23
Sandstone and sherd	2	1	1			2	1	3	1	1	1	15	15
Porphyry (3070)	12	2	2	1	2	6	1	3	1	3	3	38	38
Hornblende diorite (3240)	4	1		1		3		5	1		7	22	23
Phanerite (3301)			1									1	1
Total	28	5	5	3	3	11	2	20	4	4	11	97	
Mancos Black-on-white													
Crushed sherd		21	6	1	2	2	1	4	1		2	40	37
Sandstone and sherd		6	1				1				1	9	8
Porphyry (3070)	2	15	4	3	5	3	2					49	45
Hornblende diorite (3240)		6		1	3	1						11	10
Phanerite (3301)													
Total	2	59	11	5	10	6	2	6	1		7	109	

Table 14. Room Block, Temper by Type Sherd Totals and Average Sherds per Vessel

Temper Types	I Redware	La Plata B/w	Klatuthlanna B/w	Moccasin Gray	II Cortez B/w	Mancos B/w	Mancos Gray	Oblique Ind.	Smeared Ind.	Tseh So style	Miscellaneous	Newcomb B/w	Chuska B/w	Newcomb Corr.	Capt. Tom Corr.	Blue Shale Corr.	Gallup B/w	Tseh So Corr.	Tohachi Banded	Coolidge Corr.	III McElmo B/w	Mesa Verde B/w	Mesa Verde Corr.	Crumbled B/w	Totals	Subtotal	Percent
Sandstone and sherd																											
Code 2040		1	1		3																				5		
Code 2041			1																						1		
Code 2050			2		7 9												4								22		
Code 2081																			2	1					3		
Code 2090						1															1				2		
Code 2103			2																						2		
Morrison fm 2112			1																						1		
Chinle fm 2113			2																						2		
Mesa Verde ss 2140																			1	1					2		
Gallup ss 2150																			1		2				3	42	6
Porphyry 3070				14	1 1	12 3	2	344	4	2	26										1	4	1		415		
Porphyry & mica (3070-11, 13)				7	111	6	41															1			188	603	86
Trachyte 3181										1		1	1	1	1	4								1	10		
Code 3240-42	1				2	5															1				9		

Table 14. Continued.

Temper Types	I Redware	La Plata B/w	Klatuthlanna B/w	Moccasin Gray	II Cortez B/w	Mancos B/w	Mancos Gray	Oblique Ind.	Smeared Ind.	Tseh So style	Miscellaneous	Newcomb B/w	Chuska B/w	Newcomb Corr.	Capt. Tom Corr.	Blue Shale Corr.	Gallup B/w	Tseh So Corr.	Tohachi Banded	Coolidge Corr.	III McElmo B/w	Mesa Verde B/w	Mesa Verde Corr.	Crumbled B/w	Totals	Subtotal	Percent
Andesite 3301				1	1	1		7	1																11		
Vitrophyre 3740											1														1		
Quartzite 4000																				1					1		
Sherd, med. 0102					1	2																			3		
Sherd, coarse 0103					3 6	7 3																1			20	55	8
Totals	1	1	9	22	145	34	8	392	5	1	1	1	1	1	1	4	4	1	3	3	5	6	1	1	700		

Bowl/Jar; minimum 63 vessels; 11 sherds per vessel average

The North Trench and Kiva Ceramics

Five percent of the 241 sherds from the north trench and kiva are from the early Ceramic Group I, dating circa A.D. 700 to 850. Pottery types include Sambrito Brown, La Plata Black-on-red, Kiatuthlanna Black-on-white, and Moccasin Gray. Kiatuthlanna Black-on-white is tentatively included in the early ceramic group due to its longevity as a type; it may be later than its suggested time span. At least five vessels are represented in the early group (Table 15).

Ninety-five percent of the sherds from the north trench and the kiva, or 230 sherds, represent a minimum of 24 vessels averaging 10 sherds per vessel. The major pottery types include Cortez Black-on-white, Mancos Black-on-white, and Mancos Corrugated, which are included in the Ceramic Group II, dating between A.D. 900 and 1150.

Radiocarbon dates were obtained from the north trench and the kiva. A date of A.D. 487 $\pm$ 100 was obtained from a charcoal lens, Stratum 4, and could be associated with the four Sambrito Brown sherds, representing two vessels. The Sambrito Brown sherds are believed to be from the early ceramic group, which is dated herein circa A.D. 700 to 850.

A C-14 date from the kiva roof (Stratum 19), A.D. 879 $\pm$ 60, is consistent with ceramics recovered from the kiva and include Cortez Black-on-white, Mancos Black-on-white, and Mancos Corrugated, nearly 77 percent of the sherds recovered. Three intrusive types from the Cibola area and five from the Chuska Valley were represented in Ceramic Group II.

Table 15. North Trench and Kiva Ceramics

	Trash	Charcoal Lens	Pit Fill	Redeposited Fill	Wall & Kiva Roof	Kiva Roof	Total
	1e	4f	5	14	18	19g	
I. Sambrito		4j[b]		3j	1j		8
La Plata B/r						1b	1
Kiatuthlanna B/w	1j						1
Moccasin Gray						1j	1
Utility (unknown period)				2j			2
IIa Cortez B/w	5j			12b,1j	1b		19
Cortez, unfired	1j						1
Cortez, small pitcher				1o[d]			1
Red Mesa B/w				1b[e],1j			2
Burnham B/w					1b		1
Gray Hills Banded						1j	1
Tohatchi Banded						1j	1
White Ware	1b,7j			9b,32j,2o[c,h]	3b,7j	8j	69

Table 15. Continued.

	Trash	Charcoal Lens	Pit Fill	Redeposited Fill	Wall & Kiva Roof	Kiva Roof	Total
	1e	4f	5	14	18	19g	
Mineral White				1b,5j			6
IIb Mancos B/w	2b,1j			10b,5j	2b,2j	15b,3j	41
Corrugated				1b,5j			6
Indeterminate	1j[i]			1j[i]	4j		6
Tseh So Style				5j			5
Oblique Ind.	14j		1j	68j	9j	10j	102
Smeared Ind.			1j				1
Patterned				1j	1j	2j	4
Chuska B/w	1j			1j			2
Blue Shale Corr.	1j			4j			5
Coolidge Corr.	1j						1
Gray Ware	5j		1j	2b,6j	4j		18
Tusayan Corr.	1j						1
III Carbon White				2j			2
Crumble House				1j			1
Totals	3b,39j	4j	3j	36b,143j,3o	7b,28j	16b,26j	309

a Tecomate
b two vessels
c lug
d pitcher, miniature
e north trench, stratum 1, A.D. 724±130
f stratum 4, north trench, A.D. 487±100
g kiva roof, A.D. 879±60
h handle
i ribbed

The South Trench

From a total of 81 sherds recovered from the south trench, 55 sherds appear to belong to one vessel of Mancos Corrugated, Oblique Indented style. However, the 81 sherds represent a minumum of 12 vessels, with an average of 7 sherds per vessel.

Four sherds from the early ceramic group, dating A.D. 700 to 850, are from three pottery types, Sambrito Brown, Bluff Black-on-red, and Moccasin Gray (Table 16).

Eighteen sherds are from the intermediate ceramic group and probably date between A.D. 1000 and 1150, as no Cortez Black-on-white sherds are present. However, Mancos Gray and Burnham Black-on-white, a Chuska Valley ware, may pre-date A.D. 1000.

The third ceramic component is represented by 72 percent of the sherds present, includes McElmo Black-on-white and Mesa Verde Corrugated, and is dated between A.D. 1100 and 1300.

Table 16. South Trench Ceramics

	Plaza	Roasting Pit	Hearth Fill (F3)	Trash	
	8	10c	11	12	Total
I. Sambrito Brown	1j	1j			2
Bluff B/r		1b			1
Moccasin Gray		1j			1
II. Mancos Gray		7j			7
Burnham B/w		1j			1
Mancos B/w		1b,1j			2
Mancos Corr. Oblique Indent.		7j			7
Mancos Corr. Smear Indent.		1j	1j		2
III. McElmo B/w		1b,1j,1o[a]			3
Mesa Verde Corr. Oblique Indented		55j[b]			55
Gray ware, smooth				1j	1
Totals	1j	3b,75j,1o	1j	1j	82

a effigy handle(?)
b rim everted 43°
c A.D. 992 ± 60

Seventy-nine of the 81 sherds came from Stratum 10, a roasting pit. A C-14 date of A.D. 992 ± 60, suggests that the roasting pit was used during the second occupation, which is dated A.D. 1000 to 1150. However, the ceramic assemblage is consistent within a single occupation.

The Room Block Ceramics

A total of 707 sherds recovered from the room block at LA 50337 were analyzed by pottery and temper types. The room block consists of six excavated rooms, 1-4, and 7-8.

San Juan wares constituted 96 percent of the assemblage with Cibola wares contributing 3 percent and Chuska wares 1 percent; one sherd of San Juan Red Ware was present. Unidentifiable body sherds were omitted from the tabulations.

Twenty-three different pottery types and 19 major temper types are included in the room block tabulations. The temper types of the room block are basically comparable to the 18 coded types described at the Pictured Cliffs site in the San Juan Valley (Warren 1985).

According to the temper analyses, 96 percent of the sherds from the room block have temper inclusions believed to be indigenous to the San Juan region; three (3 percent) have temper similar to that of the Cibola region, mainly the eastern Red Mesa Valley; and one (1 percent) contains trachyte from the Chuska Valley. The one sherd of San Juan Red Ware contained the hornblende diorite (code 3242, 3240) characteristic of the Four Corners area.

At least 85 percent of the sherd assemblages of the room block were utility ware produced in the San Juan area, probably much of it local. At least one unfired vessel of Cortez Black-on-white and two partially reconstructible utility vessels of Mancos Corrugated were present in Room 2 of the room block.

Within the room block as a whole, a minimum of 56 different vessels is indicated by noting temper differences within pottery types. Estimating the number of vessels by room, pottery and temper type, and by form resulted in a total of 72 vessels represented. No estimate of the number of years involved in producing and breaking the estimated vessels is suggested.

George M. Foster (1960) attempted to determine the life expectancy of ceramic vessels and the average number of pots of a village household. He found that some pots used daily might survive a month, while a special vessel with infrequent use might survive five or more years. The presence of children and animals reduced the longevity of a ceramic vessel. Foster has suggested that an average life of a pot used daily might be six months. One household might have several pots.

Even at the rate of one pot per year, the estimated 56 to 72 different vessels represented in the six rooms of the room block, only 9 to 12 vessels would be present in each household for a period of 9 to 12 years. None of the rooms were represented by one or more trash middens, however. Estimates, therefore, of vessels per household would be completely skewed in the absence of middens (Table 17).

Both Chuska and Cibola wares were present in Rooms 1 to 4 and Room 7. Potsherds from Room 8, however, are all subfloor and are apparently pre-dating room construction. A C-14 date obtained from the hearth (F. 24) fill below the floor of Room 8, suggests a date of A.D. 693 ± 70, for the subfloor trash relating this to an early occupation at the site. Most of the ceramics from the trash level (Stratum 61) postdate A.D. 900, however.

Table 17. Estimated Number of Vessels per Room in the Room Block, by Ware

Room	San Juan Ware	Chuska Ware	Cibola Ware	Red Ware	Total
1	8	1	1		10
2	17	4	1	1	23
3	2				2
4	9	1	2	1	13
7	4	1	2		7
8 (subfloor)	7	2	7	7	17
Totals	47	9	13	3	72

Room 1

A total of 51 sherds representing a time span from A.D. 775 through 1300 are present (Table 18). Sherds from a minimum of 12 vessels are present in the subfloor deposit. These appear to be from disturbed cultural materials as they range from Moccasin Gray (A.D. 700-900) to Mancos Corrugated (A.D. 900 to 1200). Floor 2 has a radiocarbon date of A.D. 1177 ± 100 from a hearth.

Table 18. Room 1 Ceramics

	Strata ?	Stratum 22	Stratum 23	26	27	24[d],28	29	33	50	Total
I. Moccasin Gray							1j			1
IIa. Cortez B/w	1b		1j				1j			3
IIb. Mancos B/w			1b,1j			1j				3
Mancos Corr. Oblique Ind.		4j	14j		2j		3j	1j	1j	25
Mancos Corr. Smeared Ind.		1j			1j					2
Blue Shale Corr.			1j				2j			3
Coolidge Corr.		1j								1
III. Mesa Verde B/w		2b								2
Mesa Verde Corr. Oblique Indented						1j				1
Black-on-white				1j						1
White Ware			1j[b]							1
Gray Ware	4j	1b,1j[a]	1j[c]		1j					8
Totals	1b,4j	3b,7j	1b,19j	1j	4j	2j	7j	1j	1j	51

a cylindrical handle; b worked sherd; c strap handle; d Feature 7, Floor 2, A.D. 1177 ± 100, hearth fill

Room 2

A minimum of 22 vessels are represented in a total of 597 sherds on the basis of pottery type, form, and temper (Table 19). Two nearly complete utility vessels and one unfired Cortez Black-on-white jar account for the high number of 27 sherds per vessel. A miniature white ware jar is also present. Four abraded or utilized sherds were recovered, including a disk fashioned from a Cortez Black-on-white bowl sherd. Intrusives include four Chuska Ware pottery types, one Cibola Ware sherd and one La Plata Black-on-red sherd.

Sherds from at least three different temporal components at LA 50337 occur in the subfloor deposit. The first has only one La Plata Red Ware sherd from a ceramic group dated between A.D. 700 and 850; the second represents an occupation between A.D. 900 and 1150, with both Cortez Black-on-white and Mancos Black-on-white present; and the third temporal component is dated from A.D. 1100 to 1300 by the presence of McElmo and Mesa Verde Black-on-white sherds.

It is suggested here that a higher than average number of sherds per vessel may indicate pottery-making activities. This is supported by the presence of two worked sherds.

Table 19. Room 2 Ceramics

	Strata							Total
	28	38	40	45	48	52	Burial 55	
I. La Plata Red	1b							1
II. Cortez B/w	5b	12b[a]					1j?	18
Cortez unfired		115j[d]						115
Cortez/Mancos B/w			4b[a]					4
Cortez B/w, corr. exterior		3b						3
Mancos Gray	2j	20j				3j		25
Mancos ribbed, patterned		51j[f]						51
Newcomb B/w							1j	1
Newcomb Corr.	1j							1
Tohatchi Banded	2j						1j	3
IIb. Mancos B/w	8b[a],5j							13
Mancos Chaco style			2b[a]					2
Mancos Corr. Oblique Ind.		118j		2j	2j		1j	123
Mancos Corr. Oblique Ind.	36j	140j[c]						176
Mancos Smeared Ind.	3j	1j		1j				5
III. McElmo/Mesa Verde B/w	1j							1
Mesa Verde B/w	4b							4
Crumbled House B/w	2j							2
Mesa Verde Corr.	1j							1
White Ware	16j[b]	20j					2j	38
Totals	18b,75j	15b,465j	6b	3j	2j	3j	6j	587

a sherd, abraded
b miniature jar
c reconstructible vessel 1
d unfired jar
e one worked disk
f reconstructible vessel 2

Room 3

Only four sherds were found in post-occupational fill of Room 3: one Mancos Black-on-white jar sherd and three Mancos Corrugated jar sherds.

Room 4

A minimum of 14 vessels are represented in this room of a total of 112 sherds (Table 20). An early component red ware sherd was noted on Floor 2. Twenty-eight sherds of an unfired buff ware, probably Cortez Black-on-white, were found on Floor 1. Three worked sherds were also present. This assemblage may be associated with the ceramics of Room 2, which also has unfired pottery and utilized sherds.

Three sherds of McElmo Black-on-white and one of Mesa Verde Black-on-white occurred in the upper strata of the room. A radiocarbon date of 704 $\pm$ 100 was obtained from the lower or third floor of the room and appears to be associated with Mancos Black-on-white and Mancos Corrugated. These types were not produced prior to A.D. 900. Post-occupation disturbance may be responsible for this.

Room 7

All potsherds from this room appear to be without provenience as they occur in post-occupational fill. A minimum of seven vessels dating from A.D. 700 to 1150 are represented by 37 potsherds (Table 21).

Table 20. Room 4 Ceramics

	Strat. 22	Fl. 1 Strat. 31	Strat. 32	Fl. 2 Strat. 39	Fl. 3 Strat. 41	Fl. 3, F.15-16, Strat. 50	West Wall	Total
I. Kiatuthlanna B/w			1b					1
Red ware				1j				1
IIa. Cortez B/w		4j						4
Cortez unfired				28j				28
IIb. Mancos B/w	1b		1b,1j	5j		1b	1b,1j	11
Mancos Corr. exterior						2b		2
Gallup B/w			1j	2j[a]				3
Chuska B/w	1b							1
Mancos Corr. Oblique Ind.	14j	5j	9j	3j		9j	1j	41
Mancos Corr. Oblique Ind.				1j[a]				1
Mancos Corr. Smeared							1j	1
III. McElmo B/w	3b							3
Mesa Verde B/w			1b					1
Totals	5b,14j	9j	3b,11j	40j		3b,9j	1b,3j	98

a worked sherd

Decorated wares are mainly Cortez and Mancos Black-on-white dating between A.D. 900 and 1150. Two sherds of Kiatuthlanna Black-on-white, which may date as early as A.D. 700, belong to the earliest ceramic group or component at LA 50337.

Table 21. Room 7 Ceramics

	Stratum 22, Level 1, 2	Stratum 50[a], Level 4	Totals
I. Kiatuthlanna B/w	2b		2
IIa. Cortez B/w	4b	1b	5
Mancos Gray	5j		5
Capt. Tom Corrugated	1j		1
IIb. Mancos B/w	2b		2
Mancos Corr. Oblique Indented	20j	1j	21
Coolidge Corrugated	1b		1
Total	8b,27j	1b,1j	37

a A.D. 745 ± 60

Table 22. Room 8 Ceramics

	Stratum 61, Level 1	Stratum 61, Levels 2 and 3	Total
I. Kiatuthlanna B/w		6b	6
IIa. Cortez B/w		1b,2o[a]	3
Mancos Gray		3j	3
Tseh So Corrugated	1j		1
IIb. Mancos B/w	2b,3j		5
Mancos Corr. Oblique Ind.	24j	24j	48
Mancos Corr. Tseh So style		2j	2
Coolidge Corrugated		1j	1
Totals	2b,28j	7b,30j,2o[a]	69

a dipper
b A.D. 693 ± 70, Strat 59; hearth, Feature 24

Room 8

A total of 75 sherds representing a minimum of 12 vessels were recovered from Room 8 (Table 22). Two ceramic periods, A.D. 700-850 and A.D. 900-1150, are indicated. The average number of sherds per vessel is six. Three intrusive wares from the Cibola area include Kiatuthlanna Black-on-white, Tseh So Corrugated, and Coolidge Corrugated. At least one Chusk white ware and one Chuska gray ware were present.

Two radiocarbon dates, one in Room 7 and one in Room 8, dated A.D. 745 ± 60 and A.D. 693 ± 70, are 150 to 200 years too early for most of the pottery types found in the two rooms and may be the result of dating old wood.

However, the sherds from Room 7 are from disturbed or unprovenienced strata, and those from Room 8 are all from subfloor trash. Both groups of sherds can be dated between A.D. 900 and 1150 according to long-established tree-ring dating (Breternitz 1966; Breternitz et al. 1974; Hayes 1964, 1975).

It should be noted that at least two vessels of Kiatuthlanna Black-on-white were present, one each in Rooms 7 and 8. These have been identified mainly upon temper and clay differences, as well as the presence of manganese in black paint. Kiatuthlanna is a long-lived type from at least A.D. 700-1000; it is of interest at the La Plata site because of its similarities in design to many of the Cortez Black-on-white motifs.

The Plaza Around the Room Block

A total of 364 potsherds from the plaza area represents a minimum of 25 vessels and 3 ceramic groups, with an average of 15 sherds per vessel (Table 23).

The first pottery group dating between A.D. 700 and 850 includes two pottery types, Sambrito Brown and La Plata Black-on-white.

The second group dates between A.D. 900 and 1150, with most of the sherds belonging to vessels produced during a post-1000 period. Cortez Black-on-white and Mancos Gray were predominant during the 900s, while Mancos Black-on-white and Mancos Corrugated constitute about 78 percent of the total for the plaza during the 1000s.

The third ceramic group dates from A.D. 1150 to 1300; types include McElmo Black-on-red, Mesa Verde Black-on-white, Wetherill Black-on-white, and Snowflake Black-on-white. The latter pottery type is intrusive from the Upper Little Colorado Cibola District.

The absence of Group III sherds in Stratum 36, fill under floor, indicates that there was no continuity between the Group II and Group III occupations. Floor 1 is apparently associated with the last occupation.

Table 23. Plaza Around Room Block Ceramics

	Strata, Post-Occupation		Fill under Occupation Surface	Total
	22	22/62	36	
I. Sambrito Brown	1j			1
La Plata B/r		1b,1j		2
La Plata Red Ware	1j			1
IIa. Cortez B/w	10j	1b	5b,3j	19
Cortez/Mancos B/w	1j			1

Table 23. Continued.

	Strata, Post-Occupation		Fill under Occupation Surface	Total
	22	22/62	36	
Naschitti B/w		1b		1
Newcomb Corr.	1j		2j	3
Mancos Gray	9j	17j		26
IIb. Mancos B/w	1b,1j	5b	1b,1j	9
Mancos Corr.		5j	18j	23
Mancos Corr. Oblique Indent.	137j	2j	44j	183
Mancos Corr. Smeared Indent.	5j	1j	17j	23
Mancos Corr. Patterned		1j	12j	13
Mancos Corr. Tseh So Style	9j	1j	23j	33
Mancos Corr. Payan Style		2j		2
III. McElmo B/w		1b		1
Wetherill B/w		14j		14
McElmo/Mesa Verde B/w	1b			1
Mesa Verde B/w		2b		2
Mesa Verde Corr.	5j			5
Snowflake B/w	1b			1
Total	3b,180j	10b,26j	6b,138j	366

Plaza I

Of a total of 208 sherds recoverd from Plaza 1, three ceramic units and a minimum of 27 vessels are represented with an average of 8 sherds per vessel. Three major ceramic units are represented with approximate time spans of A.D. 700-850, 900-1150, and 1150-1300. Eighty-eight percent of the sherds fall within the intermediate group. A radiocarbon date of A.D. 827 $\pm$ 100 appears to be intermediate in time between the earlier and the middle ceramic units. The earlier unit dates A.D. 700 to 850, but only seven sherds of this unit were present in the fill below Plaza 1 (Table 24).

The intermediate ceramic group includes both Cortez Black-on-white and Mancos Black-on-white with Mancos Black-on-white and Corrugated predominating. The later ceramic unit includes McElmo and Mesa Verde Black-on-white. One sherd of Reserve Smudged suggests the possibility that this unit may date A.D. 1200 to 1300, as imports from the Upper Little Colorado region to the Salmon Ruin were common in that time period.

Other imports to LA 50337 include sherds of six utility ware types from Chuska Valley and one from the Cibola area, all dating to the intermediate ceramic unit.

Two miniature vessels, one a tecomate classed as Cortez Black-on-white and the other a miniature Mancos Corrugated jar, were recovered from Strata 44 and 66, respectively.

Plaza 2

A total of 35 sherds and one Mancos Corrugated jar, oblique indented style, were recovered from Plaza 2 strata. The large restorable jar of Mancos Corrugated was from the hearth fill (F. 35, Stratum 77). A minimum of 11 vessels were represented including the restorable jar. Sherds from the three ceramic temporal groups were present (Table 25).

Table 24. Plaza 1 Ceramics

	Ramada Hearth			Pit Fill			Fill Below Plaza 1		T
	44b	30	51	65	66	68	57	73	
I. La Plata Red Ware								1b	1
Moccasin Gray			1j	2j			1j	2j	6
IIa. Cortez B/w	6j[c]		1j	1b,1j				2b	11
Mancos Gray	10j			5j			2j	1j	18
Burnham B/w							1b		1
Brimhall B/w							1b		1
Capt. Tom Corr.				3j					3
Newcomb Corr.				1j					1
Tohatchi Banded				1j					1
IIb. Mancos B/w	4b,6j		1b,1j	4b			1b,7j		24
Wetherill B/w[a]					1b[a]				1
Wetherill B/w	2j							1j	3
Chuska B/w	1b								1
Mancos Corr. Tseh So Style	1j			2j			1j	1j	5
Mancos Corr. Oblique Indented	38j		4j	21j	1j[d]		19j	5j	88
Mancos Corr. Smeared Indented	12j		3j	3j	1j[e]	1j	1j		21
Mancos Corr. Tooled, Punctate		2j							2
Blue Shale Corr.	1j			1j				1j	3
III. McElmo B/w	2b			7b					9
Mesa Verde B/w				1b					1
Mesa Verde Corr.	8j								8
Reserve Smudged				1j					1
Totals	7b,85j	2j	1b,10j	13b,41j	1b,2j	1j	3b,31j	3b,11j	209

a Sosi-Dogozhi Style (2140 + Fe)
b Stratum 44: A.D. 827 ± 100
c Tecomate, miniature
d miniature jar
e large jar

Table 25. Plaza 2 Ceramics

	Strata			Totals
	72	83, Feature 37	77, Feature 35	
I. Chapin B/w	1b			1
Moccasin Gray	1j			1
II. Cortez B/w	1b			1
Mancos B/w	1b,2j	3b		6
Mancos Corr. Tseh So Corr.	1j			1
Mancos Corr. Oblique Indented	26j		1j[a]	27
Mancos Corr. Smeared Indented	4j			4
III. McElmo B/w	1b	1b		2
Reserve Smudged		2b[b]	1b[b]	3
Totals	4b,34j	6b	1b,1j	46

a large jar
b white paste, temper (2050-03) sherd and sandstone

Chapin Black-on-white and Moccasin Gray are in the first ceramic group dating from A.D. 700 to 850; Cortez Black-on-white, Mancos Black-on-white, and Mancos Corrugated in the second group; and McElmo Black-on-white and Reserve Smudged in the third group A.D. 1150 to 1300. The smudged sherds may be from the same vessel as the sherd found in Plaza 1. Twelve smudged sherds were reported from the Badger House Community by Hayes and Lancaster (1975) in the upper levels of the dump. Reserve Smudged was also present in the late occupation at Salmon Ruin, A.D. 1200, an apparent import from the Upper Little Colorado area.

Plaza 3

A total of 18 sherds were recovered from the Plaza 3 area, most of which are utility wares, including Moccasin Gray, Mancos Gray, and Mancos Corrugated. One carbon-on-white sherd probably dates to the latest group, A.D. 1150-1300. A minimum of six vessels are represented with an average of three sherds per vessel (Table 26).

A radiocarbon date of A.D. 735 ± 70 appears to be associated with the earilier ceramic period of A.D. 700 to 850. The date was obtained from a hearth fill (F. 8), Stratum 84.

Plaza 4, North of Room Block

Of a total of 232 sherds from Plaza 4, north of the room block, 15 local pottery types and 9 intrusive types were identified (Table 27). Seven of the intrusive types represented were from the Chuska Valley, two from the Cibola area, and one from the Four Corners area. Sherds from the three temporal groups were well represented. No radiocarbon dates were obtained from this provenience.

Table 26. Plaza 3 Ceramics

	Stratum 64	Hearth Fill, Stratum 84	Totals
I. Moccasin Gray		2j	2
II. Mancos Gray	1j	3j	4
Gray Ware (Cibola?)	1j		1
Mancos Corrugated Smeared Indented		1j	1
Mancos Corrugated Oblique Indented		9j	9
III. Carbon/white		1b	1
Totals	2j	1b,15j	18

A minimum of 24 vessels were represented with an average of 10 sherds per vessel. All three ceramic groups were represented with the intermediate group comprising 88 percent of the sherds; Group I and Group III each comprised 6 percent of this assemblage.

Table 27. Plaza 4 Ceramics

		Trash on Plaza				
	Stratum 22	Stratum 78	Stratum 79	Stratum 80	Stratum 85	Total
I. La Plata B/r		1b				1
Piedra B/w		1b				1
Kiatuthlanna B/w		7j				7
Moccasin Gray		6j				6
IIa. Cortez B/w	3b	13b,5j	3b			24
Cortez B/w(?)		1b				1
Mancos Gray	2j	53j			1j	56
IIb. Mancos B/w	1b,1j	3b,3j	1b,3j	2b		14
Mancos Corrug. Oblique Indent.	9j	43j	19j	2j	2j	75
Mancos Corrug. Patterned		3j				3
Mancos Corrug. Tseh So Style		5j				5
Newcomb B/w		1b				1
Naschitti B/w		2b				2
Gray Hills Banded		4j				4
Capt. Tom Corr.		3j				3
Blue Shale Corr.		2j		1j		3
Tohatchi Banded	1j	10j				11
Wetherill B/w	2b		1b			3
III. McElmo B/w		1b,1j				2

Table 27. Continued.

	Stratum 22	Trash on Plaza		Stratum 80	Stratum 85	Total
		Stratum 78	Stratum 79			
Mesa Verde Corr.	3j					3
Hunter Corr.	1j	5j	1j	1j		8
Totals	6b,17j	30b,143j	5b,23j	2b,4j	3j	233

Room 13 and Plaza

The ceramics of Room 13 were divided into two areas, Room 13 and the plaza south of Room 13. A total of 454 potsherds were recovered from the two areas, with the sherd counts equally divided (Tables 28 and 29). The early ceramic group included three pottery types, La Plata Black-on-red, Moccasin Gray, and Kiatuthlanna Black-on-white, with a total of 19 sherds. However, only one late group sherd was present, a McElmo Black-on-white jar sherd.

A minimum of 17 vessels was represented in Room 13 and its adjoining plaza with an average of 14 sherds per vessel. The most common sherds were Mancos Corrugated, totaling 151 sherds. Intrusives included La Plata Black-on-red and Kiatuthlanna Black-on-white and five different Chuskan imports.

The plaza south of Room 13 produced 228 sherds with a minimum of 15 pottery types averaging 15 sherds per vessel. Seven sherds of the early ceramic group were present from La Plata Black-on-red and Moccasin Gray vessels. Sherds from the varieties of Mancos Corrugated comprised 68 percent of the total assemblage. A small pitcher of Cortez Black-on-white from Stratum 94 was analyzed for pollen. Two radiocarbon dates were obtained from Room 13 and the associated plaza. The first date of A.D. 1013 ± 60 is from Stratum 108, Floor 2, Feature 45, a warming pit. The only sherds associated with this provenience are three Mancos Corrugated, variety oblique indented, utility sherds. The date is consistent with the suggested dates for the intermediate ceramic group, A.D. 900-1150. Mancos Corrugated has a long production period, ranging from A.D. 900 to 1200. The second date from Feature 36, a ramada on the plaza, appears to be too early at A.D. 477 ± 80 for a pottery association.

A third date associated with Room 13 is from redeposited subfloor trash below the room. The date A.D. 662 ± 70 may be associated with building debris (Stratum 104). Ten sherds of La Plata Black-on-red were recovered from Stratum 104; the estimated dates for the early ceramic group, which is characterized by intrusive red wares and brown wares, are A.D. 700 to 850. The 10 sherds constitute 37 percent of the La Plata Red Wares recovered from the site.

Ceramic Group I consituted 5 and 3 percent of the sherds from Room 13 and plaza south of Room 13. Ceramic Group IIa produced 11 and 4 percent, respectively; and Ceramic Group III constituted only 1 percent of Room 13 sherds. Although Group I ceramics were present in small percentages, Groups IIa and b contributed the bulk of the sherds in both proveniences.

A white ware sherd from Stratum 87, plaza surface, was abraded on four edges. A small pitcher of Cortez Black-on-white from the plaza surface was analyzed for pollen.

Table 28. Room 13 Ceramics

	Stratum 22	Stratum 97	Stratum 100	Stratum 101	Stratum 108[c]	Stratum 109	Stratum 103	Stratum 104[e]	Stratu m 121	Total
I. La Plata B/r								8b,2j		10
Kiatuthlanna B/w	2b									2
IIa. Cortez B/w	6b,3j						1b,3j	6b,4j	1b	24
Mancos Gray	1j									1
Burnham B/w	1b									1
IIb. Mancos B/w		1b,2j	1b,2j	9b[b]		1b	3b,2j			21
Mancos Corr. Oblique Ind.	17j	25j	10j	29j	3j	1j	19j	44j		148
Mancos Corr. Smeared Ind.							1j			1
Mancos Corr. Patterned, Tooled			1j				1j			2
Taylor B/w	1b									1
Capt. Tom Corr.		1j								1
Blue Shale Corr.	1j						1j	18j		20
Burnham B/w	1b									1
III. McElmo B/w		1j								1
White ware				1j[a]						1
Totals	11b,22j	1b,29j	1b,13j	9b,30j	3j	1b,1j	4b,27j	14b,68j	1b	235

a abraded edge; b two drill holes; c Room 13, F. 45, Floor 2, A.D. 1013 ± 60; d Room 13, Plaza, F. 36(?), A.D. 477 ± 80; e Room 13, subfloor trash, Strata 103, 104, A.D. 662 ± 70

Table 29. Plaza South of Room 13 Ceramics

Strata	22	75	76	81	82, 86	87	90	91	98	94	99	Total
I. La Plata Red Ware			1j		2j							3
Moccasin Gray		2j	2j									4
IIa. Cortez B/w			4j			1j				1j[b]	1b	7
Tohatchi Banded	1j											1
Unfired	1b,1j											2
IIb. Mancos B/w	10j	23b,4j			3b	1b,2j	5j	1j			1b,1j	51
Mancos Corr. Ext.			3j		1j							4
Mancos Corr. Oblique Ind.	55j	36j	14j	1j	3j	5j	18j	3j	1j	1j	9j	146
Mancos Corr. Smeared Ind.				1j	1j							2
Mancos Corr. Pattern	1j		1j		1j	2j					1j	6

Table 29. Continued.

Blue Shale Corr.	2j											2
White ware						1j[a]						1
Total	1b,70j	23b,42j	25j	2j	3b,8j	1b,11j	23j	4j	1j	1b,1j	2b,11j	228

a worked sherd, four edges
b small pitcher, pollen analysis

The North Plaza

A total of 116 potsherds, representing a minimum of 29 vessels, averaged four sherds each. Five specialized forms were present including a canteen from a white ware vessel from the Cibola area; a local Mancos Black-on-white dipper; a La Plata Black-on-red tecomate (seed jar); a squash effigy vessel of Cortez Black-on-white; and a small Moccasin Gray pitcher.

All three ceramic groups were represented; 17 of the pottery types present are intrusive to the area; 12 are probably locally made in the San Juan area. The intrusive types represented include Kiatuthlanna Black-on-white, Abajo Polychrome, Bluff Black-on-red, La Plata Black-on-red, Gray Hills Banded (Chuska Valley), Newcomb Black-on-white (Chuska Valley), Captain Tom Corrugated (Chuska Valley), Red Mesa Black-on-white (Cibola area), the Cibola White Ware canteen, Toadlena Black-on-white (Chuska), and Blue Shale Corrugated (Chuska Valley). Four of the five pottery types in the earlier ceramic group are intrusive, and may be contemporary with the associated pit structure (Table 30).

Table 30. North Plaza Ceramics

	Stratum 22	Trash	Sand & Charcoal	Pit fill, F. 41	Sand & Charcoal	Plaza Surface	Pit, F. 48	Total
		89	92	95	106	110	111	
I. Abajo Polychrome						1b		1
Bluff B/r			2b		7j			9
La Plata B/r		2b,1j[c]		1j	1b			5
Kiatuthlanna B/w					2b[f]			2
Moccasin Gray			11j[e]	3j	1j			15
IIa. Cortez B/w	2j	1b	1b,2j[d]	8b,3j	1b			18
Mancos Gray		1j	5j	3j	15j		1j	25
Newcomb B/w			1j	1j				2
Red Mesa B/w			1b	1b				2
Carbon/white			3j					3
Gray Hills Banded					1j			1
Capt. Tom Corr.			3j					3
IIb. Mancos B/w	1b,1j[b]		4j		1j			7
Mancos Corr. Oblique Ind.	3j	2j	3j	2j	2j			12

Table 30. Continued.

Mancos Corr. Patterned, Tooled	1j							1
Mancos Corr. Tsch So					1j			1
Toadlena B/w					1b,1j			2
Cibola White Ware	1j[a]							1
Blue Shale Corr.			3j	3j				6
Totals	1b,8j	3b,4j	4b,35j	9b,16j	5b,29j	1b	1j	116

a one canteen
b one dipper
c one tecomate
d one squash effigy
e one pitcher
f one lavender glaze, Arizona
g A.D. 796 $\pm$ 50, F. 49, hearth fill

Only one of the 18 north plaza proveniences produced a high percentage of Group I ceramics, which includes Abajo Polychrome, Bluff Black-on-red, La Plata Black-on-red, Kiatuthlanna Black-on-white, and Mocassin Gray. Sambrito Brown, which is included in the group was not present at the north plaza. Twenty-eight percent of the sherds from the north plaza were from the early Ceramic Group I. However, 14 proveniences had from 1 to 11 percent of Group I pottery types. As the Group I ceramics date between A.D. 700 to 800 or 850, it is possible that timbers from the roof were re-used during early Group IIa, which dates between A.D. 900 and 1000, with a major decorated type being Cortez Black-on-white. Twenty-two percent of the sherds from the pit structure and 47 percent of the sherds from the north plaza were identified as Cortez Black-on-white and contemporary types of Group IIa. Seventy-two percent of the sherds from the pit structure date to Group IIb, with Mancos Black-on-white the major decorated ware, dating A.D. 900-1150.

The Group I pottery a LA 50337 is comparable to the Rosa phase of the Navajo Reservoir District, which has been dated by radiocarbon, dendrochronology, and trade pottery to a period between A.D. 700 and 850. This is the only ceramic group of the Navajo Reservoir District that includes Sambrito Brown, Abajo Red-on-orange, La Plata Black-on-red, Bluff Black-on-red, and contemporary black-on-white trade pottery. Sambrito Brown is considered a minor component of the Rosa phase ceramics, as it was not produced after A.D. 750 (Eddy 1966).

Dates obtained during the excavations at LA 50337 fall within the Rosa phase chronology. These include a date from Feature 49, hearth fill, in the north plaza, of A.D. 796 $\pm$ 50, and two dates from the roof (Stratum 117) of the associated pit structure, A.D. 714 $\pm$ 60 and 786 $\pm$ 60.

The Pit Structure

A total of 158 potsherds from the pit structure were identified by pottery type and form; in addition, a total of 164 sherds were examined by type and by temper classification (Tables 31 and 32). A minimum of 30 vessels averaging a least 6 sherds per vessel were represented; a range of 1 to 51 sherds per vessel was indicated by the temper analysis. However, potsherds of only three vessels were recovered from below the post-occupational fill (Stratum 118). Associated with the floor and bench (Stratum 119) and hearth fill (Stratum 120) were five sherds of Cortez Black-on-white, all of which were tempered with a granitic porphyry (3070) and decorated with black mineral paint; the motifs were all framed "squiggle" hachures.

Table 31. Pit Structure Ceramics

	116	117	118	119	69	Total
I. Sambrito Brown	4j[a]					4
La Plata B/r	2b					2
Kiatuthlanna B/w	1b					1
Moccasin Gray	1j	1j				2
IIa. Cortez B/w	6b,3j	3b,2j	2j[f]	1b	4b	21
Mancos Gray	11j					11
Red Mesa B/w	2b					2
IIb. Mancos B/w	2b					2
Mancos Corr. Oblique Ind.	53j[c]	16j[d]	18j[e]	2j		88
Mancos Corr. Patterned	22j[b]					22
Gallup B/w[g]	1b,1j					2
Blue Shale Corr.	1j					1
Totals	14b,95j	3b,19j	20j	1b,2j	4b	158

a polished, sandstone temper
b variety, patterned, Vessel 2
c variety, oblique indented, Vessel 3
d variety, oblique indented, Vessel 1
e variety, oblique indented, includes small pitcher
f one sherd, abraded on four edges
g early Gallup B/w, circa A.D. 900?
h C-14 dates: A.D. 714 ± 60; Stratum 117, roof

The predominant pottery type in the pit structure is Mancos Corrugated, which constitutes 70 percent of the recovered sherds. Over one-half of the Mancos Corrugated sherds were tempered with a local rock, classified herein as a porphyritic granite; one-fourth (24 percent) were tempered with a biotite granite porphyry. Dates range from circa A.D. 900 to 1200.

Fourteen percent of the sherds are from Cortez Black-on-white vessels tempered mainly with local igneous rocks from terrace gravel; however, at least three Cortez Black-on-white sherds were tempered with three different sandstone tempers.

Two Red Mesa Black-on-white and two early Gallup Black-on-white sherds are no doubt intrusive from the Cibola area or the Little Colorado drainage area. The earliest dates obtained for Gallup Black-on-white include a Gallup or Dogoszhi style framed hachure potsherd from a sixth century site at Chaco Canyon (SJ 423); another early Dogoszhi-style sherd was found at LA 2507, north of Gallup. The sherds came from a floor cist dated by tree-rings at A.D. 622-623 (ARMS files).

A general absence of Mancos Black-on-white--two sherds in the "mixed roof fall," Stratum 116--may indicate occupation of the pit structure prior to A.D. 900, the earliest suggested date for Mancos Black-on-white. Only two of the 106 Mancos Corrugated sherds in the pit structure were recovered from below the post-occupational fill (Stratum 118), suggesting that they may not be

Table 32. Pit Structure Temper Types and Ceramic Types

Temper	Code	Sambrito Brown	Sambrito Sandy	Klatuthlanna B/w	La Plata B/r	Moccasin Gray	Cortez B/w	Red Mesa B/w	Mancos Gray	Mancos B/w	Gallup B/w, early	Mancos Corr. Oblique Indented	Mancos Corr. patterned	Blue Shale	Grayware	Totals	Percent
A. Sherd, med.	0102			1												1	1
B. Sandstone, fine grain	2022										1					1	5
Sandstone, med. grain	2050							1							1	2	
Sandstone, med. grain, hematite	2081														1	1	
Sandstone, coarse	2083		2													2	
Sandstone, very coarse	2092	2														2	
C. Sandstone, Morrison fm.	2112							1								1	3
Sandstone, Chinle fm.	2113						1				1					2	
Gallup Sandstone, fine-med. grain	2150						2									2	
D. Porphyry, granitic	3070					3	14		9	2		51	9		4	92	56
Porphyry with biotite	3070 11, 13								3			2	34			39	24
Porphyry with med. sandstone	3070 2150											8				8	5
E. Trachyte, Chuska	3181													1		1	< 1
F. Diorite, hornblende, black hornblende	3240				2		6									8	8
G. Vitrophyre, gray	3740											1	1			2	1
Totals		2	2	1	2	3	23	2	12	2	2	62	44	1	6	164	

minimum 28 vessels; 6 sherds per vessel

associated with the pit structure occupation.

A number of early pottery types from post-occupational fill include Sambrito Brown (A.D. 400 to 750); Kiatuthlanna Black-on-white (? to 900+); La Plata Black-on-red (A.D. 800 to 1000); Moccasin Gray (A.D. 775 to 900), and Red Mesa Black-on-white (A.D. 875 to 1050).

Intrusive wares at the pit structure were minimal. Four sherds of Sambrito Brown, representing at least two vessels may date prior to A.D. 750. Also present were sherds of La Plata Black-on-red dating circa A.D. 800 to 1000.

Summary and Remarks

The prehistoric ceramics from the San Juan site, LA 50337, on the La Plata River, indicate three periods of occupation. The first is characterized by La Plata Red Wares and Sambrito Brown Wares, both intrusive to the site, and a time span between A.D. 700 and 850. Although there is a thin scattering of sherds from this period across the site, concentrations appear to be confined to Room 13 and plaza, the north plaza, and the pit structure. The assemblage is comparable to the Rosa phase of the Navajo Reservoir District (Eddy 1966) and the Piedra phase (Hayes 1964) in the Mesa Verde area.

The second and major occupation is comparable to the Ackmen and Mancos phases of Wetherill Mesa (Hayes 1964) and is dated from A.D. 900 to A.D. 1150. The major pottery types include Cortez Black-on-white and Mancos Black-on-white. The occupation appears to be the major one at LA 50337 with 84 percent of the potsherds recovered at the site. Intrusive wares were mainly from the Chuska Valley and the Cibola area; however, many of the vessels present may have been produced at other sites in the San Juan Valley as substantial amounts of sherd and sandstone temper, a major temper west of Farmington and the La Plata River, were present at LA 50337.

The third occupation produced only 132 sherds among 9 proveniences. Carbon paint wares including McElmo and Mesa Verde Black-on-white were common decorated wares; the earlier Wetherill Black-on-white occurred in three proveniences. Intrusive wares from the Chuska Valley and the Upper Little Colorado may be indicative of a major settlement in the San Juan Valley in the early 1200s.

LITHIC ASSEMBLAGE

Bradley J. Vierra

A total of 2,274 lithic artifacts were analyzed from the site. See Appendix 1 for a description of the lithic analysis methodology. The artifacts include 1,940 pieces of debitage, 71 cores, 6 tested cobbles, 24 pieces of large angular debris, 23 cobble unifaces, 16 cobble bifaces, 16 hammerstones, 7 projectile points, 1 biface, 3 pendants, a bead necklace, a hoe, a tchamajia, a maul, 11 axes, 27 one-hand manos, 34 two-hand manos, 27 undetermined mano fragments, 3 milling stones, 3 basin metates, 13 slab metates, 12 trough metates, 6 undetermined metate fragments, 19 undetermined ground stone fragments, a mortar, a pestle, and 4 mineral manuports.

Material Selection

Debitage, Cores, and Heavy-Duty Tools

The majority of debitage is chert (51.3 percent), with lesser amounts of basalt (18.6 percent), silicified wood (11.1 percent), and chalcedony (7.9 percent). The remaining materials compose 11.1 percent of the assemblage. Table 33 presents the material selection data on debitage, core reduction, and heavy duty tool groups. Most of the cores are made of chert (31.5 percent), basalt (24.7 percent), and quartzite (20.5 percent). Chert and basalt have a similar distribution among the debitage and core groups. However, silicified wood and chalcedony cores appear to be lacking when compared with the debitage, and quartzite cores seem to be overrepresented. The remaining core reduction/heavy duty tool artifacts exemplify a somewhat similar distribution as the cores. Large angular debris mainly consists of quartzite and basalt; cobble unifaces of chert, quartzite, and basalt; and cobble bifaces of quartzite, igneous materials, and chert. Hammerstones are usually made of quartzite and chert nodules.

Why are there more quartzite multifaceted cores represented? These may actually represent tools and not cores because quartzite is also the dominant material among cobble unifaces and bifaces. That is, flakes are removed to prepare the edge of a cobble tool and not solely to be used themselves. Obviously, nonsiliceous materials like quartzite and igneous rocks would produce a stronger edge and therefore be more conducive for use in heavy-duty types of activities. For example, axes recovered from the site are predominantly made of igneous materials. Therefore, we would expect to find that multifaceted quartzite cores have been utilized more often than chert cores, and that chert flakes were more often used than quartzite flakes. The data support this interpretation.

Ground Stone

Material selection information on ground stone is presented in Table 34. Most of the ground stone is made of either sandstone or igneous rock materials. One-hand manos are distributed roughly evenly between the two categories. Two-hand manos, slab metates, trough metates, and undetermined ground stone fragments are primarily made of sandstone.

