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Contents

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KANSAS ANTHROPOLOGICAL ASSOCIATION

The Kansas Anthropological Association is the oldest amateur archeological organization in the state. Its membership is made up of individuals and institutions interested in the prehistoric and historic peoples of the area. The objectives and goals of the Association are the preservation and interpretation of archeological and ethnographic remains within the state; the scientific study, investigation, and interpretation of archeological remains and ethnographical materials; the publication and distribution of information concerning Kansas archeology and ethnology; and the development and promotion of a greater public interest and appreciation for the heritage of the state.

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PUBLICATIONS

In 1999 members will receive at least four issues of the *Kansas Anthropological Association Newsletter* (ISSN 1069-0360) and one journal, *The Kansas Anthropologist* (ISSN 1069-0379). They also receive six issues of *Kansas Preservation*, the newsletter of the Cultural Resources Division of the Kansas State Historical Society. All members and interested individuals, professional or amateur, are invited to submit material to the editors for use in these publications. Back issues of the journal or newsletter, if available, may be ordered from the Historian-Recorder at the address listed above. Prices will be furnished upon request.

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LIFE ON THE HIGH PLAINS BORDER: ARCHEOLOGICAL INVESTIGATION OF THREE LATE PREHISTORIC HABITATION SITES IN SOUTHWEST KANSAS

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The Kansas Anthropologist 20:1–106

This paper studies three Late Prehistoric (A.D. 1000–1500) habitation sites in southwest Kansas through a reporting of fieldwork and analysis of the materials recovered. It seeks to answer one question in particular: Do these sites, which have been identified as components of the provisional Wilmore complex, have the degree of similarity one would expect for sites grouped under a common taxonomic term?

Fieldwork methods are reviewed, and the results of the individual projects are discussed. Analysis encompasses all aspects of the assemblages: ceramic and lithic artifacts and faunal and floral remains.

The result of this extensive analysis is that the three sites, while bearing similarities on a broad scale, are distinct in important ways. As a consequence, it is proposed that the Wilmore complex is no longer a useful taxonomic term. While the research has rejected a narrow taxonomic distinction for the three sites, it is proposed that a regional variant, the Plains Border Variant, exists along the margin of the High Plains and that the sites discussed here are components of that more general taxonomic unit.

INTRODUCTION

In 1983 archeologists at the Kansas State Historical Society (KSHS) were contacted by an amateur archeologist in southwest Kansas who had collections from several sites in Kiowa, Comanche, and Meade counties. Ceramics in the collections indicated the possibility of a previously unrecognized culture that had lived on the High Plains margin of southwest Kansas. Specifically, decorated rim sherds and occasional incised body sherds were the primary items that set apart this group of sites.

In 1984 KSHS archeologists conducted field investigations in cooperation with the Kansas Anthropological Association (KAA) at the Bell site (14CM407) in Comanche County. Upon completion of that summer's fieldwork, KSHS archeologists believed that there was sufficient evidence to provisionally define the Wilmore complex, named after the town of Wilmore, located a short distance away from the Bell site. As defined, the complex lies within an area bounded by the Arkansas River on the north, the Medicine Lodge River on the east, Crooked Creek on the west, and the Oklahoma state line on the south. These boundaries are not well established but are currently thought to represent the general limits of this culture (Figure 1).

In 1989 another site, also near Wilmore in Comanche County, was investigated as a means of providing additional information about the material culture of the Wilmore complex. While preliminary analyses have discussed the general results of the fieldwork, little quantified data has come from these investigations.

In late 1997 an effort to remedy this situation was set in motion. KSHS archeologists sought to return to southwest Kansas to investigate another potential Wilmore complex site. During June of 1998, the Kansas Archeology Training Program (KATP) field school was held in Meade County near the town of Fowler to excavate the Lundeen site (14MD306). In this volume the results of that fieldwork are combined with formal analyses of the two Wilmore-area sites in order to address the poorly defined nature of the Wilmore complex.

NATURAL SETTING

GEOLOGY

While no comprehensive geological study has been conducted in Comanche County, notes on the geology of adjacent portions of Kiowa County and the general geology of the area provide a view of

[redacted]

Figure 1. Map of southwest Kansas showing the location of the Wilmore complex and sites discussed in the text.

Comanche County geology. Bedrock outcrops in the area are primarily Permian or Cretaceous in age (Figure 2). In Comanche County these outcrops are typically of Cretaceous age and occur in a broken band, stretching from the northeastern corner through the west-central portion of the county. Other outcrops are more scattered across the northwest and south-central parts of the county.

Cheyenne sandstone occurs in a variety of shades, although white and light gray are its most common colors (Latta 1948:78). Yellow, brown, red, and purple sandstones also occur and are the result of differential amounts of iron oxide staining. While the cross-bedded friable sandstone is the primary component of the formation, lenses of shale and conglomerate also occur. Twenhofel (1924:15) reported the occurrence of erosion-resistant lenses of quartzite in the sandstone. Several heavily eroded outcrops of Cheyenne sandstone in the area are known as "Hell's Half Acre," perhaps the most well known being located in the northeast corner of Comanche County (Latta 1948:80).

Lying above the Cheyenne sandstone is the Kiowa shale, primarily composed of thick zones of marine shale interspersed with sandstone lenses and bands of highly fossiliferous limestone. The shale is composed of thinly laminated bands of dark gray to black shale, which grades to lighter grays, browns, and reds in the upper portion. Clays or clay shales also occur in the upper part of the formation.

Other formations either do not outcrop in Comanche County or their outcrop zones are limited to widely scattered examples. Tertiary Ogallala deposits may occur in small remnant exposures above outcropping Cretaceous rocks in the northern part of the county, and more notable outcrops have been described to the north in Kiowa County (Latta 1948:91–94) and west in Clark County (Green and Fairer 1995:13–14). The Ogallala formation consists of crossbedded sand, gravel, caliche, clay, and silt. Cementation, occurring as a result of calcium carbonate leaching, results in "mortar bed" conglomeritic beds. Sandstones also may occur (Smith 1940: 41–43). Upper Cretaceous Dakota formation materials are not mentioned as occurring in the county, but a concentration of prehistoric lithic reduction sites along Indian Creek in east-central Comanche County contain quartzites that have been identified as Dakota quartzite. This occurrence of apparent Dakota materials may be related to the resistant nature of the quartzite, resulting in its appearance as an erosional remnant on the landscape. Alternatively, these quartzites may instead be related to the quartzite reported in the Cheyenne sandstone.

Outcrops of Permian-age deposits are limited to the extreme southern end of the county. Whitehorse sandstone and Day Creek Dolomite might be expected to be the primary formations recognized in these Permian outcrops.

Farther to the west in Clark County, Permian bedrock outcrops are notable across the northeast to west-central part of the county. Redbed exposures here contain Day Creek Dolomite among other formations. The Day Creek material bears special mention as it contains localized cherts (Green and Fairer 1995:15), which were utilized as a source of knapable stone by the prehistoric inhabitants of the area. This gray to grayish-blue translucent material often contains moderate amounts of internal fractures. While these fractures may have limited the usefulness of some materials in the exposure, extensive workshops scattered across the uplands of Clark County, particularly north of Sitka and in the vicinity of Ashland, testify to its use over the course of the prehistoric utilization of the region.

Pleistocene and Recent alluvial formations mantle much of the northern portion of the county. The Kingsdown silt is the primary surface formation across the uplands of the upper Mule Creek drainage (Latta 1948:98). The formation is generally thought to have been laid down in the late Pleistocene or early Recent period (Smith 1940:111–116). It is dominated by a light tan to brown silt, although minor amounts of clay, caliche, sand, and gravel also are recorded.

Two terrace formations of Pleistocene age have been identified on the Medicine River in southern Kiowa County (Latta 1948:98). Similar terrace formations might be expected along portions of the larger drainages of Comanche County, although the presence of these has not been demonstrated or reported. Recent alluvium occurs in the stream valleys of many drainages in the county, ranging from broad areas of material covering drainage valleys to thin bands limited to adjacent portions of stream channels. Interspersed bands of clays, silts, and gravels occur in these alluvial settings (Latta 1948:100).

The largest remnants of Peorian loess, formed during the Wisconsin Glaciation of the Pleistocene epoch (Hoffmann et al 1989:89), are isolated in the north-central portions of the county, including the upper reaches of the Mule Creek drainage basin. Dune sand in the form of low mounds and small hummocks are noted on the general geologic map of the county. These dune deposits typically overlie Pleistocene-age alluvium. Dunes in similar settings in Kiowa County are Quaternary in age (Latta 1948:100). The composition of these dunes is primarily fine- to medium-grain

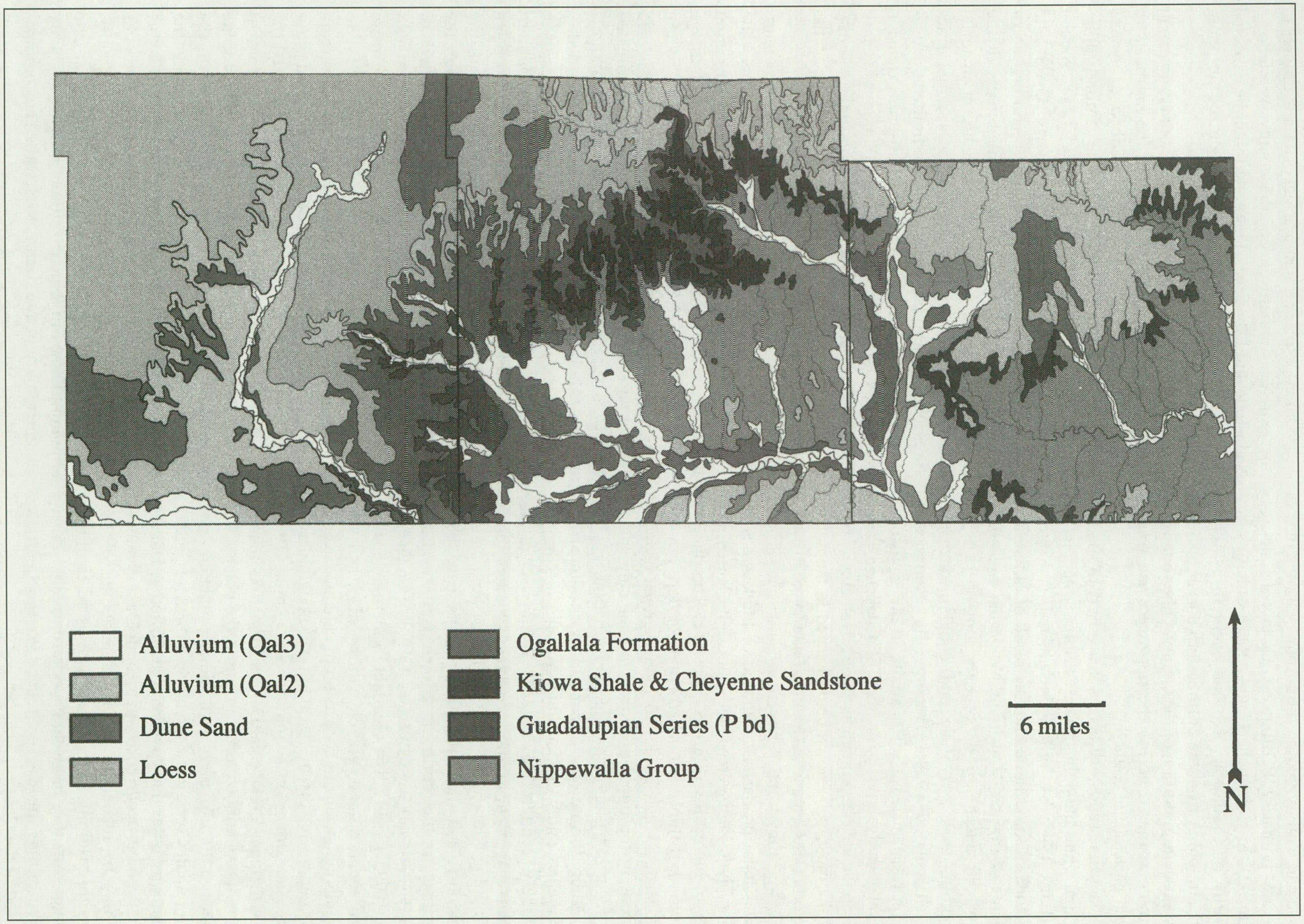

Figure 2. Tri-county map depicting major geologic features.

quartz sand with limited amounts of coarser sand, clay, and silt (Latta 1948:100).