Table 33. Material Selection

	Chert	Silicifed Wood	Chalcedony	Quartzite	Igneous	Basalt	Schist	Siltstone/ claystone	Limestone	Sandstone	Total
Debitage	994	215	153	21	83	361	1	92	12	8	1940
Projectile points	3	0	4	0	0	0	0	0	0	0	7
Bifaces	0	1	0	0	0	0	0	0	0	0	1
Cores and Heavy Duty Tools											
unidirectional	3	0	0	0	1	3	0	3	0	0	10
bidirectional	6	0	0	1	2	0	0	1	0	0	10
multifaceted	10	4	1	11	4	9	0	4	0	0	43
bifacial	2	0	0	2	0	4	0	0	0	0	8
pyramidal	0	0	0	0	0	0	0	0	0	0	0
blade	0	0	0	0	0	0	0	0	0	0	0
bipolar	0	0	0	0	0	0	0	0	0	0	0
Tested cobbles	2	0	0	1	3	0	0	0	0	0	6
Large angular debris	3	0	1	8	3	6	0	3	0	0	24
Cobble unifaces	7	0	0	5	3	5	0	2	0	1	23
Cobble bifaces	3	0	1	4	4	2	0	1	1	0	16
Hammerstones	6	0	0	7	1	0	0	2	0	0	16
Axes	0	0	0	1	8	2	0	0	0	0	11
Mauls	0	0	0	0	0	0	0	0	0	1	1

Table 34. Ground Stone Material Selection

	Sandstone	Cobble Sandstone	Massive Sandstone	Igneous	Quartzite	Basalt	Schist	Total
One-hand mano	7	5	0	13	2	0	0	27
Two-hand mano	16	8	2	10	0	1	0	34
Mano fragment	7	5	1	12	2	0	0	27
Milling stone	1	0	0	1	1	0	0	3
Basin metate	1	0	0	2	0	0	0	3
Slab metate	8	2	2	1	0	0	0	13
Trough metate	3	0	5	4	0	0	0	12
Metate fragment	3	1	1	1	0	0	0	6
Ground stone	12	1	0	4	1	0	1	19

Raw Material Availability

Most of the lithic raw materials selected for the production of tools are locally available in terrace gravels and Upper Cretaceous deposits, including the Kirtland/Fruitland, Ojo Alamo, and Nacimiento formations. The siltstone/claystone used to make the tchamajilla from Room 1 and the bead necklace from Room 2 can be obtained from these local Upper Cretaceous deposits (Warren, personal communication). Intrusive materials found at the site include four pieces of azurite and malachite and two turquoise pendants found around the ramada in Area 5 of the room block and a turquoise pendant fragment recovered from the plaza, south of Room 13.

Lithic Reduction Strategy

Debitage

Table 35 summarizes the various stages of lithic reduction represented by the assemblage. Primary core reduction includes only 2.2 percent (38) of the total debitage assemblage, of which chert makes up 58 percent (22). The majority of the debitage (1,124, 65.5 percent) is present in the secondary cortical core reduction stages. Most of this is chert (593, 53.0 percent), with lesser amounts of basalt (221, 19.7 percent) and silicified wood (101, 9.0 percent). Secondary noncortical core reduction debitage makes up 30.8 percent (549) of the assemblage. It, too, is dominated by chert (245, 46.6 percent), with smaller amounts of basalt (109, 19.9 percent), silicified wood (73, 13.3 percent), and chalcedony (72, 13.1 percent).

Very few tertiary tool retouch flakes were observed (5, 0.3 percent). These include two scraper and three undetermined retouch flakes made of silicified wood, chert, and basalt. Sediments from flotation samples were screened through a .0328 inch mesh and then scanned for

Table 35. Lithic Reduction Stages

	Primary	Secondary Cortical	Secondary Noncortical	Tertiary	Cortical/ Noncortical Ratio
Chert	22	593	256	1	2.4
Silicified wood	5	101	73	3	1.4
Chalcedony	0	63	72	0	0.9
Quartzite	3	5	3	0	2.7
Igneous	2	58	14	0	4.3
Basalt	3	221	109	1	2.0
Sandstone	0	6	1	0	6.0
Schist	0	1	0	0	0.0
Siltstone	3	66	19	0	3.6
Limestone	0	10	2	0	5.0

small artifacts. Eleven of 40 samples yielded small flakes. These were mainly from hearth contexts, but they were also recovered from a pit, a floor, and a plaza surface. The artifacts include 12 core flakes, a biface retouch flake, a piece of angular debris, and a spall flake from a hammerstone. The core flakes have cortical and faceted platforms with an angle of about 60 degrees. These appear to be core platform preparation flakes, which are generally short, wide flakes with a mean length of 7.8 mm and width of 11.2 mm.

The overall cortical to noncortical ratio is 2.1. A high ratio generally reflects an emphasis on the initial stages of core reduction, and a low ratio on the later or tertiary stages of tool production/maintenance. The ratio of 2.1 supports the emphasis on the early stages of core reduction as reflected in the large amount of primary and secondary cortical core reduction debitage.

The flake to angular debris ratio is also indicative of the stages of reduction present on a site. A high ratio generally reflects an emphasis on the tertiary stages of reduction and a low ratio on core reduction because more angular debris is produced during core reduction activities than tool production/maintenance. The ratio can also be affected by the core reduction technique and the quality of the material type being reduced. The flake to angular debris ratio is 7.6. This is extremely high, especially when compared with Archaic assemblages that emphasize tool production/maintenance and have a ratio of 4.3 (Vierra 1985b:159).

Most of the flakes are whole (87.7 percent) with a mean width of 23.7 mm and a mean length of 27.3 mm. Sullivan and Rozen (1985:769, 773) note that core reduction activities tend to produce more whole flakes than tool production/maintenance. Only two blades from flake cores were observed. They were 17 by 30 mm and 20 by 78 mm respectively. One chert bipolar flake was also recorded. Several flakes resembling burin spalls were analyzed. However, they probably represent attempts to prepare core platforms, not to create a tool graving edge.

Cores and Heavy-Duty Tools

Core reduction technique is conditioned by several variables, including material type, nodule size and shape, and reduction trajectory, that is the process of producing a finished tool. The debitage assemblage reflects an expedient technology geared towards the production of core flakes. The core types present also reflect this same expedient reduction strategy. Most of the cores are multifaceted (44, 62.1 percent), with the remainder including unidirectional, bidirectional, and bifacial cores. None of the more specialized pyramidal or blade core types were observed.

Most of the cores have not been fully reduced or exhausted. Multifaceted cores exhibit the highest exhaustive percentage rate of 32.5 percent. Presumably cores did not need to be so fully reduced since lithic raw materials were so readily available in nearby terrace gravels. Also, cores were often used as tools before they could be reduced to the exhausted stage. Many more of the cobble unifaces (21.7 percent) were exhausted than the cobble bifaces (6 percent). However, more of the cobble bifaces (75 percent) exhibited edge damage than the cobble unifaces (52 percent). This probably means that the cobble unifaces predominantly reflect expedient cores with flakes being removed from unprepared cortical platforms. Of the debitage, 21.6 percent exhibit cortex on the platform only. In contrast, cobble bifaces were apparently often used as heavy duty tools.

Table 36 lists the platform types monitored for the debitage. The large number of faceted platforms (800, 41.2 percent) corresponds with the presence of multifaceted, unidirectional, bidirectional, and bifacial cores. There are almost as many cortical platforms (700, 36.1 percent) that correspond with the emphasis on the initial stages of core reduction and the presence of tested cobbles, cobble unifaces, and cobble bifaces. Fifty-five percent of the flakes with cortical platforms have cortex on the platform only. This represents an expedient reduction technique in which flakes are progressively removed from unprepared cortical platforms situated at the end of a cobble uniface (also see Vierra 1985a:17). This technique is similar to Schiffer's (1976:105) "tangerine core technique," although it appears to be progressively reduced around the perimeter of the nodule in contrast to working straight through the nodule. The technique of reducing a cobble uniface as described here could be termed the "end-to-end technique."

Facially Retouched Tools

Seven projectile points and one biface were recovered from the site. Five of these points were found among the burned remains of a ramada on Plaza 1 in Area 5 of the room block. The five points are quite similar (see Fig. 29). They are whole chalcedony side-notched points with slightly convex bases. Their blades are straight to convex-concave (proximal-distal). The latter is related to their possible function as drills. The points are made on thin flakes with bidirectional retouch. Together they resemble what Moore (1981:31) defined as his Type 5 points.

One projectile point was recovered from a redeposited context (Stratum 14) above the kiva in the north trench. It is an expedient point, made on a flake with only minimal marginal retouch along the blade. The base of the point consists of the flake platform. The last point found was associated with the child burial (Feature 55) under Room 1. It is a red chert side-notched point with a straight base and convex blade edge. It exhibits bidirectional retouch and is missing both sides of its base. Table 37 provides the measurement data recorded for the projectile points.

Table 36. Debitage Platform Types

Faceted	800 (41.3%)
Cortical	700 (36.1%)
Absent	126 (6.5%)
Collapsed	44 (2.2%)
Battered	39 (0.8%)
Unidirectionally Retouched	4 (0.2%)
Bidirectionally Retouched	1 (0.1%)

Table 37. Projectile Point Measurements (in mm)

Prove-nience	Artifact No.	Overall Length	Blade Length	Blade Width	Neck Width	Stem Length	Stem Width	Thick-ness
Area 5	3499	22	17	10	5	3	10	2
Area 5	3500	28	23	10	5	3	10	2
Area 5	3501	23	18	11	6	3	12	2
Area 5	7737	30	24	10	5	3	10	2
Area 5	7750	27	27	13	7	3	13	4
North Trench	546	16	10	9	8	4	14	5
F. 55	7252	27	17	13	7	6	-	5

The only biface recovered from the site was also found with the child burial under Room 1. It consists of a proximal fragment 15 mm wide, 22 mm long, and 3 mm thick. The biface has a lanceolate shape with slightly convex blade edges and a straight base. A retouched piece was found in a mixed roof/fill context above the pithouse. It is 13 by 7 by 1 mm in size and was produced by marginally retouching a thin flake along its total edge perimeter. Similar tools designated as perforators were found at Salmon Ruins (Shelley, pers. comm., 1986).

Other Tools

Tabular igneous cobbles or sometimes split cobbles were predominantly selected for the production of axes. All 11 of the axes analyzed exhibit hafting modifications. These consist of two notches either pecked or flaked into the opposite lateral sides of the tool. Sometimes the cobble selected for use as an axe already fit the desired finished shape of the tool. Other times a cobble was split in half or modified by unidirectional or bidirectional retouch along the lateral sides and working edge of the tool. The working edge of the tool was also prepared by first being roughly shaped by pecking, after which the surface was ground down in a motion perpendicular to the edge. This grinding acted to sharpen the cutting edge of the axe.

Only one tchamajia fragment was found on Floor 2 of Room 1a. It had been broken along the haft with the front or working edge of the hoe blade remaining. The tool was made on a thin (9 mm) piece of tabular siltstone/claystone. The hafting notches had been bidirectionally retouched along both lateral edges of the tool. The sides of the tchamajia are ground smooth. This grinding action was done perpendicular to the working edge, and again acted to sharpen the working edge. The lateral sides of the hoe blade adjacent to the working edge have also been ground and rounded.

Another possible hoe/axe was recovered from Plaza 2. It is made of a tabular rhyolite cobble, with two flaked and pecked hafting notches. The working end of the tool was shaped with bidirectional and unidirectional retouch. A maul was also found on Plaza 3, which consists of a full-grooved sandstone cobble.

Tool Use

Debitage

Edge modification occurs on 370 pieces (19.1 percent) of the debitage, either as marginal retouch or damaged edges. Most of these are made of chert (189, 51.5 percent) with lesser amounts of silicified wood (71, 19.6 percent), basalt (59, 14.1 percent), and chalcedony (30, 8.3 percent). This is a similar distribution to the one observed for the overall debitage assemblage. Therefore, it appears that these lithic materials were being selected for the production of flakes to be used as expedient tools (see also Vierra 1985a:19).

Marginal retouch occurred on 194 pieces. Most of these (120, 61.9 percent) exhibit bidirectional retouch (Table 38). The majority of the retouched edges (179, 92.3 percent) were also utilized. A total of 355 damaged edges were observed, which presumably reflects some form of use-wear. The majority of these exhibit unidirectional scarring (125, 35.2 percent) and unidirectional scarring with rounding (95, 26.8 percent). Figure 50 shows the distribution of edge angle by damage type. As can be seen, unidirectional scarring has a mode of 40 degrees, unidirectional rounding of 30-40 degrees, and unidirectional scarring/rounding at 50 degrees. In contrast, bidirectional scarring and bidirectional scarring/rounding have a mode at 30 degrees and bidirectional rounding is bimodally distributed at 40 and 60 degrees. Vierra (1980:384) observed a bimodal distribution for edge angles on damaged edges, with one ranging from 20-50 degrees and the second from 60-90 degrees. These presumably reflected different sets of activities. Most of the use-wear in this study lies within the 20-50 degree range; bidirectional rounding is the only wear pattern in the 60-90 degree range.

Table 39 shows the type of edge outlines selected for all modified edges. Most of these are either straight (135, 36.5 percent) or convex (126, 34.1 percent). Only 28 edges exhibited serration. Five projections with rotary wear reflect use as expedient drills and 20 with edge wear reflect use as gravers.

The size of the core flakes used as expedient tools should be conditioned by the functional requirements of the activity. It does appear that slightly larger and wider flakes were selected for use. The mean whole utilized core flake width is 30 mm and length is 35 mm, in contrast to the unutilized flakes, which have a mean width of 22 mm and length of 26 mm.

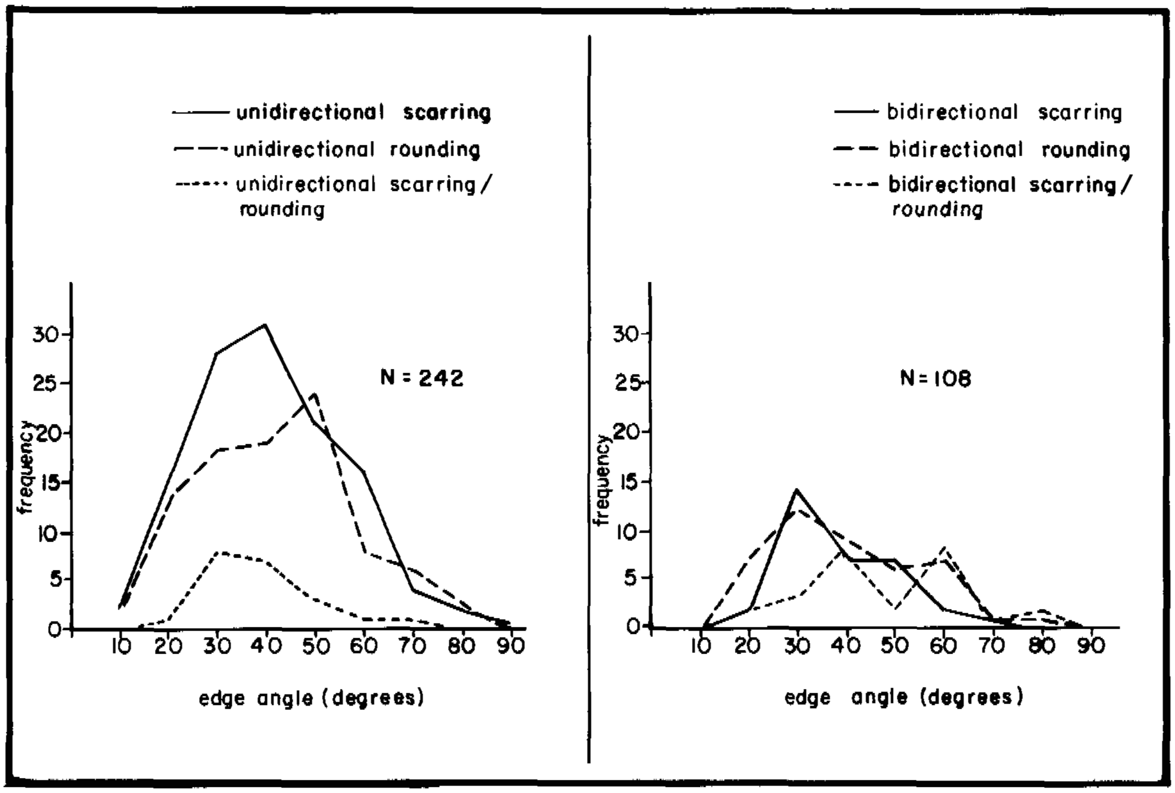


Figure 50. Debitage edge damage.

Table 38. Retouched and Damaged Edges

Retouch Type	No./Percent	Mean Edge Angle
Unidirectional dorsal	57/29.4	49.1 degrees
Unidirectional ventral	17/ 8.8	51.1 degrees
Bidirectional	120/61.9	51.5 degrees
Damage Type	No./Percent	Modal Edge Angle
Unidirectional scarring	125/35.2	40.0 degrees
Bidirectional scarring	35/ 9.9	30.0 degrees
Unidirectional rounding	22/ 6.2	50.0 degrees
Bidirectional rounding	29/ 8.2	40/60 degrees
Unidirectional scarring/rounding	95/26.8	30/40 degrees
Bidirectional scarring/rounding	44/12.4	30.0 degrees
Abraded/grounded	5/ 1.4	60.0 degrees

Table 39. Modified Edge Outline

Edge Outline	No./Percent
Straight	135/36.5
Concave	47/12.7
Convex	126/34.1
Straight/concave	15/ 4.1
Straight/convex	14/ 3.8
Concave/convex	31/ 8.4
Flat	2/ 0.5

Cores and Heavy-Duty Tools

Cores appear also to have been used as tools besides a source of debitage. Three (30.0 percent) unidirectional, one (10.0 percent) bidirectional, thirteen (32.5 percent) multifaceted, and six (75.0 percent) of the bifacial cores showed signs of damage in the form of battering on edges (chopper wear) and on natural surfaces (hammerstone wear) (Table 40). Most of the unidirectional and bidirectional cores were simply used as cores, however many of the multifaceted and bifacial cores appear to have also acted as important heavy-duty tools. The fact that 66 percent of the multifaceted utilized cores and 83 percent of the bifacial cores are made from nonsiliceous materials supports this argument. These tools exhibited a mean edge angle of 61 degrees.

One (16.6 percent) tested cobble, five (20.8 percent) pieces of large angular debris, twelve (52.1 percent) cobble unifaces, and twelve (75.0 percent) cobble bifaces also exhibit signs of battered edges or natural surfaces. The cobble unifaces appear to represent both expedient cores and heavy-duty tools, while most of the cobble bifaces reflect formal heavy-duty chopping tools with a mean edge angle of 72 degrees. One cobble biface, consisting of a split cobble with bidirectionally retouched edges and a total battered perimeter, was found lying on a slab metate in a milling bin (Feature 39). It presumably was used to roughen the face of this metate. Dodd (1979) has described the importance of heavy-duty battered tools for ground stone production/ maintenance and for the processing to various materials on the surface of metates.

The hammerstones mainly exhibit one to two battered loci along the perimeter of the cobble. As many as six battered loci, or a continuous battered perimeter, were also observed.

Facially Retouched Tools

All five of the projectile points recovered from the ramada on Plaza 1 exhibit evidence of use. This consists of bidirectional scarring or rounding with some discoloration along the tips of the points. It appears that these artifacts were probably used as hafted drills and not projectile points. Edge damage was not observed on the other two projectile points, the biface, or the retouched piece that could be attributed to use-wear.

Table 40. Core/Heavy-Duty Tool Damage

	Exhausted		Number of Damaged Loci per Artifact							Damage Type for all Loci					Location of Damage for all Loci						Mean Edge Angle
	No	Yes	0	1	2	3	4	5	>6	Bat	Rnd	Abra	Scar	Grnd	Edge	Conv	Ridge	Flat	All	Flake Scar Ridge	
Core																					
Unid.	8	2	7	1	0	1	0	0	1	8	0	0	0	2	7	0	1	1	0	1	30
Bid.	7	3	9	0	0	1	0	0	0	3	0	0	0	0	0	1	1	1	0	0	-
Multi.	27	13	27	4	3	3	1	0	2	34	0	2	0	2	11	7	12	4	0	0	61
Bif.	8	0	2	3	2	0	1	0	0	10	2	0	0	1	4	4	3	1	0	1	65
Pyr.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blad.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bip.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Test. cob.	n/a	n/a	5	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	-
Large ang. debris	n/a	n/a	19	5	0	0	0	0	0	3	2	0	0	1	4	1	0	1	0	0	64
Cob. unif.	18	5	11	4	5	1	2	0	0	12	3	1	2	2	11	4	2	3	0	0	60
Cob. bif.	15	1	4	3	5	2	0	2	0	18	4	0	2	5	15	5	4	2	0	3	72
Hs.	n/a	n/a	0	4	5	2	3	1	1	40	1	0	0	1	2	27	8	1	1	0	-

Unid. = unidirectional; Bid. = bidirectional; Multi. = multidirectional; Bif. = bifacial; Pyr. = pyramidal; Blad. = blade; Bip. = bipolar; Test. cob. = tested cobble; Large ang. debris = large angular debris; Cob. unif. = unifacial cobble; Cob. bif. = bifacial cobble; Hs. = hammerstone; Bat = battered; Rnd = rounded; Abra = abraded; Scar = scarred; Grnd = ground

Other Tools

Five of the axes show signs of damage along their cutting edges. This includes three edges with bidirectional rounding and two battered/rounded edges with no step fracturing. Bidirectional scarring and rounding was observed along the working edge of the tchamajilla, however no damage was found on the edge of the hoe/axe artifact. The maul was battered on both of its ends.

Ground Stone

The function of one- and two-hand manos can be contrasted in relation to the type of striations present, battering, and cross-section. One-hand manos have usually been associated with a generalized grinding function, whereas two-hand manos have been associated with the processing of corn (Bartlett 1933; Lancaster 1984:251-252). Three types of striations were monitored: longitudinal (parallel to the long axis), transverse (perpendicular to the long axis), and rotary. Twenty-seven ground surfaces with visible striations were identified for the one-hand manos and 34 striated surfaces for the two-hand manos. Of the one-hand manos, 53.8 percent exhibit transverse striations, 34.6 percent longitudinal, and 11.5 percent rotary. In contrast, transverse striations were observed on 60.8 percent of the two-hand manos, longitudinal on 26.0 percent, and rotary on 13.0 percent. The prevalence of transverse striations is not surprising since it shows that both types of manos were primarily used with the long axis of the artifact perpendicular to the grinding surface. The larger percentage of longitudinal striations observed for the one-hand manos also shows that they did have a somewhat more generalized function than the two-hand manos. Battering was rarely found on any of the manos, although one-hand manos did exhibit a slightly greater use as hammerstones.

Four types of cross sections were monitored for manos. These include plano/convex, convex/convex, parallel, and wedge. Of the one-hand manos, 62.5 percent exhibit a plano/convex cross section. These artifacts were generally made of small unmodified river cobbles ground on one side only. The variety of sizes and shapes of these cobbles reflect their more generalized function. Most of the two-hand manos have a biplano cross section. These tools are formally prepared manos with a large grinding surface on both sides of the artifact. They are about 260 by 170 by 30 mm in size. Of the two-hand manos, 28.1 percent have a plano/convex cross section. These tools have one grinding surface, often with finger grips and wear along the perimeter of manos, reflecting that they were used in a trough metate. They are generally smaller but thicker than the biplano-sided manos, measuring about 210 by 130 by 40 mm. Finger grips are primarily found on two-hand manos, and wear along the edge of a mano due to its use in a trough metate was only observed on two-hand manos. Of the two-hand manos, 18.8 percent have a wedge-shaped cross section. These tools have been ground on both sides and are about 190 by 100 by 20 mm in size. As pointed out by Lancaster (1984:251), this type of cross section generally reflects manos that have had more pressure applied to the trailing edge of the artifact. In general, it appears that the two-hand manos are formally prepared tools with large grinding surfaces, presumably used in the processing of corn meal.

All the metates upon which striations were visible exhibited longitudinal wear patterns. This included a basin, eight slab, and eight trough metates. It shows that grinding did take place along the long axis of these artifacts. Only slab and trough metates were of a sufficient size to determine the length and width of their grinding surfaces. Four slab metates have a mean length of 318 mm and range from 141-440 mm, while four trough metates generally have a longer grinding surface with a mean length of 440 mm and a range from 410 to 500 mm. In contrast, the slab metates have wider a grinding surface with a mean of 210 mm and a range from 190 to 240 mm, compared to a mean width of 190 mm and a range from 150 to 210 for trough metates. The greater length of the two-hand biplano cross-sectioned manos probably reflects that they were used on slab metates that exhibit the greatest width. Mano width, the presence of finger holds, and polished ends indicate that the two-hand plano/convex manos were used in conjunction with trough metates. The wedge-shaped two-hand manos may have been used with either slab or trough metates.

In five cases where it could be determined, all the trough metates were open at both ends. The mean depth of six troughs was 67 mm with a range from 40 to 130 mm. Hayes and Lancaster (1975:151) note that trough metates open at both ends were used in milling bins, as were slab metates.

Only one metate was found in the context that it was originally used. This was a slab metate situated within a milling bin on the plaza south of Room 13. A biplano mano fragment was recovered near the metate. A trough metate fragment was found next to a metate rest on Plaza 1 in Area 9 of the room block. Nearby, in Area 10, a large cobble metate with a slight trough was present by itself, and was probably self-standing when used.

Lithic Technology

Lithic technology is the product of the adaptive strategy implemented by a cultural system. In a general sense it is the means by which people provide for their basic needs. In a more specific sense it is the tools and the process of producing and using these tools that are necessary to meet the basic needs. Therefore, studying the organization of lithic technologies will help us understand cultural adaptations, and in this instance, the organization of Anasazi subsistence-settlement systems.

Lithic assemblages and the stone tool manufacturing process can be studied in terms of the reduction trajectory involved in their creation. "The term reduction trajectory refers to the stagelike sequence of stone tool manufacture beginning with initial core selection and preparation, through the end point of final tool completion" (Chapman 1982:237). For analytical purposes this sequence has already been divided and discussed in three parts: material selection, lithic reduction strategy, and tool use (Chapman 1977:372-374; Chapman and Schutt 1977; Schutt and Vierra 1980; Wilmsen 1970:66-74). Simply stated, the sequence begins with the initial selection of a suitable lithic raw material, followed by the production of the tool, which is then used, maintained, and eventually discarded. As pointed out by Chapman (1982:238), several different core reduction techniques can be used during the manufacturing process. The complexity of this chain of events has been illustrated by several researchers through the use of flow charts that show the multiple avenues and by-products that can be followed through the life of a tool (Gould 1977:167; Schiffer 1972; Schutt and Vierra 1980:64).

Vierra (1983, 1985a, 1985b) argues that the generalized Anasazi reduction strategy was an expedient one, geared toward the production of flakes for use as expedient tools (also see Sullivan and Rozen 1985). This involves a core/flake reduction trajectory that can be examined through the lithic assemblage on LA 50337. Up to now the assemblage recovered from the site has been discussed together. This was done for simplicity in the presentation of the data and because of sample size considerations. It should be pointed out that there are multiple processes involved in the formation of an archaeological assemblage, including group size, group structure, site function, length of occupation, reoccupation, site furniture, curation, scavenging, and natural processes, all of which help to create and modify an assemblage through time. Some or all of these factors have certainly affected this site assemblage. The overall site assemblage actually represents multiple assemblages from several different occupation episodes. However, it can be argued that the majority of these are the by-product of a residential site function, and can therefore be studied as one unit. This analytical methodology is also more representative of the site as a whole, rather than being biased towards specific intrasite activity areas. That is, a sampling problem exists when you try to look at assemblages associated with each different occupation episode, since they may be from inside a room, on a plaza, in a trash deposit, in a redeposited stratum, or a combination of these. These different sized samples and different contextual associations are not comparable. Lumping them together should provide us with a more representative sample of the full range of activities present on a residential site.

For comparative purposes, the lithic assemblage from LA 50337 will be contrasted with those from Archaic and Anasazi logistical and residential sites from the northern San Juan Basin (Vierra 1985b), and Anasazi residential sites from the Albuquerque (Vierra 1985a) and Pojoaque (Anschuetz 1986) areas. The latter two sites are especially relevant, not only because of their residential site function, but because they too are located along major drainages with locally available sources of raw materials. Similar lithic materials are present in these nearby river gravel deposits (although they vary in abundance and diversity), with the exception of obsidian, which can only be found along the Rio Grande. Table 41 presents the information on these assemblages.

Siliceous materials, in particular chert and chalcedony, appear to be the most prevalent material type selected for reduction. As already noted, secondary cortical core reduction debitage dominates the assemblage at LA 50337 (65.5 percent). Several core reduction techniques are used including multifaceted cores with cortical and faceted platforms, unidirectional cores with a single prepared platform, bidirectional cores with two opposing prepared platforms, and cobble unifaces with unprepared cortical platforms. All of these represent a more expedient type of reduction strategy, with little or no platform preparation. In contrast, most of the assemblages from the Coors Road site (56.3 percent) and the Pojoaque site (80.8 percent) consist of secondary noncortical core reduction debitage. This corresponds with a cortical to noncortical ratio of 2.1, .77, and .20 for each of these sites, respectively. Most of the initial stages of core preparation and reduction probably occurred away from the latter two sites. However, the core reduction techniques are similar, with multifaceted, unidirectional, and cobble unifaces present on the Coors Road site and multifaceted cores on the Pojoaque site. It should be noted that the sample from the Pojoaque site was taken from a trash deposit. This may be a somewhat biased sample, although a trash deposit from a long-term occupied pueblo should be more reflective of the range in residential site activities.

The rarity of tool retouch flakes indicates that tool production/maintenance activities occurred less frequently than core reduction on Anasazi residential sites. This contrasts assemblages, where tool flakes represent 19.4 percent and 14.6 percent of the debitage assemblage, respectively. They too have a low cortical to noncortical ratio (.78 and .71), reflective of an emphasis on the latter stages of reduction.

Table 41. Intersite Comparison Data

				Northern San Juan Basin data[3]		
	LA 50337 (n=1,940)	Coors Road[1] (n=440)	Pojoaque[2] (n=166)	Archaic (n=1,000+)	Anasazi lithic/ceramic (n=1,000+)	Anasazi habitation (n=500+)
Material Selection (in percentages)						
chert	51.2	34.8	62.0	--	--	--
basalt	18.6	7.5	4.2	--	--	--
silicified wood	11.1	3.2	0.0	--	--	--
chalcedony	7.9	46.8	24.7	--	--	--
Lithic Reduction						
primary	2.2	2.0	0.8	--	--	--
secondary cortical	65.5	41.4	16.8	--	--	--
secondary noncortical	30.8	56.3	80.8	--	--	--
tertiary	0.3	0.3	1.6	19.4	14.6	6.6
cortical/noncortical ratio	2.1	0.8	0.2	0.8	0.7	1.0
flake/angular debris ratio	7.6	3.8	3.2	4.3	3.4	2.5
whole flakes/total flakes	87.7	94.5	54.1	--	--	--
Tool Use						
modified edges/total debitage	19.1	13.4	11.5	--	--	--
retouched edges/total debitage	1.0	1.4	3.0	--	--	--
damaged edges/total debitage	18.3	12.0	8.4	1.8	2.4	3.3

1 Vierra 1985a
2 Anschuetz 1985
3 Vierra 1985b

Most of the Anasazi assemblages exhibit a flake to angular debris ratio of 2.5 to 3.8. However, the Archaic assemblages have a higher ratio of 4.3 and LA 50337 an even higher 7.6. The high ratio for Archaic assemblages is not surprising since they emphasize tool production/maintenance activities that tend to produce more flakes than angular debris. It is interesting that LA 50337 has such a high ratio of flakes, especially when one considers that expedient core reduction techniques were used.

The percentage of whole flakes in the Anasazi assemblages range from 54.1 percent to 94.5 percent. As noted by Sullivan and Rozen (1985), more whole flakes are generally produced during core reduction activities. The Pojoaque and Coors Road sites, both of which emphasize secondary noncortical core reduction, have very different percentages of whole flakes, even though the core reduction techniques appear to be quite similar. The remaining portion of the flake fragments also appear to be quite variable between the three sites. LA 50337 mainly has broken lateral (5.4 percent) and distal (4.0 percent) fragments versus the Pojoaque site, which includes proximal (18.8 percent) and distal (14.8 percent) fragments, and the Coors Road site has mainly midsections (3.5 percent). Very different processes appear to be affecting the production of broken flakes in relation to these three sites. The flakes from Pojoaque appear to be much smaller (15.8 by 17.9 mm) than the ones from LA 50337 (23.7 by 27.3 mm) or the Coors Road site (22.3 by 19.7 mm), and therefore may be more prone to breakage.

Specific lithic material types were selected for the production of flakes to be used as expedient tools. At LA 50337, chert is the dominant material type present and is what was most often utilized. Similar patterns were observed for the Coors Road and Pojoaque sites with chert and chalcedony materials.

The percentage of debitage with modified edges range from 11.5 percent to 19.1 percent. Of these, very few exhibit marginally retouched edges (1.0-3.0 percent). Walker (1978) notes that unmodified edges were more efficient than retouched edges for some types of activities (for example, butchering). Of the marginally retouched edges, 92.3 percent were also utilized in the LA 50337 assemblage, whereas 44.4 percent of these edges were utilized in the Coors Road assemblage. The percentage of debitage with damaged edges (presumably reflecting use-wear) ranges from 1.8 percent to 18.3 percent. The lower utilized percentage rates for debitage in the northern San Juan Basin samples are in part a result of the in-field analysis methodology. However, it can still be seen within this sample that Anasazi residential assemblages contain more utilized debitage (3.3 percent) than Archaic assemblages (1.8 percent), showing that expedient tool use and not tool production/maintenance was a more important activity on these Anasazi sites.

The relationship between edge angle and edge damage can provide some information on the range of functional activities that occurred at a site. Most of the edge damage observed at LA 50337 consisted of unidirectional scarring with a mode of 40 degrees. The assemblages at the Coors Road and the Pojoaque sites exhibited similar amounts of unidirectional and bidirectional scarring with mean edge angles of 40 and 43 degrees, respectively. It would appear that edge angles of about 40 degrees are more highly selected for use on Anasazi residential sites. This can be contrasted with Vierra's (1980) study that identified a bimodal edge angle distribution on Archaic summer residential sites, with a 20-50 degree group and a 60-90 degree group. The one Anasazi logistical site in his analysis exhibited a single mode of 60 degrees. Unidirectional scarring was the dominant use-wear observed on all the sites.

One might ask that if the Anasazi reduction strategy was geared toward the production of flakes to be used as expedient tools, why then are there not more utilized flakes represented in the assemblages? The presence of damage depends on a number of factors including tool function, material type, edge angle, and the object being worked. Brose's (1975) experiment showed that unretouched flakes can have short use-lives with very little observable wear produced (also see Gould et al. 1971:156). The low magnification that was used during the analysis also affects the number of damaged edges identified. Lastly, more debitage was probably produced than was actually utilized (see Gould et al. 1971:160-161; Shackley and Kerr 1985:95). The expedient core reduction techniques used by the Anasazi appear to be less efficient for producing consistent useable flake forms. This is supported by the fact that nonutilized flakes are generally a different size than utilized flakes. The former have a mean width of 22 mm and length of 26 mm, in contrast to the latter that exhibit a mean width of 30 mm and length of 35 mm. Larger flakes were selected from the available flake population for use.

This study indicates that Anasazi residential site reduction strategies were represented by a core/flake reduction trajectory, with flakes used as expedient tools. Table 41 also shows that Anasazi logistical sites (i.e., lithic and ceramic scatters) exhibit a slightly different technology than that found on the residential sites (also see Vierra 1985b and Phagan 1984). This technology is more similar to that observed in Archaic assemblages that reflect a greater emphasis on the production and maintenance of highly curated formal tools (for example, bifaces and projectile points). This Archaic reduction strategy has been characterized as a core/blank/tool trajectory (Vierra 1983, 1985b). It has also been argued that these Archaic assemblages represent the summer residential components of the settlement system, and that a high residential foraging organized strategy was implemented during this time of the year (Vierra and Doleman 1984). It would therefore appear that components of a settlement system that reflect a high degree of residential mobility may be characterized by a core/blank/tool reduction trajectory. In contrast, components of a settlement system that reflect a low degree of residential mobility (for example, Anasazi residential assemblages) may reflect a core/flake reduction trajectory. Likewise, components that lie between these two extremes (Anasazi logistical sites), exemplify an appropriately modified reduction trajectory.

AN OVERVIEW AND DISTRIBUTIONAL ANALYSIS OF THE FAUNAL REMAINS

Linda Mick-O'Hara

Introduction

The excavations at LA 50337, which produced the sample of faunal remains discussed in this section, were initiated as a result of the exposure of this site in a state highway project of State Road 170 (see Fig. 2). The site is extensive and the majority of the pueblo probably extends under the A-Z Auto Parts store west of the project area. Excavation was restricted to the right-of-way on either side of State Road 170 and provided an intriguing view of an area peripheral to the main pueblo unit. Six different areas were tested during the excavation process. Vierra (this volume), through the use of radiocarbon dates, dendrochronology, ceramic evidence, and stratigraphy, has identified five time periods during which at least part of the site area was used. These occupations began in the sixth century A.D. and continued into the thirteenth century A.D. with the major occupation between the tenth and eleventh centuries. A pithouse, kiva, several plaza surfaces, and one room-block area, all with associated trash, were exposed during the excavation process. The following report will focus on the faunal remains recovered from these areas in several different ways.

Each section of this study could be looked at as a progressive dissection and more detailed analysis of the faunal remains recovered during this excavation. The first section looks at the recovered faunal assemblage as a whole and compares it with assemblages recovered at other sites in the general vicinity. Section 2 divides the fauna recovered by site area and compares the species identified, fragmentation, and burning relative to the excavation technique used and the type and condition of the structural remains or features isolated. These results may again be compared to other small site excavations in the general area. Section 3 analyzes the remains by the occupational sequence established by Vierra to observe any changes in procurement or usage through time. This section also attempts to analyze the faunal remains recovered with respect to their depositional context and distribution, comparing plaza surfaces, room floors, hearth areas, pit fill, room fill, and trash areas. Each section also contains preliminary conclusions using the data at hand. Section 4 provides a synthesis of the results and conclusions from all the previous sections along with overall interpretations and conclusions reached in this report.

Methodology

All faunal identifications included in this report were accomplished using the faunal comparative collections of the Museum of Southwestern Biology, which is housed in the biology building on the University of New Mexico campus. Some preliminary identifications were done using Gilbert (1980; Gilbert et al. 1981) and Olsen (1964, 1979). Preliminary determination of species availability in the study area as well as possible changes in availability over time, were done using Findley et al. (1975) for mammals and Ligon (1961) for birds. Difficult identifications were performed by using measurements as stated in Gilbert (1980).

Identification and description of the faunal remains included as many levels as possible. Each faunal fragment was identified as closely as possible to order, family, genus, and species. The element was identified and the relative portion of each element was described. To prevent the possible over-identification of some elements, fragments were refitted to produce more complete and possibly more identifiable segments where possible. The side of the element was determined as axial, left, right, or unknown. Age was determined primarily by noting epiphyseal fusion and the porosity of the bone relative to the size of the element.

In addition to the process of identification described above, all faunal fragments were observed for evidence of burning and the extent and variation in burning was noted. Burning may be observed as a result of cooking processes, discard into firepits, or as a side product of depositional context (for example, burned roofing). Cut marks, and what was apparently deliberate breakage, along with any root etching, weathering, and erosion were also noted and recorded under taphonomic processes. Taxonomic identifications and processing information were used to create the complete tables on file at ARMS. These tables were summarized to create the tables contained within this report. Complete information not found in the summary tables may be found at the Archeological Records Management System, Historic Preservation Division, Santa Fe.

An Overview of the Faunal Remains Identified from LA 50337

The excavations at LA 50337 produced 880 fragments of bone including the bone tools or worked bone identified and 101 fragments of eggshell. Of the bone fragments recovered, 532 or 60.4 percent of the sample could be identified only to the general categories of bird, small mammal, medium mammal, and large mammal (Table 42). Fragments of bird that were not identifiable to genus or species were primarily long-bone fragments. Fragments of mammal bone that could not be identified to a finer level included long-bone fragments, plate or blade fragments, and rib fragments. In this report, identifications of small mammals encompass those species equal to or smaller than a jackrabbit in size. Medium mammals include those species larger than a jackrabbit but smaller than an antelope in size, and large mammals refer to those species antelope size or larger. All fragments or elements that could be identified to a more specific level were identified at least to the order and to the family, genus, and species where possible.

Of the 348 bone fragments or elements (39.6 percent of the total sample) identifiable beyond a general level, five fragments were identifiable only to the order Artiodactyla, five fragments could be assigned to three different families, and twelve fragments were identified to six genera. The remaining 326 fragments could all be identified with confidence to 16 different species (see Table 42 for a detailed overview).

Taking into account identifications that could only be made to a general level, several frequencies may be explained by viewing the faunal sample as a whole. The general category of large mammal accounts for 292 of these fragments. Because large mammal elements are greater in size, surface, and density when compared to medium or small mammals (Binford and Bertram 1977), their survival rate in depositional context would be greater compared to the other general categories used including birds. Thus, given that only one large mammal species could be identified in the total sample *(Odocoileus hemionus)*, the fragments of long bone may represent

Table 42. Summary of Faunal Species Identified from LA 50337

Species	No. of Elements or Fragments	Percent of Identified Bone	Percent of Sample
Birds, Aves			
Birds, general	27		3.1
Tetraonidae (grouse or ptarmigan)	2	0.6	0.2
Meleagris gallopavo (turkey)	36 101 eggshell	10.3	4.1
Mammals			
Small mammal	174		19.8
Medium mammal	39		4.4
Large mammal	292		33.2
Leporidae (rabbits)	2	0.6	0.2
Sylvilagus sp. (cottontails)	3	0.9	0.3
Sylvilagus auduboni (desert cottontail)	125	35.9	14.2
Lepus sp. (jackrabbit)	2	0.6	0.2
Lepus californicus (black-tailed jackrabbit)	45	12.9	5.1
Ammospermophilus leucurus (white-tailed antelope squirrel)	1	0.3	0.1
Cynomys gunnisoni (Gunnison's prairie dog)	47	13.5	5.3
Thomomys bottae (Botta's pocket gopher)	11	3.2	1.3
Papogeomys castonops (yellow-faced pocket gopher)	1	0.3	0.1
Perognathus sp. (pocket mouse)	2	0.6	0.2
Dipodomys ordii (Ord's kangaroo rat)	3	0.9	0.3
Peromyscus maniculatus (deer mouse)	2	0.6	0.2
Neotoma spp. (woodrats)	1	0.3	0.1
Neotoma albigula (white-throated woodrat)	1	0.3	0.1
Neotoma mexicana (Mexican woodrat)	1	0.3	0.1
Ondatra zibethicus (muskrat)	1	0.3	0.1
Canis spp. (dog/wolf/coyote)	1	0.3	0.1
Canis sp. (dog/coyote)	3	0.9	0.3
Canis cf. *familiaris* (Pueblo dog)	2	0.6	0.2
Procyon lotor (raccoon)	1	0.3	0.1
Mustelidae (weasels and allies)	1	0.3	0.1
Mephitis mephitis (striped skunk)	2	0.6	0.2
Artiodactyla (even-toed hooved mammals)	5	1.4	0.6

Table 42. Continued.

Species	No. of Elements or Fragments	Percent of Identified Bone	Percent of Sample
Odocoileus hemionus (mule deer)	47	13.5	5.3
Total	880*	100.3	99.6

Unidentifiable fragments = 532 or 60.4 percent of the total sample. This total includes the bone tools analyzed in this sample.

fewer elements than would be suggested from the frequency alone. The fragmentation of large mammal long bone in the extraction of bone marrow and the production of bone grease has been documented in ethnographic studies (Binford 1978). This would produce splinters of long bone more numerous per element and more frequently recovered during standard ¼-inch mesh screening than fragments of medium mammal, small mammal, or bird bone. In addition, large mammal long bone is frequently curated for later use in the production of bone tools (see Table 43 for incidence of large mammal bone used in bone tool production). This may result in the introduction of large mammal long-bone fragments into site contexts from curated bone as well as from the by-products of food processing.

Falling behind the recovery of large mammal bone fragments but still significant in the overall bone sample are the 174 fragments of small mammal bone. At first the frequency of small mammal bone fragments would seem to somewhat counter the arguments made above, but when the number of species of small mammal identified in this sample is considered (13 out of the 16 species identified), it can be seen that the number and variety of small mammals utilized or intrusive in this sample is significantly greater than the number of large mammals used. Because preservation and probably recovery of small mammal remains is notably less for any comparable individual or element of large mammal, the number of fragments present in this sample that are only generally identifiable corresponds well with the number of elements and variety of species identified in the faunal sample.

The 39 fragments of medium mammal identified are in line with the recovery and identification of only two species of mammal in that size range. The number of medium mammal species identified at most archaeological sites and the relative frequency of fragments or whole elements identified is usually low (Rood and Rood 1984; Neusius 1985). This may be due in part to the fact that many mammals falling within this category lead fairly solitary existences and thus are not as easily procured.

The identification of 27 fragments to the general category of birds was done using two main criteria, (1) an absence of cancellous tissue, and (2) the relative thickness of the compact tissue was thin for the approximated diameter of the complete section. There was a predominance of turkey bone in the identifiable bird fragments that suggest this may extend to those fragments only identifiable at a general level. The overall compact tissue thickness and curvature of these fragments would tend to support this conclusion.

Those faunal fragments that could be identified to a more specific taxonomic level give additional information on faunal availability and overall utilization in this archaeological sample. Availability and utilization of each order, family, genus, and species and their overall percentage representation in the sample is presented below and summarized in Table 42.

Table 43. Species Used for Bone Tool Production

Species	Element	Tool
Meleagris gallopavo (turkey)	tibiotarsus	1 bone bead
Small mammal	long bone	1 fragment with drill hole
Medium mammal	long bone	1 awl tip
Large mammal	long bone	2 awls 2 awl tips 2 awl fragments 1 needle 1 scored edge
Odocoileus hemionus (mule deer)	metacarpal metatarsal tibia	1 awl fragment 1 awl 1 shuttle 1 smoothed fragment 1 awl

Total bone tools in sample = 17

Birds

Tetraonidae (Grouse or Ptarmigan)

Members of this family are medium to large chickenlike birds. Most species of this family are presently confined to the eastern part of the state or to mountainous areas today. *Centrocercus urophasianus* (sage grouse) is the widest spread member of this family in New Mexico, but is restricted to mesas and medium slopes with sage cover between 5,500 and 8,000 ft in elevation. Because the prehistoric distribution of the other grouse species that occur in this state may have been greater, the two faunal fragments identified to this family were not considered to be sage grouse, although this is a likely species candidate.

Meleagris gallopavo *(Turkey)*

There are several subspecies of turkey within the state of New Mexico but they differ only in plumage. The distribution of wild turkeys is statewide. Although wild turkeys can be caged and kept for food and feathers, the subject of their domestication by prehistoric Puebloan populations will not be approached here. The presence of 36 bone fragments and 101 pieces of eggshell assignable to this species indicates that their use during the overall occupation of this pueblo is significant. Most fragments of eggshell were quite small and the relative number of actual eggs represented is unknown. The eggshell fragments occurred mostly in the excavated room-block area (Area 3) in fill context. Turkey bone fragments are more widespread in occupational context but the variety of elements identified suggests that individual birds were probably not kept at this pueblo. The eggshell and bone probably come from wild birds captured away from the pueblo proper.

Mammals

Leporidae (Rabbits)

A proximal rib fragment and one tooth could be identified only to the rabbit family in general. This family is represented in the state by seven species, of which *Lepus californicus* and *Sylvilagus auduboni* are the most likely representatives in the study area.

Sylvilagus *sp. (Cottontails)*

Three small ribs were identifiable as cottontail but again the most likely species in the study area would be *Sylvilagus auduboni.*

Sylvilagus auduboni *(Desert Cottontail)*

This is the most frequently occurring species of cottontail in the state of New Mexico. Its distribution is statewide while the distribution of the two other species of cottontail are much more localized both in elevation and in geographic distribution throughout the state. Separation of *Sylvilagus auduboni* from the other two species may be accomplished by comparing the depth of the dentary relative to the alveolar length of the cheektooth row for mandibles (Findley et al. 1975:83-85). One hundred and twenty-five bone fragments were identified to this species. Thus by bone frequency occurrence alone, this was the most frequently occurring species in the overall site representing 14.2 percent of the total sample and 35.9 percent of the identifiable bone. Of the faunal remains identified to this species, 17 or 13.6 percent of the fragments attributed to this species showed some evidence of burning, which may reflect some usage and processing patterns that are relative to size (for example, stew pot activities related by Beaglehole [1936] for the historic Zuni). Desert cottontail remains, as well as some of the other small mammal species, also exhibit some breakage and discoloration patterns that are consistent with boiling and roasting patterns.

Lepus *sp. (Jackrabbits)*

There are four species of jackrabbits that occur in New Mexico. Those other than *Lepus californicus* are isolated to northern and mountainous areas or in the case of *Lepus callotis,* to the far southwest corner of the state. Two tooth fragments corresponded to the size and morphology of the jackrabbit but could not be identified further. Thus, they were included only at the family level.

Lepus californicus *(Black-tailed Jackrabbit)*

As mentioned above, black-tailed jackrabbits are the most widely distributed species of jackrabbit within the state boundary. They occur in a wide variety of environmental zones and are the only species that actually occur within the study area, though introduction of other species from hunting trips to the east can not be totally excluded. *Lepus californicus* was the fourth most frequently identified species in the overall faunal sample and the 45 bone fragments or elements attributed to this species represent 5.1 percent of the total sample and 12.9 percent of the identified bone. Some evidence of burning occurred on 37.8 percent of the bones identified to this species and, as noted for *Sylvilagus auduboni,* there were breakage and discoloration patterns noted that are consistent with boiling and roasting. The higher percentage of burned bone may be a result of disposal into fires after the animal was roasted and consumed. This disposal pattern may be related to the larger size of the jackrabbit when compared to that of the cottontail.

Ammospermophilus leucurus *(White-tailed Antelope Squirrel)*

This species is most common in grasslands and marginal piñon-juniper woodlands and would have been available in the immediate study area under consideration. One pelvis fragment of this species was identified in the overall faunal sample. This specimen was from Plaza 1 context in the room-block area (Area 3) and its occurrence with respect to its intrusiveness or use at the site is unknown.

Cynomys gunnisoni *(Gunnison's Prairie Dog)*

This species once occurred over a much wider area of the state but presently can be found in grassland areas to the north and west. It occurs in low valleys but is also common in park land, meadows, and montane forests at least to 10,000 ft in elevation. Gunnison's prairie dog ranks just behind the desert cottontail in number of faunal fragments attributed to this species (47). Bones from this species account for 5.3 percent of the total sample and 13.5 percent of the identifiable bone. Burning was evident on 17.0 percent of the bone identified to this species, and like the desert cottontail and the black-tailed jackrabbit, the prairie dog bone identified shows some breakage patterns and discoloration consistent with boiling and roasting.

Thomomys bottae *(Botta's Pocket Gopher)*

This species is ubiquitous throughout the state with the exception of higher elevations, and exhibits a considerable geographic variation in size. Of the 11 elements attributed to this species, 9 were cranial fragments. This predominance of cranial versus postcranial fragments indicates that the occurrence of this species is not intrusive in nature, suggesting that it was utilized by the population to some degree (Thomas 1971).

Papogeomys castonops *(Yellow-faced Pocket Gopher)*

This species does not occur in the study area today but some evidence indicates that its range previously extended further west (Findley et al. 1975:154). Thus, the presence of this species may indicate that it was present in the study area at the time the site was occupied. It can be readily distinguished from other gophers in possessing only one groove in each upper incisor. The single maxillary fragment identified to this species was identified by this trait. The utilization or intrusiveness of this species is unknown.

Perognathus *sp. (Pocket Mouse)*

At least two species of the genus *Perognathus* occur in the study area today. These are *Perognathus flavus* and *Perognathus flavescens*. The identification of these species is difficult, so the two elements attributed to this genus could not be further identified. Both bone fragments were recovered from the excavation of a roasting pit (Area 2) and may be intrusive into this site context.

Dipodomys ordii *(Ord's Kangaroo Rat)*

This is one of the most common desert rodents in the state and occurs almost everywhere below mid-woodland (Findley et al. 1975:174). It is also the only five-toed kangaroo rat within state boundaries. The three long bones attributed to this species all exhibit spiral or snap breakage and one specimen displayed some light brown discoloration (burning or roasting?). This evidence, along with the fact that only larger limb bones were identified (Thomas 1971), suggests that this species was included in the diet of the prehistoric population.

Peromyscus maniculatus *(Deer Mouse)*

Deer mice are capable of living in almost every habitat in New Mexico and have been frequently captured or observed within the general study area (Findley et al. 1975:204, 206-210). The two elements assigned to this species include one cranial fragment and a partial pelvis. This species may have been intrusive into site context. Some tanning on the pelvis fragment, however, may suggest that it was included as part of the diet.

Neotoma *sp. (Woodrats)*

Four species of woodrats occur in the study area today and probably occurred in even greater numbers prehistorically. The humerus fragment assigned to this family was immature, making more detailed identification tenuous.

Neotoma albigula *(White-throated Woodrat)*

This species is widespread in the state, with populations tending to oscillate in habitat and the presence of other woodrat species. One mandible was assigned to this species and the intrusive nature or dietary contribution of this species is unknown.

Neotoma mexicana *(Mexican Woodrat)*

This species is primarily montane in nature (Findley et al. 1975:247) but does co-occur with *Neotoma albigula* in the study area. Both species tend to like more mesic environments and their presence at the site may indicate an increased moisture regime at some points during occupation. The one femur identified as Mexican woodrat was burned black, but the context in which this occurred is unclear and may have been a result of structural burning rather than use and discard.

Ondatra zibethicus *(Muskrat)*

Muskrats occur along the Rio Grande and Pecos and San Juan rivers along both drainage ditches and in marsh areas (Findley et al. 1975:264). One complete immature femur was identified in the site sample. The occurrence of this element may indicate the utilization of this species for food or curation for some other reason.

Canis *spp. (Dog, Wolf, Coyote)*

One rib midsection could only be identified to this level. The occurrence of this bone fragment in the general room block fill may indicate that it was most likely from the dispersed elements of one or more individual dogs. Because this cannot be said with certainty, identification must remain at the generalized genus level.

Canis *sp. (Dog or Coyote)*

Three canine tooth fragments could be identified to this level. These specimens, like the more general designation, could have been part of the dispersed dog elements found in the room block fill.

Canis *cf.* familiaris *(Pueblo Dog)*

One immature pelvis fragment and one complete third metatarsal represent this species in the site sample. They exhibited some weathering and were located in fill context above the room block area of excavation.

Procyon lotor *(Raccoon)*

Raccoons are common around all permanent watercourses in the state and are occasionally found in desert and grassland areas far from water (Findley et al. 1975:298). This species is found both to the east and to the west of the immediate study area and could have been procured on a hunting trip and returned to the site. One distal humerus fragment identified as raccoon was recovered from the kiva.

Mustelidae (Weasels and Allies)

Many of the members of this family occurring within the state are confined to more mountainous areas, but mink, badger, and striped skunk do occur within the study area. One immature radius fragment was identified only to the family level. The immature nature of the fragment would not allow further identification.

Mephitis mephitis *(Striped Skunk)*

This is the most common species of skunk in the state. Skunks are often attracted by human construction and are frequently found in or near agricultural fields (Findley et al. 1975:311). Two immature axis vertebra were assigned to this species. Both specimens were burned with one element occurring in a roasting pit (Feature 2) and the other in a pit structure context. The areas of recovery for these remains and their mottled burning suggests that this species contributed to the diet of the occupants of this site.

Artiodactyla (Even-toed Hoofed Mammals)

Five very fragmentary elements could only be identified to this level. The elements identified were fragments of teeth, ribs, and vertebra, and were probably the results of processing behavior.

Odocoileus hemionus *(Mule Deer)*

Mule deer range through all elevations and habitats in this state while *Odocoileus virginianus* (white-tailed deer) is fairly restricted in its occurrence to the central and southwestern mountainous areas of New Mexico. Of the 47 bone elements that were assigned to this species, the majority were long bones and phalanges. This may reflect differential butchering and disposal patterns where long bones (especially metapodials) would be set aside for the extraction of bone marrow (Binford 1978) and hooves might accompany these elements or perhaps were being used in glue production. Only 12.7 percent of these elements show evidence of burning but most of the long-bone fragments assigned to the large mammal category are probably results of the processing of this species.

Mule deer remains are second only to desert cottontail remains identified in this sample, making up 5.3 percent of the total sample and 13.5 percent of the identified bone. Its use at the site was significant but the elements identified may reflect the utilization of only three individuals.

The species description given above and the summary of species in Table 42 includes the worked bone that was recovered during excavation. Table 43 is a tabulation by species, element, and tool type of the 17 pieces of worked bone recovered during excavation. Ten of these pieces of worked bone were awls or awl fragments. Also included in the worked bone inventory was a bone bead, a needle, a shuttle, and three worked fragments not identified to any specific tool category. One awl, three awl fragments, and one piece of bone with a scored edge exhibit evidence of burning. The burning on these tools was the result of the burning of the structures with which they were associated, predominately the room block, the ramada associated with Room 13, the north plaza, and the pit structure. Fourteen or 82.4 percent of the worked bones were fashioned from large mammal remains and provide some evidence for the curation of large mammal long bone.

Information from faunal reports in general is standardly given for a site as a whole and occasionally for separate areas within a given site. Because the comparative information is only available at that level of resolution, comparisons of this La Plata site faunal sample can be performed most easily using the information presented above.

A Regional Comparison

The evaluation of the faunal remains from LA 50337 will not include the bone tools just discussed but will concentrate on the percentages of the identified species represented in the LA 50337 sample and those represented in other samples in the general area. Sample size variability between different excavations sets limitations on the conclusions that might be reached. Binford et al. (1982) found a strong linear correlation between number of species and the elements identified and the size of the overall excavation samples. Thus, as the overall sample from any excavation or area of an excavation increases, we should see a relative increase in the overall species identified and in the number of elements assigned. This sample size problem should be kept in mind throughout the discussion that follows.

Not far west of LA 50337, the sites that are part of the San Juan Coal Lease project can provide a source of faunal material. During the analysis of the San Juan sample, 465 bones (40 percent) of the sample could be identified to the genus and species level. This sample is an overview of the faunal remains recovered from ten sites so that comparisons with a single site sample can be made only very generally. The ten sites tested cover an occupational time period from A.D. 850 to at least A.D. 1300 using ceramic chronologies for the area. This occupational time span falls within the major occupational framework for LA 50337. Identification of the faunal remains from the San Juan Coal Lease sites resulted in the assignment of remains to 14 different mammal and bird species (Rood and Rood 1984). The similarity between the San Juan composite sample and the sample from LA 50337 is fairly good. All but three of the species that occur in the San Juan samples are present in the La Plata sample. Black-tailed jackrabbit was the most frequently identified species from the sites in the San Juan Coal Lease compared to desert cottontail in the LA 50337 sample. This change in the predominant species is most likely due to microenvironmental differences that would result in differential species abundance. Even though frequencies vary between the two areas, as they would between any samples taken even from the same site, the dominant species utilized by the prehistoric populations are the same with the exception of *Odocoileus hemionus* (mule deer). Both areas exhibit the predominant utilization of small mammal species, mainly black-tailed jackrabbit, desert cottontail, and Gunnison's prairie dog. Mule deer occurs much less frequently in the San Juan Coal Lease faunal sample than it does in our study area. Because season of occupation and the size of various sites was not addressed when considering the faunal sample in the San Juan Coal Lease area, it is hard to evaluate this difference. The difference may be due to season or length of occupation of the sites in the coal lease area when compared to the longer occupation of the puebloan site.

Excavations in the Dolores project area and in Chaco Canyon also produced faunal samples that may be compared to LA 50337. Again, elevational and environmental differences must be taken into account in these comparisons but a general evaluation may prove helpful.

Neusius (1985) discusses the breadth of accumulated information on the faunal remains recovered in the Dolores Archaeological Program excavation. Also included in this report is a list of those species available in the Dolores area, their relative abundance, and a table of those species that have been documented as a resource used by humans. The Dolores project covers a large area and the species diversity and a composite of the species used at all the sites would logically be much greater than that in our study area sample. Some 21,919 bone fragments (28.6 percent) of the total bone) were identifiable in the overall Dolores faunal sample. If Binford's (Binford et al. 1982) information on species diversity and sample size is applied, one would expect many more species to be identified in the large sample rather than from the sampling of any single site.

Even with the greatly increased number of genera and species identified and the greater number of environments included in the Dolores project, some general similarities may be seen in the LA 50337 faunal sample. The species noted as predominant in the LA 50337 faunal sample are the dominant species in the overall Dolores sample. Considering the fact that 154 orders, genera, or species were identified in the Dolores sample, the similarity in predominant species suggests the great abundance of desert cottontails, black-tailed jackrabbits, and Gunnison's prairie dogs. Their abundance throughout the Southwest region in general resulted in their heavy utilization as a protein resource in a variety of environmental contexts.

Mule deer remains are greater than those of prairie dog in the overall Dolores sample and greater than jackrabbit remains identified at LA 50337. In both areas the increased survival of large mammal versus small mammal bone (Binford and Bertram 1977) may have influenced the number of elements identified as mule deer relative to those identified to the other predominant species. Thus, while each individual or utilized section of a mule deer carcass represents a great deal more consumable muscle mass, the overall number of individuals used in the Dolores area and at LA 50337 was small relative to the other dominant species identified. This ratio may be due to the smaller number of mule deer occurring in any one area and their occurrence and temporary aggregation relative to the scheduling of agricultural pursuits.

It may be helpful to make one additional comparison to the LA 50337 faunal sample. Akins (1985) has done a review of the faunal remains recovered during a number of site excavations in Chaco Canyon. Chaco Canyon lies to the south and west of our study area but is still well within the northwestern region of the state and a general comparison would seem useful.

Akins's (1985) review of excavated faunal materials from Chaco Canyon includes samples identified from 26 sites. These include samples from both large and small site contexts. Species identifications are tallied for each site (1985:314) and the number of species identified range from 6 to 71 per faunal sample. The more recent Chaco project excavations resulted in larger faunal samples with more species identified overall. This result was probably due to improved excavation techniques (screening) that were more likely to consistently recover faunal remains.

The most consistently identified species from the site sample in Chaco Canyon were desert cottontail, black-tailed jackrabbit, Gunnison's prairie dog, mule deer, antelope, and mountain sheep. While the La Plata site faunal sample was significantly smaller than a number of the samples reviewed for Chaco Canyon, desert cottontail, black-tailed jackrabbit, and Gunnison's prairie dog are still the dominant species. This reinforces what has been seen in the other regional comparisons.

Thus, throughout the region and indeed across the majority of the Southwest, lagomorphs (rabbits) and the larger rodent species are the predominant remains in archaeological faunal samples. Desert cottontail, black-tailed jackrabbit, and Gunnison's prairie dog are the predominant small mammal species in the overall sample at LA 50337. This is consistent with the faunal samples from other sites in the general region.

Mule deer was also a main species recovered from LA 50337. This large mammal species was dominant in the Dolores and Chaco excavation samples. It is clear that it was utilized when available by prehistoric populations in the general region and specifically by the occupants of the La Plata site studied here. Preservation biases would tend to favor the recovery of large mammal bone but even occasional use of this resource would add significantly to the protein consumed by any prehistoric group.

Turkey also contributed to the diet of the occupants at LA 50337 and bone and eggshell were recovered from all but one excavation area. Turkey ranks fifth among the species identified. Though the majority of the bone and eggshell come from the room-block area, its presence in most areas of the site may indicate somewhat higher usage than the element frequency this sample reveals.

Overall, the species identified from LA 50337 are similar to those from other sites of the general region. The distribution of these species over the site and as part of the various occupation periods can be used to better understand variability in the presence, recovery, and utilization of these species.

An Overview of the Faunal Remains Produced in Each Area of Excavation at LA 50337

The excavations at LA 50337 extended into six different areas of the site. These excavation areas contained a variety of features, surfaces, and structural units. The amount excavated in each area varied. In this section, each area of excavation will be reviewed and compared to the other excavated areas to shed some light on the variability in distribution and condition of the faunal sample recovered from LA 50337. Other excavations in the general region will be referred to again in this section as supporting evidence of availability and use of species in the La Plata site sample.

Area 1 (North Trench)

This area was the first tested during site excavations. A trash area and ash lens was uncovered and part of a large kiva was exposed. The majority of bone was recovered from the kiva context. A total of 52 pieces of bone or 5.9 percent of the total sample and six pieces of eggshell were recovered. Of the bone found in this area, 26 fragments or 50 percent of the area sample could be identified as small, medium, or large mammal. The remaining 26 bone fragments could be identified to eight different genera or species (Table 44). Of the bone recovered from this area, 11 pieces exhibit some evidence of burning and these fragments occur both in trash and kiva contexts (Table 45).

Table 44. Summary of Faunal Identification for Area 1

Species	Element	Portion/Side, Age*	MNE
Birds			
Meleagris gallopavo (turkey)	carpometacarpus	1 fragment/L/M	0.5
	long bone	2 fragments	--
	eggshell	6 fragments	--
Mammals			

Table 44. Continued.

Species	Element	Portion/Side, Age*	MNE
Small mammal	metapodial	1 diaphysis frag.	.05
	long bone	4 fragments	--
Medium mammal	long bone	3 fragments	--
Large mammal	rib	1 proximal frag.	--
	long bone	17 fragments	--
Sylvilagus auduboni (desert cottontail)	skull/maxilla	1 medial and zygoma A/U	1.0
		1 medial and dentition L/M	1.0
	mandible	1 horiz. ramus and dentition R/M	0.5
	humerus	1 distal and more than half a shaft R/M	0.5
	pelvis	1 pubis missing L/M	0.5
	femur	2 prox and less that half a shaft L/M	2.0
	tibia and fibula	1 prox. and more than half a shaft R/M	0.5
Lepus californicus (Black-tailed jackrabbit)	vertebra atlas	1 complete A/M	1.0
	vertebra thoracic	1 damaged A/U	0.08
	vertebra lumbar	1 transverse process A/U	0.14
	radius	1 diaphysis frag. L/U	0.5
	tibia	1 diaphysis frag. L/U	0.5
Thomomys bottae (Botta's pocket gopher)	skull/maxilla	1 anterior and medial w/ dentition A/M	1.0
Neotoma mexicana (Mexican woodrat)	femur	1 prox. and more than half a shaft R/M	0.5
Procyon lotor (Raccoon)	humerus	1 distal foreman R/U	0.5
Mephitis mephitis (Striped skunk)	vertebra axis	1 complete A/I	1.0
Odocoileus hemionus (Mule deer)	radius metacarpal	1 distal frag. L/M 5 diaphysis frag. R/U	---

Table 45. Burning Noted on Faunal Fragments, Area 1

Species	Element/Portion/Side	Burning
Large mammal	6 long bone fragments	black
Sylvilagus auduboni	pelvis complete left	mottled light to black
Lepus californicus	femur proximal left	light brown
Neotoma mexicana	femur proximal right	black
Mephitis mephitis	axis complete axial	mottled brown to black
Odocoileus hemionus	metacarpal diaphysis right	black

Desert cottontail and black-tailed jackrabbit were identified most frequently in the area sample and, like other species identified, were represented by both cranial and postcranial elements. Thus, no disposal or utilization preference by element frequency was noted. One desert cottontail element exhibited evidence of carnivore gnawing. The spiral fracturing, tan to chalky coloration, and snap breaks on lagomorph and turkey elements would tend to support the process of roasting meat for consumption along with some boiling.

Area 2 (South Trench)

Both the north and south backhoe trenches were excavated on the east side of State Road 170. The south trench did not expose any major structural unit but did encounter a roasting pit (Feature 2), which was then fully excavated by expanding the trench area into four test units. From this excavation 109 bone fragments were recovered or 12.39 percent of the total faunal sample. The majority of the bone was found within the context of Feature 2. Of this bone, 62 fragments (56.9 percent of the area sample) could be identified to the general categories of bird and small, medium, or large mammal. The remaining 47 bone fragments (43.1 percent of the area sample) could be identified to 12 different categories of family, genus, or species (see Table 46). Burning was present on 35 bone fragments (32.1 percent of the area sample) (see Table 47 for details). All of the burned faunal material was recovered from Feature 2.

The predominant species identified from Area 2 are Gunnison's prairie dog and desert cottontail. Other than these species, three elements could be assigned to each of the following species: black-tailed jackrabbit, Botta's pocket gopher, and turkey. The identifiable element sample contained both cranial and postcranial elements for most species with the exception of Botta's pocket gopher. The three elements assigned to this species were all part of the cranial complex. This is interesting in that small animals, which might be included as part of a stew pot, may have the cranial complex severed prior to inclusion in the pot. Mottled tanning and spiral breaks and snap fractures on small mammal elements in this area would also suggest that meat was processed by roasting as well as by boiling.

Area 3 (Room Block)

The room block lies to the west of State Road 170. The majority of the pueblo was outside of the highway right-of-way and thus the sample from this area was actually recovered from only a few rooms and plaza areas that extended into the right-of-way. There were 537 bone fragments recovered from this area or 61.02 percent of the total sample along with 92 fragments of eggshell. Of this number, 339 bone fragments (63.1 percent of the area sample) could be identified as bird or small or large mammal. The remaining 198 fragments (36.9 percent of the area sample) were identifiable to 17 families, genera, or species (see Table 48 for details). Of the total number of faunal remains from this area, 63 elements exhibit some evidence of burning (Table 49). These burned elements were scattered throughout the area of excavation.

The most frequently identified species from this area were desert cottontail, turkey, and mule deer with Gunnison's prairie dog and black-tailed jackrabbit behind these in frequency. The majority of the desert cottontail was recovered from plaza context while the majority of the turkey remains were excavated from the post-occupational fill and the mule deer was scattered throughout the excavation area. There seems to be no real preference for any one anatomical part for these species.

Table 46. Summary of Faunal Identification for Area 2

Species	Element	Portion/Side/Age*	MNE
Birds			
Bird	plate or blade	3 fragments	-
	long bone	4 fragments	-
Meleagris gallopavo (turkey)	skull	1 quadrate frag. R/U	0.5
	mandible	1 articular process R/U	0.5
	humerus	1 diaphysis R/U	0.5
Mammals			
Small mammal	tooth	1 maxillary frag.	-
	long bone	44 fragments	-
Medium mammal	rib	1 fragment	-
	long bone	1 fragment	-
Large mammal	long bone	8 fragments	-
Leporidae (rabbits)	rib	1 proximal	-
Sylvilagus sp. (cottontails)	rib	3 complete	-
Sylvilagus auduboni (desert cottontail)	skull	1 parietal frag. R/U	0.5
	vertebra lumbar	2 centrum frags. A/U	-
	humerus	1 distal + less than ½ shaft L/M	0.5
	pelvis	1 ilium frag. L/U	0.5
		1 ilium + acetabulum L/U	0.5
	tibia	2 diaphysis R/U, L/U	1.0
	metatarsal gen.	1 proximal damaged	0.1

Table 46. Continued.

Species	Element	Portion/Side/Age*	MNE
Lepus sp. (jackrabbit)	tooth	1 fragment	-
	tooth incisor	1 mandibular frag. R/U	-
Lepus californicus (black-tailed jackrabbit)	humerus	1 proximal frag. R/M	0.5
	metacarpal 3rd	1 complete L/M	0.5
	tibia	1 distal epiphysis frag. L/M	0.5
Cynomys gunnisoni (Gunnison's prairie dog)	skull	2 frontal A/M, L/U	1.5
		1 frontal + part orbital R/M	0.5
		1 occipital frag. R/U	0.5
	skull/maxilla	1 anterior frag. + incisor R/M	0.5
		1 medial + dent. R/M	0.5
	mandible	1 anterior + incisor R/M	0.5
	scapula	1 glenoid fossa + blade R/M	0.5
	humerus	2 diaphysis L/U, R/U	1.0
		1 dist. + less ½ shaft L/M	0.5
		1 dist. + greater ½ shaft L/M	0.5
	radius	1 complete R/M	0.5
	ulna	1 complete distal unfused L/I	0.5
	fibula	1 diaphysis	0.5
		1 proximal R/M	0.5
	metatarsal 5th	1 complete L/M	0.5
Thomomys bottae (Botta's pocket gopher)	skull/maxilla	1 anterior frag./ no dentition A/U	1.0
	mandible	1 ascending ramus L/U	0.5
		1 dentition missing R/M	0.5
Perognathus sp. (Pocket mouse)	skull	1 auditory bulla R/U	0.5
	humerus	1 complete prox. unfused L/I	0.5
Neotoma spp. (woodrats)	humerus	1 prox. + greater than ½ shaft unfused L/I	0.5
Mustelidae (weasels and allies)	radius	1 dist. + less than ½ shaft R/I	0.5
Odocoileus hemionus (mule deer)	phalange 1st	1 complete U/M	0.25
	phalange 2nd	1 damaged proximal	0.25

Table 47. Burning Noted on Faunal Fragments, Area 2

Species	Element/Portion, Side	Burning
Bird	2 long bone frags.	light to black
Small mammal	5 long bone frags.	mottled light to dark brown
	7 long bone frags.	brown to black
	2 long bone frags.	black
	1 long bone frag.	mottled light gray
Medium mammal	1 long bone frag.	calcined
Large mammal	6 long bone frags.	brown to black
	1 long bone frag.	mottled light gray
Sylvilagus auduboni	humerus distal, left	black
	pelvis ilium frag., left	calcined
	metatarsal gen. proximal	dark brown
Lepus californicus	humerus proximal, right	light brown to dark brown
	metacarpal 3rd, left	mottled light brown
Cynomys gunnisoni	frontal + orbital, right	mottled light brown
	mandible complete, right	mottled light to dark brown
	humerus diaphysis, right	brown to black
	ulna complete, left	mottled dark brown
	ulna proximal, right	black

Table 48. Summary of Faunal Identifications for Area 3

Species	Element	Portion/Side/Age*	MNE
Birds			
Bird	long bone	20 fragments	-
Meleagris gallopavo (turkey)	skull	1 complete A/U	1.0
		1 occipital area A/U	1.0
		3 fragments	-
	mandible	1 dentary missing L/M	0.5
		1 process missing R/M	0.5
	vertebra atlas	1 complete A/M	1.0
	vertebra axis	1 complete A/M	1.0
	vertebra cervical	1 centrum frag. A/U	0.08
		1 damaged A/U	0.08

Table 48. Continued.

Species	Element	Portion/Side/Age*	MNE
	humerus	2 dist. + >½ shaft L/M	1.0
	radius	1 dist. + >½ shaft L/M	0.5
		1 damaged distal L/M	0.5
	ulna	1 complete L/M	0.5
	carpometacarpus	1 complete L/M	0.5
	sternum	1 anterior carinal margin A/U	1.0
	femur	1 complete L/M	0.5
	tibiotarsus	2 proximal fragments	-
		1 distal L/M	0.5
		1 diaphysis L/U	0.5
		1 diaphysis frag.	-
	fibula	1 proximal frag. L/U	0.5
	phalanx 1	1 distal frag. R/U	0.5
	phalanx 2	1 proximal frag. R/U	0.5
	phalange	2 proximal frags.	--
	eggshell	92 frags.	--
Tetraonidae (grouse and ptarmigan)	humerus	1 complete R/M	0.5
	ulna	1 diaphysis R/U	0.5
Mammals			
Small mammal	plate or blade	15 fragments	--
	long bone	59 fragments	--
Medium mammal	tooth canine	1 root, part enamel	--
	plate or blade	12 fragments	--
	long bone	12 fragments	--
Large mammal	skull	17 fragments	--
	tooth	1 enamel fragment	--
		1 root fragment	--
	vertebra	9 fragments	--
	rib	1 proximal fragment	--
		26 fragments	--
	plate or blade	24 fragments	--
	metapodial	1 proximal fragment	--

Table 48. Continued.

Species	Element	Portion/Side/Age*	MNE
	long bone	140 fragments	–
Sylvilagus auduboni (desert cottontail)	skull	1 frontal L/I	0.5
		1 frontal complete A/M	1.0
		1 frontal damaged L/M	0.5
		1 anterior zygoma L/M	0.5
		1 zygoma complete R/U	0.5
		1 zygoma, temporal R/M	0.5
		1 auditory bulla L/M	0.5
		1 petrous temporal R/U	1.0
		1 parietal frag. R/U	0.5
		1 occipital A/M	1.0
		1 sphenoid A/U	1.0
		3 fragments	–
	skull/maxilla	1 dentition, anterior zygoma R/M	0.5
		1 medial w/ dentition, zygoma A/M	1.0
		1 medial, part zygoma A/M	1.0
	mandible	4 ascending ramus L/M, I, U, U	2.0
		1 anterior missing L/M	0.5
		1 fragment R/U	0.5
		1 horiz. ramus w/ dent. L/U	0.5
	vertebra atlas	1 frag. A/I	1.0
	vertebra cervical	2 complete A/U, A/M	0.28
	vertebra thoracic	3 complete A/M, I, U	0.25
		1 spinal process A/U	–
		1 spinal process missing A/I	0.08
	vertebra lumbar	3 centrum A/J, I, U	0.43
		1 processes missing	0.08
		1 damaged A/I	0.08
		2 fragments	–
	scapula	1 blade L/U	0.5
		1 glenoid fossa L/M	0.5
	humerus	1 complete/proximal unfused R/J	0.5
		1 distal R/M	0.5

Table 48. Continued.

Species	Element	Portion/Side/Age*	MNE
		2 proximal L/M, R/U	1.0
	radius	1 complete R/M	0.5
		1 proximal R/M	0.5
	ulna	2 prox. + <½ shaft L/U, R/M	1.0
		1 prox. R/M	0.5
	rib	1 proximal	-
		1 shaft fragment	--
	pelvis	2 pubis missing, L/I, R/M	1.0
		1 ischium posterior R/M	0.5
		1 ilium fragment R/M	0.5
		1 acetabulum, part ilium R/U	0.5
	femur	1 dist. + <½ shaft R/M	0.5
		1 distal R/M	0.5
		3 distal epiphyses L/I, R/I, R/U	1.5
		2 distal unfused R/I (both)	1.0
		1 proximal R/M	0.5
		1 diaphysis L/U	0.5
	tibia	1 complete/distal unfused R/I	0.5
		1 dist. + >½ shaft L/M	0.5
		1 distal L/M	0.5
		1 proximal epiphysis R/I	0.5
		2 prox. + >½ shaft R/M, L/I	1.0
		1 proximal R/M	0.5
	astragalus	1 complete R/M	0.5
	calcaneum	3 complete 2L/M, R/M	1.5
		1 fragment L/U	0.5
	metatarsal 2nd	1 complete/distal unfused L/I	0.5
	metatarsal 3rd	1 complete/distal unfused L/I	0.5
	metatarsal 4th	2 complete R/M, R/I	1.0
	metatarsal 5th	2 complete/distal unfused R/I, L/I	1.0
		1 prox + <½ shaft L/U	0.5
Lepus californicus (black-tailed jackrabbit)	skull	1 frontal frag. R/U	0.5
		1 auditory bulla + petrous R/M	0.5

Table 48. Continued.

Species	Element	Portion/Side/Age*	MNE
	rib	1 complete	--
	radius	1 diaphysis frag. L/U	0.5
	femur	1 complete unfused L/I	0.5
		1 prox. + <½ shaft L/M	0.5
		2 diaphyses L/U, R/U	1.0
	tibia	2 diaphysis L/U	0.5
	metatarsal 4th	1 prox. + distal. frags. R/M	0.5
	metatarsal gen.	1 dist. + <½ shaft	--
		1 prox. + <½ shaft	--
		1 prox. + >½ shaft	--
Ammospermophilus leucurus (White-tailed antelope squirrel)	pelvis	1 ilium, acetabulum L/M	0.5
Cynomys gunnisoni (Gunnison's prairie dog)	mandible	2 ascending ramus missing 2 R/M	1.0
		1 ascending ramus frag. L/M	0.5
		1 complete L/M	0.5
		1 incisor missing R/M	0.5
		1 horiz. ramus + dentition L/M	0.5
		1 horiz. ramus frag. R/U	0.5
	humerus	2 dist. + >½ shaft R/M, L/M	1.0
		1 dist. + <½ shaft R/M	0.5
		1 diaphysis frag. L/U	0.5
	ulna	1 complete R/I	0.5
	pelvis	1 ilium frag. R/U	0.5
		1 ischium + acetabulum L/I	0.5
	femur	1 dist. + >½ shaft, unfused R/I	0.5
		1 diaphysis L/U	0.5
	tibia	1 complete R/M	0.5
		1 dist. + >½ shaft L/M	0.5
Thomomys bottae (Botta's pocket gopher)	skull	1 frontal A/M	1.0
	mandible	1 ascending ramus frag. R/U	0.5
		1 horiz. ramus/ no dentition R/I	0.5
	vertebra lumbar	1 centrum + part processes A/U	--
Papogeomys castanops (yellow-faced pocket gopher)	skull/maxilla	1 medial/with dentition R/U	0.5

Table 48. Continued.

Species	Element	Portion/Side/Age*	MNE
Dipodomys ordii (Ord's kangaroo rat)	ulna	1 prox. + >½ shaft L/M	0.5
	femur	1 dist. + <½ shaft L/M	0.5
Peromyscus maniculatus (deer mouse)	skull	1 frontal A/M	1.0
	pelvis	1 complete R/M	0.5
Neotoma albigula (white-throated woodrat)	mandible	1 horiz. ramus + dentition L/M	0.5
Ondatra zibethicus (muskrat)	femur	1 complete/unfused R/I	0.5
Canis sp. (dog/coyote)	tooth canine	3 fragments L/M	0.25
Canis spp. (dog/wolf/coyote)	rib	1 midsection	--
Canis cf. *familiaris* (Pueblo dog)	pelvis	1 ilium frag./unfused R/I	0.5
	metatarsal 3rd	1 complete L/M	0.5
Artiodactyla (even-toed hooved mammals)	tooth	2 fragments	--
	vertebra lumbar	2 transverse process frags. A/U	--
	rib	1 proximal frag.	--
Odocoileus hemionus (mule deer)	skull	2 zygoma frags. R/U	0.5
	vertebra thoracic	1 spinal process A/U	0.08
	vertebra lumbar	1 centrum frag. A/M	0.17
	scapula	2 blade frags. L/U	0.5
	radius	1 proximal L/M	0.5
	ulna	1 proximal frag. L/M	0.5
	carpal unciform	1 complete L/M	0.5
	metacarpal	1 dist. + >½ shaft R/I	0.5
		1 proximal + shaft frag. R/M	0.5
	metapodial	1 shaft fragment	--
	pelvis	1 ilium frag. L/U	0.5
	femur	1 distal (18 frags.) R/U	0.5
	tibia	1 distal (3 frags.) R/M	0.5
	phalange 1st	3 complete 2R/I, R/M	0.38
	phalange 2nd	2 complete R/I	0.25
	phalange 3rd	3 complete 2 R/I, U/U	0.38
	phalange vestigial	2 complete	--
	sesamoid	3 complete	--

Table 49. Burning Noted on Faunal Fragments, Area 3

Species	Element/Portion/Side	Burning
Meleagris gallopavo	ulna complete, left	brown distal
	carpometacarpus, left	black proximal
	femur complete, left	brown to black shaft
	tibiotarsus, left	mottled light to dark brown
	phalange gen.	black
Small mammal	1 long bone diaphysis frag.	brown to black
	5 long bone frags.	mottled brown to black
	3 long bone frags.	mottled light to black
	5 long bone frags.	black
Medium mammal	1 long bone frag.	mottled light to dark brown
	1 long bone frag.	brown to black
	1 long bone frag.	black
Large mammal	6 long bone frags.	mottled light brown
	2 long bone frags	mottled light to dark brown
	5 long bone frags.	mottled light to black
	5 long bone frags.	black
	2 long bone frags.	calcined
Sylvilagus auduboni	maxilla medial axial	mottled light brown to black
	thoracic vertebra axial	mottled brown
	lumbar vertebra axial	mottled light brown to black
	tibia proximal, right	brown distal
	tibia distal, left	mottled dark brown
Lepus californicus	rib	light brown
	radius diaphysis, left	black
	femur complete, left	mottled light to black
	femur diaphysis, left	mottled light to dark brown
	femur diaphysis, right	black
	metatarsal gen.	light brown to black
Cynomys gunnisoni	mandible complete, left	mottled light to dark brown
	pelvis ilium frag, right	mottled brown
	tibia complete, right	dark brown to black/ends
Papogeomys castonops	maxilla complete, right	mottled light brown

Table 49. Continued.

Species	Element/Portion/Side	Burning
Dipodomys ordii	ulna proximal, left	light brown
Canis spp.	rib midsection	mottled light to black
Canis sp.	tooth canine	light brown
Odocoileus hemionus	tibia distal, right	mottled light to black
	metacarpal complete, right	black proximal
	phalange 3rd	light brown

Root etching and weathering of the bone from this area suggests that much of the bone refuse was exposed on a ground surface and remained near that surface before it was transported to another context by maintenance activities at the pueblo. Discoloration on small mammal elements, snap and spiral breaks, and the chalky appearance of some fragments indicate that processing by both roasting and boiling occurred.

Area 4 (Room 13 and Plaza)

Room 13 and its associated plaza lie to the north of the main room block. A total of 68 bone fragments were recovered from this area, which was 7.73 percent of the total sample. Of this bone, 50 fragments (73.5 percent of the area sample) could be identified to the general categories of small, medium, or large mammal (Table 50). All 26 elements (38.2 percent of the area sample) that exhibited evidence of burning were in these general categories (Table 51). The majority of these burned elements were recovered from a burned ramada area next to Room 13.

The remainder on the bone from this area, 18 fragments or 26.5 percent of the area sample, were placed in five different species. The most frequently identified species were Gunnison's prairie dog and desert cottontail. Any element utilization bias could not be determined from this sample.

One mule deer radius exhibited evidence of having been cleaved through the distal epiphysis, which may have been the process used to remove the remainder of the lower leg and hoof prior to further processing. Erosion and weathering was also noted on a number of the small mammal remains from this area. This may have resulted from exposure for some time and then redeposition during maintenance activities as well as possible erosion due to percolation of water through the deposits in the room block area. Breakage patterns and discoloration possibly associated with roasting of meat was also noted in this area.

Table 50. Summary of Faunal Identifications for Area 4

Species	Element	Portion/Side/Age*	MNE
Birds			
Meleagris gallopavo (turkey)	pollex	1 complete L/U	0.5
Mammals			

Table 50. Continued.

Small mammal	long bone	19 fragments	-
Medium mammal	plate or blade	1 fragment	-
Large mammal	skull	1 fragment	-
	long bone	19 fragments	-
Sylvilagus audubonis (desert cottontail)	skull	1 parietal A/U	1.0
	vertebra lumbar	1 centrum, transverse processes A/M	0.14
	pelvis	1 ilium frag. R/U	0.5
	femur	1 diaphysis R/U	0.5
	tibia	1 diaphysis frag. R/U	0.5
Lepus californicus (black-tailed jackrabbit)	astragalus	1 complete L/M	0.5
Cynomys gunnisoni (Gunnison's prairie dog)	vertebra lumbar	1 centrum A/U	0.14
	radius	1 prox. + >½ shaft R/M	0.5
	ulna	1 prox. + >½ shaft R/M	0.5
	pelvis	1 ischium, acetabulum R/M	0.5
	femur	1 prox. + >½ shaft L/M	0.5
	tibia	2 diaphyses R/U	1.0
Odocoileus hemionus (mule deer)	radius	1 distal epiphysis frag. L/I	0.5
	tibia	1 distal + shaft frag. L/M	0.5
	metatarsal	1 proximal + shaft frag. L/M	0.5

Table 51. Burning Noted on Faunal Remains, Area 4

Species	Element/Portion/Side	Burning
Medium mammal	1 plate/blade	black
Large mammal	1 long bone frag.	light brown to black
	12 long bone frags.	black
	12 long bone frags.	black to calcined

Area 5 (North Plaza)

The North Plaza was discovered during the excavation of test pits to the north of Room 13. A total of 65 bone fragments or 7.39 percent of the complete faunal sample were recovered from this area along with three pieces of eggshell (see Table 52). Thirty-two of the bone fragments (49.2 percent of the area sample) could only be identified to small, medium, and large mammal. the remaining bone, 33 fragments or 50.8 percent of the area sample, was identified to eight different families or species. Among the bone from this area there were only eight pieces that exhibited evidence of burning (Table 53).

The predominant species identified from this area were black-tailed jackrabbit, desert cottontail, and mule deer. Breakage patterns exhibited on the long bone fragments of both jackrabbit and cottontail would indicate breakage just prior to or at the time of consumption and would also have exposed the small amounts of marrow present in the long bones.

Table 52. Summary of Faunal Identification for Area 5

Species	Element	Portion/Side/Age*	MNE
Birds			
Meleagris gallopavo	eggshell	3 fragments	--
Mammals			
Small mammal	tooth incisor	1 anterior frag.	--
		1 maxillary frag. R/U	--
	rib	1 fragment	--
	plate or blade	2 fragments	--
	long bone	14 fragments	--
Medium mammal	long bone	7 fragments	--
Large mammal	rib	2 fragments	--
	long bone	4 fragments	--
Leporidae (rabbits)	tooth	1 complete	--
Sylvilagus auduboni (desert cottontail)	ulna	1 prox. olecranon missing L/U	0.5
	pelvis	1 acetabulum L/M	0.5
		1 ilium + acetabulum frag. L/U	0.5
	femur	1 prox. > ½ shaft L/I	0.5
	tibia	1 diaphysis frag. R/U	0.5
	astragalus	1 complete R/M	0.5
	calcaneum	1 complete L/M	0.5
Lepus californicus (black-tailed jackrabbit)	skull	1 temporal L/M	0.5
		1 zygoma anterior R/U	0.5
	skull/maxilla	1 fragment superior R/U	0.5
	mandible	1 ascending ramus missing R/M	0.5
	scapula	1 inferior plate R/U	0.5
	humerus	1 dist. + >½ shaft R/M	0.5
	radius	1 diaphysis frag. R/U	0.5
	ulna	1 semilunar notch R/U	0.5
	tibia	5 diaphyses frags. 2 L/U, 3 R/U	--

Table 52. Continued.

Species	Element	Portion/Side/Age*	MNE
	calcaneum	1 damaged R/M	0.5
	metatarsal 5th	1 complete/distal unfused R/I	0.5
Cynomys gunnisoni (Gunnison's prairie dog)	humerus	1 diaphysis R/I	0.5
Thomomys bottae (Botta's pocket gopher)	femur	1 diaphysis R/U	0.5
Dipodomys ordii (Ord's kangaroo rat)	tibia	1 dist + <½ shaft L/M	0.5
Odocoileus hemionus (mule deer)	vertebra axis	1 centrum (12 frags.) A/M	1.0
	scapula	1 blade L/U	0.5
	carpal scaphoid	1 complete L/M	0.5
	metatarsal	2 distal, part shaft R/M	1.0
	phalange 1st	1 complete R/M	0.12
	phalange 2nd	1 complete R/M	0.12

Table 53. Burning Noted on Faunal Remains, Area 5

Species	Element/Portion/Side	Burning
Medium mammal	1 long bone frag.	black
Large mammal	2 long bone frags.	black
Sylvilagus auduboni	calcaneum complete, left	mottled brown to black
Lepus californicus	tibia diaphysis, left	mottled brown to black
	calcaneum complete, right	calcined
Thomomys bottae	femur diaphysis, right	black proximal
Odocoileus hemionus	scapula blade, left	mottled light to black

Area 6 (Pit Structure)

This area lies just south of Room 13. Excavation partially exposed a burned pit structure. The faunal remains from this area were discovered during the partial excavation of this structure. A total of 48 bone fragments or 5.45 percent of the complete faunal sample were recovered from this area. Of that sample, 23 fragments (47.9 percent of the area sample) could be identified to six different species (Table 54). Eighteen elements from the area sample exhibited some evidence of burning (Table 55). Nine of these elements were recovered from the burned pit structure roof. Thus, the burning noted on the bone seems to have been a result of the burning of the structure and not a result of consumption and disposal activities.

The species most frequently identified from this area were black-tailed jackrabbit and desert cottontail. A few elements from both of these species exhibit some mottling and tanning that may be associated with roasting.

The brief descriptions of the LA 50337 faunal remains by area provides the basis for further comparison between areas of the site and this sample with sites in the general region. As mentioned in the previous section, the species identified from LA 50337 are essentially the same as those from other sites in the general region. It is interesting to note that organization of the species within an area of the site by frequency results in the predominance of different species in various areas of the site. These species were always from the overall small group of predominant species noted for the site as a whole. The variation in frequency would seem to relate more to the size of the area sampled rather than to any true distributional variation in usage. In relating this observation to the comparison of this site to other sites in the region, it is most likely that any variation noted in the ranking of dominant species is predominantly due to variations in size of the areas sampled at each site and not to any fundamental difference in species utilization.

Table 54. Summary of Faunal Identifications for Area 6

Species	Element	Portion/Side/Age*	MNE
Mammals			
Small mammal	rib	1 complete	-
	plate or blade	3 fragments	-
	long bone	8 fragments	-
Medium mammal	rib	1 diaphysis frag.	-
Large mammal	long bone	10 fragments	-
Sylvilagus auduboni (desert cottontail)	vertebra lumbar	2 damaged A/U	0.28
		1 centrum A/J	0.14
	humerus	2 dist. + >½ shaft L/M	1.0
	radius	1 dist. + >½ shaft L/M	0.5
	ulna	1 diaphysis L/U	0.5
	femur	2 diaphysis L/U	1.0
	metatarsal gen.	2 damaged	0.2
Lepus californicus (black-tailed jackrabbit)	skull	1 zygoma anterior R/U	0.5
	vertebra lumbar	1 process missing A/M	0.14
		1 centrum + transverse processes A/M	0.14
		2 centrum frags. A/U, M	0.28
	radius	1 prox. + <½ shaft L/M	0.5
	pelvis	1 pubis missing R/M	0.5

Table 54. Continued.

Species	Element	Portion/Side/Age*	MNE
Cynomys gunnisoni (Gunnison's prairie dog)	radius	1 complete R/M	0.5
		1 diaphysis R/U	0.5
	ulna	1 complete R/M	0.5
Thomomys bottae (Botta's pocket gopher)	skull	1 frontal A/U	1.0
	skull/maxilla	1 anterior + medial A/U	1.0
Mephitis mephitis (striped skunk)	vertebra axis	1 centrum A/I	1.0
Odocoileus hemionus (mule deer)	metapodial	1 distal epiphysis frag.	0.25

Table 55. Burning Noted on Faunal Remains, Area 6

Species	Element/Portion/Side	Burning
Medium mammal	rib midsection	brown to black
Large mammal	4 long bone frags.	brown to black
	1 long bone frag.	black
	2 long bone frags.	black to calcined
Sylvilagus auduboni	2 lumbar vert., axial	calcined
	radius distal, left	mottled
	ulna diaphysis, left	mottled brown proximal
	femur diaphysis, left	mottled light brown
	2 metatarsal, gen.	mottled dark brown
Lepus californicus	radius proximal, left	light to dark brown proximal
Mephitis mephitis	axis centrum, axial	mottled dark brown to black
Odocoileus hemionus	metapodial	black to calcined

Distribution of Faunal Remains by Occupation at LA 50337

In the two previous sections of this report, the faunal remains were discussed with respect to the site as a whole and by their physical areas of association. In this section the occupational sequence developed through the use of radiocarbon dating, stratigraphy, and use of ceramic chronology will be used to divide the faunal remains recovered from various proveniences into their temporal association. Certainly some movement through both cultural and natural processes occurred during and after site occupation but this association might give us a sense of usage changes and differing disposal patterns over time. Summary tables are included for the sequence that follow.

Occupation I

This occupational level was limited as a whole to Stratum 4, an ash/charcoal lens from the north trench, and an isolated hearth (Feature 54) located beneath Plaza 3 in the room block area. It has been dated to the sixth century A.D. The only faunal remain recovered from this context was one fragment of a small mammal long bone. Considering the limited area of excavation and the fact that this bone fragment was found in an ash lens but was not burned, its primary association with Stratum 4 is tenuous.

Occupation II

The primary components at this site assigned to Occupation II are the pit structure located in Area 6, a hearth located in a backhoe trench south of the pit structure (Feature 21), the north plaza surface, and Plaza 3 in the room-block area. This occupation centered around the eighth century A.D. Faunal remains were recovered from the excavation of the pit structure and Plaza 3 (Table 56).

Table 56. Summary of Faunal Identifications for Occupation II

Species Present	Pit Structure Benches	Pit Structure Fill	Pit Structure Roof	Plaza 3 Surface	Hearth Fill, Plaza 3, F. 38
Meleagris gallopavo				8 eggshell	
Small mammal	1 long bone	1 plate/blade	1 long bone		9 long bone
	1 rib	1 long bone			
Medium mammal		1 rib			7 plate/blade
Large mammal		7 long bones	1 long bone		16 skull frags.
					1 rib
					5 plate/blades
					20 long bones
Sylvilagus auduboni	1 femur	2 humeri	2 vert. lumbar		4 skull frags.
		1 radius	1 femur		1 vert. thoracic
		1 ulna	1 metatarsal gen.		1 scapula
					2 pelvis
					1 femur
					1 tibia
					1 metatar. 2nd
					1 metatar. 3rd

Table 56. Continued.