In Meade County the geology generally consists of Pleistocene and Recent alluvial deposits, loess, and dune sands. Earlier bedrock materials are restricted to the southeast part of the county. Here limited outcrops of Permian age are related to the Taloga and possibly the Whitehorse formations (Frye 1942:93). These Permian rocks contain beds of red sandstone, siltstone, shale and thin beds of gypsum. More recent deposits, consisting of Tertiary-age Ogallala formation materials, are found in much of the same area. The exceptions to this are scattered areas of undifferentiated Ogallala material along and west of Crooked Creek, particularly in the central part of the county.

Mantling the majority of the county, particularly on the High Plains tableland in the northwestern part of the county, is a broad, relatively flat zone of Kingsdown silt. This band includes the previously described silt layer as well as overlying loess deposits, which apparently cannot be easily distinguished from them (compare Frye and Hibbard 1941:420).

Between the Kingsdown silt and the upper Ogallala formation material, a formation similar in many regards to the Ogallala material occurs. The Pleistocene-age Meade formation outcrops to the west of Crooked Creek, beginning near the center of the county and continuing in a broadening pattern across the south-central area. These materials include gravel, sand, silt, caliche, clay, and ash layers (Frye 1942:103). Mortar beds, similar in many respects to the Ogallala formation, occur locally.

More recent alluvium is common across the floor of the Artesian Valley, where natural levees frequently occur. Thin bands of alluvial deposits also occur along most drainages in the county.

Extensive areas of dune sand of Recent age may be found at various points in the county. By far the most prevalent area of duning occurs in the southern part of the county along the Cimarron River. Another area of dune sand is found in the northeast corner of the county, adjacent to the eastern margin of the Artesian Valley. Smith (1940:167) and Frye (1940:14) both refer to these dunes in the northeastern part of the county when discussing evidence for a lake of some duration in the area of the Artesian Valley in the terminal Pleistocene or somewhat later.

Soils

In Comanche County soils formed in a variety of geologic settings. In the vicinity of Wilmore, where sites 14CM406 and 14CM407 are situated, two soil associations are important for discussing the sites. Both soil associations were formed on alluvial deposits. Valley soils lie on relatively recent alluvial deposits, while those in the nearby uplands are associated with older geologic deposits of alluvium (Hoffmann et al. 1989:89).

Site14CM406, located on an upland ridge spur overlooking Mule Creek (Figure 3), is positioned on the margins of an extension of the Clark clay loam, a member of the Abilene-Clark-Case upland soil association (Hoffman et al. 1989:5). Soils of this association are found on ridgetops and their accompanying sideslopes. The Clark clay loam, upon which the site rests, is a deep, moderately well drained soil having 3–7 percent slopes. Soils of this association are almost exclusively related to an extension of the High Plains physiographic province into the northern part of the county.

Site 14CM407 is located in the valley of Mule Creek along a broad, low terrace of Kaski loam (Figure 3). The Kaski loam is a minor soil member found in the Lincoln-Waldeck floodplain soil association (Hoffman et al. 1989:12). Soils of this group are situated along the floodplains of major drainages in the county, and major soils affiliated with the group are occasionally flooded. The association is near the upper limits of its distribution along Mule Creek with the more strongly sloping members of the Abilene-Clark-Case occurring farther upstream. The Kaski loam is a deep, well drained soil, composing nearly level terraces adjacent to their accompanying drainages. Canadian fine sandy loam occasionally accompanies the Kaski soil as an adjacent terrace deposit. Both are subject to rare flooding. Waldeck sandy loam and Zenda clay loam are located on the floodplain adjacent to this particular Kaski terrace. These soils are subject to seasonal flooding and have seasonal high water tables (late fall through early spring) of between 2 and 4 sfeet today (Hoffman et al. 1989:38).

To the west in Meade County, soils have formed in Late Pliocene and Pleistocene outwash and loess deposits, as well as alluvial deposits laid in more recent geologic times (Tomasu 1977:56). Loess and alluvial deposits are the primary parent materials in vicinity of 14MD306.

The site lies along a narrow band of Uly silt loam (Figure 4). Soils of the Uly series in this section of the county are minor soil members of the Harney-Missler upland soil association (Tomasu 1977:4). This soil association occurs throughout the Artesian Valley along and north of the middle Crooked Creek

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Figure 3. Topographic setting of the Wilmore area showing 14CM406 and 14CM407.

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Figure 4. Topographic setting of the Fowler area showing 14MD306.

drainage. In the vicinity of the site, Harney silt loam occurs across the broad, nearly level upland to the north. The Uly soils here slope gently (1–6 percent) nearly to the edge of Crooked Creek. Patches of Ness soils are associated with shallow depressions scattered across the uplands. This silty clay is poorly drained and can be underwater for short to more extended periods of time.

Soils located on the adjacent floodplain and low terraces of Crooked Creek are affiliated with the Roxbury-Leshara-Likes association (Tomasu 1977:4). The Roxbury silt loam dominates the floodplain and the lowest terrace formations near the site, although Leshara clay loam also borders some sections of Crooked Creek nearby. Roxbury soils are deep, nearly level, and well drained. The Leshara soil, while similarly thick and level, tends to be somewhat poorly drained by comparison.

Physiography

Two physiographic provinces make up the majority of the region in and around the sites discussed in this research (Figure 5). The Red Hills extend across much of south-central Kansas, including parts of Comanche, Clark, and Meade counties. These Red Hills or "Cimarron Breaks" (Moore 1930) are essentially a region of badlands. Topographic relief is about 500 feet across the region and can range up to 300 feet over short distances (Smith 1940:23). The unit derives its name from the commonly exposed redbeds (shale, sandstone, siltstone, and gypsum) of Permian age (Schowe 1949:302). The area is most well known for its steeply eroded bluffs, flat-topped buttes, and pinnacles especially across much of Barber County. While these prominent features give the region its name, the topography more often consists of low hills and rolling lowland plains. Sinks and caves have developed throughout the area, where groundwater permeation has dissolved gypsum and salt layers. Formations of geologic note include Big and Little Basins in western Clark County.

The western edge of the area covered in this report is located on the margin of the High Plains physiographic province. Additionally, a narrow finger of the High Plains extends far to the east across the northern portions of Clark and Comanche counties. The High Plains surface is not a horizontal bed but rather rises slowly from east to west some 2,000 feet across its extent in Kansas. In western Meade County the High Plains tableland is readily apparent. In the vicinity of Crooked Creek and along this eastward extension, the typical feature of the High Plains, namely its general lack of features, is muted by the limited breadth of the extension. While the High Plains are broad, flat uplands that may have no obvious drainage, topographic relief is not uncommon. Locally, drainage dissection and other phenomena allow for variations in elevation of as much as 300 feet. Major drainages have broad, flat valleys, while lesser drainages are confined to more steeply walled, comparatively narrow valleys (Schoewe 1949:314). Dune fields, associated locally with the Cimarron River, and numerous shallow depressions across the uplands add additional variation to the physiographic setting.

Flora

In the vicinity of the sites, modern soil descriptions, General Land Office (GLO) maps and field notes provide information on the potential natural vegetation communities present around the time of initial settlement. This reconstruction reveals a mosaic of floral communities that are linked most commonly to general soil type and moisture availability. Each section is composed of a variety of species, although overlapping of types between adjacent communities is to be expected. Floral communities are not static, but rather are variable, depending on the climate of a given time period, as well as on local soil and topographic conditions (Table 1, Figures 6 and 7).

In general, medium to tall grasses dominate the floral setting, being especially plentiful in areas of rich, deep soil and soils with abundant available moisture. A mix of short to medium grasses may be expected in drier topographic settings, such as uplands and areas of poorer soil. Numerous varieties of forbs and shrubs occur throughout the area. Trees generally are restricted to locations along the drainages, although scattered hardy individuals may be found in other settings, such as sheltered draws.

In the two locales discussed here, short grasses are more common across the broad uplands of Meade County, with trees occurring almost exclusively along the major drainages. The density and variability of species typically would be lower than in the vicinity of Crooked Creek, where larger numbers of mid to tall grasses thrive in very moist to locally wet settings. Mule Creek, on the other hand, might have supported a gallery forest along its perennial drainage with a greater abundance and variety of understory growth. The valley, being smaller in size than that of Crooked Creek, might not have yielded

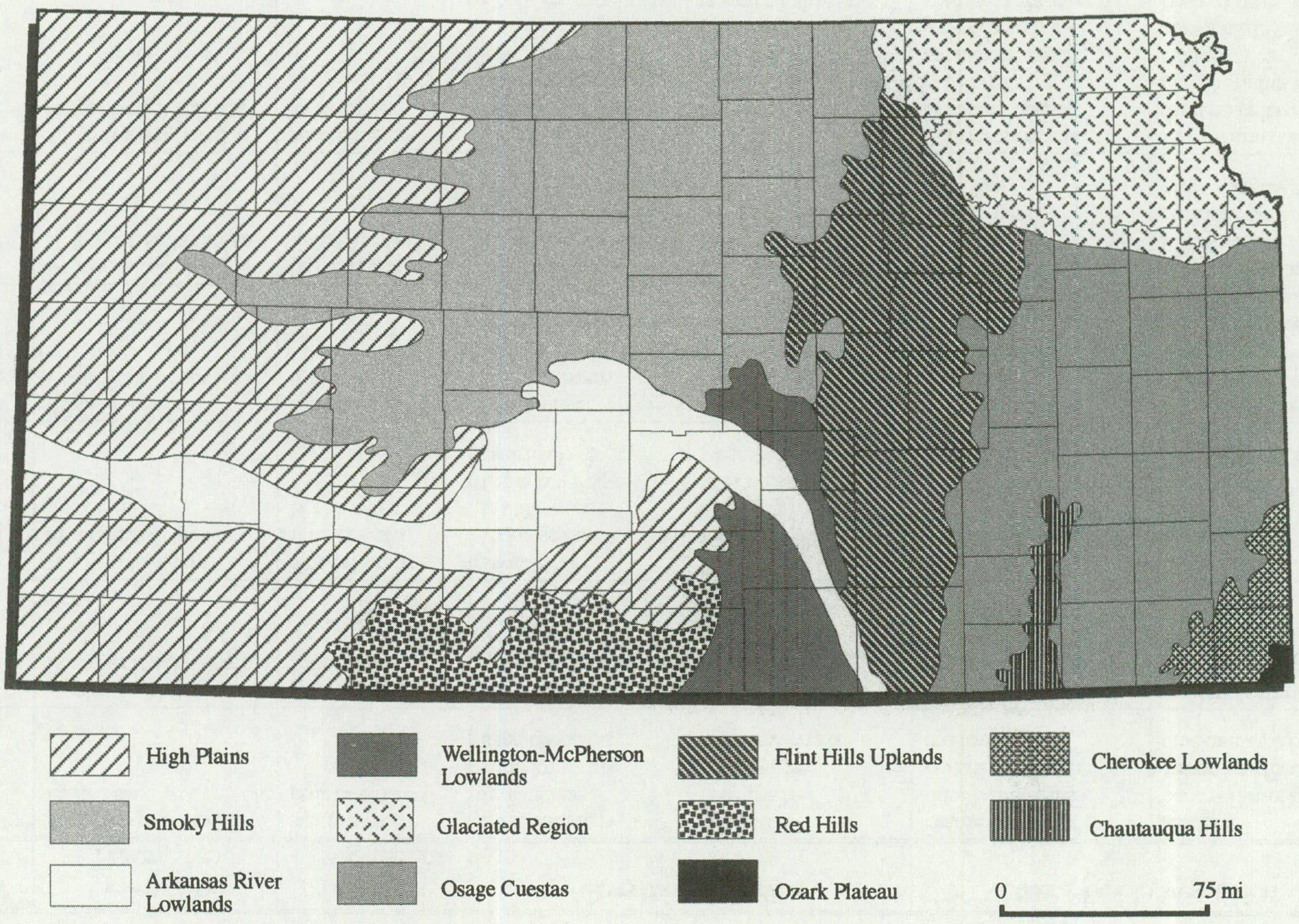

Figure 5. Physiographic map of Kansas.

Table 1. Range Vegetation Types in the Study Area.