Species Present	Pit Structure Benches	Pit Structure Fill	Pit Structure Roof	Plaza 3 Surface	Hearth Fill, Plaza 3, F. 38
					1 metatar. 5th
Lepus californicus		1 skull	1 radius		
		4 vert. lumbar			
		1 pelvis			
Cynomys gunnisoni		2 radius			1 mandible
		1 ulna			
Thomomys bottae		1 skull			
		1 maxilla			
Mephitis mephitis		1 vert. axis			
Odocoileus hemionus		1 metapodial			1 vert. lumbar
					1 pelvis
					1 femur

Bone was recovered from the bench area, the fill, and in the roof remains of the pit structure. Only three pieces of bone were found in bench context while 27 fragments were discovered in the fill and seven bone fragments were recovered from the burned roof material. The majority of the material excavated from the roof was burned, probably as a result of the fire that destroyed the structure. Desert cottontail and black-tailed jackrabbit remains were identified most frequently from the pit structure context. Four elements exhibited some evidence of tanning that could be a result of roasting and two elements had been gnawed by carnivores. The carnivore gnawing could have been that of dogs who were enjoying the remnants of the pit structure occupants' dinner.

The faunal remains from Plaza 3 were recovered from both the plaza surface and the hearth fill from Feature 38. Eight pieces of turkey eggshell were found on the plaza surface while 75 bone fragments were excavated from the fill of Feature 38. Only three pieces of bone from the hearth exhibited evidence of burning. This would suggest that the bone contained in Feature 38 was swept into the hearth when it was no longer in use. The predominance of both desert cottontail and large mammal remains in this feature suggest that both were utilized in the general vicinity. The remains of desert cottontail have the highest frequency in this occupation sample followed by fragments of large mammal bone.

Occupation III

This occupation of the pueblo took place between the tenth and eleventh centuries A.D. The occupation utilized most of the room block area except for Plaza 3, the trash below Room 13, the kiva in the north trench, and Room 13. A large amount of the faunal remains recovered from this site were found during the excavation of the room-block area. With the addition of the other areas of the excavation just mentioned, this occupation was more extensive than the others at this

Table 57. Part 1, Summary of Faunal Identifications for Occupation III

Species Present	Plaza 1, Surface	Mixed Trash above Plaza 4	Fill between Plazas 1 & 2	Room 4, Subfloor	Wall-stripping, Rooms 1 & 2	Trash in Rooms 8 & 9	Fill, Room 5 below Plaza 1	Fill below Floor 1, Room 5	Hearth fill on Plaza 1, F. 9 & 28
Birds								1 long bone	
Tetraonidae	1 ulna								
	1 humerus								
Meleagris gallopavo	1 sternum	1 phalange gen.					10 eggshell	12 eggshell	14 eggshell
								1 phalange	
Small mammal	2 long bone	2 long bone	1 long bone			5 long bone	5 long bone	9 long bone	2 long bone
								8 plate/blade	
Medium mammal	2 long bone								
	5 plate/blade								
Large mammal	5 long bone					1 long bone		1 long bone	
Sylvilagus auduboni	1 mandible				1 vert. cerv.	1 calcaneum	1 maxilla	1 skull	
	1 vert. thoracic				1 humerus		1 vert. lumbar	1 mandible	
	1 femur						1 ulna	1 vert. cerv.	
							1 femur	2 vert. thorac	
							1 tibia	2 vert. lumbar	
							1 metatars. 4th	1 scapula	
								3 humerus	
								1 radius	
								1 ulna	

Table 57. Part 1, Continued

Species Present	Plaza 1, Surface	Mixed Trash above Plaza 4	Fill between Plazas 1 & 2	Room 4, Subfloor.	Wall-stripping, Rooms 1 & 2	Trash in Rooms 8 & 9	Fill, Room 5 below Plaza 1	Fill below Floor 1, Room 5	Hearth fill on Plaza 1, F. 9 & 28
								2 rib 2 pelvis 5 femur 2 tibia 2 calcaneum 1 metatars 5th	
Lepus californicus								1 skull 1 femur 1 metatars 4th	1 radius
Cynomys gunnisoni	1 mandible				1 humerus	1 mandible 1 ulna 1 femur		1 humerus 1 tibia	
Thomomys bottae								1 vert. lumbar	
Peromyscus maniculatus								1 skull 1 pelvis	
Artiodactyla	1 vert, lumbar			1 rib					
Odocoileus hemionus		1 scapula 1 metacarpal 2 phalange 1st				1 tibia		1 phalange 1st	

Table 57. Part 1, Continued

Species Present	Plaza 1, Surface	Mixed Trash above Plaza 4	Fill between Plazas 1 & 2	Room 4, Subfloor	Wall-stripping, Rooms 1 & 2	Trash in Rooms 8 & 9	Fill, Room 5 below Plaza 1	Fill below Floor 1, Room 5	Hearth fill on Plaza 1, F. 9 & 28
		2 phalange 2nd							
		2 phalange 3rd							
		1 phalange vest.							
		3 sesamoid							

Table 57. Part 2, Summary of Faunal Identification for Occupation III

Species Present	Ramada Rm. 5, Fl. 2, Plaza 1	Plaza 2, Surface	Hearth fill, Plaza 2, F. 35	Pit fill, Plaza 2	Fill above North Plaza	Pit fill in North Plaza	Redeposit. trash, North Plaza	Trash on Plaza 4	Burials 1, 2, 3	Kiva 1 fill	Kiva 1 roof	Profile north trench	Trash below Rm. 13
Meleagris gallopavo	4 eggshell				3 eggshell				1 carpomet.	6 eggshell			1 pollex
									1 tibiotar.	2 eggshell			
Small mammal	1 long bone	2 long bone	2 long bone		1 tooth	1 tooth	1 long bone	13 long bone		1 long bone	1 long bone	1 long bone	16 long bone
	2 plate/ blade				1 rib	4 long bone						1 metacar.	
					10 long bone								
Medium mammal					4 long bone	1 long bone	2 long bone	13 long bone		1 long bone		2 long bone	
Large mammal		18 long bone		1 long bone	1 rib	1 rib		1 skull		1 rib	8 long bone	6 long bone	2 long bone
		2 plate/ blade			3 long bone	1 long bone		1 tooth		3 long bone			
								9 vert.					
								63 long bone					
								17 plate/ blade					
Leporidae					1 tooth								
Sylvilagus auduboni	4 skull	1 mandible		1 long bone	2 pelvis	1 tibia	1 ulna	3 skull	1 mandible	1 mandible	1 maxilla	1 maxilla	1 skull

Table 57. Part 2, Continued

Species Present	Ramada Rm. 5, Fl. 2, Plaza 1	Plaza 2, Surface	Hearth fill, Plaza 2, F. 35	Pit fill, Plaza 2	Fill above North Plaza	Pit fill in North Plaza	Rede-posit. trash, North Plaza	Trash on Plaza 4	Burials 1, 2, 3	Kiva 1 fill	Kiva 1 roof	Profile north trench	Trash below Rm. 13
	1 maxilla	1 vert. lumbar			1 femur		1 calca-neum	1 maxilla			1 humerus		1 femur
	1 mandible				1 astra-galus						1 pelvis		1 tibia
	1 vert. axis										2 femur		
	1 vert. thoracic										1 tibia, fibula		
	2 vert. lumbar												
	1 pelvis												
	1 femur												
	1 tibia												
	1 astragalus												
	1 calcaneum												
	1 metatars. 4th												
	1 metatars. 5th												
Lepus californicus	1 rib				1 skull frag.	1 tibia	1 skull frag.	1 femur		1 vert. atlas	1 vert. thorac.		1 radius
					1 maxilla		1 scapula			1 vert. lumbar	1 radius		1 ulna

Table 57. Part 2, Continued

Species Present	Ramada Rm. 5, Fl. 2, Plaza 1	Plaza 2, Surface	Hearth fill, Plaza 2, F. 35	Pit fill, Plaza 2	Fill above North Plaza	Pit fill in North Plaza	Redeposit. trash, North Plaza	Trash on Plaza 4	Burials 1, 2, 3	Kiva 1 fill	Kiva 1 roof	Profile north trench	Trash below Rm. 13
					1 mandible		1 tibia				1 tibia		2 femur
					1 humerus								1 tibia
					1 radius								1 astragalus
					1 ulna								
					1 tibia								
					1 calcaneum								
					1 metatars 5th								
Ammospermophilus leucurus	1 pelvis												
Cynomys gunnisoni		1 humerus			1 humerus								1 vert. lumbar
		1 pelvis											
		1 femur											
Thomomys bottae	2 mandible				1 femur			1 skull			1 maxilla		
Papogeomys castonops	1 maxilla												
Dipodomys ordii	1 ulna				1 tibia								
	1 femur												

Table 57. Part 2, Continued

Species Present	Ramada Rm. 5, Fl. 2, Plaza 1	Plaza 2, Surface	Hearth fill, Plaza 2, F. 35	Pit fill, Plaza 2	Fill above North Plaza	Pit fill in North Plaza	Rede-posit. trash, North Plaza	Trash on Plaza 4	Burials 1, 2, 3	Kiva 1 fill	Kiva 1 roof	Profile north trench	Trash below Rm. 13
Neotoma albigula	1 mandible												
Neotoma mexicana										1 femur			
Canis sp.	1 tooth canine												
Procyon lotor										1 humerus			
Mephitis mephitis											1 vert. axis		
Artiodactyla								1 tooth					
Odocoileus hemionus	1 carpal												
	1 meta-carpal				1 scapula	1 vert. axis		1 ver. thoraci c			1 radius		1 radius
					1 carpal scaphoid			1 metapo dial			1 meta-carpal		1 tibia
					2 metatars								
					1 phalange 1st								
					1 phalange 2nd								

Table 57. Part 3, Summary of Faunal Identifications for Occupation III

Species Present	Room 13, Floor 1	Hearth fill in Plaza area	Plaza Surface	Ramada south of Room 13	Room 13, roof fall	Trash between Plaza & Ramada
Small mammal						3 long bone
Medium mammal				1 plate/blade		
Large mammal	1 long bone	8 long bone	1 long bone	16 long bone		1 long bone
Sylvilagus auduboni				1 vert. lumbar		1 pelvis
Cynomys gunnisoni						1 pelvis
Odocoileus hemionus					1 metatarsal	

site and thus resulted in the production of the majority of the faunal remains.

The exposure of the Plaza 1 surface isolated 22 bone fragments, of which only eight could be identified beyond a general level. The mixed trash above Plaza 4 contained 15 bone fragments of which 12 could be identified as mule deer. The majority of these elements were heavily weathered bones from the hoof and lower limb. This suggests that the bones were refuse that had been exposed to the elements for a long period.

The fill between Plazas 1 and 2, Room 4 subfloor, and the wall-stripping of Rooms 1 and 2 resulted in the recovery of only a few bone fragments that are identified in Table 57. The hearth fill on Plaza 1 in Feature 9 and Feature 28 also contained few remains and 14 pieces of turkey eggshell.

The fill in Area 5 below Plaza 1 held 15 bone fragments and 10 pieces of turkey eggshell. Desert cottontail was the predominant species identified within this provenience level as well as within the fill below Floor 1 in Area 5, which contained 56 bone fragments and 12 pieces of turkey eggshell. This provenience contained 27 fragments identifiable as desert cottontail. A few bone fragments identified as desert cottontail from the fill in Area 5 below Plaza 1 fit with fragments from the fill below an occupation surface in Area 5 and indicate that some vertical movement did take place after the disposal of trash within the area.

The ramada connected with Area 5, Plaza 1 held 31 bone fragments and 4 pieces of turkey eggshell. Desert cottontail was the predominant species identified from this provenience as it was in those mentioned above. A number of the elements of desert cottontail exhibited a tan and mottled tan discoloration that could indicate roasting of meat on the bone.

The Plaza 2 surface, the hearth fill in Feature 35 on Plaza 2, and the pit fill in Feature 37 on Plaza 2 contained 27, 2, and 2 bone fragments respectively. No species clearly dominates in these units and 25 fragments could only be identified as small or large mammal.

The excavation of the fill above the north plaza, the pit fill in Feature 41 in north plaza, and the redeposited trash on the north plaza resulted in the recovery of 43, 11, and 8 bone fragments respectively. Three pieces of eggshell were also recovered from the fill above the north plaza. The species with the highest frequencies of element identification from these units are black-tailed jackrabbit and mule deer. Butchering was evident on a scapula fragment and metatarsal identified as mule deer. Several bone fragments appeared slightly eroded, which may be due to the drainage of water through the cultural deposits or surface exposure of the fragments. Two elements of desert cottontail in the north plaza fill and one element from the north plaza trash have carnivore tooth markings that may have been made by puebloan dogs.

Excavation of the trash on Plaza 4 resulted in the recovery of 126 bone fragments but 117 of these were only identifiable as small, medium, or large mammal. Since only 9 fragments could be identified to species, there was no predominant species for this unit. Many of the large mammal long-bone fragments were splintered. This may have been the result of processing long bones from mule deer for marrow leaving few identifiable elements for this species.

Burials 1, 2, and 3 were associated with only three fragments of bone and two of these were worked bone. One bone bead and a bone fragment exhibiting polish could be identified as turkey. The remaining fragment of a desert cottontail mandible showed no evidence of working and may have come into its excavation context by post-depositional processes.

The kiva fill, the kiva roof, and the north trench profile excavation produced 11, 22, and 11 fragments of bone respectively. The kiva fill also contained eight pieces of turkey eggshell. No predominant species can be identified for these units except for the kiva roof, which produced six elements identifiable as desert cottontail. The increased number of fragments recovered from the kiva roof may indicate that processing activities took place on the roof during the use of the kiva by the occupants of the site. One element of desert cottontail recovered from kiva roof context exhibited evidence of carnivore tooth-marking. This, again, was probably the result of the consumption of puebloan refuse by puebloan dogs.

Excavation of the trash below Room 13, Room 13 Floor 1, and Room 13 roof fall produced 31, 1, and 1 bone fragments respectively. The predominant species from the trash below Room 13 are black-tailed jackrabbit and desert cottontail. Some tan mottling was noted on lagomorph and prairie dog elements and may be the result of roasting. One tibia assigned to mule deer was cleaved through the distal epiphysis. This may have resulted when the rest of the lower leg was severed during processing or as a product of marrow extraction.

The hearth fill from Feature 43 in the plaza area near Room 13, the plaza surface, and the ramada south of Room 13 along with the trash between the plaza and ramada contained 8, 1, 18, and 6 bone fragments respectively. The majority of the bone from these units (see Table 57, part 3) could only be identified as small, medium, or large mammal. Twenty-six of the bone fragments from these units exhibited some evidence of burning. This was probably a product of the burning of the ramada area.

If all of the units containing faunal remains that compose this occupation are taken together, the predominant species identified would be desert cottontail, followed by black-tailed jackrabbit and mule deer. The large amount of bone fragments that could only be identified as large mammal may indicate a higher utilization of mule deer than the identifiable elements would suggest. The number of bone fragments only identifiable as small mammal may indicate the same for smaller mammals.

Occupation IV

This occupation has been dated to the twelfth century A.D. Faunal remains were recovered from Feature 2 and the fill above Feature 2. Feature 2 provided the major expression of this occupational period from the LA 50337 excavations. A summary listing of the remains recovered from this unit and the fill is included in Table 58.

Excavation of Feature 2 recovered 90 bone fragments while the fill above this feature contained only 14 fragments. The main species identified from the roasting pit was Gunnison's prairie dog. Elements identifiable to this species included both cranial and post-cranial fragments and an ulna assigned to this species had been severed horizontally near the proximal end. Lagomorphs were also identified from this feature and fill indicating, at least from this sample, an emphasis on the utilization of small mammals at this time.

Table 58. Summary of Faunal Identifications for Occupations IV and V

Species Present	Feature 2, Roasting Pit	Fill above Feature 2	Post-occupational fill, Stratum 22 and associated strata
Birds	2 long bones	3 long bones	19 long bones
Meleagris gallopavo	1 skull		42 eggshell
	1 mandible		3 skull
	1 humerus		2 mandible
			1 vert. atlas
			1 vert. axis
			2 vert. cerv
			1 humerus
			2 radius
			1 ulna
			1 carpometacarpus
			1 phalanx 1
			1 phalanx 2
			1 femur
			3 tibiotarsus
			1 fibula
Small mammal	38 long bone	6 long bone	6 long bone
	1 tooth, incisor		5 plate/blade
Medium mammal	1 long bone		2 tooth
	1 rib		3 long bone
Large mammal	7 long bone	1 long bone	1 skull
			2 rib
			31 long bone
			1 metapodial
Leporidae	1 rib		
Sylvilagus sp.	1 rib		
Sylvilagus aububoni	1 skull	1 tibia	1 mandible
	1 vert. lumbar		
	1 humerus		
	2 pelvis		
	1 tibia		

Table 58. Continued.

Species Present	Feature 2, Roasting Pit	Fill above Feature 2	Post-occupational fill, Stratum 22 and associated strata
	1 metatars. gen.		
Lepus sp.	1 tooth	1 tooth	
Lepus californicus	1 humerus		1 skull
	1 tibia		1 tibia
	1 metatars. 3rd		3 metatars gen.
Cynomys gunnisoni	4 skull		4 mandible
	2 maxilla		1 humerus
	1 mandible		1 pelvis
	1 scapula		
	4 humerus		
	1 radius		
	2 ulna		
	1 fibula		
	1 metatars. 5th		
Thomomys bottae	1 maxilla		
	2 mandible		
Perognathus sp.	1 skull		
	2 mandible		
Dipodomys ordii	1 humerus		
Ondatra zibethicus			1 femur
Canis sp.			1 rib
Canis cf. *familiaris*			1 pelvis
			1 metatars. 3rd
Mustelidae	1 radius		
Artiodactyla			1 long bone
Odocoileus hemionus		1 phalange 1st 1 phalange 1st	1 skull
		1 phalange 2nd 1 phalange 2nd	1 radius
			1 ulna
			1 phalange 3rd
			1 phalange vestig.

Occupation V

Evidence for this occupation comes from post-occupational fill at the site and from Feature 53 located north of Room 13. Faunal remains were recovered from post-occupational fill only. Excavation isolated 113 bone fragments along with 42 pieces of turkey eggshell. The species most frequently identified from the remains was turkey, which was represented by both bone and eggshell. A number of bone fragments exhibited varying degrees of weathering and erosion, which may have been a product of the position of these remains near the ground surface or the length of time between initial disposal and deposition.

When the faunal remains recovered from LA 50337 are looked at by occupation, several aspects of the assemblage seem notable. Desert cottontail dominates the identifiable faunal sample throughout most of the occupational history of the site. Vagaries of sampling and the number of excavation units assigned to any occupation add variation in the species identified that may not be real. Black-tailed jackrabbit, mule deer, and Gunnison's prairie dog are consistently identified by moderate to low numbers of elements throughout site occupation. When the bone identified to small and large mammal is considered, all of these species were probably represented in these splintered elements and thus were more frequently utilized than the number of identifiable elements would indicate.

The major variations in identified remains resulting from variations in the use pattern happened late in the occupational history of the site. Gunnison's prairie dog has the highest frequency of identifiable elements from Feature 2 (Occupation IV). This may have resulted from a crash is the lagomorph population, an increase in the prairie dog population making them easier prey, or it may again be an artifact of the limited areal sample taken.

Turkey clearly dominates by identifiable element frequency during Occupation V. Though turkey bone and eggshell were identified in low frequency during all occupations, the dominance during this late occupation at LA 50337 most likely reflects a change in utilization. The reason for this change is unclear but it may reflect an increase in the turkey population in the area or the caging or domestication of the birds, thus providing a stable population for consumption.

Conclusions

The overview of the faunal remains recovered from LA 50337 and their review by area and by occupational association has provided some interesting results. The identifications made in the overall sample and the dominant species identified are very much in line with those identified from other sites in the region. It was noted in the overview that as sample size increases, so does the number of species likely to be identified at a site and the number of elements that might be identified. It is interesting that the largest number of species identified in this sample are from the largest area of excavation (Area 3) and the most extensive occupation (Occupation III).

The dominant species identified in Area 3 and during Occupation III (desert cottontail, black-tailed jackrabbit, and mule deer) reflect those that dominate the overall site sample, as would be expected. The variation comes into play when we look at the faunal sample in a variety of ways and are able to see the changes in the sample identifications both spatially and temporally. Spatially there were variations due to sample size, due to the discovery of structural units, and the differentiations within structural units among roof, fill, and floor areas. This may indicate that a roof may be used as a processing area but disposal and maintenance activities may result in bone accumulation in unused pits and hearths as well as unused rooms.

If maintenance activities do result in the dumping of faunal remains into secondary contexts, then temporal associations may be confused during the longer periods of occupation, and variations that might be noted in species utilization would be blurred. When the occupation is shorter in length, variations in faunal utilization could be seen. This was true during Occupation V and perhaps during Occupation IV at LA 50337.

Mottled tanning of bone fragments, spiral and snap breaks, along with some element frequencies give clues to possible processing and cooking practices used by occupants of this site. There was some evidence of possible roasting and breakage related to preparation and consumption in all areas of the site sample and during all occupations. For the most part, preparation changed very little during the occupation of this site but increased use of marrow might be interpreted when fragments of large mammal long bone increase in number during parts of Occupation II.

Though the overall sample taken from this pueblo was small, a sense of the breadth and intensity of species utilization can be seen even though the amount of variability over the whole site remains unknown. The sample exhibited some variation both through space and through time while conforming to the species found at other sites in the general area.

FLOTATION AND MACROBOTANICAL EVIDENCE OF PLANT USE THROUGH ANASAZI OCCUPATION OF LA 50377, IN THE LA PLATA RIVER VALLEY, NORTHWEST NEW MEXICO

Mollie S. Toll

Introduction

LA 50337, a large Puebloan occupation in the La Plata River Valley north and west of Farmington, New Mexico, has provided a tantalizing patchwork of archaeological plant materials. Excavations in the right-of-way on either side of State Road 170 (see Fig. 2) allow some limited views of an extensive stratigraphically complex site. Taking into account radiocarbon and dendrochronological dates with ceramic assemblages and stratigraphy, Vierra (this volume) has determined that site use began in the sixth century A.D. (trash deposits in the north trench and an isolated hearth below the room block), and included major occupations in the eighth (pit structure and north plaza surface) and tenth centuries (room block, kiva, Room 13, and Feature 2). The presumed center of site activity during these periods lies preserved and out of reach below a modern building. Later dates and ceramic types in an isolated hearth (Feature 53) are evidence of at least sporadic use of the site area during the fourteenth century.

Preservation of floral debris is good throughout the sample of proveniences excavated. The 39 flotation samples analyzed provide a record of diverse plant use including cultivated crops, weedy annuals, grasses, cacti, sedge, and pinyon, in all site occupation periods. Charcoal identification serves as evidence of wood taxa utilized for firewood and construction. Details of crop plant morphometrics were obtained from macrobotanical remains (collected during excavation), providing some insight to growing conditions over time, and a basis for comparison with Anasazi farming efforts elsewhere in the San Juan Basin. Burning and collapse of the pit structure roof preserved a number of perishable items (remains of a basket, a wooden ornament, beans, corn husks, and stems) that don't often survive.

Methodology

Soil samples collected during excavation were processed by the Laboratory of Anthropology using the simplified "bucket" version of flotation (see Bohrer and Adams 1977). A measured volume ranging from 1,270 to 6,475 ml 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), catching organic materials floating or in suspension. After the recovered material had dried, each sample was reviewed microscopically at 7-45x. Taxonomy and scientific nomenclature follow Martin and Hutchins (1981), and common names are used according to the *Field Guide to Native Vegetation of the Southwest Region* (USDA 1974). As the soil samples varied in size, it was necessary to adjust the number of seeds recovered to reflect the volume of the sample in liters. Actual number of seeds recovered is reported, as well as the standardized seeds-per-liter.

Charcoal was abundant in LA 50337 deposits. In all flotation samples with sufficient charcoal, a sample of 20 pieces was identified. Each piece was snapped to expose a fresh transverse section, and identified at 45x. This same method was used in examining charcoal remains recovered from the site during excavation. Low-power, incident light identification of wood specimens does not often allow species--or even genus-level precision, but can provide reliable information useful in distinguishing broad patterns of utilization of a major resource class.

Items catalogued during excavation as macrobotanical remains were examined individually. Corn remains were found throughout LA 50337 and consisted largely of fragmentary cob pieces. Cob diameter, cupule width, and cupule height were measured with dial calipers, according to description by Nickerson (1953). An adjustment of 21 percent was added to compensate for estimated shrinkage of cob parts during carbonization (Cutler 1956); both actual and adjusted measurements are given in tables. Also recovered were a collection of charred kernels from the kiva, and husks and stems from the pit structure. Other floral specimens, including squash seeds and beans, were identified by comparison with voucher specimens in the Castetter Laboratory reference collection.

Results

North and South Trenches

Excavation at LA 50337 began in the North Trench, parallel to SR 170 on the east side. The uppermost cultural stratum consisted of redeposited trash, dated by C-14 as A.D. 724 $\pm$ 130. Plant remains in flotation consisted only of carbonized corn cob fragment (Table 59), while charcoal included a variety of coniferous, shrubby, and riparian taxa (Table 60). A bell-shaped pit, cut into underlying Strat 3, was filled with laminated trash. Though the soil matrix here appeared to resemble Strat 1, flotation contents of the pit sample were very different, including a substantial variety of unburned seeds of weedy annuals (Table 59). Together with a very large number of tiny fragments of rice grass caryopses, these unburned weed seeds argue for probable rodent disturbance. Many of these seeds were highly eroded. Charcoal in this location is again quite varied (Table 60), presumably reflecting accumulation from multiple burning events. Strat 4 at the bottom of the trench dates to 487 $\pm$ 100 (C-14) and consists of an ash and charcoal lens not burned in place. Several of the plant materials recovered by flotation were carbonized; hedgehog cactus, pigweed, nightshade family (probably groundcherry), and corn are all likely food products (Table 59) while juniper twigs may relate to the heavily coniferous fuel use documented by charcoal composition (Table 60).

Kiva 1 produced botanical materials in several of the strata exposed by the north trench. Six measurable carbonized corn cob fragments (FS 175) were found in mixed trash and alluvial fill (Strat 14) coincident with the bench tops. Strat 18, mixed roof and wall debris, included some incompletely carbonized coniferous wood, and many small diameter saltbush branches (Table 61). In burned roof material lying on the floor (Strat 19) we again find an abundance of small diameter branches (Table 61). This sample is higher in cottonwood/willow than saltbush, and includes some juniper mast. Carbonized corn kernels in this same level (FS 244) suggest corn (spread out to dry?) was on the roof when it burned. Flotation sample 95 from the kiva floor level contained carbonized juniper twigs (likely related to overlying roofing materials) and two burned seeds (Table 59). The latter are both economics (prickly pear and nightshade family). Carbonization may have been an accident of food processing or a result of the roof burning.

Table 59. Flotation Results, North and South Trenches, LA 50337

Species	North Trench				South Trench	
	#3, Structure 1, Trash	#10, Structure 3, F. 1, Pit	#13, Structure 4, ash/ charcoal lens	#95, Kiva 1, Floor	#18, Plaza Surface	#37, Structure 10, F. 2, roasting pit
WOODY PERENNIALS						
Atriplex (saltbush)		2/ 1.3*				130/* 687.0
Juniperus (juniper)			T*	T*	T*	
Pinus edulis (pinyon)					1/ 1.7*	
GRASSES						
Oryzopsis (ricegrass)		1/ 0.6[1]			6/ 10.0*	
POSSIBLE ECONOMICS						
Echinocereus (hedgehog cactus)			1/ 0.8*		2/3.3*	
Opuntia (prickly pear)				1/ 3.3*		
Chenopodium (goosefoot)		5/ 3.1			2/ 3.3*	
Amaranthus (pigweed)		1/ 0.6	2/ 1.6*			
Portulaca (purslane)		1/ 0.6				
Solanaceae (nightshade family)		1/ 0.6	7/ 5.6*	1/ 3.3*		
Sphaeralcea (globemallow)		2/ 1.3	1/0.8			
Nicotiana (tobacco)		1/ 0.6				
CULTIVARS						
Zea (corn)	C*	C*	C*		C*	
PROBABLE CONTAMINANTS						
Compositae (sunflower family)			2/ 1.6			
Others					1/ 1.7[2]	

Table 59. Continued.

Species	North Trench				South Trench	
	#3, Structure 1, Trash	#10, Structure 3, F. 1, Pit	#13, Structure 4, ash/ charcoal lens	#95, Kiva 1, Floor	#18, Plaza Surface	#37, Structure 10, F. 2, roasting pit
Euphorbia (spurge)		1/ 0.6				
# Taxa	1	10	7	3	7	1
# Taxa Burned	1	2	5	3	6	1
TOTAL SEEDS						
Actual	0	15	13	2	12	130
Estimated	0	9.3	10.4	6.6	12.0	687.0

* some or all items charred. Number above slash indicates actual number of seeds counted; number below slash indicates estimated number of seeds per liter of soil

[1] > 200 broken fragments present in sample

[2] *Salsola*

Table 60. Charcoal Composition, Flotation Samples from North and South Trenches

Species	North Trench				South Trench	
	#3, Structure 1, Trash	#10, Structure 5, F. 1, Pit	#13, Structure 4, ash/charcoal lens	#95, Kiva 1, Floor	#37, Structure 10, F. 2, roasting pit	#18, Plaza surface
CONIFEROUS						
Juniperus	2 0.1	3 0.1	7 0.2			10 0.3
Unknown conifer	2 0.3	3 0.1	5 0.1		5 0.1	9 0.2
Total conifer	4 0.4	6 0.2	12 0.3	0	5 0.1	19 0.5
NONCONIFEROUS						
Atriplex	1 +		3 +		15 1.0	1 0.1
Artemisia	1 +					
Chryso-thamnus		6 0.2				
Populus/ Salix	3 0.1		5 0.1	20 0.4		
Unknown nonconifer	11 0.3	8 0.2				

Table 60. Continued.

Species	North Trench				South Trench	
	#3, Structure 1, Trash	#10, Structure 5, F. 1, Pit	#13, Structure 4, ash/charcoal lens	#95, Kiva 1, Floor	#37, Structure 10, F. 2, roasting pit	#18, Plaza surface
Total nonconifer	16 0.4	14 0.4	8 0.8	20 0.4	15 1.0	1 0.1
TOTAL	20 0.8 g	20 0.6 g	20 0.4 g	20 0.4 g	20 1.1 g	20 0.6 g

South of Figueroh Road, the south trench exposed a plaza surface (Strat 8). The 15-cm deep level included charcoal and some artifacts. Flotation (18, Table 59) revealed substantial variety but low density of floral economics, including probable fuel (juniper) and food (pinyon, ricegrass, hedgehog cactus, goosefoot, and corn) taxa. An unburned Russian thistle seed is sure evidence of some modern contamination, possibly during excavation.

A large pit (Feature 2) exposed in the east wall of the south trench dates late in the LA 50337 sequence (C-14: 992 $\pm$ 60). Well-oxidized pit sides testify to burning in place; some sort of roasting function has been suggested. Flotation (37, Table 59) revealed a substantial concentration of carbonized saltbush fruits in conjunction with a charcoal assemblage heavily weighted towards saltbush (Table 60). Large charcoal sent for dendrochronological analysis included 88 percent coniferous, 12 percent cottonwood (n = 8), and the remaining larger pieces, collected as macrobotanical materials, showed also significant coniferous and cottonwood/willow elements (46, Table 61). Also present were carbonized grass stems (41, Table 61) and fibrous material (23, too fragmentary for positive identification, but resembling old bark or mast of *Juniperus*), as well as a single charred corn shank (45).

Room Block and Surrounding Plaza

In Room 1, at the north end of the exposed section of the room block, botanical remains derive from two hearths, and two locations, on Floor 2. On Floor 1, Feature 5 (109), a very shallow adobe-lined hearth, contained charred prickly pear seeds in addition to burned saltbush fruits (Table 62) and saltbush charcoal (Table 63). On Floor 2, Feature 7 (106) contained low frequency carbonized weed seeds. Floor 2 locations west (117) and east (118) of the adobe wing-wall showed generally similar assemblages consisting chiefly of unburned annual weed seeds (two taxa present in both locations, pigweed and winged pigweed, comprised 82 percent and 75 percent of sample seed contents). Substantial depth of protective overburden allows for the possibility of preserved unburned perishables in this location.

Post-occupational fill in Room 2 netted both corn (Bag 450/Sample 138, four carbonized cob fragments) and squash (unburned seeds, Bag 450/Sample 138, Bag 383/Sample 326) macrobotanical remains. Botanical items from fill in an unburned adobe-lined pit (Feature 17) on Floor 1 included a single, unanalyzed corn cob (Bag 486) and flotation remains (149). Both corn kernels and cob parts were also present in this sample, as well as carbonized grass seeds and juniper twigs (Table 62). The latter may be related to juniper wood used as fuel, a small component in the assemblage from this pit; nonconiferous wood types (saltbush, cottonwood/willow) were more prominent (Table 63). Unburned weed seeds in Sample 149 (pigweed, beeweed, spurge) are of doubtful cultural affiliation as excavators noted rodent disturbance in the pit fill.

Table 61. Composition of Wood Collected During Excavation as Macroremains

Species	Kiva		South Trench		Room Block Plaza 1			Room 13		Pit Structure					
	#72 TP9 Strat 18	#87 TP9 Strat 19	#41 F. 2 Strat 10	#46 F. 2 Strat 10	#134 Area 5 Level 6	#162 Area 5 Level 7	#119 Area 6 F. 9	Bag 696 F. 36 (arrow shaft end?)	#263 F. 45 Hearth	#276 Strat 117	#277 Strat 117	#292 Strat 117	#293 Strat 117	Bag 990 Strat 119 (ornament)	Bag 996 Strat 119 (artifact)
Zea	1 stem 0.3									leaves, stems 2.0	leaves, stems --	leaves, stems 2.1			
CONIFEROUS															
Juniperus							1 0.7								
Unknown conifer	2[a] 0.7		1 --	82 81.4			3 3.3								
Total conifer	2 0.7		1 --	82 81.4	--	--	4 4.0								
NONCONIFEROUS															
Atriplex	30[b] 6.2	15[b] 1.1	0.4	7[d] 34.2			2 1.2		6 3.8	45 10.6	++[b]	16 2.0	++[b]		
Atriplex/ Sarcobatus	5 0.2		2	2[d] 9.3											
Artemisia														3 2.4	
Populus/ Salix		23[c] 94.6		9 37.6	36 11.0	1 0.4		1 0.2					+[d]		7 32[e]
Unknown nonconifer			1 0.1				2 0.6	1 0.6							
Total nonconifer	35 6.4	38 95.7	3 0.5	18 81.1	36 11.0	1 0.4	4 1.8	2 0.8	6 3.8	45 10.6		16 2.0		3 2.4	7 32
Unid. mixed & frag. roofing		++ 37.8	1 --	++ 13.3		mono. frags.				++ 55.9					
TOTAL	38 7.4 g	38++ 133.5 g	5 0.5 g	100++ 175.8 g	36 11.0 g	1 0.4 g	8 5.8 g	2 0.8 g	6 3.8 g	45++ 68.5 g	na	16 4.1 g	na	3 2.4 g	7 32 g

sample number; [a] not completely carbonized. [b] small diameter. [c] most are segments of a branch about 75 mm in diameter. [d] large diameter (10-25 mm). [e] approximately.

No flotation samples were processed from the fragment of Room 3 that was excavated. A carbonized corn shank (Sample 317) was recovered from post-occupational fill (Strat 22). Corn parts (such as this shank and leaf and husk fragments recovered elsewhere in the site) not directly related to the basic transportable units of kernels on or off the cob are reasonable confirmation of our assumption that corn was grown locally, rather than transported in.

In Room 4, flotation samples derive from hearths on Floor 2 (Feature 13, #130) and Floor 3 (Feature 16, #140). The shallow, unlined hearth on Floor 2 contained only corn as potential food remains (Table 62). Charcoal included both juniper and nonconiferous elements (Table 63). Morphology of this pit is consistent with heating features designated in Chaco Canyon sites as heating pits, which tended to contain lower diversity and quantities of economic plant types, in comparison with larger, more formal features designated as firepits (Toll 1985b). A deeper, partially slab-lined hearth on Floor 3 dated to 704 ± 100 and contained charred saltbush fruits as well as corn remains (unburned pigweed seeds may be intrusive) (Table 62). Two carbonized cob fragments (Bag 493) were present in a subfloor stratum of laminated sand (Strat 50) as evidence of subsistence activity elsewhere in the site before Room 4 was constructed.

In Room 7, flotation and wood macro samples derive from Floor 1, a prepared adobe surface less than half a meter below present ground level. Sample 165 from the central area of the floor yielded a single unburned goosefoot seed, while the central hearth (Feature 22, dating 745 ± 60) contained low frequencies of burned goosefoot and pigweed seeds (Table 62). Attention is drawn to similar patterning seen in much clearer detail at Pueblo Alto in Chaco Canyon. At this largely tenth-century pueblo with floors several meters below surface, constellations of several economic plant taxa occurred, burned, in numerous heating features and then unburned on the floor surface, decreasing in density farther away from the concentration of heating features (Toll 1985a). This patterning occurred with several taxa, with substantial numbers of seeds, and in several habitation rooms, arguing convincingly for the economic significance of unburned floor seeds. It is at least possible that goosefoot operated in a similar way in Room 7 of LA 50337, though seed quantities here are very low and depth is not far from present ground surface. Charred juniper twigs in Feature 22 likely correspond to fuel use in the hearth, which was heavily coniferous (Table 63).

Room 8, added to Room 7 but with a C-14 date of 693 ± 70, may have functioned as a habitation room. Level with the base of the walls (but lacking any associated discernible floor surface) was Feature 24, a shallow basin hearth. Winged pigweed seeds and both corn kernel and cob parts constitute the clear economic floral remains in this provenience (#175; Table 62), while saltbush fruits and juniper twigs could relate to firewood (heavily coniferous, but including some saltbush: Table 63).

Plaza Areas Associated with the Room Block

Adjacent to the masonry room block are outdoor use areas, some bounded by low walls (Areas 5, 6, 9, 10, 11, 12). Three distinct, sequential occupation surfaces were defined: Plazas 1, 2, and 4 are associated with the occupation of the room block, and Plaza 3 underlies and predates the room block.

Items recovered in fill *above* Plaza 1 largely relate to Strat 22 (post-occupational fill) including carbonized corn cob fragments in Area 5 (Bag 348), Area 6 (Bag 312), and Area 9 (Bag 561). In Area 5, a post room-block hearth (Feature 12) with only small amounts of related use surface (Strat 35) contained a substantial diversity (9 taxa) of carbonized economic seeds, (#125; Table

Table 62. Flotation Results, Room Block, LA 50337

Species	#109 Rm. 1 Fl. 1, F. 5 hearth	#106 Rm. 1 Fl. 2, F. 7 hearth	#117 Rm. 1a, Fl. 2	#118 Rm 1b, Fl. 2	#149 Rm. 2 Fl. 1, F. 17, pit	#130 Rm 4, Fl. 2, F. 13, hearth	#140 Rm. 4, Fl. 3, F. 16, hearth	#165 Rm. 7, Fl. 1	#168 Rm. 7, Fl. 1	#175 Rm 8, Fl. 1, F. 24, hearth
WOODY PERENNIALS										
Atriplex	5/ 20.0*			1/ 0.5			1/ 1.8*			5/ 3.6
Juniperus		T		T*	T*	T			T*	T
GRASSES										
Gramineae					8/ 6.2*					
POSSIBLE ECONOMICS										
Opuntia	4/ 16.0*		1/ 0.6							
Chenopodium		1/ 1.4*						1/ 1.1	1/ 1.4*	
Amaranthus	1/ 4.0		10/ 5.6	4/ 2.2	1/ 0.8		2/ 3.6		3/ 4.3*	
Cycloloma (winged pigweed)			4/ 2.2	2/ 1.1						4/ 2.9*
Cleome (beeweed)					1/ 0.8					
Sphaeralcea			2/ 1.1							

Table 62. Continued.

CULTIVAR										
Zea					0.8* C*	C*	C*			1/ 0.8*
PROBABLE CONTAMINANTS										
Others				1/ 0.5[1]						
Euphorbia					1/0.8					
Unknown	1/ 4.0	4/ 5.7*								
# Taxa	4	3	4	5	7	2	3	1	3	4
# Taxa Burned	2	2	0	1	3	1	2	0	3	2
TOTAL SEEDS										
Actual	11	5	17	8	13	0	3	1	4	10
Estimated	44.0	7.1	9.5	4.3	10.2	0	5.4	1.1	5.7	7.2

* some or all items charred. Number above slash indicates actual number of seeds counted; number below slash indicates estimated number of seeds per liter of soil.

[1] *verbena*

Table 63. Charcoal Composition, Room Block and Plaza

	Unknown	Coniferous					Nonconiferous								Total
		Juniperus	*Pinus edulis*	*P. ponderosa*	Unknown	Total	*Atriplex*	*Atriplex/ Sarco.*	*Sarcobatus*	*Artemisia*	*Chrysothamnus*	*Populus/ Salix*	Unknown	Total	
Room Block															
109 Rm. 1, Fl.1, F. 5, hearth						0	1 +	19 0.5						20 0.5	20 0.5g
106 Rm. 1, Fl.2, F. 7, hearth						0	3 0.1	11 0.4				1 +	5 0.1	20 0.6	20 0.6g
149 Rm. 2, Fl.1, F. 17, pit		3 0.3				3 0.3	7 0.3	1 +				4 0.1	5 0.1	17 0.5	20 0.8g
130 Rm. 4, Fl.2, F.13, hearth		8 0.3				8 0.3	6 0.3		1 +			3 +	2 0.1	12 0.4	20 0.7g
168 Rm. 7, Fl.1, F. 22, hearth		4 0.1			11 1.1	15 1.2	4 0.1						1 +	5 0.1	20 1.3g
175 Rm. 8, Fl.1, F. 24, hearth		12 0.3			5 0.1	17 0.4	2 +					1 +		3 +	20 0.4g
Plazas															
125 Area 5, F. 12, hearth		1 +				1 +	7 0.3	2 +				3 0.1	7 0.1	19 0.5	20 0.5g
159 Plaza 1, St. 44, ramada surface						0						19 1.1	1 +	20 1.1	20 1.1g
183 Plaza 1, F. 20, hearth		4 0.1			4 0.1	8 0.2	2 0.1					5 0.1	5 0.1	12 0.3	20 0.5g
189 Plaza 1 (Area 10) F. 31, hearth		3 0.2				3 0.2						17 0.4		17 0.4	20 0.6g
220 Plaza 2, F.37, hearth	1 +	1 +	2 0.1		3 +	6 0.1	3 0.2				1 +	8 0.1	1 0.1	13 0.4	20 0.5g
198 Plaza 3, F. 35, hearth				2 0.1	2 0.1	4 0.2					2 0.1	11 0.2	5 0.1	18 0.4	22 0.6g

Table 63. Continued.

	Unknown	Coniferous					Nonconiferous								Total
		Juniperus	*Pinus edulis*	*P. ponderosa*	Unknown	Total	*Atriplex*	*Atriplex/ Sarco.*	*Sarcobatus*	*Artemisia*	*Chrysothamnus*	*Populus/ Salix*	Unknown	Total	
172 Plaza (Area 5) F.23, hearth		4 0.1			10 0.4	14 0.5		1 +		2 0.1		3 0.2		6 0.3	20 0.8g
222 Plaza 4, St. 78, trash		5 0.1				5 0.1						13 0.2	2 0.1	15 0.3	20 0.4g
Total pieces	1	45	2	2	35	84	35	34	1	2	3	88	34	197	282
% pieces	+	16	1	1	12	30	12	12	+	1	1	31	12	70	100
Total weight (g)	+	1.5	0.1	0.1	1.8	3.5	1.4	0.9	1	0.1	0.1	2.5	0.8	5.8	9.3g
% weight	+	16	1	1	19	37	15	10	+	1	1	27	9	63	100

64). Corn, ricegrass, and five weedy annuals are all likely food products, while saltbush fruits and juniper twigs can both be related to the charcoal assemblage. In wall fall below Strat 35 were found additional charred corn cobs (Bags 391 and 404).

In Area 5, wall and ramada debris (Strat 44) lying on Plaza 1 again illustrated a high diversity of carbonized seed types in flotation (Sample 159; Table 64), repeating juniper, ricegrass, and pigweed found in the Feature 12 hearth, but adding prickly pear cactus and sedge.

The selection of economic weeds differs somewhat from sample to sample, but the prominent characteristic of nearly all these plaza locations is a substantial diversity of economic types, leaning heavily towards annual weeds (12 carbonized types in all) but including also corn, ricegrass, two cacti, and sedge. Nearly all charcoal in Strat 44 (possible ramada) was cottonwood/willow (Tables 61 and 63). In contrast, wood in a large unlined pit with burned sides (Feature 9) in Area 6 consisted chiefly of conifer and saltbush specimens (Table 61). Feature 9 fill also contained corn: 16 measurable cobs and numerous additional fragments (Bag 315). Another unlined pit with burned sides, Feature 20, showed a significant array of carbonized economic plant debris (this time including beeweed; Table 64) and coniferous as well as saltbush, cottonwood/willow charcoal (Table 63). In this same ash and charcoal level at the bottom of Feature 20 was a carbonized corn cob (Bag 587). In Area 10, Feature 31 was also associated with the Plaza 1 surface. This shallow, unlined basin hearth contained carbonized seeds of four edible annual weeds as well as corn remains (Table 64); charcoal in this feature was mostly very small pieces of cottonwood/willow (Table 63).

Plaza 2 was defined chiefly in relation to two hearths located west and southwest of Room 7. Both are shallow unlined basin types with a mixed array of charcoal types (conifers plus rabbitbrush and cottonwood/willow; Table 63). Both hearths contained carbonized saltbush fruits, but saltbush *wood* turned up only in Feature 37. Seed diversity was considerably higher in Feature 37; among the flotation remains, ricegrass, pigweed, winged pigweed, and globemallow were all unburned but highly eroded and encrusted with matrix (not recent intrusives).

On Plaza 3, underlying the room block, we have flotation samples from two hearths as well. Feature 38, a large oblong pit, was designated as a hearth because of burning in evidence at one end. All seeds present were unburned, though highly eroded, and may have all belonged to one taxon, *Chenopodium* (Table 64). Feature 23, a shallow unlined basin hearth, contained a substantial diversity of carbonized annual weed seeds, plus corn; charcoal was varied, but mostly coniferous.

Trash (Strat 78) lying on Plaza 4 (exposed only in grids north of Room 1) was rich in economic floral remains. Flotation materials included carbonized mallow and nightshade family seeds and corn (Table 64). The various unburned seeds were considerably eroded; included were two taxa--hedgehog cactus and sedge--which do not produce large quantities of widely disseminated seeds, and which are certainly possible by-products of human subsistence activity at LA 50337.

Room 13 and Plaza

Room 13 and some associated plaza areas and extramural features are situated to the north of the room block. A C-14 date of 1013 ± 60 (Feature 45) suggests Room 13 may postdate the room block. To the south of Room 13, remains of a burned ramada (Strat 82/86, including carbonized

Table 64. Flotation Results, Room Block Plaza, LA 50337

	#125 Area 5, F. 12, hearth	#159 Plaza 1, St. 44, ramada	#183 Plaza 1, Area 6, F. 20, St. 51	#189 Plaza 1, Area 10, F. 31, St. 70	#198 Plaza 2, F. 35, St. 77	#220 Plaza 2, F. 37, hearth	#201, Plaza 3, F. 38, hearth	#172 Plaza 3, Area 5, F. 23, hearth	#222 Plaza 4, St. 78, trash
WOODY PERENNIALS									
Atriplex (saltbush)	4/ 2.5*			1/ 1.1	1/ 0.8*	5/ 3.6*			
Juniperus (juniper)	T*	T*	T*		T	T*			
GRASSES									
Oryzopsis (ricegrass)	2/ 1.3*	2/ 2.0*				1/ 0.7			
POSSIBLE ECONOMICS									
Echinocereus (hedgehog cactus)									1/ 0.7
Opuntia (prickly pear)		1/ 1.0							
Cyperaceae (sedge family)		10/ 10.0*							1/ 0.7
Chenopodium (goosefoot)	1/ 0.6*			6/ 6.3*			10/ 8.3	17/ 20.0*	3/ 2.0
Amaranthus (pigweed)	11/ 6.9*	7/ 7.0*	8/ 16.0*	4/ 4.2	1/ 0.8*	8/ 5.7		6/ 7.1*	13/ 8.7
Portulaca (purslane)	1/ 0.6*							1/ 1.2*	
Cycloloma (winged pigweed)				8/ 8.4*		2/ 1.4			2/ 1.3
Mentzelia (stickleaf)		4/ 4.0*						1/ 1.2	
Cleome (beeweed)			1/ 2.0*			1/0.7*			

Table 64. Continued.