Range Site	General Soil Description	Dominant Vegetation	Common Vegetation		Other Notable Vegetation	
Choppy Sands	A: loamy fine sand B: fine sand	sand bluestem prairie sandreed	little bluestem indiangrass sand lovegrass sand dropseed	paspalum blue grama hairy grama sand sagebrush	prairie sagewort false buffalograss annual three-awn red lovegrass	sandbur common sunflower lemon scurfpea chickasaw plum
Clay Upland	A: clay or silt loam B: clay/silty clay loam	side-oats grama little bluestem	big bluestem buffalograss switchgrass	blue grama red three-awn tall dropseed western ragweed	slimflower scurf-pea prairie coneflower prickly pear prairie sagewort	scarlet globemallow dotted gayfeather daisy fleabane
Limy Upland	A: silty clay loam B: silty clay/clay loam	side-oats grama little bluestem big bluestem	switchgrass indiangrass buffalograss Canada wildrye prairie clover	blue grama big sandreed hairy grama tall dropseed western wheatgrass	broom snakeweed western ragweed slimflower scurfpea tenpetal blazingstar blue grama	black samson leadplant pricklypear sand sagebrush Chickasaw plum
Loamy Terrace	A: silt loam B: silty clay loam	big bluestem indiangrass	switchgrass little bluestem Canada wildrye western wheatgrass side-oats grama	blue grama buffalograss sand dropseed tall dropseed ashy goldenrod	western ragweed heath aster vine mesquite Illinois bundleflower Louisiana sagewort	American licorice pitcher sage aromatic aster small soapweed American plum
Loamy Upland	A: loam/silt loam B: silty clay/clay loam	big bluestem little bluestem	side-oats grama Canada wildrye western wheatgrass dotted grayfeather	blue grama buffalograss tall dropseed sand dropseed	western ragweed red three-awn prickly pear leadplant	silver bluestem tumblegrass prairie coneflower prairie sagewort
Sands	A: sand/loamy sand B: loamy fine sand/sand	sand bluestem indiangrass	little bluestem switchgrass sand lovegrass giant sandreed lemon scurf-pea Louisiana sagewort	side-oats grama blue grama western ragweed sand sagebrush sand dropseed prairie sunflower	Scribners panicum chickasaw plum pricklypear small soapweed showy gaillardia six-weeks three-awn	Engelmann daisy sand paspalum prairie sunflower silktop dalea silky prairie-clover bush morning glory

[redacted]

Figure 6. Fowler vicinity range vegetation types.

[redacted]

Figure 7. Wilmore vicinity range vegetation types.

the abundance of seasonal aquatic zones as found along Crooked Creek. The upland setting, however, would be similar overall, although perhaps shorter grasses would not be quite so prevalent.

Fauna

A variety of grassland settings, riparian woodlands, scattered woodlands, flowing streams, seasonal ponds, and oxbow lakes contributed to the diversity of faunal species available in prehistory. Large mammals consisted of bison, wapiti, deer (mule and white-tailed), and pronghorn. Common smaller mammalian species were badger, skunk, prairie dog, pocket gopher, fox squirrel, ground squirrel, black-tailed jack rabbit, cottontail, weasel, raccoon, swift fox, coyote, and gray wolf. Numerous small mammals, such as rats, mice, and voles, would have been found in the area.

Riverine settings likely contained muskrat, buffalo fish, bullhead, channel catfish, sunfish, gar, and various mussels. Also present in the area were numerous reptiles, amphibians, and birds, including turtles, snakes, frogs, toads, raptors, songbirds, and migratory waterfowl.

Hydrology

Clark and Meade counties lie within the Cimarron River drainage basin. Site 14MD306 is located along the middle reaches of the Crooked Creek drainage, which constitutes one of the Cimarron's primary tributaries. The headwaters of Crooked Creek may be found to the north and west in extreme eastern Haskell County. From this point the creek moves in a general east and south direction, although it certainly justifies its name. The creek makes several major shifts in direction along its course in the eastern half of Meade County. In its upper reaches, "the valley is a broad, shallow basin and the stream's gradient relatively flat," but its lower portion is characterized by a valley that "becomes narrower and deeper, and the stream's gradient is steeper" (Smith 1940:23). After heavy rainfall the quiet creek often becomes a raging torrent, quickly leaving its low banks to cover wide areas of the floodplain (Smith 1940:23). The creek has been a perennial stream at least in its lower portion until recent times. Even in dry times pools of water were noted along most of its upper course (GLO field notes). In Meade County its perennial nature can be attributed to groundwater conditions that prevail today (Frye 1942). Although irrigation and other groundwater usage has drawn the watertable down, existing seeps and springs attest to the once lush setting through which Crooked Creek flowed.

The Artesian Valley lies between Meade and Fowler in central and northeast Meade County. Across this broad basin and along its margins, numerous seeps and springs flowed. In the vicinity of 14MD306, a seep or spring was located along the bank of the creek just off the south edge of the site (Don Hildebrand, personal communication). On Hildebrand's property, which extends to the south of 14MD306 along Crooked Creek, more than 100 seeps and springs were once located, although none is recognizable today (Flowers 1995:4). The bottomland across the creek from the site was subirrigated until recently, fed by a near-surface water table (Steve Lundeen, personal communication). Also in the valley were numerous swales and depressions that were filled by the annual flooding of Crooked Creek. Some of these areas could be better described as lakes, as they were more than 100 acres in size and held water for several years at a time.

Comanche County is drained primarily by the Salt Fork of the Arkansas River, whose headwaters lie in the southern part of the county. Some of the western part of the county lies within the margins of the Cimarron River drainage basin. Mule Creek is a major tributary of the Salt Fork. It heads to the north in southern Kiowa County, traveling southeast across the northeast quarter of Comanche County. Its course in south-central Kiowa County is described as ephemeral (Latta 1948:20). Other drainages heading in Kiowa County and traveling south are noted to be ephemeral streams in their upper courses, becoming perennial streams in their middle and lower reaches (Latta 1948:19–20). GLO survey field notes indicate that fresh, cool water was available along Mule Creek as it crossed Comanche County.

Climate

The present-day climate of the area may be described as continental. Winters are often cold and dry, while summers are commonly very warm, with the majority of the annual precipitation occurring in the spring and early summer (Flora 1948:1). Climatological data, provided from Ashland in Clark County indicates that the average daily minimum temperature in the winter is 20.4° F while the average daily maximum recorded in summer is 96° F (Tomasu 1977:60).

The area is considered marginal for growing crops without the benefit of irrigation and is located near the one hundredth meridian (99° to 100.5°), which coincides roughly with the 20-inch annual precipitation line (Wedel 1938). Nearly three-quarters of the annual precipitation occurs from April through September. During late summer atmospheric instability produced by afternoon heating occasionally results in widely scattered convection type thunderstorms. The annual precipitation in Comanche County averages 23.98 inches, but 2 years in 10 will average less than 19 inches or more than 27.8 inches (Hoffmann et al. 1989:102). Meade County averages slightly less annually with 22.34 inches. Averages, however, can be misleading as rainfall can vary from as little as 15 inches to as much as 31 inches over a 10-year period.

Droughts are frequent, with severe droughts occurring about every 20 years (Bark 1961). The cause of drought conditions has been explained by both Borchert (1950) and more recently by Bryson and Hare (1974) as the persistence of strong westerlies that typically dominate winter weather patterns into the spring and summer months, effectively barring the penetration of moist air. The site localities lie within an area where a combination of variables, including moderate to strong southerly winds, warm temperatures, low humidities, and light precipitation can and often does combine at least for short periods of time to produce highly stressful crop-growing conditions (Tomasu 1977:61).

Analytical Methods

Ceramic Analysis

Body sherds initially were grouped according to size. Those with surface areas of less than 3 cm^2 were not analyzed except to note decoration or surface treatments that were infrequent in the remaining collection. The balance of the body sherd sample was analyzed for size, thickness, exterior surface treatment, temper, and general section from which the sherd originated (i.e., neck, shoulder, body, base).

Surface treatment categories included plain, cordmarked, and smoothed cordmarked varieties. Plain surfaces were considered to be those with no evidence of modification. Cordmarked surfaces were identified as those with no evidence of modification after application of the cordmarks. Smoothed cordmarked surfaces included a wide range of lightly to almost completely obliterated impressions, almost exclusively caused by wiping of the cordmarked surface while the clay was still pliable.

Determination of temper was aided by the use of a 10X hand lens and a binocular microscope capable of magnifying to 70X. When present as a tempering agent, sand particles were measured using the scale and terminology developed by Wentworth.

General characteristics of individual sherds included vessel section and size (surface area). Typically, sherd curvature was the primary criterion for distinguishing between the various regions of a vessel, although sherd thickness and exterior surface characteristics were considered as well. Sherd size was determined simply by measuring the surface area of a particular sherd to the nearest square centimeter. Both sherd curvature and size were thought to provide some qualitative information useful for determining breakage patterns and the degree to which sherd lots were representative of vessel completeness, thereby helping to indicate potential vessel size of some unrestorable vessels in the excavated sample.

Occasional evidence of decoration on body sherds also was noted. The most frequent traits included groups of incised lines and punctates and occasional applique. Decorative elements and partial motifs were recorded as encountered. Their general orientation on the sherd and the position of the sherd in relation to the original vessel were observed.

Rim sherds were analyzed to determine form and orientation, and specific measurement of the orientation from vertical was taken when possible. Rim height was measured when both the lip and the neck/shoulder juncture were present. Diameter of the vessel at the lip was measured when possible by placement of the sherd on a template. Admittedly, this procedure was most reliable when used on larger specimens. Sherds that were especially small or otherwise exhibited a potentially deceptive arc were excluded. Lip types were recorded as rounded, flat, and beveled. Finally, decorative treatments were noted when present. Finger pinching, fingernail impressing, punctating, various appliqueing, and incising or impressing of lines on lips and necks were observed. Individual sherd decoration was measured to provide a range of variables for comparative purposes, such as placement on the sherd, distance between elements, and general size of elements.

Reconstructible vessels or vessel sections were subjected to further analysis of form and size through the use of computer enhancement. This process has been detailed elsewhere (Bevitt 1994); hence, it is only briefly outlined here. Vessel profiles, including those for which minor extrapolations were necessary to complete the rim-to-base cross section, were used to create three-dimensional wire frame images to which color and texture of sherds were applied across their respective portions of the vessel.

Lithic Analysis

Lithic technologies typically created vast quantities of debris through the creation and useful life of a stone tool. Chipped stone debitage was studied as a means of better understanding the lithic reduction strategies of the site inhabitants. Debitage is not discussed explicitly in terms of frequency from different excavation levels or various features because there was limited evidence of multiple occupations by the same or different cultures at any of the sites. Where there was evidence of multiple or long-term occupations, such as intersecting features at the Booth site, comparisons would be problematic due to the difficulty of distinguishing the separate features.

Topics of exchange and mobility can be addressed to some degree through the identification of raw material types. Relative distances to sources are important variables.

The presence of large amounts of cortex was noted, since it can indicate that the raw material was not significantly reduced elsewhere prior to the creation of flakes in the assemblage at hand. When present, the position of cortex on a flake can also assist in this assessment. The type of apparent cortex, whether it is obvious quarry cortex or a hardened rind developed through stream rolling, is important in ascertaining acquisition locale and by inference may provide information about exchange (e.g., Wycoff 1993.)

Platforms were observed for a series of variables. Platforms can contribute data about the reduction trajectory and percussion method. General platform modification and removal angle were used to differentiate between intermediate to late stage biface reduction and early stage biface or blocky core reduction. Platform modification, or the lack thereof, can provide some general measurement of the knapper's experience (Tomka 1985) and allow inference of the reduction trajectory (Odell 1989). Typically, platform faceting and edge modification are associated with biface reduction. The absence of these attributes may represent either early biface reduction or simply core reduction. Removal angle can also provide insight into the general nature of the size and form of the material being reduced. The platform angle measurement in this study is comparable to Tunnell's (1978) "vertical removal angle" and consists of the arc of intersection of the platform plane with the plane running the length of the ventral face of the flake. Steep removal angles are associated with core and early biface reduction, while relatively shallow removal angles are indicative of later stage biface reduction.