	#125 Area 5, F. 12, hearth	#159 Plaza 1, St. 44, ramada	#183 Plaza 1, Area 6, F. 20, St. 51	#189 Plaza 1, Area 10, F. 31, St. 70	#198 Plaza 2, F. 35, St. 77	#220 Plaza 2, F. 37, hearth	#201, Plaza 3, F. 38, hearth	#172 Plaza 3, Area 5, F. 23, hearth	#222 Plaza 4, St. 78, trash
Solanaceae (nightshade family)	1/ 0.6*	2/ 2.0	1/ 2.0*					1/ 1.2*	42/ 28.0*
Descurainia (tansy mustard)								2/ 2.4*	
Sphaeralcea (globemallow)				3/ 2.1*		3/ 2.1			2/ 1.3*
CULTIVARS									
Zea (corn)	C*		C*	C*	C*	1/ 0.7* C*		4/ 4.7* C*	C*
PROBABLE CONTAMINANTS									
Compositae (sunflower family)		1/ 1.0	1/ 2.0						
Others	3/ 1.9*[1]	2/ 2.0*[2]		1/ 1.1*[3]					
Euphorbia (spurge)									1/ 0.7
Unknown							3/ 2.5[4]		
# Taxa	9	9	6	7	4	8	2	7	9
# Taxa Burned	9	6	5	5	3	5	0	6	3
TOTAL SEEDS									
Actual	23	29	11	22	2	21	13	32	65
Estimated	14.4	29.0	22.0	23.2	1.6	14.9	10.8	37.6	43.4

* some or all items charred. Number above slash indicates actual number of seeds counted; number below slash indicates estimated number of seeds per liter of soil
[1] *Corispermum* [2] *Helianthus* [3] *Plantago* [4] Cheno-am

Table 65. Flotation Results, Room 13 and Plaza, LA 50337

	#248 Plaza F. 40, hearth	#237 Plaza F. 43, hearth	#254 Room 13, Floor 2	#262 Room 13 Floor 2, F. 45, hearth	#264 Room 13 Floor 2, F. 46 E½ hearth[1]	#266 Room 13 Floor 2, F. 46 W½ hearth[2]	#320 F. 53 extramural hearth
WOODY PERENNIALS							
Atriplex (saltbush)					1/ 0.7*		42/ 36.5*
Juniperus (juniper)	T*						
GRASSES							
Oryzopsis (ricegrass)	1/ 1.0*						2/ 1.7*
POSSIBLE ECONOMICS							
Echinocereus (hedgehog cactus)							1/ 0.9*
Opuntia (prickly pear)							1/ 0.9*
Cyperaceae (sedge family)				1/ 0.7			
Chenopodium (goosefoot)	6/ 5.9*		1/ 0.9	21/ 15.0*	1/ 0.7	3/ 3.0*	3/ 2.6*
Amaranthus (pigweed)	3/ 2.9*		3/ 2.7	32/ 22.9		7/ 7.0	11/ 9.6
Portulaca (purslane)				2/ 1.4			
Cycloloma (winged pigweed)							5/ 4.3*
Solanaceae (nightshade family)		1/ 1.0*					5/ 4.3*
Sphaeralcea (globemallow)				1/ 0.7*			2/ 1.7*

Table 65. Continued.

	#248 Plaza F. 40, hearth	#237 Plaza F. 43, hearth	#254 Room 13, Floor 2	#262 Room 13 Floor 2, F. 45, hearth	#264 Room 13 Floor 2, F. 46 E½ hearth[1]	#266 Room 13 Floor 2, F. 46 W½ hearth[2]	#320 F. 53 extramural hearth
CULTIVARS							
Zea (corn)	C*		C*	C*	C*		1/ 0.9* C*
PROBABLE CONTAMINANTS							
Others						3/ 3.0*[3]	
Euphorbia (spurge)				2/ 1.4			
Unknown							22/ 19.1
# Taxa	6	1	3	7	3	3	11
# Taxa Burned	5	1	1	2	2	2	9
TOTAL SEEDS							
Actual	11	1	4	59	2	13	95
Estimated	10.8	1.0	3.6	42.1	1.4	13.0	82.5

* some or all items charred. Number above slash indicates actual number of seeds counted; number below slash indicates estimated number of seeds per liter of soil
[1] hearth [2] warming pit [3] *Plantago*

Table 66. Charcoal Composition, Room 13 and Plaza

	#237 Plaza F. 43	#248 Plaza F. 40	#262 Room 13, St. 108	#264 Room 13 F. 46, hearth, E	#266 Room 13, F. 46, hearth, W	#320 N of Rm 13, F. 53 hearth	North Plaza		Pit Structure			
							#244 F. 41 pit (trash fill)	#259 F. 49, St. 112	#303 Fl. 1	#309 F. 52	#323 S. bench	#179 F. 21, extra-mural hearth
Unknown					1 +				1 +			
CONIFEROUS												
Juniperus		3 0.1			1 +	1 0.1	3 0.1	1 +	1 +	2 +		
Pinus edulis					1 +							
P. ponderosa	5 0.1	1 +					1 +					
Unknown	7 0.1	8 0.1	1 +		2 +	5 0.1	7 0.2		1 +	6 0.3	4 0.1	
Total	12 0.2	12 0.2	1 +	0	4 +	6 0.2	11 0.3	1 +	2 +	8 0.3	4 0.1	0
NONCONIFEROUS												
Atriplex		5 0.2	15 1.1	20 0.9	11 0.4	13 0.4	1 +	6 0.2	13 1.1	10 0.5	13 0.6	18 0.6
Sarcobatus		1 +										

Table 66. Continued.

	#237 Plaza F. 43	#248 Plaza F. 40	#262 Room 13, St. 108	#264 Room 13 F. 46, hearth, E	#266 Room 13, F. 46, hearth, W	#320 N of Rm 13, F. 53 hearth	North Plaza		Pit Structure			
							#244 F. 41 pit (trash fill)	#259 F. 49, St. 112	#303 Fl. 1	#309 F. 52	#323 S. bench	#179 F. 21, extra-mural hearth
Artemisia								6 +				
Chrysothamnus					1 +	1 +	1 +	2 0.2		1 +		
Populus/Salix	6 +	2 0.1	4 0.1		2 +		5 0.1	2 0.1	4 0.2	2 0.2	2 +	2 0.1
Unknown	2 +				1 +		2 0.1	3 0.1			1 +	
Total	8 +	8 0.3	19 1.2	20 0.9	15 0.4	14 0.4	9 0.2	19 0.6	17 1.3	12 0.7	16 0.6	20 0.7
TOTAL	20 0.2g	20 0.5g	20 1.2g	20 0.9g	20 0.4g	20 0.6g	20 0.5g	20 0.6g	20 1.3g	21 1.0g	20 0.7g	20 0.7g

corn cobs, Bags 640 and 789, and two possible arrowshaft fragments (see Fig. 46), one made of willow and one of an undetermined dicot shrub, Sample 432) were superimposed on a plaza surface (Strat 87/94). Two sampled hearths articulated with this surface. Flotation sample 248 came from upper ("last use") fill of a shallow adobe-lined basin hearth, Feature 40. Floral economics were varied though not plentiful, and included corn, ricegrass, goosefoot, pigweed, and (unburned) wild tobacco (Table 65). Burned juniper twigs probably relate to the substantial component of coniferous charcoal in Feature 40; other charcoal elements included saltbush, greasewood, and cottonwood/willow (Table 66). Fill in Feature 43, a large oblong hearth, included considerable ceramic, lithic, and bone trash. Floral elements (Sample 237) were very low by contrast, and included a single charred Solanaceae seed (Table 65) and varied charcoal (Table 66).

Room 13 flotation samples derive from the earlier of two floors. Sample 254 from an area of floor near the south wall contained carbonized corn and unburned seeds of two edible weeds common in Room 13 and throughout the site (Table 65). Two large, divided heating features (each with a section apparently used as a hearth and another as a warming pit) were likely used sequentially during occupation of Floor 2. Sample 262 is thought to represent hearth use in Feature 45, and included carbonized weeds and corn (Table 65). Feature 46, used first and then plastered over, showed corn, saltbush fruits (Table 65) and entirely saltbush wood (Table 66) in the segment designated as hearth use (Sample 264), and carbonized seeds of two edible weeds and a wide variety of fuel wood in the segment designated as warming pit use (Sample 266).

To the north of Room 13, an extramural hearth, Feature 53, dated very late (C-14, 1291 $\pm$ 60) in the occupation sequence of LA 50337. The flotation sample from this provenience was especially rich in variety of cultural floral remains. Corn and seeds of ricegrass, two cacti, and four edible weeds were all carbonized. Abundant burned saltbush fruits may relate to saltbush wood, the most frequent of several fuel types present.

North Plaza

In the north plaza, some 20 m north of Room 13, redeposited trash (Strat 89) was encountered in Test Pit 16 less than half a meter below present ground surface. Four carbonized corn cob fragments (Bag 759) were present in company with ceramic, lithic, and bone debris, in a laminated sand, ash, charcoal, and gravel matrix. More charred cob fragments (Bag 740) were encountered in deeper, rodent-disturbed trash (Strat 92). A large pit (Feature 41) at the bottom of this level contained redeposited trash. Carbonized corn cob fragments were present in both macroremains (Bag 810) and flotation (Table 67). Other economic plant debris included juniper twigs (possible firewood correlate; Table 66) and sedge, goosefoot, beeweed, nightshade family, and mallow seeds. Adobe blocks and chunks suggest the pit may have functioned as a borrow pit, but the trash fill is not likely to relate to the original pit use.

On an occupational surface (Strat 110) below Feature 41 and slightly to the north, a shallow basin-shaped feature (Feature 49) was encountered. Unburned pit sides imply the charcoal-stained fill was redeposited; a C-14 date of A.D. 796 $\pm$ 50 links the hearth contents to the second occupation period at LA 50337. Corn debris (Bag 879 and flotation sample 259) were present together with more burned sedge and pigweed (Table 67).

Pit Structure

A pit structure south of Room 13 predates occupation of the room block (C-14 dates consistently point to the neighborhood of A.D. 750, while Cortez Black-on-white ceramics found there are currently interpreted as dating a century or more later). An intact roof apparently burned in place and fell sometime after abandonment, preserving a rich assemblage of carbonized floral remains. Table 68 serves to organize the considerable amount of material by stratum.

Actual roof levels (Strata 116 and 117) contained materials distinctly different from those levels directly associated with the floor and fill immediately above (Strat 118 and 119). Although corn remains were present in nearly all pit structure proveniences, these tended to be far more numerous, and included larger pieces of cobs along with husks and shanks in the actual roof. The distribution of corn parts certainly suggests the pit structure roof was used for drying and/or initial processing of corn. Noting the absence of kernels, however, the corn assemblage in place when the roof burned probably represents corn debris remaining after the dried kernels had been removed for storage or further processing elsewhere. Other cultivars (represented solely by beans found on the bench; Sample 317) were confined to the interior of the pit structure. We do not know if other potential food plant remains were restricted to internal locations (Tables 67, 68) as we lack comparable flotation data from the roof levels. These taxa were restricted in variety to a few edible weed types (notably pigweed), in contrast to many other proveniences at LA 50337. Note that hearth contents (Flotation Sample 309) are essentially indistinguishable from floor and fill assemblages.

Wood use also varies distinctly between roof and interior pit structure locations. Saltbush was the prime roofing material, while the saltbush within the pit structure was marked by the additional presence of saltbush fruits, and significant amounts of coniferous and cottonwood/willow charcoal (Tables 66, 68).

Several perishable artifacts were carbonized and preserved in pithouse deposits associated with the floor. Pieces of a twill plaited basket (Sample 310) are of particular interest. Adovasio (1977:99) notes that plaiting is a relatively simple basketry technology with maximum structural plasticity and diversification of form (including containers, bags, mats, sandals, and many other items). In this basket, two sets of elements are made of the same material and are both "active," with each element in one set passing over two in the other set at staggered 2/2 intervals (Fig. 47). Elements in the La Plata basket are solid, terete (round in cross section) monocot stems, unmodified except for flattening. Taxonomic possibilities that fill the bill include sedges (Cyperaceae) and rushes (Juncaceae), but not grasses, which are hollow stemmed. There are in the neighborhood of a dozen members of the sedge and rush families that are known to grow today in streamside or marshy habitats in northern New Mexico (Martin and Hutchins 1980). Charred contents of this basket include a material composed of minute aligned fibers, and a second material that bubbled in carbonization, probably a carbohydrate food. Packed with the basket in Sample 310 is a square knot, made with strips of unmodified yucca leaves. Two wooden artifacts include a star or sun-shaped ornament or pendant (Bag 990) carved from a dense dicot wood, and a possible digging stick fragment (Bag 996) of cottonwood or willow (Fig. 45).

An extramural hearth (Feature 21) about 2 m to the south of the pit structure contained seed types similar to those found within the pit structure (Tables 67, 68). Charcoal was almost entirely saltbush, with a small element of cottonwood/willow.

Table 67. Flotation Results, North Plaza and Pit Structure

	North Plaza		Pit Structure				
	#244 F. 41, pit	#259 F. 49, pit	#305 (assoc. w/ basket on St. 118)	#303 Floor 1	#309 F. 52, hearth	#323 south bench	#179 F. 21, extramural hearth
WOODY PERENNIALS							
Atriplex (saltbush)			1/ 1.1*	5/ 5.6*		7/ 7.4*	1/ 1.1*
Juniperus (juniper)	T*			T*	T*	T*	
POSSIBLE ECONOMICS							
Cyperaceae (sedge family)	1/ 0.9*	2/ 1.8*					
Chenopodium (goosefoot)	17/ 15.5*		2/ 2.2	1/ 1.1*	2/ 1.6*		
Amaranthus (pigweed)		9/ 8.2*	1/ 1.1*	10/ 11.1*	1/ 0.8*	2/ 2.1*	3/ 3.3*
Cleome (beeweed)	10/ 9.1*						
Solanaceae (nightshade family)	1/ 0.9*				3/ 2.4*		
Sphaeralcea (globemallow)	1/ 0.9*		1/ 1.1				2/ 2.2*[1]

Table 67. Continued.

	North Plaza		Pit Structure				
	#244 F. 41, pit	#259 F. 49, pit	#305 (assoc. w/ basket on St. 118)	#303 Floor 1	#309 F. 52, hearth	#323 south bench	#179 F. 21, extramural hearth
CULTIVARS							
Zea (corn)	C*	C* 2/ 1.8*		C*	C*		C*
PROBABLE CONTAMINANTS							
Compositae (sunflower family)	2/ 1.8						2/ 2.2
Euphorbia (spurge)						2/ 2.1*	
# Taxa	8	3	4	5	5	4	5
# Taxa Burned	7	3	2	5	5	4	5
TOTAL SEEDS							
Actual	32	13	5	16	6	11	8
Estimated	29.1	11.8	5.5	17.8	4.8	11.6	8.8

[1] *Malvaceae*

Table 68. Summary of Pit Structure Floral Remains by Stratigraphic Provenience

		CORN	BEANS	EDIBLE WEED SEEDS	CONIFERS	SALTBUSH	COTTONWOOD	MISC.
Strat 116	Mixed roof/fill	Bag 925: 2 cobs*, 3 shanks						
Strat 117	Roof	Bag 976: 10 cobs*, 8 shanks* Bag 949/S277: leaves, stems Bag 950/S276: leaves (2.0g) Bag 960/S292: husks* (2.1g)				Sample 276: n=45 (10.6g) Sample 292: n=19 (2.0g) Sample 293: present	Dendro samples 274-5, 278, 280, 283-5, 289, 291, 294-9: 100% *Populus*. Sample 293: present	Sample 276: mixed fragmentary roof (55.9g) Sample 292: mixed frag. roof (34.9g)
Strat 118	Post-occupational fill (lying on floor)	Bag 993: 4 cobs*		Flot. 305: *Amaranthus*, *Chenopodium*, *Sphaeralcea*		Flot. 305: 1 fruit*	Dendro samples 311-12: both *Populus*	
Strat 119	Floor	Flot. 303: cupules*		Flot. 303: *Chenopodium**, *Amaranthus*	Flot. 303: juniper twigs and charcoal	Flot. 303: 5 fruits and charcoal 65%	Flot. 303 charcoal 20%	
	Bench		Bag 1004/S317: 4 cotyledons*	Flot. 323: *Amaranthus**	Flot. 323: juniper twigs & charcoal 20%	Flot. 323: charcoal 65%	Flot. 323 charcoal 10%	
	F. 52, hearth	Flot. 309: cupules*		Flot. 309: *Chenopodium**, *Amaranthus**, Solanaceae*	Flot. 309: juniper twigs & charcoal 40%	Flot. 309: charcoal 50%	Flot. 309: charcoal 10%	
F. 21, extra-mural hearth		Flot. 179: cupules*		Flot. 179: *Amaranthus**, *Sphaeralcea**		Flot. 179: 1 fruit & charcoal 90%	Flot. 179: charcoal 10%	

Cultivars at LA 50337

Morphometrics of corn recovered at LA 50337 are notable chiefly for their uniformity between eighth- and tenth-century deposits (Table 69). Cob diameter (a rough indicator of overall cob size), row number, and size and shape of cupules all remain quite stable between these occupations. Sampling inadequacies are an important consideration here: sample size is very small, and all representatives of the earlier period come from one structure. The largest class of LA 50337 cobs derive from deposits that cannot be assigned reliably to a specific time period.

Looking at size and shape parameters from Anasazi corn in the Four Corners area (Table 70), one sees a good deal of variability is apparent within any given time period. In the central San Juan Basin, conditions for farming were particularly poor (low precipitation with considerable variability in timing from year to year); cobs were generally smaller than in areas of more dependable rainfall, and decrease somewhat in size over time. LA 50337 shows some affinities with others sites along major tributaries (such as Turkey Pen and Salmon Ruin): cob diameter and cupule size are both notably large. In many late Pueblo II and Pueblo III corn assemblages, a major shift in cob row number is documented (A.D. 1000-1100 at Mesa Verde, and ca. A.D. 1100 at Salmon Ruin). Hybridization with a Mexican 8-rowed flour corn, Mais de Ocho, is thought to be responsible for an increase in 8-rowed cobs, together with an increase in cob size (Winter 1973). La Plata corn from both eighth- and tenth-century proveniences (64 percent of cobs with 12 or more rows) clearly predates any such introduction of a low-rowed genotype.

The few carbonized bean cotyledons found at LA 50337 are testimony to heavy preservation bias against beans, rather than low dietary importance. Convincing explanation for the low representation of beans in open archaeological sites include threshing away from habitations and cooking by boiling (Kaplan 1956), as well as quick susceptibility to deterioration processes and lack of a durable by-product (Gasser and Adams 1981). Preservation of beans in open sites has often been afforded by a major fire, smothered by a collapsing roof, as in the pit structure at La Plata, a pit structure in Chaco (Toll 1982), and Salmon's tower kiva (Bohrer 1980). Size and shape of the La Plata specimens (Table 13) indicate they fall within the known range for the common bean, *Phaseolus vulgaris* (Kaplan 1956). Absence of seed coat and hilum precludes determination of varieties according to Kaplan's regional typology (1956). Two incomplete and unburned squash seeds were recovered from post-occupational fill in Room 2. A width of 9.5 mm was measurable on one specimen (Sample 138). It is likely the specimens derive from the most widely distributed squash type, *Cucurbita pepo,* but high erosion allows identification only at the level of *Cucurbita* sp.

Wood at LA 50337

In examining patterns of wood use over time at the La Plata site, care must be taken to distinguish species composition data according to its source. Charcoal recovered by flotation tends to be considerably smaller than wood samples collected by excavators, and others have noted the correlation between wood type and specimen size (Paul Minnis, pers. comm.). We find repeated instances of very different species preferences for fuel as opposed to house construction or tool and ornament manufacture, so that wood assemblages should also be distinguished according to functional context.

Table 69. Corn Morphometrics Over Time at LA 50337

Time Period	Proveniences	x diameter	COBS							KERNELS		
			% 8 row	% 10 row	% 12 row	% 14 row	x row #	x cupule width	x cupule height	x length	x width	x height
II, A.D. 700s	#925 Pit Structure #976 Pit Structure, Strat 117 #993 Pit Structure, Strat 118	14.0 (adj=16.9) cv.=.241 n=13	--	36	55	9	11.5 cv=.112 n=11	6.4 (adj=7.71 cv=.176 n=17	3.4 (adj=4.2) cv=.148 n=17			
III, A.D. 900s	#315 Plaza 1, Area 6, F.9 #587 Plaza 1, Area 6, F.20 #670 Plaza 2 #673 Plaza 2 #632 TP 13, F. 34 #810 North Plaza, F. 41 #879 North Plaza #244 Kiva (kernels)	14.4 (adj=17.4 cv=.147 n=17	14	21	57	7	11.1 cv=.153 n=14	6.6 (adj=7.9) cv-.151 n=26	3.4 (adj=4.1) cv=.169 n=26	8.5 cv=.074 n=39	8.2 cv=.106 n=48	5.1 cv=.185 n=48
Unknown (redeposited material)	#175 Kiva, TP 9 #764 Plaza 4 #740 North Plaza #759 North Plaza #450 Room 2	12.6 (adj=15.2) cv=.186 n=26	4	43	39	13	11.2 cv=.140 n=23	5.7 (adj=6.9) cv=.160 n=36	3.4 (adj=4.1) cv=.173 n=36			

#s = Bag numbers
measurements in mm
(adjusted average dimensions include 21% added to compensate for shrinkage during carbonization)

Table 70. Comparative Zea Cob Measurements, NW New Mexico and SW Colorado, in the Eighth to Tenth Centuries A.D.

	ROW NUMBER							COB DIAMETER			CUPULE WIDTH			CUPULE HEIGHT		
	% 8 or less	% 10	% 12	% 14+	n	x	cv	n	x mm	cv	n	x mm	cv	n	x mm	cv
8th century																
LA 50337[1]		36	55	9	11	11.5	.112	13	16.9	.241	17	7.7	.176	17	4.2	.148
29SJ628[2]	14	33	37	16	51	11.1		51	14.9	.220	14	7.3	.174			
LA 26749[3]	17	33	50		6	10.7		6	11.4		16	6.7	.158	16	3.6	.090
10th century																
LA 50337[1]	14	21	57	7	14	11.1	.153	17	17.4	.147	26	7.9	.151	26	4.1	.169
29SJ629[4]	34	38	25	3	182	9.9		196	11.9	.275	196	6.2	.231			
29SJ1360[5]	10	45	39	6	31	10.8		31	14.8	.190	31	7.3	.203			
Turkey Pen[6]	27	19	33	20	68	11.0		68	15.1		68	8.0				
11th-13th century																
NMAP sites LA 19414[a], 19516, 19546, 19553	18	37	36	10	62	10,7		62	9.4		62	5.0				
Pictured Cliffs[b]	14	29	29	29	7	11.4	.195	7	12.2	.180						
Salmon Ruin[c] Chacoan Occupation A.D. 1080/1090-1130					50	11.9		11	16.0	.080						
Mesa Verde Occupation A.D. 1180-1280					60	10.6		50	14.0	.181						

Table 70. Continued.

	ROW NUMBER							COB DIAMETER			CUPULE WIDTH			CUPULE HEIGHT		
	% 8 or less	% 10	% 12	% 14+	n	x	cv	n	x mm	cv	n	x mm	cv	n	x mm	cv
Pueblo Alto[4] Red Mesa Phase A.D. 1020-1040/50	49	22	21	9	150	9.8		152	12.6	.244	71	6.7	.253			
Gallup Phase A.D. 1050-1100	18	41	34	6	474	10.6		473	12.4	.224	116	6.1	.208			
Late Mix Phase A.D. 1100-1150	23	39	33	5	252	12.2		254	12.2	.227	64	6.1	.199			

Figures reflect 21% added to measurements of carbonized specimens to compensate for average shrinking during carbonization. Salmon cv's are approximate, as they are averages of the constituent subsample cv's

[1] This study [2] Chaco Canyon; Toll 1985b [3] Crownpoint; Donaldson 1981 [4] Chaco Canyon; Toll 1981 [5] Chaco Canyon; McKenna 1985 [6] SE Utah; Donaldson 1982

[a] Winter in Hogan and Winter 1983:441 [b] Toll in Farwell and Wening 1985:127 [c] Doebley and Bohrer 1983

Table 71. Bean Cotyledon Dimensions, LA 50337

Bag #	Length	Width	Thickness	Comments
1004, Pit Structure	13.1	6.7	3.9	charred; one cotyledon
	12.5	6.5	3.2	charred; one cotyledon
	12.7	7.1	2.9	charred; one cotyledon
	unmeasurable			charred; one cotyledon

In northwestern New Mexico and southwestern Colorado, clear patterns of change in wood use over time are repeated at site after site. Given a preference for coniferous species (largely juniper and pinyon) particularly for firewood, a first-level distinction is between those higher elevation sites with easy access to conifers, and lower elevation areas where conifer distribution is both patchy and sparse. Grass Mesa (5MT23), a large village excavated by the Dolores Project, provides a good example of the former case. Early assemblages here are dominated by juniper and pines, while after A.D. 850 cottonwood, oak, and various dicot shrubs and trees increase in relative importance, suggesting depletion of preferred types in the immediate site vicinity (Kohler et al. 1984). Farther south, in the Four Corners (Toll 1983) and Chaco regions (Toll 1985b; Donaldson and Toll 1982), firewood derives substantially from locally available shrub species such as saltbush, greasewood, and sage. In comparison with Archaic occupations in these areas, and as the Anasazi occupation progresses, the small percentage of coniferous wood used actually increases. As population density and aggregation mount, San Juan Basin inhabitants appear to go to greater lengths to make a go of it. Further, prevalence of wood types that are preferred and in short supply is distinctly greater at larger sites (Toll 1985b).

La Plata site wood use reasonably fits best the Grass Mesa wood resources depletion model. In flotation assemblages (which largely reflect fuel usage), a high percentage of coniferous wood is characteristic of only a single charcoal lens from the earliest occupation (A.D. 487 $\pm$ 100), and coniferous fuel drops off in subsequent occupations (Table 72). Cottonwood/willow is highly correlated with isolated roof contexts (Feature 31 fill in Occupation II, and Kiva floor fill in Occupation III). Looking at macrobotanical wood (Table 73), we can see that coniferous wood is linked closely to heating features. Again, cottonwood/willow correlates with roof contexts as well as manufacturing. Saltbush is found in both roof and fuel contexts, but is not used for manufacturing.

Discussion

In spite of considerable geographic variability in the area encompassing northwestern New Mexico and southwestern Colorado, substantial differences in the record of Anasazi plant use seem relegated chiefly to the realms of corn morphometrics and species selection of wood. Wild plant use shows a relatively stable pattern of utilization of a broad spectrum of weedy annuals and a smaller number of grasses (Table 74). Goosefoot occurs both ubiquitously and abundantly (Salmon's "cheno-ams" include both goosefoot and pigweed seeds). Other widespread weeds include pigweed, purslane, groundcherry, and other members of the Solanaceae, beeweed, and winged pigweed, with mustard, tickseed, sunflower, tickleaf, and several others used less often.

Table 72. Wood Use (Percent Pieces) from LA 50337 Flotation, Stratified by Major Occupational Period

	I 500-600s A.D. North Trench #13	II 700-800s A.D. Pit Structures #303, 309, 323	III 900-1000s A.D.					IV 1100s A.D. Feature 2 #37	V late 1200s A.D. Feature 53 #320
			Room Block #106, 109, 130, 149, 168, 175	Plaza #159, 183, 189	Kiva #95	Room 13 #262, 264, 266	Total		
CONIFEROUS									
Juniperus	35	5	23	12		2	14		5
Pinus edulis						2	<1		
Undetermined	25	18	13	7		5	9	25	25
Total	60	23	36	19	0	9	23	25	30
NONCONIFEROUS									
Atriplex	15	59	19	3		77	27	75	65
Atriplex/ Sarcobatus			26				12		
Sarcobatus			1				<1		
Chrysothamnus		2				<1			5
Populus/Salix	25	13	8	68	100	10	30		
Undetermined		2	11	10		2	8		
Total	40	76	65	81	100	91	77	75	70
Unknowns		2				2	<1		

Table 73. Wood Use (Percent Weight) from LA 50337 Macrobotanical Remains, Stratified by Major Occupational Period and Functional Context

	II 700-800s A.D.		III 900-1000s A.D.			IV 1100s A.D.
	Construction #276, 277, 292, 293,	Manufacturing Bags 990, 996	Construction #72, 87, 134, 162	Fuel #119, 263	Manufacturing Bag 696	Fuel #41, 46
Total Weight	84.0g	34.4g	152.3g	9.6g	0.8g	163.0g
CONIFEROUS						
Juniperus				7		
Undetermined			<1	34		50
Total			<1	41		50
NONCONIFEROUS						
Atriplex	12		5	52		21
Atriplex/ Sarcobatus			<1			6
Artemisia		7				
Populus/ Salix		93	70		25	23
Undetermined				6	75	<1
Total	12	100	75	58	100	50
Unid. mixed & frag. material	84		25			
Zea	4		<1			

Table 74. Comparative Overview of Occurrence of Selected Taxa in Flotation Samples at Anasazi Sites in the Four Corners Area

	700s-800s LA 50337, Occ. II, L, Hab, n=7[a]	900s 5MT83711 S, Hab, n=17	900s-1000s LA 50337, Occ. III L, Hab, n=15[b]	1000s-1200s Pictured Cliffs[2] S, SU, n=14[c]	Late 1000s-1100s Salmon, Primary Occ.[3] L, Hab, n=19[d]	Late 1100s-1200s Salmon, Secondary Occ.,[3] L, Hab n=45[d]	Late 1200s LA 50337, Occ. V, L, Hab, n=1[f]	900-1275 San Juan Coal Lease[4] S?, ?, n=34[g]	9 Anasazi Sites Navajo Mines Archeo. Project[5] S, Hab&SU, n=37
PERENNIALS									
Echinocereus						4%	100%	3%	
Opuntia		12%	13%				100%		
Rhus					5%	11%			
Cyperaceae					5%	11%			
GRASSES									
Oryzopsis	14%	41%		7%	11%	9%	100%	26%	22%
Sporobolus						13%			32%
WEEDY ANNUALS									
Cheno-ams					42%	31%		18%	
Chenopodium	43%	59%	27%	7%			100%	15%	49%
Cycloloma	14%		7%		5%		100%	9%	11%
Amaranthus	86%	29%	7%						11%
Portulaca		6%		7%	26%	16%			3%
Solanaceae	29%	12%	7%			16%	100%	3%	

Table.74. Continued.

	700s-800s LA 50337, Occ. II, L, Hab, n=7[a]	900s 5MT83711 S, Hab, n=17	900s-1000s LA 50337, Occ. III L, Hab, n=15[b]	1000s-1200s Pictured Cliffs[2] S, SU, n=14[c]	Late 1000s-1100s Salmon, Primary Occ.[3] L, Hab, n=19[d]	Late 1100s-1200s Salmon, Secondary Occ.,[3] L, Hab n=45[d]	Late 1200s LA 50337, Occ. V, L, Hab, n=1[f]	900-1275 San Juan Coal Lease[4] S?, ?, n=34[g]	9 Anasazi Sites Navajo Mines Archeo. Project[5] S, Hab&SU, n=37
Cleome	14%	6%			5%	2%		12%	5%
OTHER	I	II	III		IV	V	VI	VII	VIII
Zea	57%	24%	47%	43%	50%[e]	52%[e]	100%	56%	49%
Total Carbonized Economic Taxa	12	12	9	4	12	18	8	12	13

Site size: S = small (less than 10 rooms), L = large (10+ rooms). Site Use: Hab = habitation, SU = special use

[1] Toll 1985c [2] Toll 1985d [3] Bohrer 1980 [4] Gasser and Birgy 1984 [5] Toll 1983

[a]#159, 183, 189 from Plaza 1; #303, 305, 309, 323 from Pit Structure.

[b]Sample 95 from Kiva; #254, 262, 264, 266 from Room 13, Samples 106, 109, 117, 118, 130, 140, 149, 165, 168, 175 from Room Block

[c]Samples from Cracked Rock (4), Turkey (6), and Stonehenge (4) shelters

[d]n of strata (1-17 samples derive from any given stratum). Percent of unburned strata with carbonized seed specimens is given for each taxon.

[e]Doebley 1981--7 of 14 primary occupation samples; 14 of 27 secondary occupation samples

[f]Sample 320 from Feature 53

[g]Data area presented for only those samples (n=34) with seeds, from 52 samples examined.

Other carbonized economic taxa present:

I *Mentzelia* (14%), *Sphaeralcea* (14%), *Helianthus* (14%), *Plantago* (14%)

II *Corispermum* (18%), Compositae (6%), *Helianthus* (6%), *Descurainia* (18%)

III *Sphaeralcea* (7%), *Plantago* (7%), Gramineae (7%)

IV *Descurainia* (5%), *Euphorbia* (21%), *Mentzelia* (5%), *Trianthema* (5%)

V *Descurainia* (7%), *Euphorbia* (21%), *Polanisia* (2%), *Mentzelia* (11%), *Trianthema* (2%), Malvaceae (2%), *Desmodium* (2%), *Polygonum* (2%)

VI *Sphaeralcea* (100%)

VII *Geranium* (3%), *Helianthus* (6%), *Mollugo* (6%), *Sphaeralcea* (3%)

VIII *Descurainia* (11%), *Mentzelia* (3%), *Sphaeralcea* (5%), *Euphorbia* (5%), uncharred *Cucurbita* (3%)

Atriplex, *Sarcobatus*, and *Juniperus* have been omitted, assuming presence frequently refers to fuel use.

Several nonweedy economics--pinyon, cacti, yucca, sedges, and shrub fruits--typically occur in very low frequency, and may be sensitive to differential deposition and degradation effects. Pinyon nut remains seem to be especially patchy; their absence at LA 50337 is most peculiar, given the close proximity of this valuable resource.

In light of a regional perspective, La Plata floral remains are chiefly notable for relatively robust corn, and surprisingly low use of coniferous wood. La Plata cobs compare best (cob diameter and cupule size) with those from Salmon; these two sites share easy access to river-bottom farming land. Agricultural conditions are distinctly poorer in most parts of the region in consideration, and this is especially true of the central San Juan Basin in the vicinity of Chaco. In contrast to Chaco, where juniper and pinyon are also available on nearby mesas, coniferous wood selected heavily from the riparian community, and shrubs used also in roofing.

Considering the very long temporal extent of occupation at La Plata, we should perhaps be impressed mostly by the stability in plant use evidenced by archaeological plant remains. With the exception of possible depletion of nearby pinyon and juniper fuel supplies, the floral assemblage over time continues to suggest a mixed subsistence economy, leaning heavily on corn agriculture, but utilizing also cultivated beans and squash, and a diverse array of wild economic weeds, grasses, and perennials. Morphometric parameters of corn are also stable between the two principal eighth- and tenth-century occupations.

POLLEN ANALYSIS OF LA 50337, THE LA PLATA RIVER, NORTHWESTERN NEW MEXICO

Karen H. Clary

In the text of this report, the analysis of pollen and the following interpretation of subsistence patterns at LA 50337 are based upon site descriptions and chronology provided by Vierra (1985a, 1985b, 1986).

Ethnographic descriptions of the use of the majority of the pollen taxa encountered in the study of pollen of LA 50337 is provided in Appendix 2. This appendix is excerpted from the more extensive ethnobotanical file of Southwestern plants compiled by Mollie S. Toll, and I acknowledge her generosity in making it available for use. It should be noted that while not discussed individually in the text of this report, most of the taxa were utilized in a specific manner or manners by Southwestern peoples. However, with few exceptions, the pollen data do not indicate that they were made specific use of in the context of features at LA 50337, only that these taxa were available for exploitation by site inhabitants.

Pollen Analysis--Introduction

Sixty-six soil samples were submitted by the Laboratory of Anthropology, Museum of New Mexico, to the Castetter Laboratory for Ethnobotanical Studies for pollen analysis. Thirty-six were paired with flotation samples (Table 75). The samples were taken from features such as hearths (21), trash pits (3), milling bins (3), pits (4), vessels (8), kiva benches (3), from under manos and ground stone (6), floors (10), and strata (8), including a surface "pinch" sample. The purpose of the sampling strategy was to provide archaeobotanical information regarding subsistence patterns of the site inhabitants, the function of features, and a chronological documentation of plant use and site environment.

LA 50337 has a 700-year history of occupation and reoccupation. Four major chronological occupations are recognized from radiocarbon and ceramic dates, ranging from the fifth century to the thirteenth century A.D. Encountered during excavation were several distinct plazas, a series of rooms, a pit structure, and a kiva. One hundred and twenty-one strata were defined during excavation.

The oldest radiocarbon date comes from a lens, Stratum 4, in the North Trench, and a hearth (Feature 54) from the southern end of the site. The second series of dates run along the west side of the excavation, including the pit structure and north plaza surface. The third series of dates range across the site and include the room block, the trash below Room 13, the roof of the kiva, Room 13 hearth, and Feature 2 (a roasting pit). The earliest dates are from Feature 53, a hearth in a profile north of Room 13. The areas sampled appear to have been used most intensively during the second and third occupations, circa the eighth century and the tenth century A.D.

Table 75. LA 50337, Pollen Samples Analyzed

Provenience	Pollen Lab No.	Botany[1]	Comment
Vacant Lot: control	85177	P. #15	
North Trench			
Stratum 1	85174	P. #2, F. #3	trash pit
Feature 1, Stratum 5	85175	P. #8, F. #10	
Stratum 4, ash/charcoal	85176	P. #12, F. #13	
Kiva 1, Stratum 14	85192	mug fill, pollen, Bag #148	
Kiva 1, Stratum 14	86006	mug wash, pollen	
Kiva 1, Stratum 19			roof
Kiva 1, Stratum 21	85181	P. #94, F. #95	floor
Kiva 1, South bench	85180	P. #77	
South Trench			
F. 2, Stratum 10	85179	P. #35, F. #37	roasting pit
Stratum 8	85178	P. #17, F. #18	plaza
Stratum 12			trash?
Room Block			
Room 1, F. 5, Stratum 26, Fl.1	85182	P.#112, F. #109	hearth
Room 1, F. 7, St. 24, Fl. 2		F.#106	hearth
Room 1a, Stratum 28, Fl. 2	85183	P. #112, F. #117	
Room 1b, Stratum 28, Fl. 2	85184	P. #114, F. #118	
Room 2, Stratum 40, Fl.1	85188	P. #128	SE corner

Table 75. Continued.

Provenience	Pollen Lab No.	Botany[1]	Comment
Plaza 1 (11), F. 26, Stratum 66	86003	pollen	inner contact, vessel
Plaza 1 (11), F. 26, Stratum 66	86001	pollen	sherd wash, lower half of vessel
Plaza 1 (11), F. 26, Stratum 66	86002	pollen	sherd and matrix from w/in vessel
Plaza 1 (11), F. 28, Stratum 68	85203	P. #186	hearth
Plaza 2 (9-10), F. 37, Stratum 83	85209	P. #219, F. #220	hearth
Plaza 2 (11), F. 35, Stratum 77	85205	P. #197, F. #198	hearth
Plaza 3 (11-12), F. 38, Stratum 84	85206	P. #200, F. #201	hearth
Below Room 7, Plaza 3			pit/trash
F. 54, E and below Plaza 3			hearth
Plaza 4, Stratum 78	85210	P. #221, F. #222	trash 96N/97E
Plaza 4, Stratum 88	85211	P. #232	95N/97E
Plaza (TP 13), F. 36, Stratum 82	85207	P. 3203	ramada
Plaza (TP 13), Stratum 87	85208	P. #212	plaza
Plaza (TP 13), Stratum 86/87, F. 36, L. 6/7	86004	pollen	fill, contact of vessel
Plaza (TP 13), Stratum 86/87, F. 36, L. 6/7	86005	pollen	sherd wash, lower half of vessel
Plaza (TP 13), F. 39	85216	P. #249	under metate
Plaza (TP 13), F. 43, Stratum 99	85212	P.#238, F. #237	hearth
Plaza (TP 13), F. 40, Stratum 96	85215	P.#247, F.#248	hearth
Room 13, Stratum 97			roof
Room 13, Stratum 101, Fl. 1	85214	P.#245	under metate
Room 13, Stratum 105, Fl. 2	85217	P.#255, F.#254	

Table 75. Continued.

Provenience	Pollen Lab No.	Botany[1]	Comment
Room 2, F. 17, Stratum 49, Fl.1	85195	P.#161, F. #149	pit
92N/96E, Stratum 56	85198	P. #169	surface below Room 2
Room 4, Stratum 31, Fl. 1	85185	P. #121	
Room 4, Stratum 32, Fl. 2	85187	P. #126	NW corner
Room 4, F. 13, Stratum 41, Fl.2	85189	P. #132, F. #130	hearth
Room 4, Stratum 39, Fl. 3	85190	P. #144	NW corner
Room 4, F. 16, Stratum 47, Fl. 3	85191	P. #147, F. #140	hearth
Room 4, F. 15, Stratum 46	85193	P. #150	milling bin
Room 7, Fl. 1, Stratum 53	85197	P. #164, F. #165	
Room 7, F. 22, Stratum 54, Fl. 1		F. #168	hearth
Room 8, F. 24, Stratum 58, Fl.1		F. #175	hearth
Plaza around Room Block (Rooms 5-6, 8-12)			
Plaza (5), F.12, Stratum 37, Fl.1	85186	P. #124, F. #125	hearth
Plaza (5), F. 23, Stratum 58, below Fl. 2	85199	P. #171, F. #172	hearth
Plaza 1 (5), Stratum 44	85194	P. #160, F. #159	ramada
Plaza 1 (5), Fl. 2			post
Plaza 1 (5), Fl. 2, Stratum 49	85196	P. #163	under mano, NE corner
Plaza 1 (6), F. 9, Stratum 30			hearth
Plaza 1, (6), F. 20, Stratum 51	85202	P. #184, F. #183	hearth
Plaza 1(9), Stratum 63	85200	P. #178	under mano
Plaza 1(10), Stratum 71	85204	P. #187	plaza/mano
Plaza 1(10), F. 31, Stratum 70		F. #189	hearth

Table 75. Continued.

Provenience	Pollen Lab No.	Botany[1]	Comment
Room 13, F. 45, Stratum 108, Fl. 2		F.#262	hearth
Room 13, F. 46, Stratum 109, Fl.2	85221	P.#265, F.#264	east ½ hearth
Room 13, F. 46, Stratum 109, Fl. 2	85222	P.#267, F.#266	west ½ hearth
Below Room 13, Plaza (TP 13)			trash
F. 53, N. of Room 13	85230	P. #319, F. #320	hearth
North Plaza			
F. 41, Stratum 92	85213	P. #243, F. #244	pit (trash)
Stratum 110	85218	P.#257	under ground stone
F. 49, Stratum 112	85129	P.#258, F.#259	hearth
F. 47, Stratum 115/111	85224	P.#270	milling bin pits
F. 47, Stratum 115/111	85220	P.#261	milling bin pits
F. 51, Stratum 114	85223	P.#269	hearth
F. 50, Stratum 113	85225	P.#272	hearth
Pit Structure			
Kiva 2, Stratum 118	85226	P.#304, F.#305	corrugated jar
Kiva 2, Stratum 119, Fl. 1	85227	P.#313, F.#303	north wall
Kiva 2, F. 52, Stratum 120	85228	P.#314, F.#309	
Kiva 2, North bench	85229	P.#316	
Kiva 2, South bench	85231	P.#324, F.#323	
F. 21, hearth in backhoe trench, south of Kiva 2, Stratum 69	85201	P.#180, F.#179	hearth

[1] P = pollen sample; F = flotation sample

Pollen Extraction

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

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

2. The sample was washed through a 180-micron mesh brass screen with distilled water into a 600-milliliter beaker.

3. Tablets of fresh quantified *Lycopodium* pollen were dissolved in each sample to serve as a control for pollen degradation or loss during the process 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 3 hours. The water and dilute HCl were carefully poured off after settling, leaving the sediments and the pollen behind in the beaker.

5. Each beaker was filled again with distilled water, stirred, and allowed to settle for 3 hours before pouring off.

6. Beakers were filled one-third full with distilled water, stirred with clean stirring rods without creating a vortex, to suspend sediments and pollen. Three 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 several times to physically separate the heavier sand from the lighter sediments and the pollen grains.

7. The sediments were transferred to 50 ml test tubes.

8. Silicates were removed by adding 50 ml of hydrofluoric acid (HF) to each beaker and placing in a hot water bath for 5 minutes. Distilled water was added twice to rinse the samples.

9. Organics were removed by the following process: The samples were rinsed with 30 ml glacial acetic acid, centrifuged and poured off. A fresh acetolysis solution was prepared, of 9 parts acetic anhydride to 1 part sulfuric acid. Thirty ml were added to each test tube, stirred, and placed in a hot water bath for 10 minutes. Tubes were removed and cooled, then centrifuges, the liquid poured off, and rinsed with glacial acetic acid, centrifuged and poured off.

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

11. Droplets of the pollen-bearing sediment were placed on microscope slides and mixed with glycerine jelly. A cover slip was placed on each slide and the slides were sealed with fixative.

12. The slides were examined using a Nikon microscope under magnifications of 200x, 400x, and 1000x. Pollen identification was made using Kapp's *Pollen and Spores* (1969), and the comparative collection of Southwestern pollen types in the Ethnobotany Lab. 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).

13. The pollen was counted and the absolute pollen ratio was computed (Stockmarr 1971). The absolute pollen ratio is a ratio of fossil pollen counted to a known quantity of exotic *Eucalyptus* control pollen that has been added.

Absolute pollen ratio		No. fossil grains x No. exotics added
(no. pollen grains/gram sediment	=	No. exotics counted x No. grams/sample

14. In some cases, scant economic pollen may be missed entirely in a pollen count due to the numerical overabundance of more prolific pollen taxa or due to poor preservation. In order to ascertain the presence or absence of an important taxon, a second microscope slide preparation was made after screening the pollen residue through a 45 micron mesh screen. Pollen smaller than 45 microns will pass through the screen while the larger pollen fraction remains atop the screen. The larger pollen fraction is then pipetted off and placed in glycerine jelly on a microscope slide. This method concentrates larger pollen and facilitates the encounter of scarce cultivar pollen such as maize and squash that are both larger than 45 microns.

Increasing Ubiquity--An Evaluation of Methods Used in Pollen Analysis

The interpretation of any archaeological data base, including pollen, is dependent upon adequate recovery. In pollen analysis, the standard 200 grain count serves as a reliable basis for data collection, organization, interpretation, and identification of the majority of pollen taxa that will occur in a given sample (Barkley 1934). However it falls short in regard to the recovery of the full set of pollen taxa present in a sample. A crucial fault of the 200-grain pollen count is that it biases the recovery of pollen taxa in favor of numerically abundant taxa, such as pine and Cheno-am, and against numerically scant but important economic taxa such as maize, squash, and cacti. Palynologists have long been aware of this problem and routinely scan a slide preparation after performing a 200-grain count in search of important economic taxa; however, scanning in this manner does not increase the probability of encountering a sought after pollen type, it merely locates the pollen if it is present in the residue.

Maize, squash, and cacti are larger than most pollen taxa, ranging in size from about 70 (maize = 70-120 microns, squash = 100-500 microns, cacti = 100-200 microns) to 500 microns. To increase the concentration of these taxa and thus the probability that they would be encountered, the smaller pollen and debris was sieved from the sample, and the larger pollen was collected from atop the sieve (see Pollen Extraction). The subsequent examination of the concentrated residue resulted in a higher ubiquity of economic taxa, enabling a more lucid evaluation of the pollen record in terms of site and feature function and subsistence patterns through time.