Chipped stone tools were analyzed using a set of basic variables, including functional tool type, raw material type, standard measurements of length, width, thickness, and weight, and the presence of thermal alteration. In addition, general bifaces were described as early, intermediate, and late stage. The terms blank and preform were applied to distinguish intermediate and late stage bifaces with no obvious signs of utilization. Notched projectile points were measured for neck width (across notches) and stem length (biface base to base of the bifacial blade). Other distinguished tool types included drills of various forms, perforators, knives, beveled knives, digging implements, endscrapers, utilized flakes, and other unspecified flake tools. Edge angles of the various tools were recorded when possible. It was hoped that, when viewed in totality, these observations might provide information on the general characteristics of the tool edges and a basis for distinction in broad terms of all modified lithic classes.

Pecked and ground stone artifacts were examined to determine functional type, raw material type, description of worked edges and faces, and, when possible, dimensions of length, width, thickness, and weight. In special instances additional measurements were acquired, such as variation of width and depth of grooves, associated with flintknapping and shaft abrasion.

Crabtree (1967:69; 1972:68) commented on the use of abrasive stones and their inclusion in a flintknapper's tool kit. In an experimental study involving the manufacture and use of both flintknapping and arrow shaft abraders, Flenniken and Ozbun (1988:46) indicated that there were several distinctive wear patterns that were recognizable on flintknapping abraders. One consisted of relatively linear V-shaped grooves of varying depth, a pattern consistent with the collection of flintknapping abraders discussed here.

Abraders with rounded or U-shaped cross sections were identified as having performed an abrasive shaping function in manufacturing arrow shafts. Briefly, a proposed manufacturing process, as depicted by Flenniken and Ozbun (1988:39–41), included shaping of the raw material into a predetermined form, followed by grooving and splitting of the stone to create a matching pair. The pair was then grooved with a stone tool to create channels into which the arrow shaft "blank" was placed. The shaft was run back and forth, while being rotated, to create a uniform dimension for the arrow shaft, which varied from 6 to 9 mm in diameter (Flenniken and Ozbun 1988:41). When the groove became too large to perform its function, the abrader pieces were rubbed together to reduce the depth and subsequently the width of the groove. This method of manufacture and rejuvenation resulted in shaped, matched abrader pairs. While most of the specimens in the collections discussed here are fragmentary, nearly all examples are shaped forms with ovoid to rectangular cross sections. Some of these tools may have been utilized individually rather than in pairs, since the grooved areas would not provide adequate contact zones for an abrader mate.

Flenniken and Ozbun (1988:48) described their third type of flintknapping abrading technique as one in which lithic pieces were drawn perpendicular to the chipped stone margin. This method often created irregular concavities across the utilized face of the stone. A similar pattern was recognized on at least some of the flat abraders described in following sections. These tools also might have functioned as whetstones. It is proposed that these tabular stones could have been used to maintain working edges on at least some categories of bone tools, including scapula hoes, "squash knives," and tibia digging stick tips.

Faunal Analysis

All bone was scrutinized for evidence of functional use. Utilized/modified specimens were subject to identification of tool type; measurements of length, width, thickness, and weight; description of modified edges and faces; and identification of element and species when possible. Unmodified bone was identified simply to element and species. The diagnostic pieces, as well as unidentifiable bone scrap, were counted and weighed.

Two basic measurements were employed to help illustrate the sample size and frequency of occurrence of any one category of remains at the site. Number of identified specimens (NISP) is the abundance of identifiable elements attributable to any one species or group. Minimum number of individuals (MNI) is the minimum number of individuals of a particular species represented by the bone collection. MNI values were calculated using standard criteria, which consisted of element and portion identification, side determination, and at least rough calculation of age (i.e., adult, juvenile, fetal). Data available in the collection of bone tools contributed to the MNI determination when possible. Sex determination was not attempted on the collections as a whole, due primarily to the focus of the project and time constraints associated with the analysis.

The faunal remains from the Bell site have been previously analyzed and are only discussed in intersite comparisons. A sampling strategy was adopted to deal with the large quantities of faunal remains from a single large feature (Feature 268) at 14MD306. Materials from two excavation units were formally analyzed with the expectation that other units from the feature would yield a similar variety and density of remains. Other units associated with the feature were reviewed in order to determine if other variations were present but not identified in the sampled group.

Floral Analysis

Floral remains collected from the sites were studied to identify the presence of particular wild and cultivated plants. Comparative samples were utilized as a means of proper identification. Different methods of flotation collection presented problems regarding direct comparison; hence, much of the deliberation focused on identification and general discussions of the presence of these materials in cultural contexts. As an analysis of the macrobotanical remains was not a primary outcome of this analysis, nonrandom samples of material were viewed in order to allow for some determination of the variety present in the samples at hand. The same sampling method used for the faunal material was employed in the analysis of floral materials from Feature 268 at 14MD306.

14CM407 — The Bell Site

Society archeologists visited site 14CM407 in late 1983 and early 1984 to record the surface area of the site and assess the potential for intact remains of the prehistoric occupation. The KATP field school was conducted from June 2 through 17, 1984. The excavation focused on several of the possible buried features at the site.

A total of 41, 2 x 2-m units was opened to investigate various subsurface soil stains and areas in between them (Figure 8). Initially a series of test units, creating a backward "L," were opened across the central portion of Area 841 ("84" for the year of fieldwork and "1" for the first area of investigation at the site that year). For the most part the test units were located outside the limits of tentatively defined features identified during earlier coring, although the northernmost extension of the "L" did extend into what was later defined as Feature 134. This early work outside of feature contexts helped to determine the very consistent depth of the plowzone at approximately 18–20 cm. The plowzone was typically a brown to grayish brown soil. In non-feature areas the underlying soil was a light brown with scattered caliche flecks throughout.

A 15-cm level was excavated to remove the majority of the plowzone. In fact 15-cm levels were the rule throughout the excavation. However, in some instances levels of 5–10 cm were utilized to more carefully inspect for subtle soil contrasts.

Shovels and trowels were utilized during the excavation. Trowels and more precise excavation tools were used to expose artifacts, whereas trowel and shovel skimming were employed for fill removal to expedite the excavation when artifact densities were low. Excavated soil from the initial level of each unit was subject to sampling for screening. Every third bucket was passed through ¼-inch mesh hardware cloth to recover smaller materials. Subsequent levels were screened in their entirety.

Artifact densities in units were generally lower than those encountered in features, with the possible exception of Units 544, 564, and 579, which exhibited a moderate density of debris to approximately 30 cm below ground surface (bgs). In at least the west half of Unit 564 and the northeast quarter of Unit 544, a darker soil, rich with cultural debris, was found that may be associated with nearby Feature 125. An adjacent unit, 579, yielded a grinding slab resting at the 30-cm level, possibly indicating a relatively undisturbed living surface in the area immediately to the east and north of Feature 125 and south of Feature 134.

Work progressed from the initial east/west and north/south lines of units to the north into Feature 134. Initial definition of features was followed by continued excavation in 10-cm levels due to the large size of most features at the site (Table 2).

Additional units were laid out over areas of subplowzone material identified by coring. Features 125 and 138 were investigated concurrently as Feature 134 was finished. Late in the field school work began in the vicinity of Feature 137 near the southern edge of the site. The initial excavation here revealed the possibility of structural remains, and all available crew members were assigned to this part of the site. Features 125 and 138 were completed near the end of the project, allowing all effort to be focused on Feature 137. The short time and large area required to expose the feature were effectively offset by the labor force, allowing for expedient excavation of the feature.

FEATURES

Feature 125 was defined primarily in Unit 563, although Units 544 and 564 also contained scattered artifacts that could be associated with the feature (Figures 8 and 9). The basin-shaped pit contained a matrix of soft dark brown/grayish soil with ashy pockets. The fill contained scattered burned earth and charcoal flecks, larger chunks of burned earth, abundant broken bone, pottery, debitage, and stone and bone tools. Among the ceramic items were sherds that were cross fitted with sherds from adjacent portions of Units 564 and 544. Sherds from the 30–40-cm level of Feature 125 were found to have a mate from the 28–33-cm level of Feature 134, suggesting contemporaneity of these pits.

Feature 134 was defined in the north end of the block excavation in Units 599, 600, 601, 602, 603, 614, and 615 (Figure 8). The base sloped upward slightly across the floor and became more pronounced as the margins of the ovoid feature were approached (Figure 10). In general the feature had an uneven floor and irregular perimeter, both of which were difficult to define. Numerous artifacts were recovered from the feature, including abundant quantities of bone (some relatively complete sections but mostly splintered fragments), worked bone, chipped stone tools and debitage, some ground stone tools, and pottery (including one reconstructible section). One rim sherd from 44 cm bgs in Unit 614 was cross-mended to a

Table 2. 14CM407 Feature Descriptions.

Feature Number	Feature Type	Depth (cm bgs)	Maximum Dimensions (cm)	
			Orifice	Base
125	Basin-shaped Pit	30-50	128	120
134	Borrow Pit	20-60	750 x 400	
137	Semi-subterranean Structure	30-65	500 x 500	
138	Basin-shaped Pit	20-70	350 x 175	
140	Post Mold	61-94	30	25
169	Hearth	65-79	43 x 38	

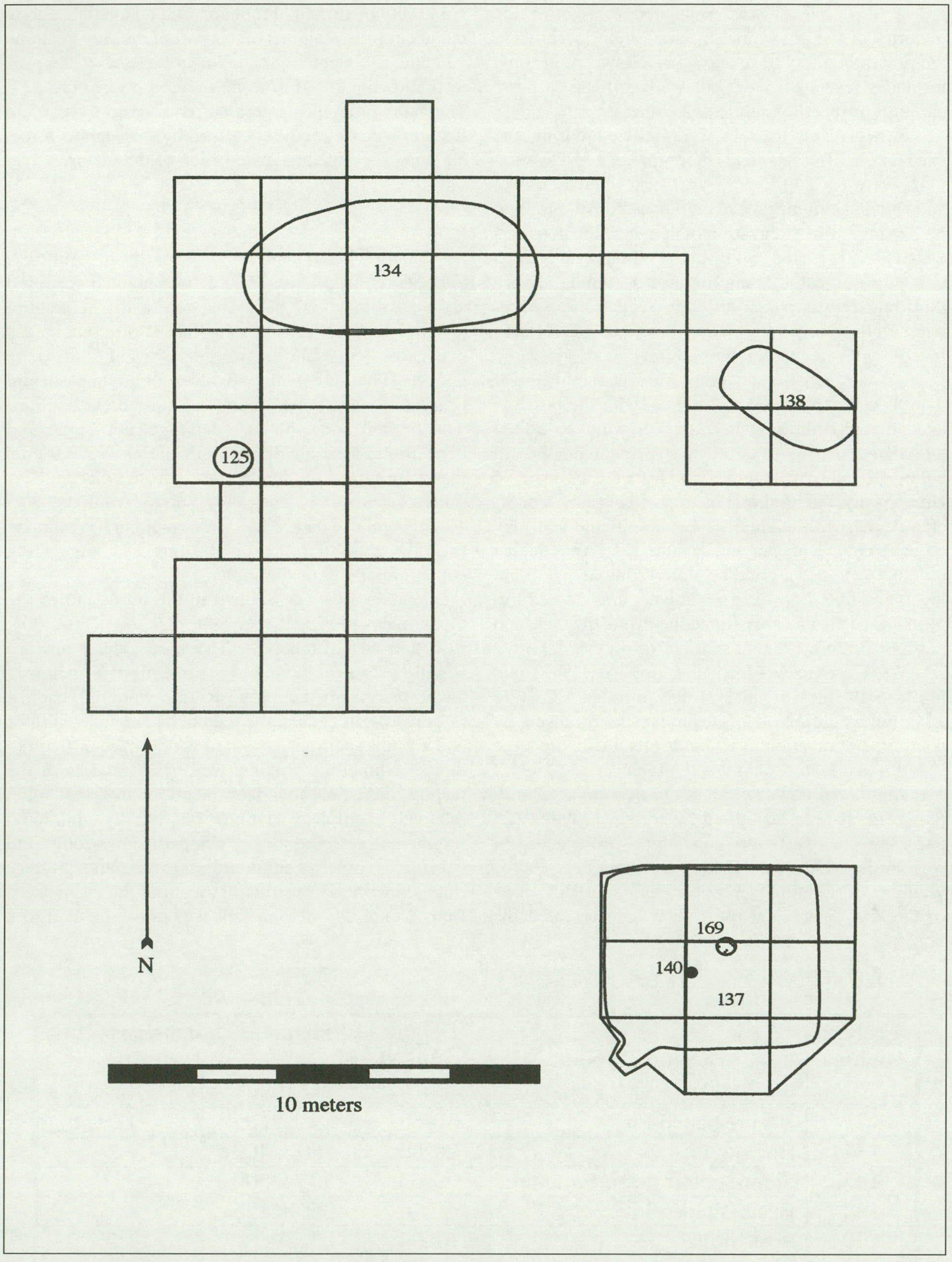

Figure 8. Excavation plan view of 14CM407.

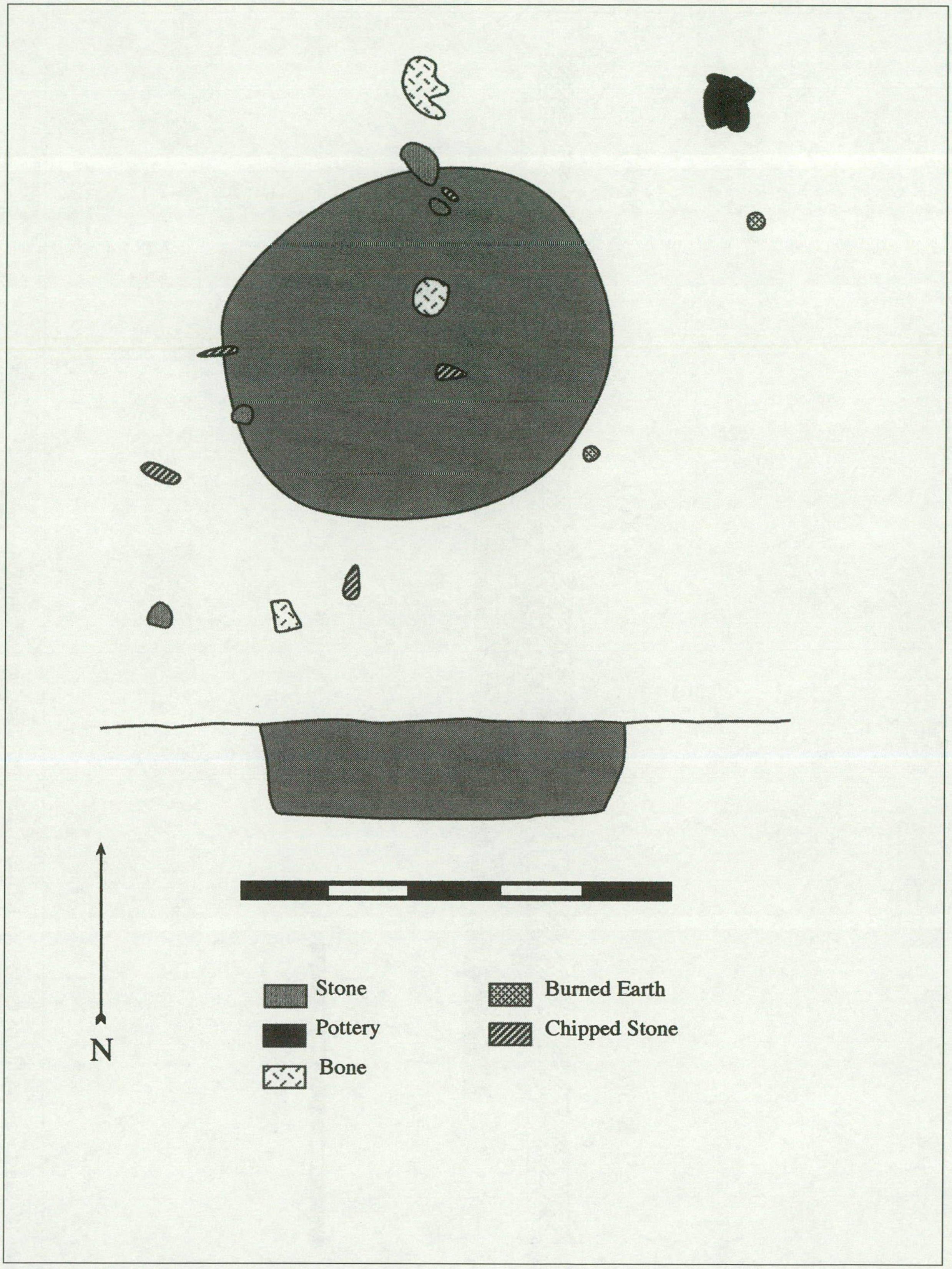

Figure 9. Feature 125 plan view and profile.

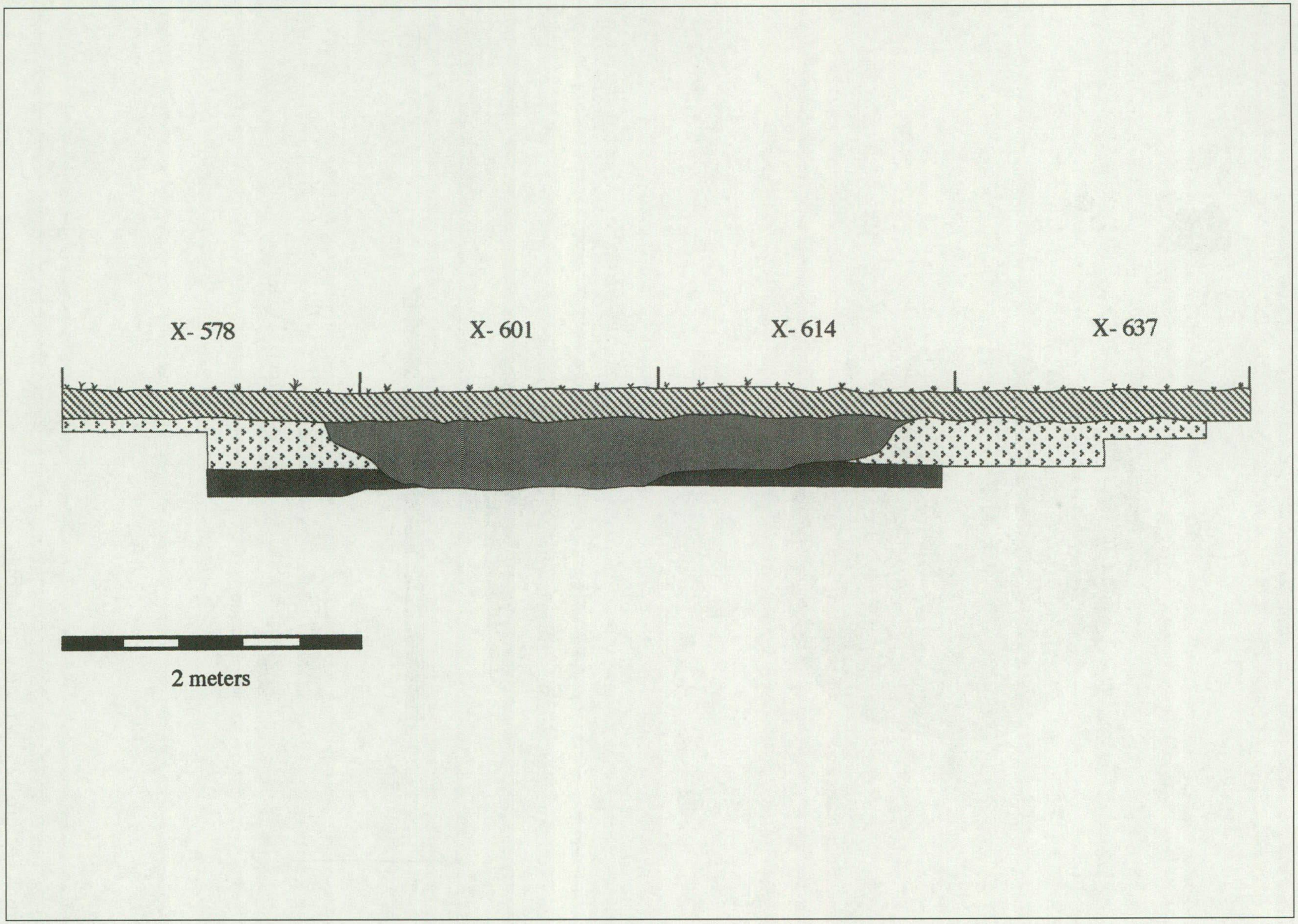

Figure 10. West wall profile of Units 578, 601, 614, and 637 showing Feature 134.

rim sherd found in the 45–60-cm level of Unit 570 in Feature 138, indicating contemporaneity of Features 134 and 138 and, by extension, Feature 125, which had ceramics in common with Feature 134.

Several profile photographs indicate a possible buried soil near the base of several units in the Feature 134 area. This paleosol appears nearly identical in color to the feature fill, although it is generally darker. The band is noted at a depth of 50–55 cm and is estimated to be 15–20 cm thick. In these same profile photos a slightly lighter zone is distinguished at approximately 60 cm, which includes the sloping margins of Feature 134. Therefore, it is believed that the feature fill extended to a maximum depth of approximately 60 cm. The base of the feature cut into this buried soil horizon, which was difficult to discern from the cultural fill. Corroborating evidence includes a moderately dense scatter of debris at around 60 cm in several units. While excavation continued below this layer as a result of chasing the dark fill, artifact concentration seems to have declined considerably. Interestingly, a corner-notched Woodland point was recovered from a depth of 64 cm bgs in Unit 615 near the west end of Feature 134. The point was not found lying horizontally in the matrix; rather it was oriented nearly vertical with the distal end down. While photographic documentation is inconclusive, this artifact may be associated with the paleosol rather than the later cultural feature. Field notes for this particular unit indicate that several large bone sections were encountered just above the 60-cm unit floor. If this material may be considered to have rested on the floor of the borrow area, material from below this zone, including the Woodland point, instead may be associated with the buried soil horizon. This possible paleosol was not encountered elsewhere in the site, although excavation rarely proceeded below 30 cm unless cultural features were encountered. On a side note, some of the difficulty with the definition of Feature 137 may be attributed to the occurrence of the paleosol in that area, since the elevation of the structure floor (60–65 cm) is similar to that of the paleosol as it occurred in the north end of the block excavation.

Feature 137 covered at least portions of Units 460, 461, 462, 429, 430, 431, 424, 425, and 426 (Figure 8). The feature measured approximately 5 m^2 and had relatively straight sides and rounded corners (Figure 11). Burned earth, grass- and pole-impressed daub, bone, debitage, chipped and ground stone tools, and ceramic sherds were sparsely scattered in the upper portion of fill. Concentrations of the same types of artifacts were recovered from the feature floor.

Feature 138 was situated in Units 569, 570, 573, and 574 (Figure 8). The feature had relatively straight walls and a floor that sloped slightly toward the center (Figure 12). The pit was best defined in Units 570 and 573 where the darker, loose feature fill readily was distinguished. Definition in Units 569 and 574 was more difficult due to extensive rodent disturbance. Pottery, including a reconstructible vessel section from the eastern margin, ground stone tools, chipped stone tools and debitage, butchered faunal remains, and worked bone were recovered from the feature.

Feature 140 was in the floor of Feature 137 (Figure 11). At this point it appeared as a circular stain of dark brown, loose soil with charcoal and burned earth flecks throughout. The feature had slightly tapering walls and a flat base (Figure 13). Several fragments of turtle carapace were found at the base along the south edge. The feature is considered to represent a substantial support post, situated a short distance southwest of the structure center.

Feature 169 was a hearth associated with the Feature 137 structure floor in Units 430 and 461 (Figure 11). The feature consisted of a ring of burned earth with an interior of dark brown fill. Once excavated, the sides of the basin sloped to a rounded base (Figure 13). The walls were generally heavily fired, while an ashy pocket at the base was mixed with chunks of burned earth and thermally altered flakes. Small amounts of charcoal also were noted throughout the matrix. Several sections of bison bone were associated with the feature, including one group of articulated lower limb elements.

Radiocarbon Dates

Two radiocarbon samples were submitted for dating. One sample was sent to Beta-Analytic (Beta-12650) shortly after fieldwork was completed. Two charcoal samples were submitted originally, one each from Features 134 and 138. Neither sample proved to be of adequate weight using standard methods, so the samples were combined. Ceramic data to be discussed later indicated that the features were likely open simultaneously, providing some confidence for combining the samples. A radiocarbon age of 780 B.P. ± 160 was acquired (Table 3). Calibration was achieved using CALIB 3.0.3, yielding a corrected age of 675 calBP (Stuiver and Reimer 1993).