During pollen analysis, separate counts were made of the unsieved pollen residue and the larger sieved fraction (grains greater than 45 microns). When compared, the results indicate that scanning the larger fraction is a useful method for detecting larger sized economic pollen

When ubiquity (presence/absence) of pollen taxa is compared between standard counts and larger fraction scans, several aspects are notable (Table 76). One is that separately, both methods

Table 76. LA 50337, Pollen Sample (n = 65) Ubiquity Differences between Counting Methods

Taxon	Standard Count[1]	Larger Fraction Scan[2]	Total Ubiquity
Opuntia imbricata	24%	42%	44%
Opuntia polyacantha	11	16	18
Cucurbita spp.	16	13	22
Zea mays	88	84	94

[1] 200 pollen grains counted
[2] Pollen fraction larger than 45 microns

parallel each other in terms of recovery, with the exception of the cholla cacti where recovery was enhanced by 20 percent with the use of the larger fraction scan. In all cases, total ubiquity was enhanced by employing both methods, from 6 percent for squash and maize, to 7 percent for prickly pear, to cholla mentioned above. There were many samples from LA 50337 (65), and the high number of samples increased the probability of encountering economic pollen types. In poorly preserved samples (less than 200 grains), ubiquity increased by 22 percent for maize. One would expect that the larger fraction scan would be most useful in sample sets that are few in number and poorly preserved.

Environmental Aspects of the Pollen Record

A surface "pinch" sample of contemporary soils was collected from the vacant lot located adjacent to the west of the north trench (Table 77). The sample contains some of the regional pollen types as well as local pollen from nearby vegetation, disturbance indicators, and economic taxa. It reflects an area disturbed by human activity, where the natural grass and shrub vegetation (sage, Mormon tea, juniper) is diminished in favor of colonizing species (Cheno-ams, sunflower family, greasewood) and a cultivar (maize). Arboreal pollen (pinyon, ponderosa, and spruce) is transported from higher elevations, or from the river course (willow).

The prehistoric pollen record also depicts a site environment impacted by the activities associated with farming and habitation. Arboreal taxa likely grew at some distance from the site, but they appear to have been closer and/or more abundant since more pollen of these types is present. It is also necessary to consider that their use for fuel and construction would add pollen to the record. Nonarboreal taxa, in particular Cheno-ams and greasewood, are abundant, suggesting that these taxa grew in the immediate vicinity of the site. Many of the Cheno-am frequencies are higher prehistorically than in the present record. This may be explained by several factors. One is differential preservation--Cheno-am pollen does not deteriorate as rapidly as other pollen taxa. They have a high relative abundance due to copious pollen production in regard to other taxa. Their weedy growth habit insures vegetative dominance in disturbed environments. Finally, the deliberate utilization of these taxa by site inhabitants for food and fuel has left an artifactual distribution. Cultivars such as maize and squash occur regularly in samples, as do the cacti cholla and prickly pear indicating that these were the taxa utilized for food that are detectable in the pollen record.

Key to Tables

( ) indicates actual numerical counts for samples with < 200 grains
\+ indicates a frequency of less than 1 %
A indicates that the taxon was abundant in a separate scan of the larger pollen fraction (pollen larger than 45 microns)
C indicates that the taxon was common in a separate scan of the larger pollen fraction (pollen larger than 45 microns)
R indicates that the taxon was rare in a separate scan of the larger pollen fraction (pollen larger than 45 microns)
a indicates that aggregates of pollen were noted during the 200 grain count for the taxon indicated

Absolute no. grains/gram - all absolute numbers were calculated on a relation to grams (weight) except where indicated. Milliliters (ml) were used in samples that were measured by volume.

Table 77. LA 50337, Relative Frequencies Derived from Pollen Counts of Site Control Sample, and North Trench

	Site Surface Control 85177, P. 15, vacant lot	North Trench			Kiva			
		85174, P. 2, St. 1, trash	85175, P. 8, F. 1, pit	85176, P.12, St. 4, ash/char.	85192, St. 14, mug fill	86006, St. 14, mug wash	85181 P. #94, St. 21, floor	85150, P. #77, S. Bench
ARBOREAL POLLEN								
Abies sp. (fir)		1						
Picea sp. (spruce)	+R	+						
Pseudotsuga menzeisii (Douglas fir)	+		+					
Pinus sp. (pine)	1C	C	9C	2C		2C	(5)C	(2)R
Pinus edulis (pinyon)	3	26		3	2C	13		
Pinus ponderosa (ponderosa)	4	3		1		3		
Juniperus sp. (juniper)	3		1					
Quercus sp. (oak)	+	2	+					
Salix sp. (willow)	2	5	2					
Ulmus sp. (elm)		+						
Juglans sp. (walnut)		+						
Celtis sp. (hackberry)		+						
Populus sp. (cottonwood)		+						

Table 77. Continued.

	Site Surface Control 85177, P. 15, vacant lot	North Trench			Kiva			
		85174, P. 2, St. 1, trash	85175, P. 8, F. 1, pit	85176, P.12, St. 4, ash/char.	85192, St. 14, mug fill	86006, St. 14, mug wash	85181 P. #94, St. 21, floor	85150, P. #77, S. Bench
NONARBOREAL POLLEN								
Cheno-am (chenopod-amaranth)	45a,C	9	61a,C	65a	90a,C	65a,C	(8)	(4)
Sarcobatus vermiculatus (greasewood)	28	6	6	2	4	3	(1)	
Gramineae (grasses)	5	3R	3		2	+		
H.S. Compositae (high spine composites)	+	5	1					(1)
L.S. Compositae (low spine composites)	4	7	5	1	+			
Artemesia sp. (sage)		17a,C					(1)	
Ambrosia-type (ragweed-type)	+	1		+				
Ephedra sp. (Mormon tea)	+	1	+			1		
Ephedra cf. *nevadensis* (Mormon tea)								
Sphaeralcea sp. (globemallow)		R			+	+		
Onagraceae (primrose family)	R						R	
Leguminosae (bean family)		1						

Table 77. Continued.

	Site Surface Control	North Trench			Kiva			
	85177, P. 15, vacant lot	85174, P. 2, St. 1, trash	85175, P. 8, F. 1, pit	85176, P.12, St. 4, ash/char.	85192, St. 14, mug fill	86006, St. 14, mug wash	85181 P. #94, St. 21, floor	85150, P. #77, S. Bench
Opuntia imbricata (cholla cactus)			R				(1)R	
Opuntia polyacantha (prickly pear)							(1)R	
Cleome sp. (beeweed)		4	4					
Zea mays (maize)	+	1A	7A	14A	1R	10	(4)a	(2)A
Unknown/deteriorated	3	5	2	11	1	3		1
SUMS								
No. grains counted	200	214	200	201	200	200	21	10
Total percent	100	100	100	100	100	100		
Absolute no. pollen grains/gram	8370	18602	12053	5540	23179 ml	2132 ml	2373	3767

Pollen Evidence for Cultivars and Economically Useful Plants

The efficient manner in which LA 50337 was sampled (many samples collected, careful collection of proveniences, attention to chronology and dating when selecting samples for analysis) enabled not only good recovery of pollen taxa, but also a more confident appraisal of the nature of utilization of these taxa both chronologically and functionally.

Cultivars maize and squash were identified in the pollen record. Maize occurs in 93 percent of the samples and squash occurs in 22 percent. The high ubiquity of maize reveals an agricultural function for the site from the beginning of its sampled occupation through the late occupations. In half of the samples it was abundant, comprising between 10 percent and 93 percent of any sample. The high relative abundance suggests that the features containing these amounts were used in direct association with maize, rather than maize being present as the result of ambient pollen.

The squash frequency is underrepresented for two reasons at least. One is that squash produces little pollen relative to other taxa. The other is that the major dietary item is the fruit rather than the flower (although it is consumed as well) and most of the flower will have long since disappeared when harvested fruits are consumed. The light representation of squash from Anasazi period coprolites (36-41 percent) from Hoy House (Johnson Canyon, Colorado), Antelope House (Canyon de Chelly, Arizona), and Chaco Canyon (New Mexico) underscores the low probability of detection in the pollen record (Clary 1984:27). Yet there is ample documentation from both the ethnographic and archaeological record of material culture that squash played a major dietary role.

Semicultivars (or managed weedy taxa) such as Cheno-ams and the sunflower family were also detected. These pollen taxa are difficult to identify to generic or specific levels. However, the macrobotanical record indicates that amaranth (pigweed and winged pigweed), goosefoot (*Chenopodium* spp.), and sunflower were utilized by site inhabitants (Toll, this volume). Other taxa of dietary importance may have been globemallow, sumac, Mormon tea, and beeweed, but their utility is difficult to assess since they are not abundant in the pollen record.

Noncultivated endemic taxa include the cacti cholla and prickly pear. Cholla occurs in 44 percent of the samples, and prickly pear in 18 percent. Both cacti have edible fruits, buds and pads and are known ethnographically to have been a major food source for Southwestern peoples. The high frequency at LA 50337 indicates that it was heavily utilized by the site occupants.

Description of Results by Excavation Unit

North Trench (Table 77)

The excavation of LA 50337 was initiated in the north trench. Paired pollen (#2) and flotation (#3) samples were collected from Stratum 1, a redeposited trash layer radiocarbon dated A.D. 724 ± 130. Pollen sample 2 contained a variety of pollen taxa including a relatively high amount of both pinyon and sage pollen (Table 76) and scant maize pollen. In the scan of the larger pollen fraction, maize was abundant, indicating that its scarcity in the standard count was due to good preservation on behalf of the other taxa. It is also interesting to note that this is one of the few samples to contain the pollen of numerous arboreal taxa--elm, walnut, hackberry, oak, willow, and cottonwood, indicating that these taxa were present in the area during the period of occupation, and of potential use. The presence of cultivar pollen indicates that the pollen was deposited during the occupational period dated. The high sage and pinyon frequencies indicate that these taxa were either components of the trash, were being utilized nearby, or were growing nearby. Their absence in the more poorly preserved samples is likely due to decomposition of the pollen rather than actual removal of the species. Toll (this volume) identified charred maize seeds and the charcoal of juniper, saltbush, sage, cottonwood, and willow (Sample 3).

Pollen sample 8 (paired with flotation sample 10) was collected from Feature 1, an unlined, unburned, bell-shaped storage pit that had been filled with laminated trash similar to the trash layer from Stratum 1. Pollen was well-preserved and contained abundant Cheno-am pollen, a moderate amount of maize pollen and scant cholla cactus pollen. The Cheno-ams contain aggregates (clumps of pollen), indicating that their presence is culturally derived rather than derived incidentally. Cheno-ams served as a food source for the Anasazi (Clary 1983; Scott 1979; Williams-Dean and Bryant 1975). The nutritious seeds were harvested seasonally and the young greens were collected as food in the spring. The complementary flotation sample (10) is thought to have been disturbed by rodent activity.

The pollen sample from the redeposited ash lens mixed with charcoal from Stratum 4, one of the earliest dated lenses from the site (A.D. 487 $\pm$ 100), was not as well preserved as the two previous samples but nevertheless contained an abundance of maize and Cheno-am pollen. The complementary flotation analysis revealed likely food products--hedgehog cactus, pigweed, nightshade family, and maize (Toll, this volume). Pigweed, a Cheno-am, may be responsible for the abundance of this taxon in the sample.

The Kiva

The kiva is situated roughly in the center of the north trench. The upper strat (13-17) of the kiva are alluvial fill deposits consisting of laminated sand mixed with varying amounts of charcoal, artifacts, and gravel. Stratum 14 removal exposed the top of a bench. Pollen was sampled from a mug (Table 77) that was situated in Stratum 14. The pollen from the mug wash was composed of a fairly abundant quantity of maize pollen and a relatively high amount of Cheno-am pollen, indicating that these taxa were components of the substance that had adhered to the inside of the mug. The sample from the fill of the mug contained scant maize pollen and a very high frequency of Cheno-am pollen. The presence of maize and Cheno-ams indicates that the deposits that filled the mug were cultural in nature as well. Samples taken from the bench (#77) and from the kiva floor (Stratum 21, sample #94) were poorly preserved. They both contained maize, Cheno-am, and pine pollen, however.

South Trench (Table 78)

The south trench is separated from the north trench by Figueroh Road. Stratum 8 was a plaza surface. The surface consists of a 15-cm-thick lens of charcoal-stained sandy loam. The pollen sample (#17) selected from the plaza surface was dominated by Cheno-am and pine pollen and also contained other vegetational components such as greasewood, grasses, sunflower family, and beeweed (Table 78). Maize was the only cultivar detected. The scant quantity of maize pollen may be indicative of maize processing activities in the vicinity of the plaza or to ambient inclusion from a nearby activity area.

Table 78. LA 50337, Relative Frequencies Derived from Pollen Counts of South Trench

	South Trench	
	85179, P.#35, F.2, roasting pit	85178, P.#17, St. 8, plaza
ARBOREAL POLLEN		
Pinus sp. (pine)	R	C
Pinus edulis (pinyon)		25
Pinus ponderosa (ponderosa)	(4)	3
Salix sp. (willow)		2
NONARBOREAL POLLEN		
Cheno-am (chenopod-amaranth)	(23)a	49a
Sarcobatus vermiculatus (greasewood)	(7)	5
Gramineae (grasses)	(2)	4
H.S. Compositae (high spine composites)	(3)	4
L.S. Compositae (low spine composites)	(3)	6
Cleome (beeweed)		+
Zea mays (maize)	R	2
SUMS		
Unknown/deteriorated		2
No. grains counted	42	200
Total percent		100
Absolute no. pollen grains/gram	9492	8370

A large "roasting pit," Feature 2, was exposed along the east wall of the trench. It lies above the plaza surface, articulating with the top of Stratum 6, and bears a radiocarbon date of A.D. 992 ± 60. The pollen sample (#35) was poorly preserved. The identification of pollen complements the flotation and macrobotanical analysis. Maize pollen was encountered as a charred maize shank. The pollen of pine (the large charcoal fraction is partially composed of coniferous wood), Cheno-ams (saltbush, a carbonized fuel source, is a Cheno-am), grasses (carbonized grass stems), greasewood, and sunflower family were also encountered. The pollen data does not conclusively indicate that this feature was used for roasting maize; however, it certainly suggests such a function.

Room Block and Surrounding Plaza

The room block and surrounding plaza are located in the southwestern portion of the excavations.

Room 1 (Table 79). Room 1, a rectangular masonry room, was situated on the northeast corner of the room block and had been cut in half by a grader. Two post-occupational fill layers (about 60 cm thick) lay atop Floor 1 (Stratum 25). The ash fill of a shallow, adobe-lined hearth on Floor 1 was sampled for pollen (#103). This sample contained a high amount of Cheno-am pollen, moderate pine and greasewood, scant grass, sunflower family, sage, Mormon tea, and maize pollen. The high frequency of Cheno-am pollen (aggregates noted) may be partially due to the use of saltbush as a fuel source (Toll, this volume). As well, the greasewood pollen may be present as a consequence of the use of greasewood as a fuel.

Near the center of Room 1, a low adobe wing wall was defined. Room 1 was subsequently subdivided into Room 1a and Room 1b. Contemporaneous with the construction of the wing wall is a prepared 1-1.5-cm-thick adobe surface, Floor 2 (Stratum 28). Feature 7, a hearth from Room 1, Floor 2 bears a radiocarbon age of A.D. 1177 ± 100. The pollen sample (#112) from Floor 2 of Room 1a contained scant maize, beeweed, primrose, Mormon tea, sunflower, grass, willow, oak, pine, greasewood, and Cheno-am pollen. Both pigweed and winged pigweed seeds (Cheno-ams) were encountered in the macrobotanical analysis. The well-preserved pollen sample from Floor 2, corner of Room 1b, yielded abundant Zea mays and Cheno-ams (again, pigweed and winged pigweed seeds were encountered). Present also was the pollen of cholla cactus. The presence of these taxa indicate a food processing function in Room 1b.

Room 2 (Table 79)

Room 2 is immediately southwest of Room 1. Floor 1 (Stratum 40) was a well-prepared adobe floor, overlain by 87 cm of rubble and fill, including human bone recovered from the 10 cm of fill above the floor. Surrounding the features on the surface of Floor 1 was a disarticulated human skeleton.

Feature 17 was a partially adobe-lined, unburned pit that had been filled with adobe, charcoal, ash, a burned maize cob, and a few sherds and lithics, and which evidenced rodent disturbance. The pollen sample from the fill of the pit (#161) yielded substantial quantities of Cheno-ams (aggregates noted), pine, and scant maize pollen. Maize kernels and cob parts, carbonized grass seeds, juniper, unburned pigweed, beeweed, and spurge were identified macrobotanical and flotation taxa.

Table 79. LA 50337, Relative Frequencies Derived from Pollen Counts of Room Block

	85182, P.#103, Rm 1, F.5, hearth	85183, P.#112, Rm 1a, St. 28, Fl.2	85184, P.#114, Rm 1b, St. 28, Fl.2	85188, P.#128 Rm 2, St. 40, Fl.1	85195, P.#161, Rm 2, F. 17, pit	85198, P.#169, surface below Rm 2	85185, P.#121, Rm 4, St. 31, Fl.1	85187, P.#126, Rm 4, St. 32, Fl.2	85189, P.#132, Rm 4, F.13, hearth	85190, P.#144, Rm 4, St. 39, Fl.3	85191, P.#147, Rm 4, F. 16, hearth	85193 P.#150, Rm 4, milling bin	85197, P.#164, Rm 7, St. 53, Fl.1
ARBOREAL POLLEN													
Picea sp. (spruce)													
Pinus sp. (pine)	C	C+	C	5C	18C	5C	2C	7C	5C	10C	14C	12C	18C
P. edulis (pinyon)	10	22	3	8	10	4	10	13	5	10	9	7	
P. pondersosa (ponderosa)	+	5	1	4	2	2	3	6	2	2	2	1	
Juniperus sp. (juniper)	1							1R					
Acer sp. (maple)			1										
Quercus sp. (oak)	1												
Salix sp. (willow)	+	1											
NONARBOREAL POLLEN													
Cheno-am (chenopod-amaranth)	64a	49R	72	37	59a,R	80a	43a	41R	17	42a	51a	37C	42
Sarcobatus vermiculatus (greasewood)	10	8	7	12	2	5	21	4	5	5	10	27C	5
Gramineae (grasses)	2	3											

Table 79. Continued.

	85182, P.#103, Rm 1, F.5, hearth	85183, P.#112, Rm 1a, St. 28, Fl.2	85184, P.#114, Rm 1b, St. 28, Fl.2	85188, P.#128 Rm 2, St. 40, Fl.1	85195, P.#161, Rm 2, F. 17, pit	85198, P.#169, surface below Rm 2	85185, P.#121, Rm 4, St. 31, Fl.1	85187, P.#126, Rm 4, St. 32, Fl.2	85189, P.#132, Rm 4, F.13, hearth	85190, P.#144, Rm 4, St. 39, Fl.3	85191, P.#147, Rm 4, F. 16, hearth	85193 P.#150, Rm 4, milling bin	85197, P.#164, Rm 7, St. 53, Fl.1
H.S. Compositae (high spine composites)	2	1	+	+	2R	+		1R			+	+	
L.S. Compositae (low spine composites)	2	1	+	4	+	1	+	2	1	2	2	3	2
Artemisia sp. (sage)	+			+	1	+	2		2	2	4	+	+
Ephedra sp. (Mormon tea)	3				1		+	1	+	4	1	1	
Ephedra nevadensis-type (Mormon tea)		1		2	2			2					2
Sphaeralcea sp. (globemallow)				2	+			1	3	+		+	
Rhus glabra (smooth sumac)				R	+			3	1				
cf. *Rumex* sp. (cf. dock)							+						
Onagraceae (primrose family)			+			R	R	+A					
Euphorbiaceae (spurge family)							1						
Anacardiaceae (cashew family)							1						

Table 79. Continued.

	85182, P.#103, Rm 1, F.5, hearth	85183, P.#112, Rm 1a, St. 28, Fl.2	85184, P.#114, Rm 1b, St. 28, Fl.2	85188, P.#128 Rm 2, St. 40, Fl.1	85195, P.#161, Rm 2, F. 17, pit	85198, P.#169, surface below Rm 2	85185, P.#121, Rm 4, St. 31, Fl.1	85187, P.#126, Rm 4, St. 32, Fl.2	85189, P.#132, Rm 4, F.13, hearth	85190, P.#144, Rm 4, St. 39, Fl.3	85191, P.#147, Rm 4, F. 16, hearth	85193 P.#150, Rm 4, milling bin	85197, P.#164, Rm 7, St. 53, Fl.1
Opuntia imbricata (cholla cactus)			1R	R	+R			1R	+C	R	R		1C
Opuntia polyacantha (prickly pear)				R				2C					
Cleome sp. (beeweed)		1					R						
Cucurbita sp. (squash)								+			+	R	+R
Cucurbita cf. *mixta* (squash)								+R	+R				
Zea mays (maize)	2C	1R	15A	20A	1R	2R	4A	5A	43A	20C	4C	5A	26A
SUMS													
Unknown/ deteriorated	2	1		7	1	2	10	6	17	5	3	7	5
No. grains counted	214	202	200	200	201	201	208	200	200	200	200	200	200
Total percent	100	100	100	100	100	100	100	100	100	100	100	100	100
Absolute no. pollen grains/gram	23030	6917	12556	2897	3605	10816	4677	4185	1837	5022	3107	1693	4305

A second pollen sample was collected from the southeast corner of Floor 1, to the south of the scattered skeletal bone. Maize pollen was abundant. Other economics detected were cholla cactus, prickly pear cactus, and squash, reflecting economic activities in the context of the period during which the floor was used as a surface. The well-preserved sample (#169) from the surface below Room 2 (Stratum 56) yielded abundant Cheno-am pollen and scant maize pollen, indicating that these taxa were utilized in the context of this stratum.

Room 4 (Table 79)

The pollen sample (#121) from the west corner of Floor 1 in Room 4 contained substantial amounts of greasewood and Cheno-am pollen, and a scant amount of maize pollen. The presence of greasewood may be due to its utility as a fuel source.

Pollen sample #132 from the fill of the hearth (Feature 13) on Floor 2 yielded substantial maize pollen as well as cholla and squash (cf. Cucurbita mixta) pollen, indicating that one function of the hearth was the utilization of these plant foods. The complementary flotation analysis identified maize remains as well (Toll, this volume).

The northwest corner of the room surface (Floor 2) contained the pollen of cultivars (squash and maize), cacti, and Cheno-ams, indicating that the floor of Room 2 was a locus of food processing activity.

Floor 3 was separated from Floor 2 by a 8-10 cm layer of wall fall. This earlier floor, like Floor 2, was a prepared adobe surface. Pollen sample #144, from the northwest corner of Floor 3, contained abundant maize pollen, cholla cactus pollen, and Cheno-am aggregates, indicating, once again, economic activity related to consumption of both wild and cultivated plant foods.

Feature 15 is a milling bin with a metate rest. Pollen sample #150, from the top of the mano in the metate rest, contained maize and squash pollen as well as abundant greasewood pollen. The presence of greasewood may be due to its utilization as a food source. Historically, the seeds were used for food (Curtin 1949:31). It may also have been a contaminant from fuel use, or growth post-occupationally, since greasewood is a colonizing taxon. The presence of the other economic taxa however, suggests that it was being utilized as a food source.

A hearth from Floor 3, with a radiocarbon date of A.D. 704 $\pm$ 100 was sampled for both pollen (#147) and flotation (#140). Maize, squash, and cacti as well as greasewood and Cheno-am pollen were encountered. Greasewood macrobotanical remains were absent from the complementary flotation sample. Hence, it is difficult to evaluate the utility of this taxon in the context of the hearth. However, it is likely that its presence is due to its utility as a fuel source or as a contaminant from the ambient pollen during the period of occupation.

Room 4 represents at least three occupations, beginning with the occupation of Floor 3. It appears to have been built at the same time as Rooms 1-3. An occupational hiatus was followed by construction above the post-occupational debris of Floor 3. The room was vacated again, with flooring later laid over some of the older wall debris. After the Floor 1 occupation, the room was abandoned.

In terms of the economic history of this room in relation to plant foods, there is no appreciable change in the pollen record from the earliest through the last occupation. Maize is present in all of the samples, from all of the features, and squash and cacti (mostly cholla) are present in all but one. Although the function of the room may have changed through time, it still appears to have been a locus of food processing activity, either in the context of preparation for consumption, or storage, or both.

Room 7 (Table 79)

Room 7 was located to the southwest of Room 4. A radiocarbon sample from a hearth (Feature 22) on Floor 1 yielded a date of A.D. 745 ± 60. This date in conjunction with the architectural evidence indicates that this surface is roughly contemporaneous with Floors 2 and 3 of Room 4 and with the occupation of Room 1 (Floor 2) and Room 3 (Floor 1). The room is presumed to have functioned as a residence. The pollen sample (#164) from the central area of the floor yielded abundant maize pollen as well as squash and cholla cactus pollen, indicating that a function of this room was in the preparation of food for consumption. Flotation samples 165 and 168 (Toll, this volume) contained goosefoot and pigweed seeds, indicating that these taxa were probable economic sources as well.

Plaza Surrounding the Room Block (Table 80)

At least four separate plaza/occupation surfaces were defined (Plazas 1, 2, 3, and 4). Areas 5, 6, 9, 10, 11, and 12 were outside plaza areas that had in part been partitioned by small wall segments.

Pollen sample 214 was taken from a hearth (Feature 12) located on a post-room block occupational surface (Stratum 35) in Area 5. The sample did not contain sufficient pollen.

Plaza 1. Plaza 1 surfaces appear to be associated with the occupation of the room block.

Plaza 1, Area 5. A ramada had burned and collapsed on top of the plaza surface. Most of the artifacts were recovered from beneath the remains of the burned ramada, including a two-hand quartzite cobble mano. Pollen sample #160 from Stratum 44 of the ramada yielded abundant maize pollen as well as the pollen of cholla cactus. The pollen sample (#163) from under the mano yielded abundant maize pollen as well as cholla cactus and scant beeweed pollen, indicating that the mano was utilized from grinding maize, if not in the processing of the other plant foods mentioned. A radiocarbon sample (from the ramada poles?) yielded a date of A.D. 827 ± 100.

Plaza 1, Area 6. Two large hearths uncovered in Area 6 are presumed to be associated with the occupational surface of Area 5. The bottom ash/charcoal lens of one (Feature 20) was sampled for pollen (#184). This hearth was a large (80 cm wide by 16 cm deep) unlined pit. Maize pollen was abundant. The flotation analysis (#183) yielded charred maize, pigweed, and beeweed, suggesting a maize roasting function, at least, if not the roasting of other plant foods in this feature (Toll, this volume).

Plaza 1, Area 9. Area 9 appears to be temporally associated with plaza Areas 5 and 6. It was a small area situated outside the northeast corner of Room 7. The pollen sample (#178) from a mano from Stratum 71 yielded the pollen of maize, prickly pear cactus, squash, and beeweed, indicating that these taxa were used in the context of the mano.

Table 80. LA 50337, Relative Frequences Derived from Pollen Counts of Plaza around Room Block

	Plaza 5	Plaza 1									Plaza 2		Plaza 3		Plaza 4	
	85186 P.#124 F.12 hearth	85194 P.#160 (5) ramada St. 44	85196 P.#163 (5) mano	85202 P.#184 (6) F.20 hearth	85200 P.#178 (9) mano	85204 P.#187 (10) St.71 mano	86003 (11) vessel contact	86001 (11) sherd wash, vessel	86002 (11) sherd in vessel	85203 P.#106 (11) F.28 hearth	85209 P.#219 (9-10) F.37 hearth	85205 P.#197 (11) F.35 hearth	85206 P.#200 (11-12) hearth	85199 P.#171 F.23, hearth	85210 P.#221 St.78 trash	85211 P.#232 St.88
ARBOREAL POLLEN																
Abies sp. (fir)								R								
Picea sp. (spruce)					+			R								
Pinus sp. (pine)		6C	4C	8C	6C	C	1C	2C	4C	C	5C	(8)C	C	(2)R	R	6C
P. edulis (pinyon)		3	5	6	7	8	14	8	10	3	16	(9)	4	(3)	1	14
P. pondersosa (ponderosa)		2	1	1	3	2	1	3	5	3	6	(3)	2	(1)	2	4
Juniperus sp. (juniper)						1						(1)	+		1	
Salix sp. (willow)						+			+				+		1	
NONARBOREAL POLLEN																
Cheno-am (chenopod-amaranth)		19	41a	32a	56a	56a	30	45	38	27a	49a	(64)	38a	(7)a	22a	31a
Sarcobatus vermiculatus (greasewood)		6	7	3	19a	4	16	32	25	5	6	(37)a	8	(1)	1	6

Table 80. Continued.

	Plaza 5	Plaza 1									Plaza 2		Plaza 3		Plaza 4	
	85186 P.#124 F.12 hearth	85194 P.#160 (5) ramada St. 44	85196 P.#163 (5) mano	85202 P.#184 (6) F.20 hearth	85200 P.#178 (9) mano	85204 P.#187 (10) St.71 mano	86003 (11) vessel contact	86001 (11) sherd wash, vessel	86002 (11) sherd in vessel	85203 P.#106 (11) F.28 hearth	85209 P.#219 (9-10) F.37 hearth	85205 P.#197 (11) F.35 hearth	85206 P.#200 (11-12) hearth	85199 P.#171 F.23, hearth	85210 P.#221 St.78 trash	85211 P.#232 St.88
Gramineae (grasses)	R					4	+	+							7	
H.S. Compositae (high spine composites)		13	7	+		6	+	R			+		2		5	+
L.S. Compositae (low spine composites)		2	2	+	1	+		+		+	3	(4)	3		3	
Artemisia sp. (sage)		2		+							+	(2)	+		1	1
Ephedra sp. (Mormon tea)			+			1		2	2	1	2		1		1	+R
Ephedra nevadensis-type (Mormon tea)			+								1					3
Sphaeralcea sp. (globe-mallow)		+	2			+			Ca	1	1					
Rhus sp. (smooth sumac)				+				+			+	(1)				
Onagraceae (primrose family)								R	+							+R
Convolvulaceae (morning glory family)												(1)	1			
Caryophyllaceae (pink family)																
Leguminosae (bean family)													+			
Euphorbiaceae (spurge family)													R			
Opuntia imbricata (cholla cactus)		+R	+R					+C	R	+R	1		R		1R	+R

Table 80. Continued.

	Plaza 5	Plaza 1									Plaza 2		Plaza 3		Plaza 4	
	85186 P.#124 F.12 hearth	85194 P.#160 (5) ramada St. 44	85196 P.#163 (5) mano	85202 P.#184 (6) F.20 hearth	85200 P.#178 (9) mano	85204 P.#187 (10) St.71 mano	86003 (11) vessel contact	86001 (11) sherd wash, vessel	86002 (11) sherd in vessel	85203 P.#106 (11) F.28 hearth	85209 P.#219 (9-10) F.37 hearth	85205 P.#197 (11) F.35 hearth	85206 P.#200 (11-12) hearth	85199 P.#171 F.23, hearth	85210 P.#221 St.78 trash	85211 P.#232 St.88
Opuntia polyacantha (prickly pear)						1R	1		R						+R	
Cleome sp. (beeweed)			+			2							1		21	
Cucurbita sp. (squash)						+						(1)R				
Cucurbita cf. *mixta* (squash)							+R		R							
Zea mays (maize)		34C	23A	37A	6R	11C	34A	4C	12C	53C	7C	(10)R	36C	(8)R	30A	26A
SUMS																
Unknown/ deteriorated		14	5	12	1			+	4	3	5	(29)	2	(10)	2	4
No. grains counted	0	200	200	200	201	207	202	202	200	201	200	170	210	32	218	200
Total percent		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Absolute no. pollen grains/gram	0	4636	2626	1815	10324	4393	14266ml	28533 ml	25111 ml	5938	1191	1768	10206	945	10595	3913

Plaza 1, Area 11. The hearth (Feature 28) sampled from Area 11 appears to have been associated with the occupation of Room 8. Room 8 was a later addition onto Room 7. Feature 28 yielded abundant maize pollen and cholla cactus pollen (#186), suggesting that the hearth was used for roasting maize and perhaps cholla cactus buds or stems. Three pollen samples were analyzed from the large Mancos Corrugated jar found near the hearth (Feature 86). One sample was taken from the inside vessel contact, another was taken from the washed inside surfaces of the potsherds, and the last was taken from the inside surface wash of a large potsherd that had been placed at the bottom of the vessel. The three samples yielded abundant maize, in particular the vessel contact sample, indicating that maize was stored or cooked in the vessel. Cholla pollen was common, and prickly pear pollen was present in the vessel contact sample. Two other taxa of note are globemallow and primrose. Both are ethnobotanically useful condiments and medicines and may have been placed in the vessel for these purposes.

Plaza 2. Feature 37, a shallow, unlined basin-shaped hearth in Stratum 72 was sampled for pollen (#219). Maize pollen was fairly common, indicating that the hearth was a locus of maize utilization. Feature 35, a second hearth, was a shallow, basin-shaped pit partially lined with cobbles and sandstone slabs. Although the pollen was poorly preserved, it yielded both squash and maize pollen indicating that these taxa were used in the context of this feature.

Plaza 3. Plaza 3 predates the occupation of the room block. Feature 38 was situated beneath Room 8 and Area 12. It was a very large, oblong pit (1.31 m by 73 cm by 31 cm) in size. The pollen sample (#200) taken from the hearth yielded abundant maize pollen as well as cholla cactus and beeweed pollen. Since the feature predates the major occupation of the room block (A.D. 735 ± 70), it can be suggested that even during the earlier occupation of the site, maize processing was a distinct activity. Although the unambiguous remains of economic plants were not found in the accompanying flotation sample (#201, Toll, this volume), the remains of maize as well as a substantial diversity of annual weed seeds were encountered in Feature 23, a shallow, unlined basin hearth.

Plaza 4. Plaza 4 is located north of Room 1 and is probably associated with the room block occupation. The pollen sample (#221) from the trash layer deposited on top of the Plaza 4 surface (Stratum 88) yielded abundant maize and beeweed pollen as well as cholla and prickly pear pollen. The presence of beeweed may be due to economic use, or it may be a function of its colonization of the trash heap, since it commonly sprouts in disturbed areas around pueblos. The complementary flotation sample was also rich in economic floral remains (Toll, this volume). The pollen sample from the plaza surface, Stratum 88, also contained abundant maize pollen, as well as the pollen of cholla cactus.

Room 13 and Plaza (Table 81). A pollen sample (#212) from Stratum 87 of the plaza yielded abundant maize pollen as well as the pollen of cholla and prickly pear cactus. A pollen sample (#203) was taken from Feature 36, Stratum 82, the remains of a burned ramada with a radiocarbon date of A.D. 477 ± 80). The ramada had burned and collapsed against the eastern wall of a milling room and onto the plaza surface. This sample contained an unusually high amount of maize pollen (87 percent), indicating that maize was present in abundance when the ramada burned. A vessel (pollen samples from vessel contact and inside surface of sherd wash) from Feature 36 contained the highest amount of maize pollen encountered in any sample from LA 50337, as well as cholla cactus pollen. Feature 39 was a milling room. In the southeast corner of the room was a milling bin with a granite slab metate set into the bottom of it. The pollen sample (#249) taken from beneath the metate yielded the pollen of maize and cholla cactus, indicating that these taxa were utilized in the context of the milling bin.

Table 81. LA 50337, Relative Frequencies Derived from Pollen Counts of Room 13 and Plaza

	Plaza Room 13							Room 13 and Feature 53, N. of Rm 13				
	85207 F.36, St.82, ramada	85208 P.#212 St.87, plaza	86004 F.36, vessel fill contact	86005 F.36, vessel sherd wash	85216 P.#249 F.39, metate	85212 P.#238 F.43, hearth	85215 P.#247 F.40, hearth	85214 P.#245 F.1, metate	85217 P.#255, Fl.2	85221 P.#265, F.46, hearth E	85222 P.#267, F.46, hearth W	85230 P.#319 F.53, hearth
ARBOREAL POLLEN												
Abies sp. (fir)								+			1	
Picea sp. (spruce)							+	+				
Pinus sp. (pine)	3C	4C	1C	1C	4C	4C	1C	28C	4C	(6)C	(1)R	C
P. edulis (pinyon)	1	3	2	2	10	6	13	10a	14			(13)
P. pondersosa (ponderosa)		1		1	3	3	1		3			
Juniperus sp. (juniper)			+			1	2					
Salix sp. (willow)							1	1			R	
Juglans sp. (walnut)							+					
NONARBOREAL POLLEN												
Cheno-am (chenopod-amaranth)	1	18a	4	2	55a	50	59a	34a	66a	(18)a	(11)	(7)
Sarcobatus vermiculatus (greasewood)	+	+		+	4	30	2	6	3	(3)		

Table 81. Continued.

	Plaza Room 13							Room 13 and Feature 53, N. of Rm 13				
	85207 F.36, St.82, ramada	85208 P.#212 St.87, plaza	86004 F.36, vessel fill contact	86005 F.36, vessel sherd wash	85216 P.#249 F.39, metate	85212 P.#238 F.43, hearth	85215 P.#247 F.40, hearth	85214 P.#245 F.1, metate	85217 P.#255, Fl.2	85221 P.#265, F.46, hearth E	85222 P.#267, F.46, hearth W	85230 P.#319 F.53, hearth
Gramineae (grasses)							1	3				
H.S. Compositae (high spine composites)		2		+	+		9			(3)		(1)
L.S. Compositae (low spine composites)	+	3	+		3	1	2	2	+	(1)		
Artemisia sp. (sage)	+				1		+		+	(1)		
Ambrosia-type (ragweed-type)		1					+			(1)		(1)
Ephedra sp. (Mormon tea)		+					1		1			
Ephedra nevadensis-type (Mormon tea)	+				+		1	8				
Sphaeralcea sp. (globemallow)	R				1				2R			
Onagraceae (primrose family)								R	R	R		
Opuntia imbricata (cholla cactus)		R	R	R	R				C+			R

Table 81. Continued.

	Plaza Room 13							Room 13 and Feature 53, N. of Rm 13				
	85207 F.36, St.82, ramada	85208 P.#212 St.87, plaza	86004 F.36, vessel fill contact	86005 F.36, vessel sherd wash	85216 P.#249 F.39, metate	85212 P.#238 F.43, hearth	85215 P.#247 F.40, hearth	85214 P.#245 F.1, metate	85217 P.#255, Fl.2	85221 P.#265, F.46, hearth E	85222 P.#267, F.46, hearth W	85230 P.#319 F.53, hearth
Opuntia polyacantha (prickly pear)		R										
Cleome sp. (beeweed)							+	+R		(3)		
Cucurbita sp. (squash)									R			
Zea mays	87A	62A,a	93A,a	92A	12C		6R	+R	2C	C	(1)C	(4)R
SUMS												
Unknown/ deteriorated	4	3		1	4	5	1	3	5	(1)		(6)
No. grains counted	202	201	200	201	201	202	202	203	200	37	13	32
Total percent	100	100	100	100	100	100	100	100	100			
Absolute no. pollen grains/gram	5636	6730	17385/ ml	21631/ ml	3090	4909	2871	5366	5580	1507	2448	502

Feature 40 consisted of an unburned and adobe-lined, circular, shallow basin hearth. Maize was present in the pollen sample (#247) analyzed from the upper fill (Stratum 96) of the feature. The complementary flotation sample (#248) yielded an array of economic taxa (Toll, this volume), indicating a mixed use of this feature in the processing of plant foods.

The pollen sample (#238) from Feature 43, fill, yielded no taxa indicative of food use. However, greasewood pollen was abundant, suggesting that it may have been a discarded fuel source.

Room 13 (Table 81)

Room 13 was a rectangular masonry room measuring 1.90 m by 2.65 m. The "roof fall" layer was Stratum 97. Stratum 101 contained Floor 1, from which a pollen sample (#245) was taken from under one of a pair of very large metates. Maize pollen was present although in scant quantity.

Floor 2 was constructed of adobe, inlaid with cobbles and sandstone slabs, overlain by a thin layer of plaster. The pollen sample (#255) taken from the floor near the south wall yielded maize, squash, and cholla cactus pollen, indicating that food preparation or storage was a function of this room during the period when Floor 2 was occupied.

Two hearth/warming pit features were present in the western (Feature 45) and eastern (Feature 46) sides of the room. Feature 45 fill had a radiocarbon date of A.D. 1013 $\pm$ 60. Feature 46 was divided into two adobe-lined pits. The pollen sample (#265) taken from the ash lens present on the bottom of the pit was poorly preserved although it yielded maize pollen. The accompanying flotation sample (#264) contained maize remains as well (Toll, this volume). A small, oxidized patch of soil in the southwestern portion of the pit yielded poorly preserved maize pollen (#267).

Feature 53, North of Room 13 (Table 81)

A backhoe trench dug north of Room 13 located, among other features, a hearth (Feature 53). It consisted of an unlined shallow basin pit with oxidized sides filled with ash and bits of charcoal and it had a radiocarbon date of A.D. 1291 $\pm$ 60. The pollen sample taken from the hearth was poorly preserved but yielded the pollen of maize and cholla cactus. The accompanying flotation sample was rich in economic taxa (Toll, this volume).

North Plaza (Table 82)

The north plaza was situated about 20 m north of Room 13. Feature 41 was a large pit encountered during excavation of Test Pit 16. The pit was unlined and filled with an unconsolidated mixture of ash and charcoal that appears to have been discarded into the pit from domestic hearths rather than burned in situ. The pollen sample from this fill yielded the economic taxa of maize, cholla (abundant in the large fraction scan), and prickly pear cacti. The complementary flotation (#244) and macrobotanical samples yielded a diversity of potentially useful economic plants, including maize, sedge, goosefoot, beeweed, the nightshade family, and the mallow family (Toll, this volume), indicating the wide variety of edible foods available for utilization by the site inhabitants.

Table 82. LA 50337, Relative Frequencies Derived from Pollen Counts of North Plaza

	North Plaza						
	85213 P.#243, F.41 pit (trash)	85218 P.#257, St.110, under ground stone	85219 P.#258 F.49, hearth	85224 P.#270 F.47, milling bin	85220 P.#261 F.47, milling bin	85223 P.#269 F.51, hearth	85225 P.#272, F.50, hearth
ARBOREAL POLLEN							
Pinus sp. (pine)	5C	14C	(3)R	C	1R	(2)R	(2)R
P. edulis (pinyon)	5	7	(6)	4	4		
P. pondersosa (ponderosa)	8	2	(2)	1	+		
Juniperus sp. (juniper)		+					
Salix sp. (willow)					1		
NONARBOREAL POLLEN							
Cheno-am (chenopod-amaranth)	41	45a	(19)	7	14	(9)	(5)
Sarcobatus vermiculatus (greasewood)	6	1			3		
Gramineae (grasses)			(5)		+		
H.S. Compositae (high spine composites)	+	1	(2)	+	1		
L.S. Compositae (low spine composites)	3	3	(5)	+	1	(1)	(1)
Ambrosia-type (ragweed type)	1				6		
Ephedra sp. (Mormon tea)			(1)	+	+		(1)
Ephedra nevadensis-type (Mormon tea)	1	+		+			
Sphaeralcea sp. (globe-mallow)	1a		(3)				

Table 82. Continued.

	North Plaza						
	85213 P.#243, F.41 pit (trash)	85218 P.#257, St.110, under ground stone	85219 P.#258 F.49, hearth	85224 P.#270 F.47, milling bin	85220 P.#261 F.47, milling bin	85223 P.#269 F.51, hearth	85225 P.#272, F.50, hearth
Cruciferae (mustard family)					1		
Opuntia imbricata (cholla cactus)	3A			R			
Opuntia polyacantha (prickly pear)	+R	1		R			
Cleome sp. (beeweed)					R		
Cucurbita foetidissima (buffalo gourd)		1					
Zea mays (maize)	11R	18R	(66)c	86A	64C	(9)R	R
SUMS							
Unknown/deteriorated	16	9	(5)	1	2	(1)	(3)
No. grains counted	200	200	117	200	210	22	12
Total percent	100	100		100	100		
Absolute no. pollen grains/gram	6150	1514	655	4018	6878	328	430

Excavation continued beneath the feature, through Stratum 106, where a milling bin was encountered. The occupation surface, Stratum 110, was defined by the presence of a thin, compacted layer of sand, with the milling bin (Feature 47/48) located at the southern end of this area. The pollen samples (#262 and #270) that were taken from the bottom of the feature contained high amounts of maize pollen and scant prickly pear and cholla cactus pollen.

A possible hearth feature (#49) was situated on the northern edge of the surface, about 80 cm north of the milling bin, and it bore a radiocarbon date of A.D. 796 ± 50. The pollen sample taken from the fill (which may or may not have been redeposited into the feature from another hearth) contained abundant maize pollen. The accompanying flotation sample also contained maize as well as sedge and pigweed (Toll, this volume).

Feature 50 was a small, unlined basin pit/hearth situated about 40 cm east of Feature 49. The pollen from this sample (#272) was poorly preserved and not diagnostic.

Feature 51, another hearth located about 40 cm south of Feature 50, yielded scant pollen, but maize was the most abundant taxon found (sample #269).

The pollen sample from beneath the two-hand mano located 20 cm north of Feature 51 yielded a substantial amount of maize pollen as well as scant prickly pear pollen.

Pit Structure (Table 83)

During the excavation of the telephone cable trench, a pit structure was located between the room block and Test Pit 13. Only the northeastern quarter of the structure was excavated. This structure predates the occupation of the room block (ca. A.D. 750, while Cortez Black-on-white ceramics are thought to date a century or more later). A 3-15 cm layer of windblown sand in the northern part of the room indicated that the structure had been abandoned before the roof burned and collapsed. A corrugated jar found on the sand (Stratum 118) above the occupational surface yielded a fill sample (#304) that contained abundant maize and scant cholla and prickly pear pollen. Since maize debris (cobs, husks) were present in the fill layers, and were used as roofing material, it is difficult to determine whether the presence of maize is due to deliberate placement of maize in the jar, from a dusting of maize pollen from the roof above, or from its inclusion in the post-occupational fill of the jar. The high relative frequency of maize pollen suggests that the jar was filled purposefully with maize kernels, pollen, or gruel.

The mostly burned floor of the pit structure (Stratum 119) consisted of a poorly prepared plaster surface about 1 cm thick. The pollen sample from the floor (#313) was poorly preserved and nondiagnostic, as was the pollen sample from Feature 52, a hearth located in the center of the floor.

The bench surfaces of the pit structure were burned. Both pollen samples were poorly preserved (north bench #316, south bench #324), but yielded maize pollen in good quantity, especially from the south bench.

The hearth (Feature 21) exposed in the water-line trench about 2 m south of the pit structure contained poorly preserved pollen (#180), although it contained maize pollen.

Table 83. LA 50337, Relative Frequencies Derived from Pollen Counts of Pit Structure, Hearth in Backhoe Trench, and Cobble-Lined Hearth

	Pit Structures					F.21, Hearth, Backhoe Trench	N of LA 50337, Backhoe Trench
	85226 P.#304 St. 118, jar fill	85227 P.#313 St. 119, Fl.1	85228 P.#314 F. 52, St. 120	85229 P.#316 N.Bench	85213 P.#324 S.Bench	85201 P.#180 F.21, hearth	85232 P.#332, Cobble hearth
ARBOREAL POLLEN							
Pinus sp. (pine)	1C	(62)C		C			
P. edulis (pinyon)	13			(27)	(8)R		(3)R
P. pondersosa (ponderosa)	3			(3)			
Juniperus sp. (juniper)	1						
NONARBOREAL POLLEN							
Cheno-am (chenopod-amaranth)	33a	(13)		(14)	(12)	(5)	
Sarcobatus vermiculatus (greasewood)	2	(6)				(5)	
Gramineae (grasses)				(8)			
H.S. Compositae (high spine composites)				(3)			
L.S. Compositae (low spine composites)	2	(1)					
Ambrosia-type (ragweed type)	+			(1)			
Ephedra sp. (Mormon tea)	2	(1)		(1)			
Ephedra nevadensis-type (Mormon tea)				(1)			
Sphaeralcea sp. (globe-mallow)	1						
Onagraceae (primrose family)				(1)			

Table 83. Continued.