In 1999 a second sample was submitted to the Illinois State Geological Survey (ISGS-4241) with the intent of obtaining a date with a smaller standard deviation for comparison with the first date. Charcoal

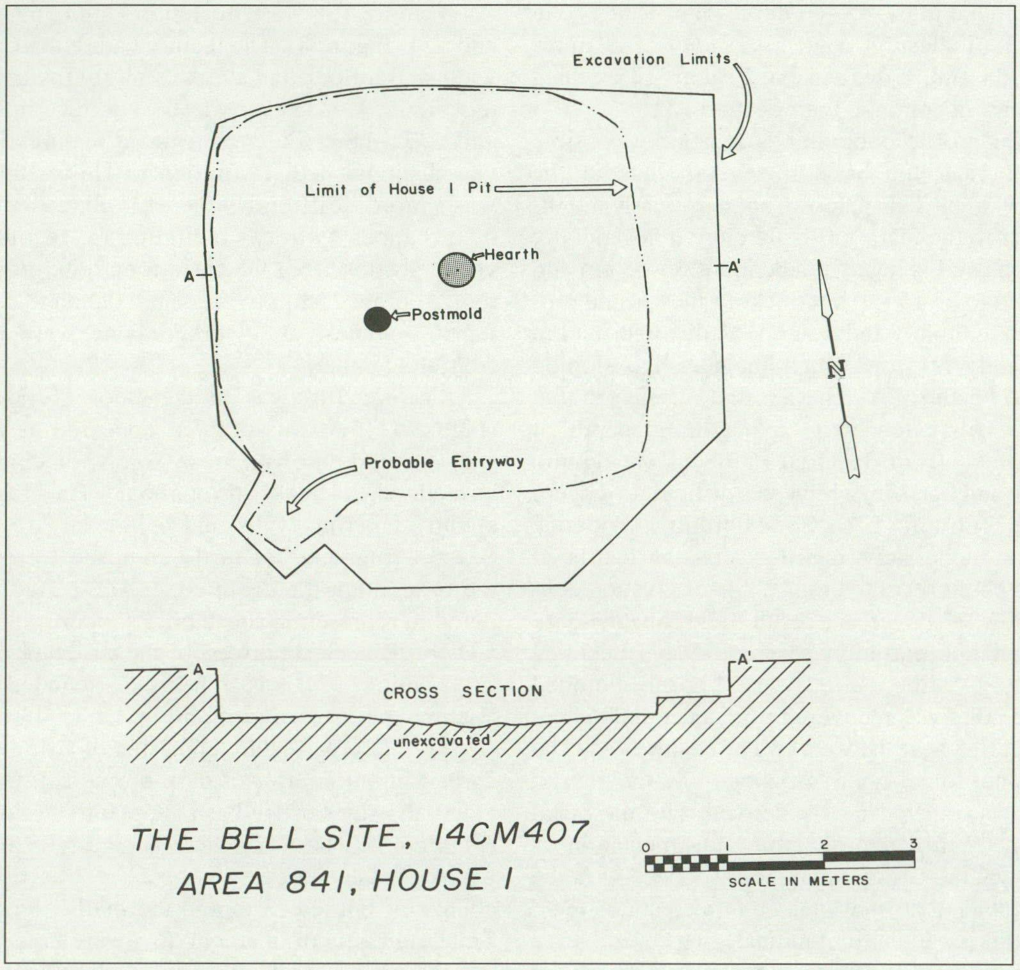

Figure 11. Feature 137 plan view and profile (Rowlison 1985:124).

was sparse in the collection, making procurement of an adequate amount of solid wood charcoal difficult. A sample from Feature 138 was considered large enough to send. Even then, C_{13} correction helped avoid a potentially skewed date. A radiocarbon age of 860 ± 70 B.P. was obtained (Table 3). Calibration yielded a corrected age of 736 calBP (Stuiver and Reimer 1993). The two dates are statistically the same at a 95 percent level of confidence.

Ceramic Artifacts

Ceramic artifacts from the Bell site were scattered throughout the block excavation but were especially common in features, particularly Features 134 and 137. Cross-mended sherds revealed that Features 125, 134, and 138 were probably open concurrently. For the purposes of this discussion, contemporaneity is assumed for all primary features at the site.

The primary vessel form from the site is a medium-sized pot with constricted neck, moderately high rim, globular body, and rounded base. Typically, vessel exteriors are cordmarked. Appendages include occasional handles — strap and loop — and lip tabs that may have functioned as useful lugs in some instances.

Three ceramic sherd clusters, one each in Features 125, 134, and 138, allowed for reconstruction of partial vessels. These vessels were reconstructed with the aid of a computer. The process began with the rim-to-base profile, using as much as was available. Obviously confidence in the results increases when most of the vessel is present. Duplicating the profile with the aid of a three-dimensional imaging program created an idealized wire-frame image of the vessel. Colors and textures from vessel parts were duplicated and applied where appropriate. The resulting image was used for purposes of illustration and analysis of vessel size and volume.

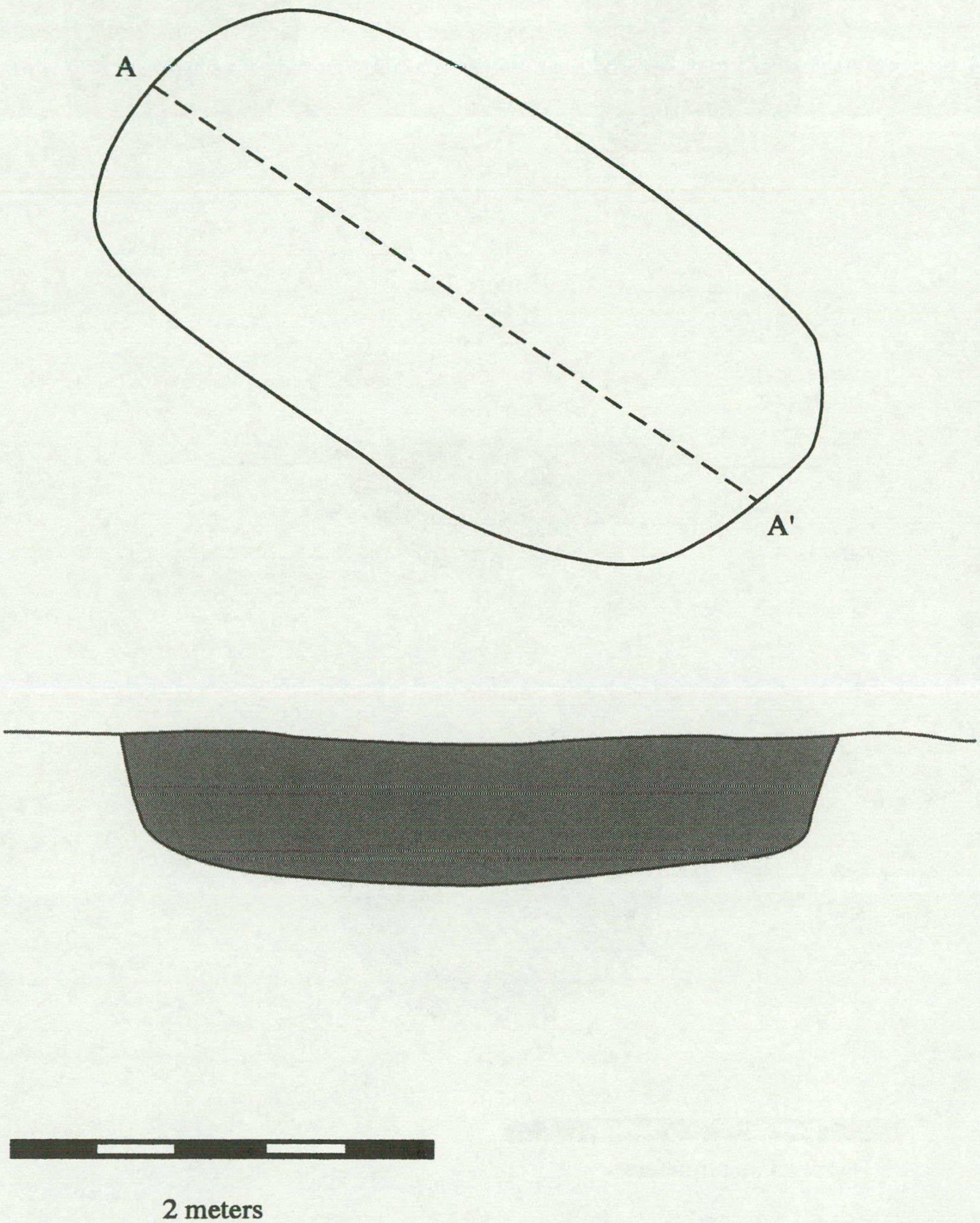

Figure 12. Feature 138 plan view and profile.

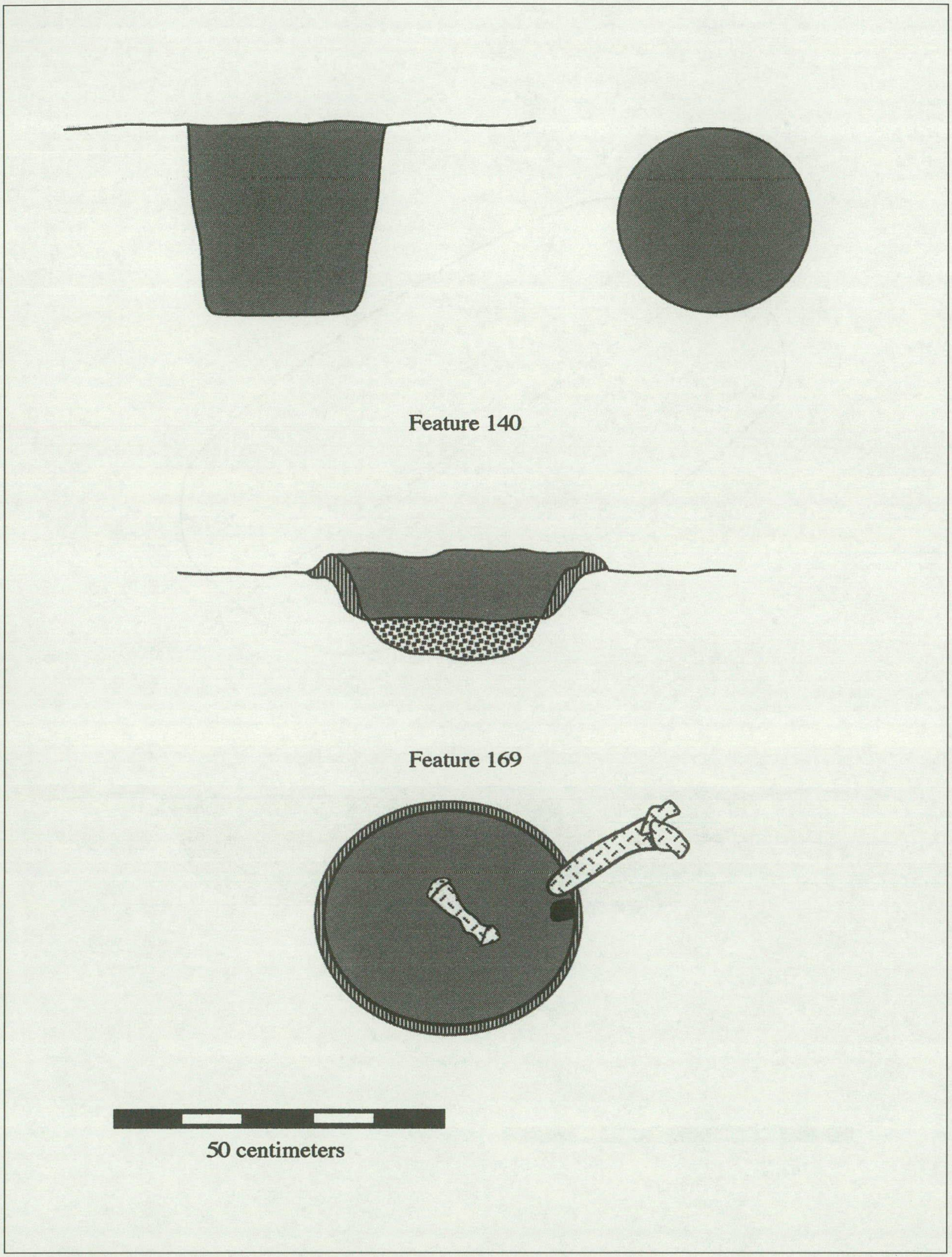

Figure 13. Features 140 and 169 plan views and profiles.