	Pit Structures					F.21, Hearth, Backhoe Trench	N of LA 50337, Backhoe Trench
	85226 P.#304 St. 118, jar fill	85227 P.#313 St. 119, Fl.1	85228 P.#314 F. 52, St. 120	85229 P.#316 N.Bench	85213 P.#324 S.Bench	85201 P.#180 F.21, hearth	85232 P.#332, Cobble hearth
Rhus sp. (sumac)	+						
Opuntia imbricata (cholla cactus)	+R						
Opuntia polyacantha (prickly pear)	R						
Cucurbita foetidissima (buffalo gourd)					(1)		
Zea mays (maize)	24C	(1)		(2)R	(13)C	(6)R	
SUMS							
Unknown/deteriorated	19	(12)		(1)		(1)	
No. grains counted	201	96	0	61	34	17	3
Total percent	100						
Absolute no. pollen grains/gram	3206	230	0	999	676	89	266

Features Exposed Under the Highway (Table 83)

The cobble hearth (Feature 56) northwest of the pit structure, exposed during the removal of highway asphalt, did not contain sufficient pollen (#332) and was not diagnostic.

Seasonal Activities Reflected in the Pollen Record

The presence of certain economically useful taxa highlights activities undertaken from spring to fall at LA 50337. The collection of cholla buds and their subsequent roasting would occur in springtime. Maize cultivation would require a late spring planting (mid-May or early June) and a September to October harvest depending upon weather conditions. The collection of Cheno-am greens would be another springtime activity. The harvest of the nutritious Cheno-am seeds and prickly pear tunas would take place from mid-summer until the fall. Winter occupation is difficult to detect palynologically, although it should be noted that the above-mentioned foods, once desiccated by roasting or air drying, could be stored and utilized at any time.

Chronologic Utilization of Economic Taxa

The radiocarbon dating and consequent ordering of the site chronology has been problematic. The subsequent dating of maize macrobotanical remains indicates that the radiocarbon dates err by as much as 250 years. Vierra (this volume) indicates that some of the dated wood had been scavenged. At present, broad generalizations may be made about the occupational sequence. Table 84 is based upon the occupational sequence described by Vierra (this volume).

In this study, four taxa--maize, squash, cholla cactus, and prickly pear cactus--are considered to be accurate indicators of economic activity related to food procurement and agricultural activity. Pollen samples from dated features and features associated with the occupational periods are plotted chronologically (Table 84). Certain aspects of the chronologic plant use record are notable:

1. Above all, the uniformity with which the economic taxa occur consistently through time indicates a long-term agricultural function for LA 50337.

2. Maize is present from the beginning (fifth century) to the end (thirteenth century) of the dated occupations. Maize pollen is abundant in numerous features throughout the occupational sequence, indicating that maize was a major crop.

3. Cholla cactus and prickly pear cactus are initially detected during the second occupational sequence (eighth century). The absence of these taxa during the earlier occupation may be due to small sample size or to their later introduction. The ubiquity of the cacti indicates that they were an integral part of the economic history of the site throughout most of its occupation. Squash appears in the pollen record during the third occupational sequence (tenth-eleventh centuries). It has a low ubiquity, which as discussed earlier, is more likely a function of its low resolution in the pollen record than its lack of utilization.

Table 84. Occurrence of Economic Pollen Taxa by Occupational Period from Features

Century A.D.	Location	Stratum	Feature	Pollen #	Economic Pollen Taxa[1]			
					Maize %	Squash	Cholla	Prickly Pear
I. Sixth	N. Trench	4		12	14A			
II. Eighth	Pit Structure			304	24C		+R	R
				313	(1)			
				314				
				316	2R			
				324	13C			
	Feature 21	69	21	180	(6)R			
	N. Plaza			257	18R			1
				258	(66)C			
				269	(9)R			
				270	86A		R	R
				272	R			
	Plaza 3			169	2R			
III. Tenth-Eleventh	Room Block		Room 1	103	2C			
				112	1R			
				114	15A			
			Room 2	128	20A	R	R	R
				161	1R		+R	

Table 84. Continued.

Century A.D.	Location	Stratum	Feature	Pollen #	Economic Pollen Taxa[1]			
					Maize %	Squash	Cholla	Prickly Pear
			Room 4	121	4A			
				126	5A	+R	1R	2C
				132	43A	+R	+C	
				144	20C		R	
				147	4C	+	R	
				150	5A	R		
			Room 7	164	26A	+R	1C	
			Plaza 2	197	(10)R	(1)R		
				219	7C			
			Plaza 1	160	34C		+R	
				163	23A		+R	
				184	37A			
				178	6R			
				187	11C	+		1R
				186	53C		1	
		66	26	vessel	34A	+R	+C	1
			Plaza 4	232	26A		+R	
	Kiva			77	(2)A			
				94	(4)A		(1)R	(1)R
	Stratum 1	1		2	1A			

Table 84. Continued.

Century A.D.	Location	Stratum	Feature	Pollen #	Economic Pollen Taxa[1]			
					Maize %	Squash	Cholla	Prickly Pear
	Feature 1	5	1	8	7A		R	
	Plaza	8		17	2			
	Room 13			245	+R			
				255	2C	R	+C	
				265	C			
				267	(1)C			
	Room 13 and Plaza			212	62a,A		R	R
				249	12C		R	
				238				
				247	6R			
	Feature 41	92	41	243	11R		3A	+R
IV. Twelfth	Feature 2		2	35	R			
	Feature 12		12	124				
V. Thirteenth	N. of Room 13		53	319	(4)R			

[1] Numbers represent relative frequencies of pollen derived from 200 grain pollen counts in Tables 2-8
( ) indicates actual numbers in samples with less than 200 grains
C Common in larger fraction scan
A Abundant in large fraction scan
R Rare in larger fraction scan
+

4. Of the cacti species, cholla has a higher ubiquity than prickly pear, which may be a reflection of differences in utilization. For example, the unopened cholla flower buds are traditionally gathered for roasting in springtime (Greenhouse et al. 1981:228-229). As a consequence, the pollen does not disperse until the buds are opened during preparation for consumption at the site. At LA 50337, the ubiquity of cholla was high and in most cases the relative frequencies were low. A similar low relative frequency (less than 5 percent) was noted by Greenhouse et al. (1981:236-237) in a pollen analysis of an experimental cholla roasting pit, suggesting that even low frequencies may point to areas of concentrated cholla utilization. Prickly pear cactus may be lightly represented due to the practice of gathering the mature fruits and pads in the late summer or early fall. By then most of the pollen from the flowers has long since dispersed. Low amounts of prickly pear pollen would be expected to be introduced to the site as a consequence of tuna or pad processing.

Comparison of Pollen Taxa at LA 50337 to Other Anasazi Period Sites

Numerous pollen studies of Anasazi period sites reveal a repetitive and predictable pattern of plant food utilization in the San Juan Basin, with slight geographical variations on the same theme. Based upon constraints imposed by environmental limitations (i.e., edaphic conditions, water availability, length of growing season), the Anasazi made use of the greatest variety of plants available for subsistence but depended upon certain ones through time. In general, cultivars that occur repeatedly in the pollen record are maize and squash. Semicultivars or managed plants are the Cheno-ams, beeweed, the low spine and high spine sunflowers (including *Helianthus,* the domesticated sunflower). Wild plants that occur are the grasses, cacti, yucca, *Ephedra,* globemallow, and purslane (Table 85) (Clary 1986). LA 50337 fits this pattern well.

A comparison of taxa among sites gives us some indication of the dynamics of plant utilization and site and feature function. When the pollen record of LA 50337 is compared to other sites nearby, certain differences and similarities relating to subsistence activities become apparent. In terms of location, size, and time period, several sites from a study by Gish (1984) are comparable to LA 50337. Sites 134, 140, 142, and 143 of the San Juan Coal Lease are situated on a floodplain basin fed by Westwater and Shumway arroyos, which drain south into the San Juan River, 10 miles west of LA 50337. The overall pollen record mirrors that of LA 50337, with the exception that another cultivar, cotton (*Gossypium* sp.), was encountered in scant quantity at sites 142 and 143, which were occupied during late PII and PIII times. At these sites, prickly pear seems to have been exploited more than cholla cactus (the opposite is true at LA 50337), possibly a reflection of the differences in localized abundance of each species, or of a more seasonal occupation of Sites 142 and 143 compared to LA 50337. An emphasis on gathered plants was more detectable at Site 143 (a room block with seven rooms and a kiva), based upon the presence of substantial quantities of high spine sunflowers and grasses (Gish 1984:201). Of its history, the economic evidence suggested a changing subsistence pattern through time at Site 143. The initial room block construction was accompanied by a variety of gathering and intense agricultural activities. By the end of the occupation, the agricultural emphasis appears to have diminished, and gathering activities increased (Gish 1984:208). In contrast, at LA 50337, the emphasis appears to have been on cultivars for the duration of its occupation, since the abundance of cultivar pollen, with the exception of Cheno-ams, consistently overshadows the pollen of gathered plants.

Table 85. Ubiquity of Economic Plant Taxa in Anasazi Period (Basketmaker III-Pueblo III) Pollen Samples in the San Juan Basin[1]

Taxon	Ubiquity (%)	Mean Relative Frequency (%)	Standard Deviation (%)
Herbs and Shrubs			
Artemisia spp.	71	2	2
Ephedra spp.	50	1	1
Sarcobatus sp.	33	2	3
Yucca spp.	3	1	0.03
Ribes sp.	1	1	0
Cactaceae	17	1	1
Cheno-am	100	40	13
L.S. Compositae	56	8	6
H.S. Compositae	45	3	2
Ambrosia sp.	35	10	8
Sphaeralcea sp.	18	2	2
Portulaca sp.	3	1	1
Cleome sp.	24	5	5
Cruciferae	3	1	0.04
Onagraceae	4	1	0
Cultivars			
Zea mays L.	60	8	7
Cucurbita spp.	4	1	1
Gossypium sp.	1	1	0

[1] Pollen percentages calculated from samples from features with 200 pollen grains (from Clary 1986); N=460

Summary and Conclusions

The pollen analysis of LA 50337, in contrast to most other Anasazi period sites, offered a unique look at the pollen record because LA 50337 is located in an area of good water availability and potential for agriculture, and has a long history of occupation. Partly as a reflection of the long-term intermittent occupation, the pollen record was particularly revealing in terms of environment, subsistence, and to some extent, seasonality.

A total of 30 taxa were identified. Of these, 13 were arboreal, 15 were nonarboreal, and two were cultivars. The ubiquity and frequency with which these taxa occur reflects a depauperate sage grassland impacted by the activities of human occupation such as agriculture, construction, fuel use, and habitation. Throughout the stratigraphy of the site, evidence for the intensive utilization of maize and the gathering of wild food sources is indicated. Of note is the increased utilization of cholla cactus in comparison to other Anasazi sites of the same time period. A year-round occupation is inferred in areas of LA 50337 with well-preserved pollen, especially during the third occupation of the site (room block and associated plazas, and Room 13). A spring through fall occupation is inferred by the presence of specific gathered and cultivated taxa such as the cacti, maize, and squash. The high number of different economic taxa in features suggests a winter occupation where stored foods were utilized together or sequentially.

SUMMARY

LA 50337 is a multicomponent Anasazi residential site located in the La Plata River Valley. Five major occupational episodes were defined at the site, based on the stratigraphic, ceramic, and radiocarbon evidence. Occupation I consists of an ash/charcoal discard deposit in the north trench and an isolated hearth situated under Plaza 3 and the room block. Radiocarbon samples from these features yielded dated of A.D. 487 ± 100 and 621 ± 80, respectively. A few sherds of a Sambrito Brown Ware jar were recovered from an ash/charcoal lens. This occupation was temporally placed at around the sixth century A.D. As already pointed out, radiocarbon dates may be older than the cultural event with which they are associated. However, they are still earlier than the other dates recovered from the site.

Occupation II is associated with the pit structure, a hearth near the pit structure, the north plaza occupational surface, and Plaza 3 under the room block. Radiocarbon dates from the pit structure consist of A.D. 714 ± 60 and 786 ± 60 and the nearby hearth of A.D. 879 ± 80. Dates of A.D. 796 ± 50 and 735 ± 70 were recovered from the north plaza surface and Plaza 3, respectively. Cortez Black-on-white pottery was present within the pit structure and nearby hearth, an Abajo Polychrome sherd was found on the north plaza surface and some Mancos Corrugated sherds were located on Plaza 3. This occupation was temporally placed around the eighth century A.D. It is earlier than the dates traditionally used for Cortez Black-on-white. However, the radiocarbon dates from the pit structure, which are associated with Cortez Black-on-white pottery, do appear to be accurate.

Occupation III is the largest sampled portion of the site, including the room block, the kiva, and Room 13. Several radiocarbon samples were collected from floors within the room block. However, these dates were determined to be too old, presumably representing scavenged fuel. The most accurate dates from the room block include A.D. 941 ± 90 and possibly 827 ± 80. Dates from the kiva are A.D. 786 ± 90 and 879 ± 60 and from Room 13 1013 ± 60. Ceramics associated with the room block include Cortez Black-on-white and Mancos Black-on-white, with Mancos Black-on-white present in the kiva and Room 13. This occupation is temporally placed around the tenth and eleventh centuries A.D.

Occupation IV is associated with an isolated roasting pit and a small occupational surface present in Area 5 above Plaza 1 in the room block area. The roasting pit yielded a radiocarbon date of A.D. 992 ± 60 and contained McElmo Black-on-white and Mesa Verde Corrugated ceramics. The occupational surface of Area 5 divided the stratigraphy containing Cortez Black-on-white and Mancos Black-on-white below it from McElmo Black-on-white and Mesa Verde Black-on-white found above it. This occupation has been temporally placed at around the twelfth century A.D.

Occupation V presumably represents the last occupational period at the site. It includes an isolated hearth found north of Room 13 and the post-occupational fill of the room block. This fill probably represents redeposited trash from the main pueblo situated upslope and outside of the right-of-way. A radiocarbon sample from the hearth dated A.D. 1291 ± 60. This is the latest date recovered from the site. The ceramics present in the post-occupational fill of the room block include McElmo Black-on-white and Mesa Verde Black-on-white ceramics. This occupation is temporally placed around the thirteenth century A.D.

There are several problems when one attempts to compare assemblages from the different occupational episodes. First, the samples were taken from different functional contexts. These include interior floors and features, exterior plaza surfaces and features, and interior and exterior trash deposits. Most of the latter strata were redeposited. Secondly, sample size varies between the occupational episodes. For example, Occupation I is only represented by an isolated ash/charcoal deposit and a single hearth. This contrasts with Occupation III which includes the room block and surrounding plaza surfaces, Room 13 with surrounding plaza, and the kiva. Therefore, some of the differences between occupational episodes may be due to varying functional contexts and sample sizes.

Subsistence information for the occupational episodes is represented by numerous macrobotanical, flotation, pollen, and bone samples. The single most consistent pattern found throughout the total occupational sequence at LA 50337 is the presence of corn. It is present as macrobotanical specimens, in flotation samples, and as pollen. The cultivation of this crop was obviously a major activity for the occupants of the site. Cob diameter and cupule size are large, but are similar to other sites situated along major tributaries. Besides corn, a variety of wild plants was also exploited during all the occupations.

Occupation II was the only occupation to exhibit the presence of beans. This included macrobotanical remains in the pit structure and the slight evidence of bean pollen on Plaza 3. Cholla and prickly pear pollen is present during Occupations II and III. Cholla pollen is more prevalent at LA 50337 when compared to prickly pear pollen. This situation appears to be reversed when compared to other local Anasazi communities. Squash pollen appears in Occupation III. Squash remains were also recovered from the post-occupational fill of Room 2 (Occupation V).

The majority of the roofing materials used during Occupations II and III was cottonwood. In contrast, the selection of materials for use as fuel may have changed through time. More coniferous wood (pinyon and juniper) appears to have been used during Occupation I, with an increase in the use of brush (saltbush) during the succeeding occupations (II-V).

The presence of corn, squash, cholla, and prickly pear indicate that the site was probably occupied throughout its history during the spring and fall. The strongest evidence for this is during Occupations II and III, and a year-round occupation is best evidenced during Occupation III. This includes well-built rooms, milling features, possible internal storage areas (Room 1b) and a variety of economic taxa present in the features.

Regarding faunal remains, cottontail appears to dominate all the occupations, with lesser amounts of mule deer, jackrabbit, and prairie dog. Two occupations seem to deviate from this pattern. The roasting pit of Occupation IV contains a much larger percentage of prairie dog remains. This of course only represents a single feature/functional context. The other pattern is the prevalence of turkey bone in the post-occupational fill levels of the room block that represent Occupation V. The sample is larger and may be more representative in this situation, however the strata probably represent redeposited materials. Again, it is difficult to evaluate the reliability of these changes.

The lithic assemblage is dominated by core reduction debitage, most of which consist of cortical debitage. Very few tool production/maintenance flakes are present. Lithic raw materials (chert) were procured from local gravels and then reduced on or near the site. Overall the lithic technology is geared toward the production of flakes used as expedient tools. The majority of this assemblage (about 75 percent) was recovered from Occupation III and is therefore biased toward this occupation. Other lithic tools present include cobble bifaces and hammerstones representing heavy duty tools, axes used for cutting wood, a tchamajilla for cultivating soil, and ground stone for processing vegetal materials. The latter consists of one- and two-hand manos and slab and trough metates used to process corn.

Cultural materials are still present within the right-of-way at 1.6 m below present ground surface. The materials include the remainder of the pit structure, kiva, hearth (Feature 56), and trash deposit (Stratum 122). It is suspected that additional features may also be present at least 1.6 m below present ground surface. By resurfacing the highway, however, these materials and any undiscovered cultural remains are preserved in place.

APPENDIXES

APPENDIX 1. LITHIC ANALYSIS METHODOLOGY

Bradley J. Vierra

Lithic artifacts were classified into seven categories: debitage (flakes and small angular debris), lithic reduction and heavy-duty tools (cores, tested cobbles, large angular debris, cobble unifaces, cobble bifaces, and hammerstones), facially retouched tools (bifaces, projectile points, and scrapers), milling equipment (manos and metates), fire-cracked rock, manuports, and other miscellaneous artifacts.

Debitage

Small Angular Debris

Pieces of material that are incidentally broken off during core reduction are called angular debris. These pieces of shatter lack definable flake characteristics, such as a platform, bulb of percussion, and proximal/distal ends. Small angular debris is distinguished from large angular debris by weight: small angular debris weighs less than 40 g and large angular debris weighs more than 40 g (Chapman and Schutt 1977).

Flakes

Freehand flakes are pieces of material that have been detached from a core or a tool, and which exhibit definable flake characteristics. These characteristics may include the presence of a striking platform, ventral and dorsal surfaces, a bulb of percussion, an eraillure, lines of force, and proximal and distal ends (Fig. 50a).

Bipolar flakes are pieces of material that have been detached from a core through the use of a bipolar reduction technique. This involves placing the core on an anvil, and striking it from above. The resultant bipolar flake differs from a freehand flake in that it may have two bulbs of percussion and/or eraillures at opposing ends.

Core Flakes. Core flakes are flakes that have been detached from a core. A polythetic set (Clark 1968:36-37) of attributes for core flakes include cortical, single, or multifaceted platforms; a platform angle of >50 degrees; dorsal scars that may be absent, parallel or perpendicular to the platform; a thickness of >5 mm; a pronounced bulb of percussion; and an eraillure. Bifacial core flakes may have more acute platform angles.

Biface Flakes. Biface flakes are retouch flakes that have been detached from a bifacially retouched artifact. A polythetic set of attributes for biface flakes includes a bidirectionally retouched platform; a lipped platform; a platform angle of <50 degrees; dorsal scars that are parallel to each other and perpendicular to the platform; a thickness f <5 mm that is relatively even from proximal to distal ends; a weak bulb of percussion; and a pronounced ventral curvature (Acklen et al. 1983).

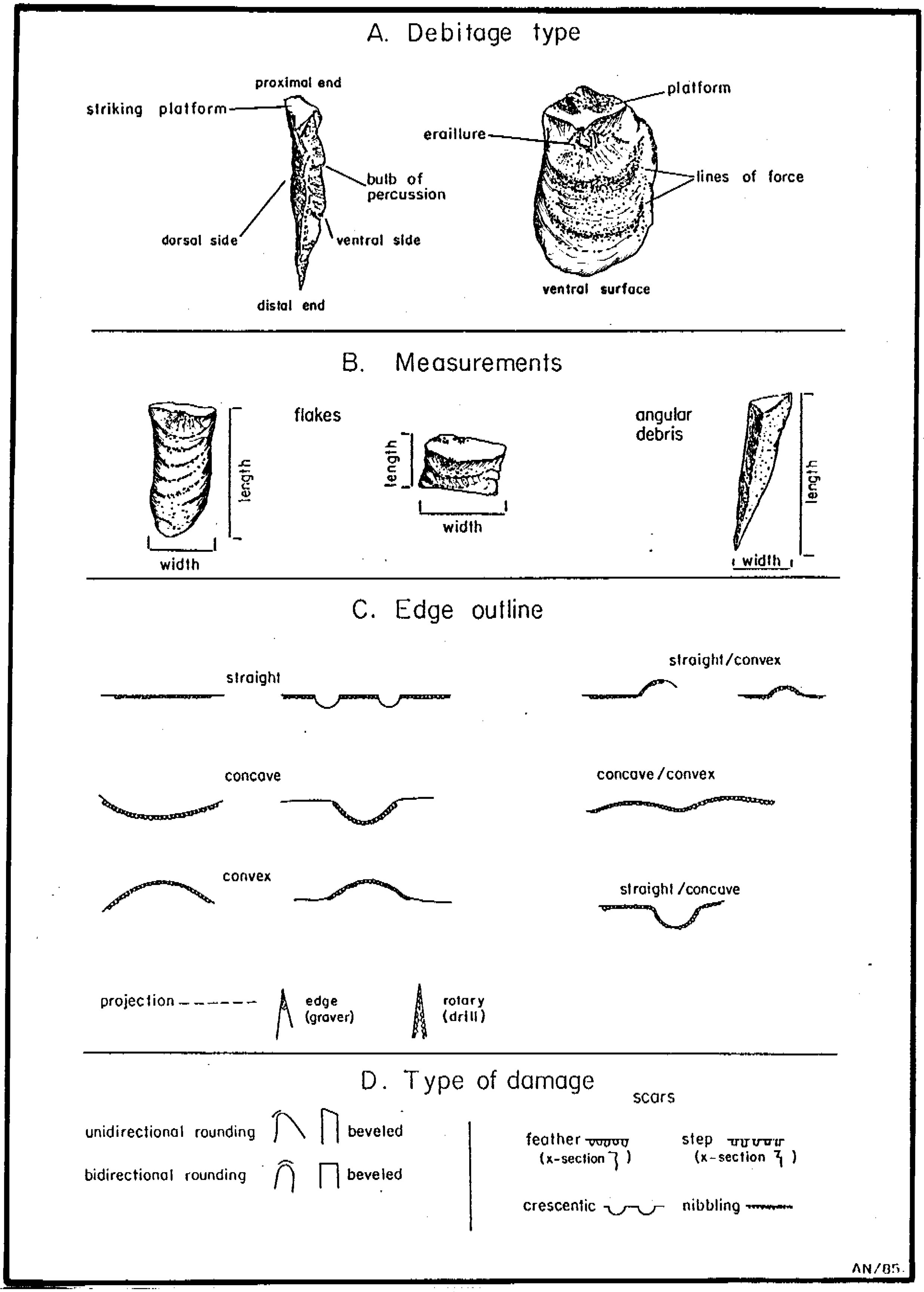


Figure 51. Attributes monitored during debitage analysis.

Scraper/Uniface Flakes. Scraper/uniface flakes are retouch flakes that may have been detached from a unifacially retouched artifact. They have the same characteristics as biface flakes, with the exception that retouch flakes from scrapers exhibit a unidirectionally retouched platform, and a platform angle of about 60-90 degrees.

Undetermined Tool. Tool retouch flakes that cannot be confidently defined as either biface or scraper flakes are called undetermined tool flakes.

Blade. Blades are flakes that are removed from a prepared blade core. Their length is generally twice their width, and they have two or more parallel dorsal scars and parallel lateral sides.

Undetermined. Undetermined flakes are those that cannot be defined as either core or tool flakes.

Attributes Monitored

Material Type. The lithic material type was recorded for all artifacts.

Material Color. The lithic material color was recorded for all artifacts.

Measurements. The length, width, and thickness of whole flakes were recorded in millimeters using a sliding caliper. Length is defined as the distance along the proximal-distal axis of a flake, and as the longest axis of the artifact for angular debris. The width measurement is taken perpendicular to the proximal distal axis or longest axis (Fig. 50b). Thickness is "the greatest measurement once the proximal-distal axis was rotated 90 degrees from the plane created by the length and width measurements" (Schutt and Vierra 1980:50). Weight was recorded for each artifact to the nearest gram, using an Ohaus triple-beam balance.

Condition. The condition of the flake was recorded as whole, proximal fragment, midsection, distal fragment, or lateral fragment. All pieces of angular debris are considered to be whole.

Cortex. Cortex is the natural outer weathered surface of a lithic nodule. Cortex was noted as either present or absent on angular debris. The presence and placement of cortex was monitored on flakes. The cortex was recorded as absent, on the platform only, on the dorsal surface only, on the platform and partially present on the dorsal surface, and on the platform and totally covering the dorsal surface. Primary core reduction is indicted by cortex on the platform and on 100 percent of the dorsal surface of core flakes. A large primary flake that has been utilized may represent an expedient primary (teshoa) flake tool. Secondary core reduction is represented by platform only, dorsal only, or platform/partial dorsal for secondary cortical core flakes, and absent for secondary noncortical core flakes. Tertiary reduction is represented by tool retouch flakes that generally lack cortex.

Platform Kind. The type of platform was recorded for flakes: cortical, faceted, unidirectionally retouched, bidirectionally retouched, collapsed, battered, or absent. A cortical platform is unprepared and situated on cortex. A faceted platform has been prepared by removing a flake(s) to crate a scar, which is then used as a striking platform. Cortical and faceted platforms are generally representative of core reduction. Unidirectionally retouched platforms are prepared platforms, which represent the remnant edge margins of unidirectionally retouched artifacts (scrapers or cobble unifaces). This retouch is only present on the dorsal surface of the flake.

Bidirectionally retouched platforms, on the other hand, represent the remnant edge margins of bifacially retouched artifacts (bifaces, projectile points, or cobble bifaces). Unidirectionally and bidirectionally retouched platforms are generally representative of too retouch flakes; however, cores might also have platforms that were prepared by retouch (to strengthen a platform and increase the control over flake removal). See Schutt and Vierra (1980:60) for illustrations of retouched platforms. A collapsed platform occurs when the majority of the platform breaks away during the removal of the flake. A battered platform exhibits impact scars or percussion rings that are the result of a cortical platform being struck, or the platform surface being hit against another object (as on a hammerstone).

Number of Modified Edges. The number of modified edges was recorded, including retouched and/or possibly utilized edges/

Edge Number. All modified edges were given a sequential number for each artifact.

Retouch. Marginal retouch is defined as retouch that extends over less than one-third of the surface of an artifact (Chapman and Schutt 1977:86). The presence and type of marginal retouch was recorded as absent, unidirectional ventral, unidirectional dorsal, or bidirectional. Unidirectionally retouched artifacts (with edge angles of > 50 degrees) may reflect expedient tools used as scrapers. In contrast, bidirectionally retouched artifacts (with edge angles of < 50 degrees may represent expedient tools used for cutting activities. Angular debris that exhibits unidirectional retouch was monitored as unidirectional dorsal.

Edge Outline. The outline of the modified edge was recorded as straight, concave, convex, straight/concave, straight/convex, concave/convex, or on a projection (Fig. 50c). A retouched and/or utilized concave edge can be considered a notch, or what has traditionally been referred to as a spokeshave.

Edge Angle. The edge angle of all modified edges was recorded to the nearest 5 degrees. This measurement is equivalent to the "spine plane angle" (Tringham et al. 1974), which measures the intersection of the dorsal and ventral surfaces at the edge. If the angle varies along the edge, then a mean edge angle or the angle that composed the majority of the edge was recorded. Dibble and Bernard (1980) consider the caliper method as the most reliable technique that can be used to measure edge angles. However, a "shurikan" edge angle template was used for this analysis. It consists of a circular disk template that has had angles cut into its sides in 5 degree increments from 20 to 90 degrees (Fig. 51). The edge to be measured is placed within a notch until the appropriate angle is found that most accurately fits the edge. The device was developed by Kaoru Akoshima (personal communication), and is considered to be quite accurate and efficient.

The selection of edge angle groups for specific functional usages has been ethnographically described by Gould et al. (1971:149) and archaeologically observed by Vierra (1980:384). The former notes that sharp-edged tools, with angles of 19-59 degrees, are associated with cutting activities and that steep-edged tools, with angles of 40-89 degrees are associated with scraping activities. Vierra found a similar bimodal distribution of edge angles selected for use, 20-50 degrees for the first group and 60-90 degrees for the second group.

Serration. The presence or absence of serration was monitored for all modified edges. This was done primarily to determine whether retouched edges were serrated to produce a denticulate tool.

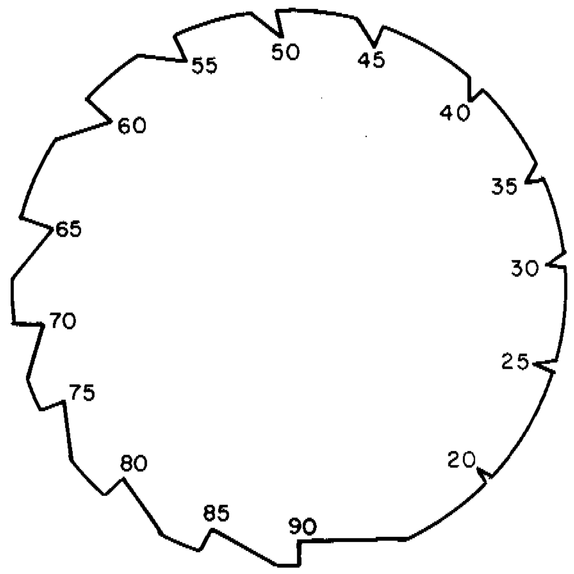


Figure 52. Shurikan edge angle template.

Edge Damage. The presence or absence of edge damage was recorded as a possible indication of use. A Bausch and Lomb binocular microscope was used at 1.5-3 power.

Type of Damage. The type of damage was also recorded. This includes unidirectional scarring, bidirectional scarring, unidirectional rounding, bidirectional rounding, unidirectional scarring and rounding, bidirectional scarring and rounding, and abraded/ground (Fig. 50d). Damage must be consistent along the edge margin to be monitored. Scarring is represented by step fracturing, feathered scars, crescentic scars and nibbling. The presence of unidirectional versus bidirectional scarring is determined by using a 1:3.5 ratio; that is, one scar on one side versus 3.5 on the opposite side. Edges that exhibit a ratio higher than 1:3.5 are considered unidirectionally scarred, while edges that exhibit a ration lower than 1:3.5 are considered bidirectionally scarred (Schutt 1982:97). Rounding is represented by a rounded edge margin, and abraded/ground by the presence of an abraded or ground surface on a piece of debitage. See Chapman and Schutt (1977:89-91) and Schutt (1982:28-33) for more in-depth descriptions and illustrations of scarring and rounding edge damage.

Projection. The type of damage present on a projection was recorded. Rotary damage consists of rounding, polish, or crushing on the tip of the projection in conjunction with step fracturing along the lateral edge margins. This presumably reflects the use of the projection as some form of drill. Edge damage refers to wear on the projection, which is mainly situated on or around the tip. This wear may reflect use as an incising or graver tool.

Comments. Comments were made about various attributes that had not been formally included within the debitage analysis format. These might include platform preparation, platform angle, burned artifacts, patinated artifacts, burination of a flake, expedient tool type, material type/source, or unusual characteristics. The analysis of debitage in part provides information on core reduction technique. Any observation considered relevant to this process was noted. Possible cobble uniface or cobble biface resharpening flakes were also noted. These would include uniface and biface flakes >5 mm in size that exhibit battered use-wear along the intersection of the cortical platform and dorsal surface or retouched platform and dorsal surface, respectively. If a piece of debitage exhibited an undefined ground surface it was monitored in this category. However, if it was determined to be a piece of a formal ground stone tool, it was monitored in that category.

Lithic Reduction and Heavy Duty Tools

Cores

Six different core types were monitored (Fig. 52a). Cores are nodules that have prepared platforms from which specific kinds of flakes are removed. Unidirectional cores have flakes removed in one direction from the same platform. Bidirectional cores have flakes removed in opposing directions from platforms situated at both ends of a core. Multifaceted cores have flakes removed from multiple platforms in many different directions. Flakes are removed from bipolar cores by placing them on an anvil and striking them. They may exhibit two positive bulbs of percussion, ar a positive bulb at one end of the core and a negative scar at the opposite end (Chapman and Schutt 1977:92). Bifacial cores have flakes removed from both faces of the same edge margin. Pyramidal cores are the same as unidirectional cores except that the distal end of the core has been modified into a point, creating the appearance of a pyramid. Blade cores are cores that are prepared so that blades can be removed. Whereas most of the cores exhibit a platform angle of >50 degrees, bifacial core platforms are generally more acute.

Cores provide information on reduction technique, reduction strategy, and technological organization. The core reduction technique may be conditioned by the size and shape of the nodule, as well as the desired finished product. For example, multifaceted core reduction techniques indicate an expedient reduction strategy, in contrast to blade core reduction techniques, which represent a specialized reduction strategy.

Bifacial cores may be a highly curated item, indicating a core/biface reduction trajectory. Flakes are removed for use, or the core may be used as a tool itself. This type of core reduction technique is expected to occur in areas where lithic raw materials are scarce. Bipolar cores represent a technique to reduce spherical and/or small sized nodules.

Other Artifacts

Tested Cobble. A tested cobble is a cobble that has only one to two flakes removed from unprepared cortical platforms. It may represent a cobble that has been tested for material quality and then discarded.

Large Angular Debris. Large angular debris weighs more than 40 g, and does not exhibit any kind of flake morphology. However, it does appear to be the by-product of core reduction (Chapman and Schutt 1977:92).

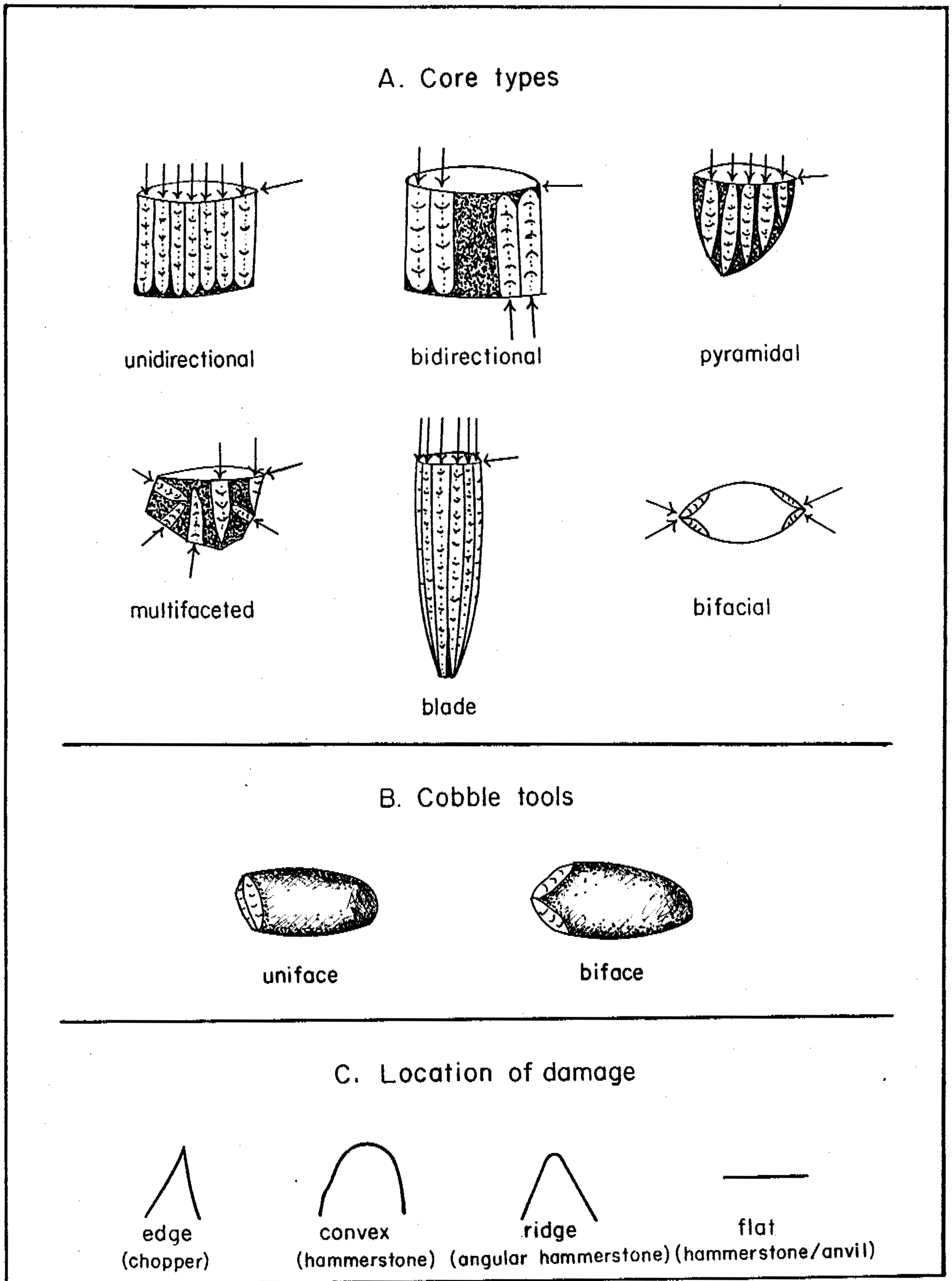


Figure 53. Artifact types and attributes monitored during lithic reduction and heavy-duty tool analysis.

Cobble Uniface. A cobble uniface has two or more flakes unifacially removed along a single edge margin, usually at one end of the cobble (Fig. 52b). The cobbles may represent cores or formal tools, and are generally made of nonsiliceous (quartzite and igneous rock) lithic materials. Cobble unifaces are similar to unifacial cores, except that cobble unifaces have cortical platforms. Cobble unifaces differ from tested cobbles in that tested cobbles only have a single flake removed from one or more different locations on a cobble.

Cobble Biface. Cobble bifaces have two or more flakes bifacially removed along a single edge margin (Fig. 52b). Formal cobble bifaces have traditionally been referred to as choppers, and they may represent either a formal tool or a core. Like cobble unifaces, they are generally made of nonsiliceous lithic materials. Cobble bifaces differ from bifacial cores in that bifacial cores are generally made of siliceous materials and have more than one or a continuous bifacially retouched edge perimeter.

Hammerstone. A hammerstone is a nodule that exhibits battering on a natural portion of its surface.

Attributes Monitored

Material Type. The material type of each artifact was recorded.

Material Color. The material color of each artifact was recorded.

Measurements. The maximum dimension was measured in millimeters as the longest axis through the artifact. The minimum dimension is measured perpendicular to the maximum axis. Thickness is the smallest dimension of the artifact. Each artifact was weighed to the nearest gram.

Platform. The type of platform present was monitored as cortical, single removal, multiple removal faceted, or multiple removal cortical and faceted. Single removal is characterized by a single faceted platform from which flakes are removed, in contrast to multiple removal, which are flakes removed from multiple faceted and/or cortical platforms.

Exhausted. The exhausted attribute was recorded for cores only. It is a subjective determination as to whether the core is still of a size to produce usable flakes. This is basically a statement related to core size, and can provide information on the extent to which a core of a specific material type is reduced. Besides representing a core that has been reduced to a very small size, exhausted cores often consist of large flakes or pieces of large angular debris that have had flakes removed.

Cortex. The presence and the amount of cortex was monitored. This includes none, 1/4, 1/4-1/2, 1/2-3/4, and greater than 3/4.

Cortex Kind. The kind of cortex present was recorded: none, water worn, and other. Water-worn cortex is that produced when the exterior of a cobble is modified through water action. The other cortex type is any nonwater-worn cortex that has been produced by natural geological processes.

Number of Damaged Loci. The number of damaged loci was recorded. This damage refers to possible use-wear and not to any kind of platform preparation.

Locus Number. Each damaged locus was given a sequential number for each artifact.

Type of Damage. The type of damage present was monitored: battering, rounding, abrasion, scarring, and ground. Battering is the pounding application of force to a specific locus when one object is struck against another. This action can produce conical impact rings (hertzian cones) on a natural surface, or bidirectional step fracturing and the deterioration of an edge margin. Rounding is the damage that results in the rounding of an edge margin; this is presumably the result of an edge coming into contact with a softer material. Abrasion is the presence of any ground or abraded surfaces on an artifact. Scarring damage is other forms of wear, including those produced through cutting and scraping motions along an edge margin. Ground damage is that produced through grinding.

Location of Damage. The location of damage was recorded. This includes on an edge, convex surface, ridge, flat surface, flake scar ridge, or all over the artifact (Fig. 52c). An edge is the intersection of one or more negative flake scar facets, and edge damage is associated with the use of an artifact as a chopper. A convex surface is a nonacute, natural convex surface; damage in this location is reflective of the artifact being used as a hammerstone. A ridge is an acute, naturally sharp surface; damage of a ridge indicates use as an angular hammerstone. Flat is a naturally flat surface; damage on this surface represents use as a hammerstone or an anvil. Hammerstone use results from a surface being struck against another object, while use as an anvil results when another object, while use as an anvil results when another object is struck against this surface. Flake scar ridges are the high points along the edge of negative flake scars; sometimes these areas are ground (on cobble unifaces), reflecting that the tool was possibly used as a plane or adze. Damage over the entire surface of an artifact presumably reflects a multifunctional use of the artifact.

Comments. Similar comments are made for these artifacts as for the debitage. Other attributes noted include the presence and nature of core platform preparation and core platform angles.

Facially Retouched Tools

Scrapers

Scrapers are "artifacts which exhibit retouch scars extending over one-third or more of only one of their surfaces" (Chapman and Schutt 1977:93). The edge angle of these artifacts is usually in the range of 60-90 degrees. Scraper types include end scrapers, side scrapers, or a combination of both.

Bifaces

Bifaces are "artifacts which exhibit retouch scars extending over one-third or more of both their opposing surfaces" (Chapman and Schutt 1977:93). The edge angle of these artifacts is usually in the range of 20-50 degrees. Projectile points are specialized forms of bifaces that exhibit hafting modifications for use as possible spear or arrow points. They are identified with respect to defined point typologies.

Attributes Monitored on All Artifacts

Measurements. Measurements were taken for whole artifacts only. Length was measured along the proximal-distal axis. Width is 90 degrees to the proximal-distal axis. Thickness is the greatest measurement once the proximal-distal axis is rotated 90 degrees. Weight is measured to the nearest gram.

Material Type. Lithic material type was recorded.

Material Color. Lithic material color was recorded.

Condition. The condition of the artifact was recorded as whole or fragmentary. Fragments were monitored as proximal, midsection, or distal. For bifaces, the end exhibiting hafting modifications is considered the proximal end, or where no modifications are present, the pointed end was considered the distal end (Chapman and Schutt 1977:93). For scrapers, the distal end is the steeply retouched and/or utilized end.

Breakage. If an artifact is represented by a fragment, then the type of break either lateral, transverse, or burin, was recorded. A lateral break is one that is parallel to the long axis of the artifact, and occurs when pressure is applied laterally to the artifact. A burin break occurs when pressure is applied to the distal end of an artifact. This results in a flake being removed along the long axis of the artifact, which terminates in a hinge. A transverse break is one that is perpendicular to the long axis (Chapman and Schutt 1977:93).

Number of Damaged Edges. The number of damaged edges was noted. Determining the difference between a possibly damaged (i.e., utilized) edge and an edge prepared for the detachment of flakes may be difficult (Sheets 1973). Damage should be consistent along an edge margin being monitored.

Edge Number. Same as for debitage.

Edge Outline. Same as for debitage.

Serration. Same as for debitage.

Edge Angle. Same as for debitage.

Type of Damage. Same as for debitage.

Attributes Monitored for Bifaces Only

Shape. The overall shape of a biface is described as being either round, ovate (pointed on opposite ends), ovoid (pointed on one end and rounded on the opposite end), triangular, lanceolate, or other (Chapman and Schutt 1977:93).

Attributes Monitored for Projectile Points Only (adapted from Moore 1981, 1983)

Blade Length. The length of the blade was measured in millimeters (Fig. 53).

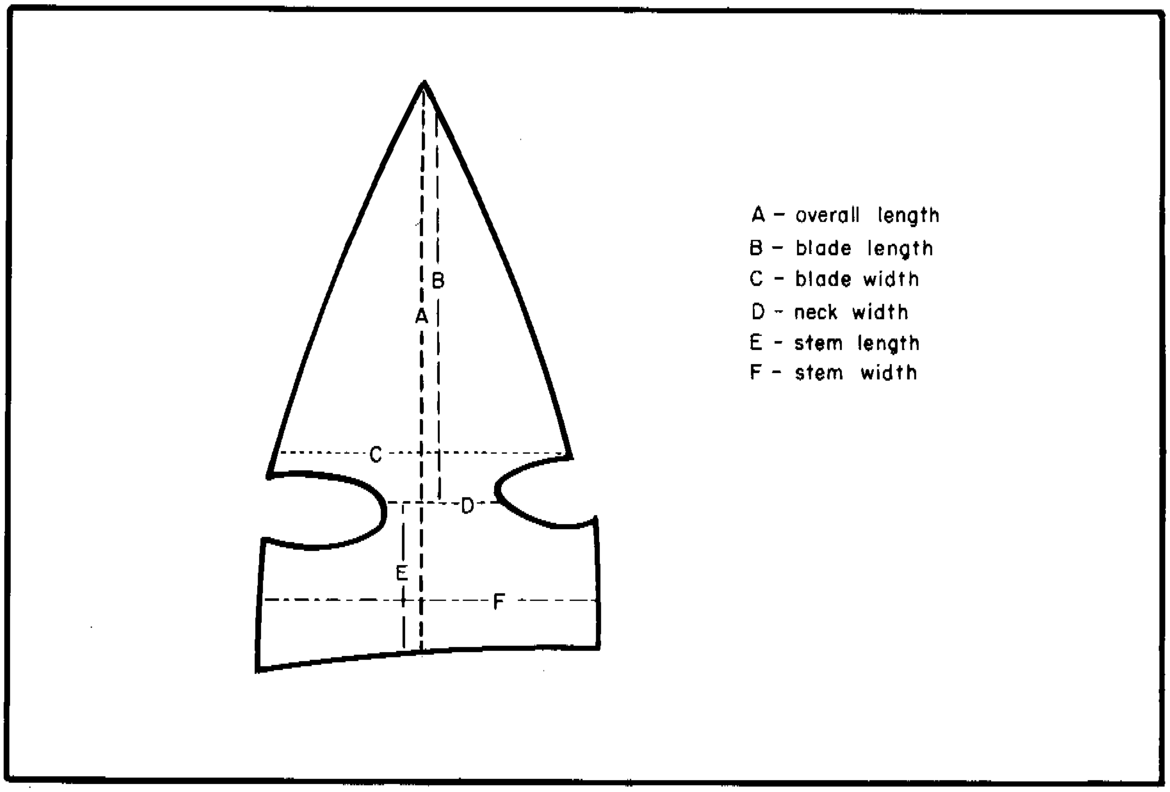


Figure 54. Projectile point measurements.

Blade Width. The width of the blade was measured in millimeters (Fig. 53).

Neck Width. The width of the neck was measured in millimeters (Fig. 53).

Stem Length. The length of the stem was measured in millimeters (Fig. 53).

Stem Width. The width of the stem was measured in millimeters (Fig. 53).

Blade Shape. The shape of the blade was described as undetermined, straight, convex, concave, convex/concave, parallel, irregular, or other.

Blade Condition. The condition of the blade was described as undetermined, serrated, ground, smooth flaked edge, irregular, or other.

Cross Section. The transverse cross section of the point was described as undetermined, plano-convex, plano-triangular, biplano, biconvex, bitriangular, convex-triangular, or other.

Hafting Type. The hafting type was described as undetermined, side notched, corner notched, basal notch, side notched/basal notched, stemmed, lanceolate, fluted lanceolate, or other.

Stem Edge Shape. The shape of the stem edge was described as undetermined, expanding, contracting, convex, concave, parallel, irregular, or other.

Stem Edge Condition. The condition of the stem edge was described as undetermined, unground, ground, or other.

Base Shape. The shape of the base was described as undetermined, no alteration, thinned, ground, thinned and ground, fluted, fluted and ground, or other.

Base Condition. The condition of the base was described as undetermined, no alteration, thinned, ground, thinned and ground, fluted, fluted and ground, or other.

Attributes Monitored for Scrapers/Unifaces Only

Scraper Type. Scraper types include end, side, double end, double side, and end/side scrapers.

Number of Retouched Edges. The number of retouched edges was recorded for each artifact.

Edge Number. Each individual retouched edge was given a sequential number for each artifact.

Edge Type. The retouched edge was monitored for location on the end or the side of the artifact.

Edge Angle. The edge angle was measured for each retouched edge.

Milling Equipment

Manos

Manos are "artifacts which exhibit at least one surface characterized by one or more smooth facets produced through grinding. Manos are hand-held implements presumably used primarily to crush and grind vegetal foodstuffs, such as seeds against metates" (Chapman and Schutt 1977:95). Manos may be of two types, one hand or two hand. One-hand manos are defined as having a width of < 170 mm, while two-hand manos have a width of > 170 mm. Thickness is also an important variable. A thin mano with a width of about 170 mm may represent a one-hand mano, in contrast to a thick mano of the same size that may need two hands to hold effectively. Weight is not an important criterion since long, thin sandstone two-hand manos may weigh less than short thick cobble one-hand manos. Unclassified manos have been denoted as undetermined mano. This is when a projected width of the fragment can not be determined.

Metates

Metates are artifacts characterized by at least one large grinding surface, the surface upon which vegetal foodstuffs may be crushed and ground with the use of a mano. Metates are classified into four types. A milling stone is a flat unmodified slab that exhibits a ground surface. A basin metate is a milling stone that has been used for an extended period of time and a ground basin has been formed in the central area of the metate surface. These two metate types are generally associated with the use of a one-hand mano, while grinding wild seeds in a rotary motion. A slab metate has a large flat prepared surface. A trough metate exhibits a deep prepared trough as a grinding surface. The trough may be closed or open on either end. These two metates are generally associated with the use of a two-hand mano, while grinding corn in a longitudinal back and forth motion. If the type of metate could not be identified, it was classified as undetermined metate.

Undetermined Ground Stone

Pieces of ground stone are artifact fragments that exhibit some form of grinding surface, but cannot be defined as either manos or metates.

Attributes Monitored

Material Type. The material type was recorded.

Measurements. For manos and metates, length is the greatest measurement parallel to the grinding motion, width is the greatest measurement perpendicular to the grinding motion, and thickness is the greatest measurement of a 90 degree plane to length and width. Note that the length of a mano (for example, two-hand) may actually be perpendicular to the long axis of the grinding surface. For undetermined fragments length is the long axis of the grinding surface, with the width and thickness previously defined. All measurements were taken in millimeters and weighed to the nearest gram.

Condition. The condition of the artifact was noted as either whole or fragment.

Mano Cross Section. The cross section of a mano was monitored as plano/convex, biconvex, biplano, or wedge shaped. N/A was used for metates and ground stone.

Burned. The presence and type of burning (for example, blackened or fire-cracked) was described.

Modification. Any intentional modification to the overall shape of the artifact was monitored. This includes absent, ground, pecked, flaked, ground/pecked, and pecked/flaked.

Ground Stone/Core. It was noted if the artifact had also been used as a core. For example, one-hand quartzite cobble manos are sometimes reused as cores.

Number of Damaged Loci. The number of damaged surfaces were monitored.

Locus Number. Each damaged surface was given a sequential number for each artifact.

Type of Damage. The type of damage was recorded. This includes absent, ground, battered, ground/battered, and other. Absent refers to mano/metate blanks that have only been shaped and not used. Ground surfaces indicate that the artifact was used as a milling implement, and battered surfaces indicate that the artifact was used as either a hammerstone (on convex or ridge surface), an anvil (on a flat surface), or a chopper (on an edge). For example, one-hand manos are often used on their ends as hammerstones.

Shape of Damaged Surface. The shape of the damaged surface was recorded as flat, concave, convex, ridge, or edge.

Striations. Striations were monitored as absent, longitudinal (parallel to the long axis), transverse (perpendicular to the long axis), or rotary (reflecting a circular grinding motion).

Pecking. The presence or absence of pecking on the grinding surface was recorded. This generally represents preparation of the grinding surface.

Finger Holds. Finger holds were monitored as absent, on one side, or on two sides.

Comments. The comments include describing any relationships among the various attributes monitored.

Fire-Cracked Rock and Manuports

Fire-Cracked Rock

Fire-cracked rocks are lithic materials that have been physically altered by the application of heat by a human agent. This artifact category specifically represents cobbles used as heat retainers in the processing of foodstuffs for consumption (for example, stone boiling or in earth ovens). Schutt and Vierra (1980:55) note two types of fire-cracked rock based on fracture patterns: breakage along irregular fracture planes, and a semiregular pattern, which is characterized by four fracture planes radiating out from the center of a cobble. The two fracture patterns may be the result of differing functions.

Manuports

Manuports are unmodified pieces of lithic raw material that have been transported from their source area to another location as a result of human behavior. This may include materials to be used in lithic reduction, temper in ceramic production, or other miscellaneous functions.

Attributes Monitored

Material Type. The material type was recorded.

Weight. Weight was measured to the nearest gram.

Other Artifacts

Other miscellaneous artifacts are individually described. These include axes, mauls, hoes, tchamajias, mortars, pestles, pendants, and beads.

APPENDIX 2. ETHNOBOTANICAL USES

by Karen Clary and Mollie S. Toll

(In alphabetical order)

Abies - Fir

Abies: fir, particularly *A. concolor* (white fir)

Twigs:	made into pipe stems among the Tewa (Robbins et al. 1916)
Resin:	used on cuts among the Tewa (Robbins et al. 1916); used as an earache remedy among the Picuris (Krenetsky 1964:43)
Foliage:	tea made for rheumatism at Acoma and Laguna (Swank 1932)
Boughs:	used for decoration (Swank 1932)

Artemisia - Sage

Artemisia: sage, in general

Plants:	were beaten into a paste and were rubbed on rheumatic body parts (Swank 1932:28)
Leaves:	were boiled to a thick paste to be used as a salve and a rub down (Swank 1932:28)

A. dracunculoides: wormwood.

Leaves:	eaten (Fewkes 1896:19)
Seeds:	used as a flavoring (Murphey 1959:29)

A. carruthi: flat sage

Seeds:	ground, mixed with water, steamed and eaten among the ancient Zuni (Stevenson 1915:65)

A. filifolia: sand sage

Bark:	toilet paper substitute among the Navajo (Elmore 1944:81)

A. fridgida: fringed sage

Wood:	"used in *pahos*" (Hough 1898:150)
Leaves:	made into medicinal tea (Robbins et al. 1916:44, 54).

A. ludoviciana: Louisiana wormwood

Plant:	was crushed and used as a body liniment; was put in shoes to prevent sweaty feet; was an ingredient for the sweat bath among the Keres (Swank 1932:28-29)

A. spinescens: button sage

Juice from plant: used as a bladder medicine among the Paiutes (Murphey 1959:41)

A. tridentata: big sage

Leaves: made into a medicinal infusion for ilium ailments (Hough 1897:42); when chewed and swallowed, as a cure for indigestion, flatulence, constant coughing (Robbins et al. 1916:45)

Dry bush: as a fuel reserve (Robbins et al. 1916:45)

Plant: made into tea and used as a seasoning among the Apaches (Reagan 1928:155); taken as a body purgative before athletic hikes and athletic contests; a tea was made to aid labor in giving birth; as a stomach ache cure among the Navajo (Elmore 1944:82)

Atriplex - Saltbush

Young leaves: eaten as greens among the Hopi (Whiting 1966:18); red leaves used as tea for blood medicine among the Keres (Swank 1932:32)

A. argentea: tumbling saltbush

Young leaves: eaten by the Hopi (Hough 1897:37); eaten at Isleta (Castetter 1935:18; Jones 1930:24)

Fruits: eaten at Acoma and Laguna (Jones 1930:24)

Seeds and expanded calyx: eaten by the Keres and used as forage for cattle (Swank 1932:31)

A. canescens: fourwing saltbush

Ashes of plant: used to color *pike' (piki)* gray (Hough 1897:40); at Hano, the ashes were used to turn the dough of *mowa* from purplish gray meal (ground from blue corn) to greenish blue (Robbins et al. 1916:54); in *piki* among the Hopi, ashes were used for the same purpose (Whiting 1966:23, 73)

Plant: used as a Kiva fuel and livestock forage (Hough 1897:42)

Branches: made into prayer sticks (Whiting 1966:23, 73)

Leaves and twigs: made into yellow dye among the Navajos (Elmore 1944:43)

Leaves: were crushed and placed on ant bites at Jemez (Cook 1930:20)

Wood: arrowheads were carved from the wood. Arrowheads of this wood were considered poisonous at Isleta (Jones 1930:24).

Smoke: from burning plant was used medicinally to revive the sick at Jemez (Cook 1930:20)

A. confertifolia: spiny saltbush

Leaves: were boiled and mixed in corn pudding (Hough 1897:38)

Water from boiled leaves: was used to mix with corn to make a pudding (Castetter 1935:18)

A. elegans: annual saltbush

Leaves: when cooked with other foods such as *Opuntia arborescens,* the leaves imparted a salty flavor to them (Russell 1908:69)

Cheno-am - Goosefoot Family and Genus *Amaranth*

Amaranthus: pigweed

Seeds:	eaten by the Keres (Swank 1932:36); eaten and sugar extracted by the Navajos (Castetter 1935:23); eaten steamed with black corn meal by the Zuni (Stevenson 1915:65); made a red dye used to color Kachina *piki,* a ceremonial bread consumed during the Kachina dances (Hough 1897:39)
Young plants:	eaten as a green among the Keres (Swank 1932:26); were boiled or fried at Picuris (Krenetsky 1964:43)
Entire plant:	was ground and made into a cosmetic paste for a smooth complexion (Krenetsky 1964:43)

Chenopodium sp.: goosefoot

Plant:	eaten by the Hopi. It was packed around the fruits of *Yucca angustissima* and baked in an earth oven (Whiting 1966:18); eaten by the Keres (White 1944:560)
Leaves:	eaten by the Pima (Curtin 1949:70); eaten at Isleta (Jones 1930:25)

C. album: goosefoot

Young plants:	eaten by the Navajos (Elmore 1944:44); eaten by the Hopi (Castetter 1935:16); eaten at Picuris (Krenetsky 1964:44)
Seeds:	eaten by the Navajo (Elmore 1944:44)

C. fremontii

Seeds:	the small, black, mustardlike seeds were used in tortillas, bread, and corn products and are said to have been used before flour came into use among the Navajos. Glucose was obtained from the parched seed meal (Elmore 1944:44)

C. leptophyllum: shinleaf goosefoot

Seeds:	an early principal food among the Zuni (Stevenson 1915:66); the Apache ate the seeds and the sprouts (Reagan 1928:156)
Young plants:	were cooked as greens among the Pueblos of the Rio Grande, the Zuni, and the Mescalero Apache (Castetter 1935:16)

Eurotia lanata: winterfat

Root:	remedy for burns among the Zuni (Stevenson 1915:51)
Plant:	forage for livestock (Hough 1897:40); forage for livestock among the Keres and the Navajos (Swank 1932:44; Elmore 1944:44)
Leaves:	remedy for blood spitting among the Navajos (Elmore 1944:44)

Cheno-ams are superb indicators of good agricultural soils and soil quality according to Weir (1976). For example, the Hopi judge soil quality on the basis of plant height (Beaglehole 1937; Yarnell 1965; Bradfield 1969, 1971; Winter 1976). These plant genera, in the Hopi Oraibi Valley, Arizona, grow well on alluvial loam soils that have several times the moisture retaining qualities of sand. *Atriplex, Chrysothamnus,* and *Sarcobatus* are known for their ability to rapidly recolonize abandoned agricultural fields as is shown in the Oraibi Valley and in Chaco Canyon (Beaglehole 1937; Bradfield 1969, 1971). On Cajon Mesa, Colorado and Utah, *Sarcobatus* grows in neat rows in place of maize on abandoned Navajo farm fields, and all three types, *Atriplex, Sarcobatus,* and *Chrysothamnus,* occur in high frequencies on abandoned aboriginal water control sites such as checkdams, terraces, and reservoirs (Winter 1976). Weir considers the fossil pollen from these plants potential markers for possible aboriginal plant use sites based on the high degree of known association with abandoned aboriginal sites in the Cajon Mesa area (1976).

Furthermore, *Amaranthus* and *Chenopodium* are also possible past economic weed species that thrive in disturbed moist areas on Cajon Mesa, including aboriginal water control sites (Winter 1976).

Cleome sp. - Beeweed, Beeplant

Cleome serrulata: Rocky Mountain beeplant

Leaves: boiled with corn. Large quantities of leaves were gathered and hung indoors to dry for winter use among the Zuni (Stevenson 1915:69)

Plant: boiled and made into a paste mixed with black numeral paint for decorating pottery (Stevenson 1915:82); boiled and made into a paint among the Tewa (Robbins et al. 1916:59); boiled and eaten (Elmore 1944:51)

Seeds: cooked and eaten (White 1944:559)

Compositae - High Spine Sunflowers

Lactuca integrata: prickly lettuce

Young, tender plants: eaten as greens at Acoma and Laguna (Castetter 1935:32)

L. pulchella: chicory lettuce

Root: gum from root was used as chewing gum among the Zuni (Stevenson 1915:68) and among the Navajos and the Apaches (Reagan 1928:158); Castetter describes the process whereby slits are made in the roots and the gummy substance is exuded from the roots and is dried before chewing (Castetter 1935:30)

L. serriola: prickly lettuce

Young plants: among the Keres, used as a lettuce (Swank 1932:51)

Taraxacum sp.: dandelion

Young plants: eaten as greens

Leaves: were ground and used as a dressing for bone fractures. At San Ildefonso, a paste made from the leaves was used on fractures with fresh leaves placed on top. Santa Clara Pueblo used a similar technique (Robbins et al. 1916:65)

T. officinale

Blossoms: a tea was made to relieve menstrual cramps among the Papagos

(Castetter and Underhill 1935:65)

Aster sp.
Flower: a tea was made to increase young female fertility (Hough 1877:41); the flower was mixed with sacred tobacco (Hough 1897:42)

A. hesperius: Among the Zuni, this species has several specific restricted uses belonging to fraternal and ceremonial personages (Stevenson 1915:43)
Blossoms: were crushed and sprinkled on live coals; the smoke was then inhaled to stop nosebleed (Stevenson 1915:43)

A. commutatus
Young shoots: eaten by the Picuris people (Krenetsky 1964:44)

A. spinosus: spiny aster
Stems: were chewed as gum by the Navajos (Elmore 1944:83) and by the Picuris people (Krenetsky 1964:44)

Chrysothamnus: rabbitbush
Plant: a yellow dye was made by the Navajos (Elmore 1944:83); used medicinally as an emetic by the Keres (White 1944:563); used as a cold remedy at Jemez (Cook 1930:21); a tea was made to cure "fright" among the Keres (Swank 1932:37)
Root: was used medicinally for fever and venereal disease at Isleta (Jones 1930:25-26)
Stem: used as a toothache remedy at Isleta (Jones 1930)
Flower buds: eaten by the people of San Felipe (Castetter 1935:24)

C. depressus: dwarf rabbit bush
Plant: an infusion was made to bathe bruises and wounds (Hough 1898:48); used as a Hopi kiva fuel and as a windbreak (Whiting 1966:95)
Stems: made into wicker plaques (Whiting 1966:95)
Flowers: yielded a yellow dye (Whiting 1966:95)

C. bigelovii
Seeds: eaten by the Apaches (Reagan 1928:156)
Flowers: yielded a yellow dye (Reagan 1928:156)

C. nauseosus: rabbitbush, chamisa
Flowers: yielded a lemon-yellow dye among the Navajos (Elmore 1944:84)
Flowers, leaves, green bark: yielded a green tint (Elmore 1944:84)

C. viscidiflorus: sticky-flowered rabbitbush
Flowers: yielded a yellow or light orange dye among the Navajos (Elmore 1944)

Xanthocephalum *(Gutierrizia sarothrae):* snakeweed, broomweed
Plant: used as a ritual emetic during retreats and before rabbit hunts among the Keres (White 1944:563)
Leaves: used as a tea remedy for venereal disease, fever, and as a refreshing bath (Jones 1930:31); made into a tea and used as an emetic and cathartic

among the Keres (Swank 1932:46-47); used as an eyewash, a wash after castrating horses, and as a rheumatism liniment (Swank 1932:46-47); the chewed leaves were used as an antidote for rattlesnake bite ("Better still, catch the snake and bite him, he will swell and die and you will not be affected" (Swank 1932:46-47); used as a bee repellent when collecting wild honey and as a sweat bath ingredient (Swank 1932:46-47); used for similar purposes by the Navajos (Elmore 1944:86)

Heterotheca *(Chrysopsis villosa):* hairy gold aster
Leaves, flowers: a tea was made and taken for chest pains (Hough 1897:44)

Senecio fendleri: notched leaf groundsel
Plant: made into a tea to cure homesickness among the Keres (Swank 1932:68-69)

S. longilobus: threadleaf groudsel
Plant: used as a sore muscle cure among the Hopi (Whiting 1966:98); used as a bug repellent among the Keres (Swank 1932:69); used as a salve (mixed with deer marrow) (Swank 1932:69)
Twigs: a tea was made to cure stomach ailments (Swank 1932:69)
Leaves: used as a pimple cure among the Hopi (Whiting 1966:98)

S. spartioides: broom groundsel
Leaves: used as a tea tonic after childbirth among the Keres (Swank 1932:68)

Cirsium lanceolatum: bull thistle
Plant: a tea was made that caused a person to vomit (Navajo) (Elmore 1944:85)

Helianthus annuus: sunflower
Root: cure for rattlesnake bite among the Zuni (Stevenson 1915:53-54) and among the Apache (Reagan 1928:158)
Seeds: cultivated by the Navajos and were eaten (Elmore 1944:87)
Seed (achene) coat: yielded a dull, dark red dye (Elmore 1944:87); yielded a purple dye among the Hopi (Heiser 1951:436-437)
Juice from seeds: used as washing water and as a dressing for cuts at Jemez (Cook 1930:23-24)
Leaves: made into a decoction and used for high fever among the Pima (Curtin 1949:103-104
Pith: used in kivas to light ceremonial cigarettes at Isleta (Jones 1930:31) Interior pulp of stalk and dry petals: used as chewing gum at Salt River Reservation among the Pima (Curtin 1949:103-104
Inner pulp of stalk: made quick-burning candles (Curtin 1949:103-104)
White pulp from stalk: was placed on the arm and burned to make the scars that are "characteristic" of the Picuris tribe (Krenetsky 1964:46)
Plant: commonly cultivated by aboriginal peoples from Canada to Mexico (Havard 1895:130); Heiser notes that the sunflower was cultivated by the Anasazi but not the plant was mixed with clay to hold it together in making pottery among the Jemez people (Cook 1930:23-24)

H. petiolaris: prairie sunflower

Seeds: yielded a blue dye used to dye Hopi blankets (Hough 1897:40)

Compositae - Low Spine Sunflowers

Xanthium commune: cocklebur

Seeds: used by the Zuni as an aid in extracting cactus needles or splinters (Stevenson 1915:62-63); were cooked with corn and eaten by the Zuni (Stevenson 1915:62-63); were ground into bread by the Apaches (Reagan 1928:161)

Roots and Leaves: produced a blood medicine made by the Apache (Reagan 1928:161)

Plant: remedy for diarrhea and vomiting at Santa Clara Pueblo and the smoke was used as a cure for urinary disorders (Robbins et al. 1916:49)

X. canadense

Plant: a liniment was made by the Navajos and used as an antiperspirant (Elmore 1944:90)

Pulp: was used as a sore eye remedy among the Pima (Russell 1908:80)

S. saccharatum

Burs: made into tea remedy for constipation or diarrhea among the Pima (Curtin 1949:97)

Plant: used medicinally among the Jemez Indians (Cook 1930:28)

Cucurbita spp. - Squash, Pumpkin

Cucurbita moschata: commonly cultivated; a type commonly found in archaeological sites

Use: planted in late May or June and harvested after frost; flowers used in preparation of special foods

Meat: boiled or baked; rind may be removed and the meat cut spirally, wound into long bundles that were tied in pairs and dried for winter use; the empty shell could be dried and used as a sounding board for the musical rasp carried by the Jemez kachina; dried shell was also used by children to carry parched corn

Seeds: roasted and eaten, or like watermelon seed used to oil the *piki* stones (Whiting 1966:93)

Ephedra - Mormon Tea

Ephedra: Mormon tea

Generally used by Indians, Mexicans, and Spanish "without distraction" for same purpose--as beverage (Balls 1970:39-40).

Stems: a tea was made and used as a tonic for kidney ailments, to purify the blood, for colds, stomach disorders and ulcers; the ground stems were used on open sores and as a salve and a poultice amongst the California Indians (Balls 1970:39-40)

Seeds: were ground and used in a beverage among the Shoshone (Murphey 1959:17)

Leaves and stems: were made into a lotion for itchy skin at Isleta (Jones 1930:28)

E. torreyana

Stems: a tea was made and used as a cough medicine, as a remedy for kidney and for bladder trouble among the Keres; used as an ingredient for the sweatbath (Swank 1932:42)

E. nevadensis

Plant: (minus the root) a tea was drunk as a cure during the first stage of syphilis among the Zuni (Stevenson 1915:49); used for gonorrhea and syphilis among the Apache (Reagan 1928:54); and the Pima (Curtin 1949:76)

Roots: were dried and sprinkled on sores by the Pima (Curtin 1949:76)

E. trifurca

Used as a remedy for venereal disease among the Navajo (Elmore 1944:24)

Gramineae - Grasses

Grasses: used as forage for livestock among the Hopi and the Keres (Hough 1877:40; Swank 1932:72); used for thatch among the Apache (Reagan 1928:160)

Bouteloua gracilis: blue grama

In bundles: the severed end of a grass bundle was used as a hairbrush while the other end was used as a broom and a strainer among the Zuni and the Apaches (Stevenson 1915:83; Reagan 1928:155)

B. curtipendula: side oats grama

In bundles: used as a broom, hearth and metate brush, and as a hairbrush (Stevenson 1915:83; Reagan 1928:155)

Oryzopsis hymenoides: Indian ricegrass

Seeds: eaten by the Hopi (Whiting 1966:18, 65); eaten by the Navajo (Elmore 1944:26); eaten by the Paiutes (Murphey 1959:29); eaten by the Zuni (Castetter 1935:27-28)

Sporobolus airoides: alkali sacaton

Seeds: eaten by the Hopi (Whiting 1966:18, 66)

S. cryptandrus: sand dropseed

Seeds: eaten by the Hopi (Hough 1877:37); eaten by the Navajo (Elmore

1944:27)

Juniperus - Juniper

Juniperus: juniper

Berries: used as a dye and as a cure for influenza among the Navajo (Elmore 1944:27)

Bark: used as a dye; the ancestors of the Navajo supposedly wore clothing of woven juniper bark (Elmore 1944:27)

Twigs: used as a dye among the Navajo (Elmore 1944:27)

Wood: produced charcoal (Elmore 1944:27)

Boughs: were used to make summer shelters where Navajo women went to weave (Elmore 1944:27); sick Paiutes, Shoshone, and Washo reclined on boughs and drank tea made from juniper leaves (Murphey 1959:53)

J. deppeana: alligator bark juniper

Fruits: eaten at Isleta (Jones 1930:33); eaten by the people of San Felipe and by the Mescalero Apache (Castetter 1935:52)

J. monosperma: one seed juniper

Twigs: a tea was made to drink previous to and after childbirth by Zuni women (Stevenson 1915:55); after being toasted, were bound tightly over a sprain or bruise to reduce pain or swelling at Hano (Robbins et al. 1916:39-40)

Wood: used for firewood among the Tewa, at Jemez, Isleta, at Acoma and Laguna and among the Navajo; used for construction purposes by the Navajo and at Jemez (Robbins et al. 1916; Cook 1930; Jones 1930; Elmore 1944); made into bows and basket frames at Acoma and Laguna (Swank 1932)

Leaves: used as medicine at Jemez (Cook 1930); used as medicine at Isleta (Jones 1930); at Acoma the leaves were ground with salt and put in the ear to get bugs out (Swank 1932)

Bark: used for tinder and as medicine among the Tewa and at Isleta, was chewed to heal spider bites at Acoma and Laguna (Robbins et al. 1916; Jones 1930; Swank 1932)

Berries: eaten by the Tewa (Robbins et al. 1916)

Opuntia - Prickly Pear

Opuntia: prickly pear

Joints and fruits: were eaten by most Southwestern aborigines (Havard 1895:116), in particular, the Navajo, the Papago, at Isleta, at Acoma and Laguna, and at San Felipe (Castetter and Underhill 1935:16; Jones 1930:35-36; Castetter 1935:35)

O. polyacantha: Plains prickly pear

Joints (plant sections): were eaten boiled with syrup among the Hopi (Whiting 1966:20)

Spines: the secretions from the spines were rubbed on buckskin, leaving it sticky, to which the garment trimmings were attached and held in position by the secretion (Navajo) (Elmore 1944:65)

O. cf. *imbricata*

Joints: dry woody joints were made into canes

Stems: the stems serve as browse for cattle, sheep, and goats, if the spines are singed off

Buds: of chollas in general, picked in April before opening; baked in a hot pit lined with stones and heated by mesquite (among the Pima) wood fire; the *Sualda* (inkweed) is added to flavor and prevent scorching; the contents were allowed to steam and bake overnight, then spread to dry and stored away

Dry buds: cooked with saltbush; also ground on a metate, mixed with wheat flour, and boiled to make *atole* (Curtin 1949:58)

Picea - Spruce

Picea: spruce

A favorite tree for ceremonial use among the Navajo (Elmore 1944:21)

Pinus - Pine

Pinus edulis: pinyon pine

Nuts: were toasted, stored for winter use and eaten by the Zuni (Stevenson 1915:70); were harvested, eaten and commercially traded by the Santa Clara Indians (Robbins et al. 1916:41); were eaten by the Hopi (Whiting 1966:63); were collected and stored among the Apache (Reagan 1928:146-147); were collected by the Navajo (Elmore 1944:21-22); a soup substitute for mother's milk was made from pine nuts (Murphey 1959:23); used for food at Isleta (Jones 1930:37); used for food at Jemez and as a red dye (Cook 1930:26); eaten by the Keres (Swank 1932:61); used as a trade good among the Navajo, Pueblo, and Spanish Americans (Castetter 1935:40-42); eaten by the Tewa, made into butter by the Navajo and eaten with corn (Castetter 1935:40-42)

Resin: at Hano, used for mending cracked water jars and used to exclude the air from cuts and sores (Robbins et al. 1916:41); among the Hopi, used for waterproofing and to repair broken pottery vessels (Whiting 1966:63) and to exclude air from cuts and sores; used as a black dye for wool, leather, and buckskin by the Navajo (Elmore 1944:24-27); used to waterproof water bottles and as a salve for open cuts and sores (Elmore 1944:24-27); used as chewing gum (Picuris) (Krenetsky 1964:47)

Wood: used for firewood at Santa Clara (Robbins et al. 1916:47); construction material for hogans (Elmore 1944:21-22); made into loom poles, ceremonial pokers, ceremonial wands, parts of the Navajo cradle and used for firewood (Elmore 1944:21-22)

Needles: along with a tea made from the twigs and a powder made from the gum, it was considered a syphilis cure among the Zuni (Stevenson 1915:57-58); were made into a tea and used as a stomach emetic among the Keres (Swank 1932:61)

P. ponderosa: ponderosa pine

Wood: used for roof timbers, kiva ladders, and was smoked ceremonially by the Hopi (Whiting 1966:22, 62); used for viga poles and for firewood at Isleta (Jones 1930:37); was a chief source of large construction logs among the Keres (Swank 1932:61)

Quercus - Oak

Quercus: oak

Wood: made into rabbit sticks, arrows, bows, digging sticks, clubs, weft bottoms, axe handles, and other utensils by the Hopi (Hough 1918)

Acorns: were eaten by the Navajo (boiled, roasted, or dried, and ground into flour) (Elmore 1944); were processed into cakes and bread by Indians (Havard 1895:118); were ground into meal and stored by the Indians of the Southwest (Struever 1977)

Branches: the Navajo made a temporary carrying basket. It was made of staves of oak twigs crossed in the center and then covered with sheepskin or goatskin. It was usually made in the field to carry yucca fruit; used for the shaft of the war club, the Navajo throwing stick, the batten stick used in weaving, lances, hoes, and the digging stick; were used ceremonially among the Navajos (Elmore 1944:40-41)

Q. gambeli: scrub oak

Wood: used for handles and other wooden portions of various implements at Isleta (Jones 1930:41); used to make clubs for rabbit hunts at Jemez (Cook 1930:24); used to make ladders at Picuris (Krenetsky 1964:47)

Acorns: were used as a staple food and was thought to give greater sexual potency at Isleta (Jones 1930:41)

Salix - Willow

Salix exigua: coyote willow and *S. irrorata:* blue stem willow

Branches: were used to line the inside of roofs at Jemez (Cook 1930:27); used to make baskets and mats by the Keres, the Hopi, and the Zuni (Swank 1932:67-68; Whiting 1966:72; Stevenson 1915:81); used in making *pahos* (prayer sticks) and occasionally in ceremonies, and the young shrubs were transplanted to convenient washes by the Hopi (Whiting 1966:72); used for prayer sticks among the Keres (Swank 1932:68)

Sarcobatus vermiculatus - Black Greasewood

Wood:	used for rabbit sticks, planting sticks, stirring rods, musical rasps, lease rods, clothes hooks in houses, arrows, and general construction, and used as the primary kiva fuel by the Hopi (Whiting 1966:22, 74); used for firewood by the Navajo, for planting sticks, Navajo dice, knitting needles, herald sticks, and when chewed, used as a remedy for ant, bee, and wasp stings (Elmore 1944:48)
Leaves:	used as forage for livestock by the Navajo, the Pima, and the Keres (Elmore 1944:48; Curtin 1949:71; Swank 1932:68); used as an emetic after being struck or shocked by lightning and used on insect bites among the Keres (Swank 1932:68); used on insect bites by the Navajo (Elmore 1944:48)
Seeds:	were roasted and eaten during hard times (Curtin 1949:71)

Zea mays L. - Maize

Plant:	cultivated and all parts were utilized extensively by the Indians of the Southwest and was also the main food staple among these people (Swank 1932:77-78)
Pollen:	used medicinally among the Keres (Swank 1932:77-78)

APPENDIX 3. THE ANALYSIS OF HUMAN REMAINS FROM LA 50337

Ann Noble

Burial 1

The skeleton recovered from Room 2 of LA 50337 is that of an adult, probably female, less than 25 years old. The skull, the innominates, and the hands are missing, making aging and sexing difficult. The remaining skeleton was well represented although most of the elements are broken and many pieces of the individual bones are missing. The bones range from good condition (such as some of the long bone shafts) to very fragile, like the ribs and vertebral centra. They all have damage to the outer table of bone from roots, indicating they were buried for some time. Elements present and their condition are listed below.

Age: right clavicle--medial end unfused, less than 25 years old

Sex: the sex of this individual was based on the femur and the humerus because the skull and the innominates were missing. The angle of the head of the femur in relation to the shaft was very high (58 degrees), which according to Godyiki (in Krogman 1957:146), in 75 percent of the groups studied, an angle of 50 degrees or more indicated a female.

The diameter of the femur head was not used because it was partially missing.

The right humerus displays a perforated olecranon fossa, which is more frequently found in females by a ratio of 3.7 to 1 (Godyiki in Krogman 1957:146).

Nonmetrically the bones appear to be gracile, indicating femaleness.

Race: Because no skull or pelvis was recovered, and all of the long bones are incomplete, racial characteristics can not be addressed.

Anomalies: The only observed anomaly in the skeleton consists of a perforated olecranon fossa in the left humerus.

Pathologies: the only pathology present was slight osteoarthritis involving the vertebral centra on both superior and inferior surfaces. No lipping was noted however.

Stature: Stature was estimated used Genoves's calculations for Mesoamerican females (Bass 1971:28, table 9) using the left femur. The femur length was 41.0 cm in length after reconstruction was made as close as possible. Therefore:

$$41(2.59) \pm 3.81$$

mean =	155.91	high	159.72 cm	low	152.10
	61.38		62.88		59.88
	5'1"		5' 2"		5' 0"

The axial skeleton consists of:

cervical vertebrae:	6 fairly complete cervical vertebra
thoracic vertebrae:	10 thoracic vertebra, partially broken and missing
lumbar vertebrae:	1 transverse arch and 8 centra fragments from the lumbar vertebrae
sacrum:	4 fragments of the anterior portion of the body of the sacrum (S2 through S5)
scapula:	both left and right scapulae, the left is in poor condition and is missing all borders and part of the spine. The right is in fair condition, missing the acromion, coracoid, and superior border.
clavicles:	the shafts of both left and right clavicles are present
ribs:	the ribs are all at least partially broken. There are 14 body fragments from left ribs, 5 right vertebral ends, and 4 left vertebral ends. Approximately 15 unsided fragments were also recovered.
sternum:	the body of the manubrium was recovered. It is in poor condition; all the borders have been eroded except for one clavicular notch.

The appendicular skeleton is represented by:

humerus:	the left humerus shaft and distal extremity; possible fragment of the humerus head; the right consists of the shaft and distal extremity
radius:	the right radius is represented by the shaft only
ulna:	the right ulna consists of the shaft and distal end, the left ulna consists of the shaft and distal end
femur:	the left femur includes the proximal extremity, shaft, and 3 fragments of the distal end; the right femur consists of the proximal end, shaft, and 2 fragments
patella:	the left patella was recovered, it is missing the medial articular facet
tibia:	the left tibia consists of the shaft (with a portion missing) and the broken fragments of the proximal and distal extremities; the right tibia is represented only by the shaft
fibula:	left is mostly complete, missing only the lateral malleolus and styloid process
feet:	right calcaneus is complete; right talus is complete; right cuboid is complete; left cuboid is complete; left calcaneus is complete, 2 unsided metatarsals consisting of 1 shaft, 1 shaft and part of proximal extremity

Burial 2, Feature 55

This burial consists of the partial skeleton of a child who was probably 6 to 7 years old at death, based on tooth eruption sequences.

The skull is badly damaged. Included are both parietals, the superior portion of the frontal, both temporals, the left alveolar portion of the maxilla and the mandible, which is complete except for the right condyle. The facial area and base of the skull are absent.

Dentition: dentition in the maxilla consists of c^1, m^1, m^2, and m^1 erupted, with i^1· i^2, c^1, and pm1 unerupted. There is a formed socket in the broken maxilla that is visible but the tooth was not recovered.

Mandibular dentition consists of the right i_1, c_1, m_1, m_2, m_1, and left c_1, m_1, m_2, m_1, which are erupted fully and left i_1, and m_2 and right m_2, which are erupting but not yet visible. There is fairly heavy attrition of the deciduous dentition causing the dentin to be exposed on the occlusal surfaces. The right m_1 has a carie on the distal and occlusal surface. Small pieces of enamel have also been exfoliated. There is pitting of the enamel on the mesial surface of c^1 and slight evidence of hypoplasia of the enamel surface, which may indicate malnourishment. The other permanent incisors have not yet erupted so the extent of this pathology is unknown. Calculus is evident on the deciduous left i_2 and c_2 although not pronounced.

The axial skeleton consists of:

The only portion of the axial skeleton recovered are 5 right ribs, 1 cervical vertebra fragment and 5 unidentified vertebral fragments. The ribs are immature, missing the heads and tubercles.

The appendicular skeleton:

Consists of the right femur shaft and proximal end (no epiphyses recovered), the right tibia shaft, both fibula shafts and the shafts of both humeri. No indices for the height of the individual could be tabulated because none of the bones were complete.

Anomalies: the only anomalies present are unintentional artificial deformation of the parietals and occipital along the lambdoidal and inferior portion of the sagittal suture commonly called "cradle boarding," and the presence of three wormian bones along the lambdoid suture.

Pathologies: Other than those noted for the dentition the only pathology found in the skeleton is in the skull. The external auditory meatus has been damaged, possibly by infection causing abscessing so that it is open bilaterally for approximately 1 cm inferior to the external opening.

Burial 3

The bone recovered from the Mountain Bell trench on the east side of the road is a right human tibia, consisting of the proximal end and shaft. It is from an adult.

Burial 4

The badly fragmented partial skeleton of a child estimated to be approximately 6 years of age at death, was recovered from the interior of a corrugated jar in Feature 26, Plaza 1. The bones are in poor condition; the skull is missing (except four teeth); all the long bones present have been cracked longitudinally from weathering and all of the ends of the diaphyses have been eroded away.

Bones that were present include:

teeth:	2 deciduous canines with fully developed roots and 2 lower permanent incisors with roots about two-thirds complete
scapulae:	both right and left scapula including the major portion of the body and spine and both glenoid cavities (missing epiphyses)
vertebrae:	the vertebral column is represented by the transverse arches of 5 thoracic vertebrae and 2 arch fragments, which are probably from the thoracic region. Five unidentified transverse arch fragments were also recovered. No centra were found.
ribs:	Three right ribs were present. One has most of the vertebral end and is broken near the sternal end, one is nearly complete but missing both ends and one is a shaft only. There are also five unsided rib fragments.
clavicle:	there is one left clavicle fragment
femur:	the majority of the left femur is present, although badly broken. It is missing both ends of the diaphysis and the epiphyses.
tibia:	the right tibia shaft is included, it too is missing both ends of the diaphysis and both epiphyses.
fibula:	the shaft of the left(?) fibula was found, no fragments of the ends were recovered.
humerus:	a badly fragmented right humerus was found, which included the distal portion and part of the anterior portion of the shaft.
pelvis:	the pelvis consists of a fragment of the right ischium.
feet:	the feet are represented by 4 metatarsals, none of which have either end of the diaphysis or epiphyses.

No measurements to determine stature and further aid in age assessment could be attempted because the long bones were in such fragmentary condition and no skull was found. The fact that the vertebral arches had not yet fused to the centra but the halves of the arches were fused, indicates the child was between 3 and 7 years of age (Bass 1971:77). The 4 teeth recovered place the age of death at approximately 6 years of age (Brothwell 1972:59). This can only be a rough estimate, lacking any other means of aging.

No evidence of pathologies or anomalies were observed. The large number of bones missing, including the skull, indicates that this is a secondary burial.

APPENDIX 4. TAPHONOMIC ANALYSIS OF THE HUMAN SKELETON FROM ROOM 2, LA 50337

Galen R. Burgett

The taphonomic analysis of faunal remains from archaeological sites has become an important part of the analytic repertoire that archaeologists employ to discern and interpret patterning in archaeological remains (Binford 1981, 1984; Brain 1981; Foley 1984; Todd 1983). However, the taphonomic analysis of human skeletal remains is largely in a formative stage and suffers from a lack of technical and methodological controls with which to identify and measure the impacts that various taphonomic agents have had on prehistoric human skeletons (but, see Sorg 1985). Because this analysis is predominantly concerned with the effects carnivores may have had on the human remains from LA 50337, the identification and description of modified bones will rely on diagnostics and patterns of modification that have been established for nonhuman bone by this author and others (Binford 1981; Brain 1981; Haynes 1980, 1982). The justification for this approach is that at present there is little information on the nature of carnivore modification of human skeletons and that while human bone is somewhat different in terms of structure and organization of the skeleton and musculature, humans are still mammals and it is believed that modification by carnivores of human remains would not be radically different from quadruped mammals.

The following discussion will deal with two dimensions of observations. First, the representation of skeletal elements and accompanying modifications, such as bone weathering and deterioration, surficial modification, and bone breakage, will be presented. Second, the spatial distribution and relationships of elements will be discussed.

Representation and Modification of Skeletal Elements

The representation of skeletal elements from Room 2 of LA 50337 (Table 86) is quite interesting in terms of the presence and absence of the various components of the human skeleton. Of note is the absence of the skull, innominates, sacrum, coccyx, as well as the hands and feet. Essentially the arms, legs, and thoracic region are present. The skeleton was almost completely disarticulated with the exception of a radius-ulna and the seventh cervical vertebra to the third thoracic vertebra.

The general surficial condition of the bones was good, but the level of deterioration was high and the vertebrae and limb bones were quite fragile. Weathering of the bones was largely Stage 2 (see Behrensmeyer 1978), but Stages 1 and 3 were also well represented. Limb bones exhibited a greater tendency to have Stage 3 weathering, while ribs and vertebrae tended to exhibit Stage 1. Overall, the various skeletal elements did not appear to have been exposed to any intense weathering agents. This may have been due to several factors. The context of the remains in a room would indicate at least minimal exposure to sunlight, temperature extremes, and moisture. Another possibility is that the body was covered quickly by sediments, thus reducing the time of exposure to weathering agents. Also, there may have been differential decomposition or removal of soft tissue resulting in different times and intensities of exposures

Table 86. Frequency of Skeletal Elements from LA 50337

Element	Number
Mandible	0
Atlas	1
Axis	1
Cervical	2
Thoracic	9
Lumbar	1
Sacrum	1
Coccyx	0
Unidentified vertebrae fragments	19
Sternum	1
Rib	11
Rib blades	8
Rib blade fragments	11
Proximal rib fragments	3
Scapula	2
Clavicle	2
Humerus	2
Radius	2
Ulna	2
Carpal	0
Metacarpal	0
Phalange (hand)	0
Innominate	0
Femur	2
Patella	1
Tibia	2
Fibula	1
Calcaneus	2
Talus	0
Tarsal	0
Metatarsal	3
Phalange (foot)	0

of the various skeletal elements. The scenario that I favor would be that the limb bones were defleshed first with the thoracic region reaching the same condition at a later time. Bone weathering is a highly complex interplay of time and intensity of exposure to microenvironmental factors of temperature, moisture, and exposure to sunlight as well as rates of sedimentary deposition and structural modifications made on the bones by other agents of attrition (Burgett and Miller 1985). In view of the previously stated facts, bone weathering as a taphonomic indicator is used in this analysis largely as a qualitative descriptive device that can indicate the conditions to which bones have been exposed. As a temporal indicator of length of exposure before burial there is simply not enough control established on the factors of weathering to justify its use in that manner.

Another factor of surficial modification was root etching of the bones. Plant roots had affected nearly all the bones examined to varying degrees, ranging from a few lines to the entire surface of the bone literally cross-hatched with marks. Heavy root etching may have masked other marks, such as carnivore tooth marks or cut marks, making positive identification of attritional agents difficult on several of the ribs.

Turning to the evidence for human or nonhuman modification of the bones, no stone tool cut marks were observed on the bones. However, a carnivore tooth mark was recorded on a distal radius and a possible tooth furrow was noted on one femur head. Other possible carnivore modifications were an ulna with the olecranon missing, both scapulae with damage to the acromion, and several ribs that may have been gnawed on their sternal ends. The sternum, while not exhibiting tooth marks, was also fragmented. Although the evidence is somewhat ambiguous, it would appear that carnivores have played a role in the modification of the remains. A complete list of the bone thought to have been damaged by carnivore action appears in Table 87. Rodent gnawing was not present on any of the bones.

Table 87. Frequency of Carnivore Damage to Skeletal Elements

Element	Positive Identification	Probable Identification
Axis		1
Rib		3
Scapula		2
Clavicle		2
Humerus		1
Radius	1	
Ulna		2
Femur		2
Fibula		1

Breakage was particularly prevalent on the ribs, but almost all limbs were broken to some extent. Vertebrae exhibited high frequencies of broken dorsal processes. The majority of breaks were transverse to the long axis of the bone and for the most part appeared to have been dry bone or intermediate-type breaks indicating some form of disturbance after the bones had dried out. Again the high degree of bone deterioration did not allow for precise identification of bone breakage types. One definite green bone break was observed on a long bone flake. Future work in refitting the broken fragments from the skeleton should prove quite informative on the nature of the breakage and at what stage of decomposition and disarticulation that breakage took place.

The missing skull and pelvis were quite intriguing but it is impossible to say whether scavengers carried them away or if human manipulation was responsible. The lack of hands and almost all of the foot bones is also an enigma. Further information on the scavenging or consumption of human bodies is needed to expand our understanding of post-mortem processes that may affect human remains. At present it is known that spotted and striped hyenas in Africa and the Middle East respectively, do frequent human burials to consume the remains and carry them off to their dens (Skinner et al. 1980). The prime candidates for the modification of the bones discussed here would be domestic dog, coyote, or fox.

Spatial Distribution of Skeletal Elements

As can be seen from the plan of Room 2, the disarticulated bones were scattered across the floor of the room, covering an area of approximately 2 m by 1.2 m. A concentration of bones consisting of ribs, vertebrae, scapulae, and leg and arm elements was located around Feature 19 and is probably the initial resting place of the once intact body. The distribution of the skeletal elements shows little relationship to relative anatomical position indicating considerable disturbance of the skeleton. The articulated elements mentioned above are some distance from the bone concentration and the vertebrae were actually found in the fill above the floor. Other elements recovered from the fill include a clavicle, the atlas, axis, other vertebrae, sternum fragment, radius, ulna, and fibula. Pre- and post-depositional disturbance appears to have substantially affected the spatial distribution of the remains, a likely combination of agents being carnivores and burrowing rodents, however human intervention cannot be ruled out. Of interest are the articulated radius-ulna, which are located at the edge of the bone scatter, and the femora, which are also in a similar relationship to the rest of the bones, demonstrating considerable displacement of these elements. The tibiae are closer to the center of the distribution and their position could indicate a flexed burial, however this is pure speculation on my part, and given the evidence of a high level of disturbance, may have ended up in their respective positions through some other means.

Overall, the spatial distribution of skeletal elements in Room 2 represents a high degree of disturbance and movement. If one considers the ideal situation of decomposition and disarticulation with no disturbance of the skeleton, then it would be expected that the bones would remain in articulation or at least in proximate physical relationship. This is not the case for the skeleton from Room 2. In fact, given the confining boundaries of the room, the distribution of bones shows a high degree of movement and scattering. Further study of the spatial distribution using anatomical and mechanical refitting of bones and fragments should allow more insight into the agents responsible for moving the bone horizontally and vertically.

Discussion and Conclusion

This analysis of the human remains from Room 2, LA 50337, has attempted to delineate and explain the taphonomic factors that have contributed to the modification of the skeleton recovered at the site. Although the evidence is somewhat scant, there has been carnivore modification and movement of the skeletal remains. Evidence also indicates that burrowing rodents have been responsible for vertical displacement of the bones and probably horizontal movement as well. Other than placing the human remains in their initial context, human involvement in movement and modification of the bones was not discernible nor measurable. However, this does not mean that human manipulation of the remains did not occur, only that the techniques and methods employed here do not directly address that problem. Again, I must stress that actualistic controls on the taphonomy of human skeletal elements are virtually nonexistent and I have relied upon my experience with ungulate remains and modern carnivores as an analytical and methodological base.

The variables that I have focused on here have included anatomical element representation, bone weathering and deterioration, surficial modifications, breakage patterns, spatial distribution, and contextual evidence. A synthesis of the observations made on the above variables is that the skeleton from Room 2 has been affected by noncultural pre- and post-depositional factors. Undoubtedly, future research on the data from site LA 50337 will provide new information and I suggest that the present study is the bare minimum necessary to understand the site formation processes that have occurred.

The previous discussion has attempted to demonstrate that the taphonomic analysis of human skeletal material must proceed on a multidimensional basis. The two basic dimensions, element representation (assemblage composition) and spatial distribution (site structure), are only the foundations for more refined studies with which to examine the human remains in relation to the site, the site in relation to a regional array of sites, and the regional array to the structure and organization of a past cultural system. To undertake this task, archaeologists must understand the cultural and noncultural formation processes that affect the material remains of the sites they excavate. This analysis has been an attempt to apply taphonomic methods to a study of human remains in hopes that it will further contribute to our understanding of site formation processes.

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