Table 3. 14CM407 Radiocarbon Dates.

Sample	^{14}C Age	95.4% (2 Sigma) Cal Age Ranges	Relative Area under Distribution
B-12650	780±160	cal A.D. 958-1447	1.00
ISGS-4241	860±70	cal A.D. 1037-1280	1.00

Two of the vessels are decorated with finger pinches below the lip, while the third is undecorated. The three vessels together are used to illustrate the typical vessel form at the site (Figure 14). Another vessel form is represented by at least one sherd from Feature 134. This small neckless jar, also known as a seed jar, exhibits a light red film on the exterior and appears to contain darker zones of cross hatching.

Vessel rims range in height from 2.2 to 5.0 cm with an average height of 3.4 cm. Rims typically are oriented at a slightly everted angle (56 percent). Vertical or near vertical rims were noted in 15 percent of the collection. Rims with more strongly everted or flaring orientations account for 12 percent and 15 percent of the sherds, respectively.

Vessel orifices range from 9 to 22 cm, averaging about 15 cm. There is generally an even distribution of vessels between 12 and 18 cm, although there may be weak evidence for a smaller orifice size of about 12 cm and a larger size of 16–18 cm. Vessel lips are often rounded (59 percent) or flattened (33 percent), and occasionally both forms occur on a single rim sherd. A small percentage (8 percent) are beveled, creating a flattened area along the exterior of the lip.

Sherd thicknesses ranges from 2.9 to13.1 mm (generally 4.5–6.5 mm), and averages 6.43 mm among body sherds and 5.86 mm among rim sherds. The thickest sherds often are associated with the area of the neck/shoulder juncture and also lower body regions. Untempered sherds are the thinnest fragments on average in both categories. Tempered sherds are more variable in thickness with no notable correlation between temper type and general vessel thickness.

Cordmarked ceramics dominate the collection, accounting for 77 percent of the analyzed sherds. Typically cordmarking is smoothed over (71 percent) to some degree, while a significantly smaller amount consist of unmodified cordmarks (6 percent). Judging from several large reconstructible sections, smoothing was not consistently applied to the vessels. Smoothed cordmarked sherds range from examples with lightly modified cord ridges to those whose cordmarks were almost completely obliterated. Apparent plainware sherds make up the remainder of the collection (23 percent). Cordmarks frequently are oriented randomly, although vertically oriented cordmarks are found occasionally on vessel rims. Rim sherds exhibit an increase in the number of plain or completely smoothed specimens. This indicates that modification of vessel exteriors was more frequent across the upper portion of the vessel, particularly on the neck and rim.

Tempering agents include sand, bone, and shell. A significant portion of the ceramic artifacts are not tempered (26 percent) and exhibit a paste that comprises a very silty (or extremely fine sandy) clay. Occasionally possible tempering particles are noted on larger sherds, but these are often isolated and might not have functioned as temper. The most common tempering agent is sand (36 percent). Particle size varies widely, from under 1 mm to more than 3.5 mm in diameter, typically averaging less than 1.5 mm. Size grades overall appear to be relatively well sorted, with particles of similar size accounting for the primary tempering agent in any one specimen, although poorly sorted sand granules are found occasionally in some sherds. Sand is mixed with crushed, burned bone in 13 percent of the collection. Bone is utilized alone in 23 percent. The remaining 2 percent of the sherds contain crushed shell temper.

Decoration is common on rim sherds and infrequent on body sherds. Decoration occurs on 44 percent of the rims (Figure 15). Finger pinching is by far the most frequent decorative technique, being observed on 26 percent of the rim sherds. Fingernail impressing was noted on 3 percent of the ceramic sherds. Applique lip tabs are found on 10 percent of the rims. The tabs themselves generally are not decorated, and some are substantial enough to have performed a useful function. Among the examples from the excavation units there often are single tabs, although pairs also are noted. From surface collections groups of as many as three tabs are found occasionally. Since most are not large enough to have been used as lugs for grasping or hanging or are oriented in such a manner as to have

Figure 14. Digitally reconstructed vessels from 14CM407.

Figure 15. Examples of rim sherds from 14CM407.

made that use unlikely, the trait is included here in the discussion of decorative elements. Other infrequently noted decorative techniques include punctates in rows along the neck (3 percent) and red-filmed rim exteriors (2 percent).

Decoration not associated with rims is restricted to a handful of sherds from the shoulder region of the vessel (Figure 16g-i). Parallel rows of incised lines, forming triangular zones set at opposing diagonals from adjacent units, are noted in at least one case. A pattern of at least two parallel incised lines, creating chevron designs, occur on two examples. In one instance this chevron pattern is associated with applique nodes. Applique nodes are identified on two additional shoulder sherds. Worthy of mention is an unusual decorated sherd collected from the site surface (Figure 16i). This sherd exhibits two incised concentric rings at the center of which is a small indented node. This decorative element is unique for the area, the only comparable examples being associated with decorative motifs on Oneota ceramics from the northeastern periphery of the Plains (Gibbon 1973; Henning 1970). It is believed, however, that this piece was created locally, since the general characteristics of the sherd are consistent with the bulk of the ceramic inventory from the site.

LITHIC ARTIFACTS

Debitage

At the Bell site a wide variety of raw materials were utilized, as indicated by the variation in the debitage class. The total of 780 pieces of debitage can be discussed in terms of local versus nonlocal materials. Raw materials that were available within the area include Dakota and Ogallala quartzites, Day Creek chert, moss agate, and various chalcedonies, which may be associated with Ogallala formation. Together these account for 40.4 percent of the chipped stone debris at the site: Dakota quartzite – 27.7 percent, Ogallala quartzite – 9 percent, Day Creek chert – 3.1 percent, chalcedony and moss agate – less than 1 percent.

Nonlocal materials were acquired from several directions. Alibates agatized dolomite (10.3 percent) was obtained from the Texas panhandle. Smoky Hill jasper (9.4 percent) from northwest Kansas accounted for a similar amount of debitage. The majority of nonlocal lithic materials was obtained from the east, primarily from the Flint Hills region of eastern Kansas. Together varieties of Florence chert make up the single most common lithic resource at the site,

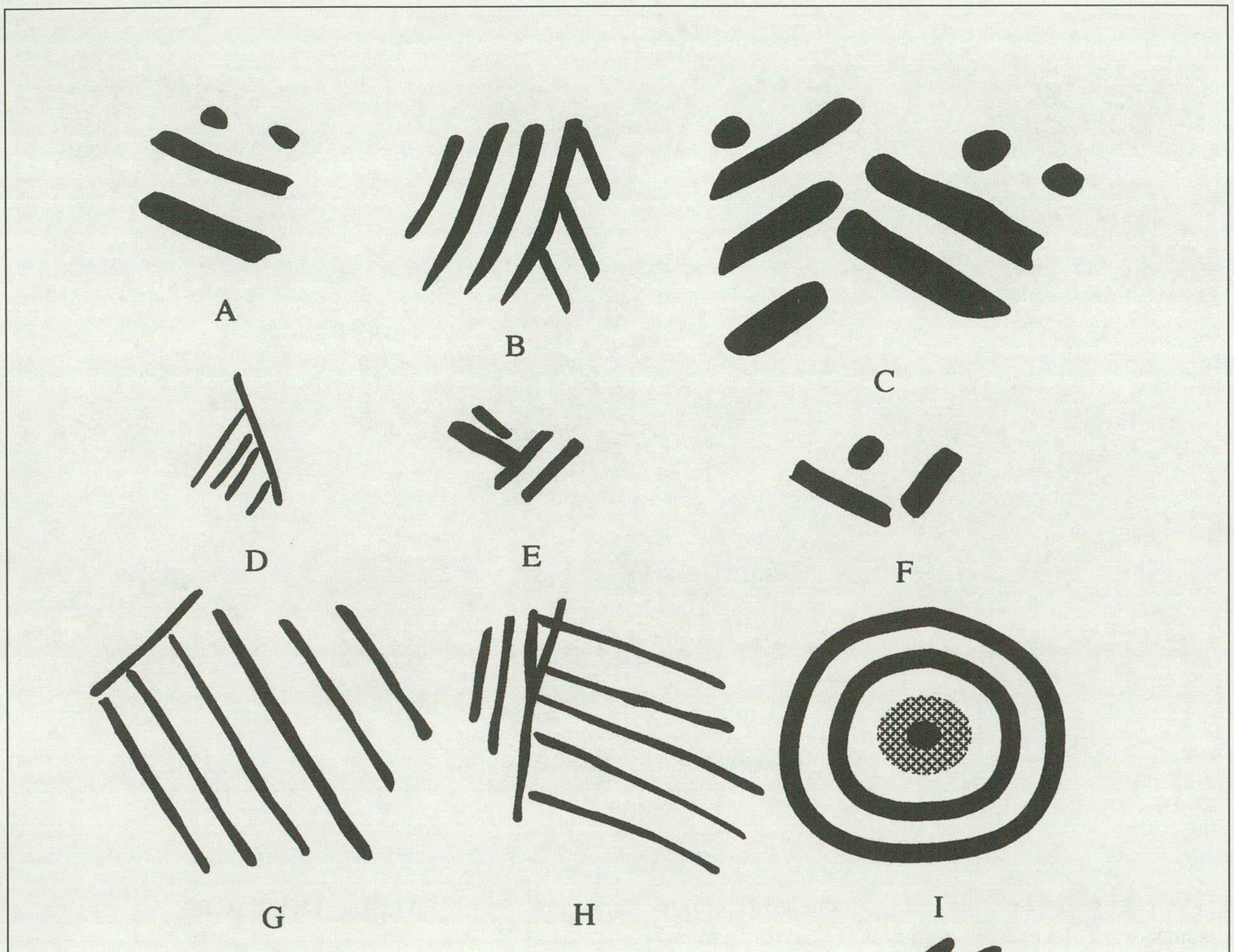

Figure 16. Decorated body sherds from the Comanche County vicinity.

accounting for 38.4 percent of the chipped stone debitage: Florence A – 12.8 percent, Wreford – 11.8 percent, Florence C – 13.6 percent, and Florence D – .2 percent. Peoria chert (.2 percent) from northeast Oklahoma was noted in isolated instances as well.

These raw materials often came into the area in reduced form. Evidence of cortex or hardened rind was noted on only 8 percent of the total debitage. Of the six Alibates agate flakes bearing some sort of exterior material, five exhibited hardened rinds indicative of recovery from a secondary source. Wycoff (1993) has indicated that Alibates agate is a minor component of streambed materials along the Canadian River in western Oklahoma, and prehistoric sites there often contain it. While the generally small size of the available gravels would exclude its use for some larger tool classes, cobbles of adequate size could be collected for use in manufacturing smaller tools (Wycoff 1993).

Additional support for the premise that chipped stone raw material was entering the area in an at least partially reduced form is the high proportion of intermediate- to late-stage biface reduction flakes in the collection. Debitage associated with this component of reduction accounts for 81 percent of the material, whereas blocky core and early-stage biface reduction flakes were encountered in only 19 percent of the collection. Among the various raw material categories only Day Creek chert exhibited a higher proportion of early reduction flakes (Table 4). Fragments of only three cores were identified, one each of Day Creek chert, Ogallala quartzite, and Smoky Hill jasper. Evidence of thermal alteration, characterized as intentional heat treatment, is limited to 4.8 percent of the collection, primarily Smoky Hill jasper and Florence cherts.

Chipped Stone Tools

The raw materials identified in the various tool classes included nearly all of the varieties recognized among the debitage (Table 5). Alibates agate (45.2 percent) frequently was used for both formal and informal tools. Florence cherts are abundant also, constituting 35.4 percent of the chipped stone tools. By variety, Wreford was utilized nearly twice as often as were either Florence A or C (18.3 percent versus 7.3 percent and 9.8 percent, respectively). Smoky Hill jasper (7.3 percent) and Dakota quartzite (4.9 percent) were the next most commonly represented materials. Occasionally encountered were Ogallala quartzite, Day Creek chert, Edwards Plateau chert, moss agate, and chalcedony. Unidentified varieties make up approximately 1 percent of the sample.

Fifteen projectile points or point fragments were recovered from the site (Figure 17). This number is nearly evenly divided between feature contexts and general excavation levels. Features 134 and 137 yielded all of the projectile points from feature contexts. Side-notched triangular arrow points of the Washita type (n = 6) are the most frequent point type. Plain triangular arrow points of the Fresno type (n = 3) also were identified, as was a single corner-notched Woodland form. Approximately half of the bifaces classified as projectile points consist of proximal, medial, or distal portions of the tool; few of these portions are useful for diagnostic purposes. Evidence of impact fractures, resulting in broken distal ends or major flake removals along the axis of the blade, was found on several specimens. Edge angles among projectile points average 33°. Only one specimen was found to measure above 35° (Table 6).

Seven alternately beveled knives were identified. Their contexts were nearly evenly divided between general excavation units and Feature 125. Complete examples indicate a diamond-shaped form, and it is suspected that most, if not all, specimens in the collection are representative of this type (Figure 17). Edge angles along the steeply beveled lateral margins of the seven specimens range from 50 to 75°, although five have edge angles greater than 60°.

Other items consist of intermediate and late-stage bifaces, classified as blanks and preforms. Bifacial blanks typically have width-to-thickness ratios of less than 3:1 and exhibit somewhat sinuous margins and generally lenticular cross sections. By contrast preforms often have a more refined appearance with width-to-thickness ratios in excess of 3:1, aligned edges, and flattened lenticular cross sections. Edge angles for the six blanks in the collections average 54°, compared to an average of 41° for the four preforms (Table 6).

Unifacial tools are dominated by informal flake tools. Typically these exhibit light to moderate edge modification or retouch, especially along lateral margins. Variety marks this category of 39 tools, with no one form typifying the group (Table 7). Expedient flake knives were identified as having relatively shallow edge angles that average 43° with little evidence of steep retouch. Possible scraping implements were more steeply angled, averaging 61°. Florence cherts are identified as 46 percent of the collection, followed by Alibates agate with 36 percent frequency. Other materials include Smoky Hill jasper, Day Creek chert, Dakota quartzite, and chalcedony (Table 5).

End scrapers by comparison are much less common but represent a more standard tool form (Table 7). Nearly 67 percent of the 12 end scrapers were

Table 4. Correlation between Reduction Strategy and Raw Material Type at 14CM407.

Raw Material	Blocky Core/ Early Biface Reduction	Intermediate/ Late Stage Biface Reduction
Dakota Quartzite	14	88
Ogallala Quartzite	6	29
Alibates Agatized Dolomite	9	26
Smoky Hill Jasper	4	23
Florence A Chert	11	36
Florence C Chert	5	22
Florence D Chert	6	39
Wreford Chert	1	0
Day Creek Dolomite	8	4
Peoria Chert	0	1
Moss Agate	0	1
Chalcedony	0	1

manufactured from Alibates agate, with Florence, Edwards Plateau, and unidentified cherts represented (Table 5, Figure 17). Two flake tool remnants, made from Alibates agate and Wreford chert, were classified simply as scraper fragments.

Pecked and Ground Stone Tools

The collection of pecked and ground stone materials from the Bell site, although primarily fragments, indicates that a variety of activities occurred at the site. These can be grouped into domestic processing and tool manufacture and maintenance categories. Functional classes within each general type are discussed below. Results of experimental investigations in tool manufacture and maintenance activities facilitated the discussion of some tool classes.

Dakota sandstone was by far the preferred raw material for this category, with 61 percent of the specimens fashioned from this stone (Table 8). Ogallala conglomerate and Cheyenne sandstone were recognized in 9 percent of the sample, and a group of miscellaneous quartzites, which were not identified to a particular geologic formation, accounted for 11 percent of the material. Infrequently occurring materials included Dakota quartzite (2 percent), Day Creek chert (2 percent), limonite (2 percent), and pipestone (4 percent).

Domestic Processing Tools

Domestic processing tools include those items that can be reasonably determined to have been used primarily for processing foodstuffs, both wild and domesticated.

Grinding Slabs. One complete specimen was recovered from a context that suggested a possible living surface in the central portion of the site. Other specimens were represented by smaller chunks and spalls. The collection included several fragments with evidence of utilization on opposite faces. Typically one face had been more heavily utilized than the other, although other sections exhibit utilization on only one face. Ten have flat faces, while two others appeared to have shallow troughs. Fully 75 percent of the slab fragments were Dakota sandstone. Examples of Ogallala conglomerate and Cheyenne sandstone were also recognized.

Several large grinding slabs were collected from the site prior to the excavation, being found during and after tilling of the terrace. While little can be said of these unprovenienced specimens, it may be concluded that at least several grinding slabs were located in relatively shallow contexts at the site and that the original ground surface of the component was disturbed by modern cultivation practices. Of the collected specimens, four come directly from or just above the floor of Feature 137. Three others came from Feature 134, and an isolated fragment was found in Feature 125. The remainder were taken from the general unit level excavations.

Manos. Eighteen manos were collected from the site. Specimens tend to have rounded faces, although

Table 5. Correlation between Chipped Stone Tool Type and Raw Material at 14CM407.

Raw Material	Informal Flake Knife	Informal Flake Scraper	End Scraper	Scraper	Projectile Point	Alternately Beveled Knife	Blank	Preform
Alibates Agatized Dolomite	10	4	8	1	7	4	1	2
Florence A Chert	1	5	--	--	--	--	--	--
Florence C Chert	3	2	1		2	--	--	--
Wreford Chert	6	1	1	1	3	2	1	--
Dakota Quartzite	3	--	--	--	--	1	2	1
Ogallala Quartzite	--	--	--	--	--	--	1	--
Smoky Hill Jasper	2	--	--	--	2	--	1	1
Moss Agate		--	--	--	1	--	--	--
Day Creek Dolomite	1	--	--	--	--	--	--	--
Edwards Plateau Chert	--	--	1	--	--	--	--	--
Chalcedony	1	1	--	--	--	--	--	--
Unidentified	--	--	1	--	--	--	--	--

flat faces were not uncommon. Some examples have rounded and flat facets on opposite faces. Tool margins are typically rounded, and the ends of the ovoid stones occasionally exhibit more intensive battering. Dakota sandstone accounts for 50 percent of the manos. Meta-quartzite cobbles and Cheyenne sandstone were also used.

Nine of the tools were recovered at or near the floor

Table 6. Measurement Ranges among Biface Classes at 14CM407.

Tool Type	Length	Width	Thickness	Edge Angle
	Range (mean) (cm)			
Washita	15.1-33.2 (22.8)	9.9-18.4 (13.5)	1.9-3.8 (2.8)	25°-44° (32°)
Harrell	20.1-25.3 (22.6)	10.9-16.1 (14.3)	2.1-3.5 (2.9)	27°-41° (32°)
Fresno	15.9-27.5 (22.2)	9.5-19.6 (14.8)	1.8-4.8 (2.9)	25°-41° (31°)
Preform	32.9	18.9-26.7 (22.8)	5.6-6.4 (6.0)	43°-50° (41°)
Blank	36.9-53.2 (42.8)	24.4-34.0 (30.5)	8.4-13.6 (11.0)	40°-70° (54°)
Alternately Beveled Knife	57.5-94.0 (71.5)	22.0-44.0 (33.5)	7.8-11.0 (8.8)	53°-70° (60°)

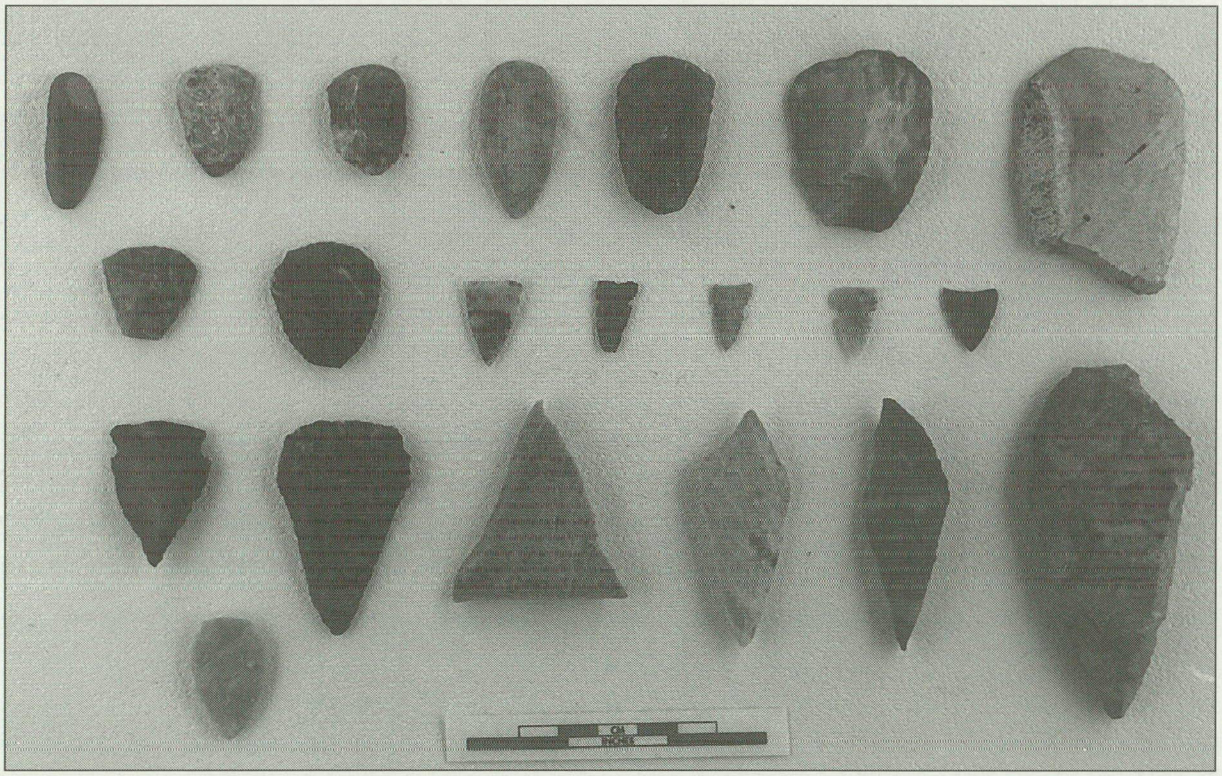

Figure 17. Examples of chipped stone tools from 14CM407.

Table 7. Measurement Ranges among Uniface Classes at 14CM407.

Tool Type	Length	Width	Thickness	Edge Angle
	Range (mean) (cm)			
End Scraper	25.5-48.9 (36.4)	19.5-48.9 (25.6)	5.6-11.9 (8.1)	55°-85° (70°)
Informal Flake Knife	27.6-69.3 (43.4)	14.7-48.8 (27.1)	3.4-12.4 (6.1)	32°-51° (43°)
Informal Flake Scraper	20.3-65.5 (37.4)	17.8-43.6 (28.5)	3.4-12.0 (7.5)	54°-70° (61°)

of the Feature 137 structure. Three others were recovered from Feature 134. The remainder was scattered throughout the general levels of the block excavation.

Nutting Stone. A single nutting stone was recovered from the site, providing secondary evidence of mast processing. The quartzite tool rests comfortably in the hand and has a single, roughly circular indentation in the center of one face. The shallow pit measures 17 mm in diameter and approximately 5 mm in depth. The stone was collected with numerous other ground stone tools from the floor of Feature 137.

Tool Manufacture/Maintenance

Pecked and ground stone tools categorized here represent items that were used during the manufacture of other objects or to maintain the useful function of other tools.

Flintknapping Abraders. Artifacts grouped here were initially separated from other abraders based on the general cross section of the associated groove or grooves. Grooves that exhibit V-shaped cross sections are attributed to modification through abrasion of chipped stone materials.

The two artifacts identified as flintknapping abraders are made of Dakota sandstone, and each apparently served another function prior to use as a flintknapping abrader. One represents a fragment of a grinding slab; the other is a large spall from a mano. Each specimen exhibits a single groove across a portion of one face. Grooves range from 3 to 4 mm in width and are generally 2 mm deep, although each may be slightly deeper along the middle portion of the groove. One tool was recovered from the floor of Feature 137; the other came from a non-feature context.

Arrow Shaft Abraders. The assemblage of nine U-shaped arrow shaft abraders is highly fragmented. Single- and multiple-grooved specimens were noted in the collection. All but one — which was made of Ogallala conglomerate — were manufactured from Dakota sandstone. The Ogallala specimen is one of two abraders created on an irregular stone. The other example (of Dakota sandstone) exhibits eight randomly oriented grooves that range from 5 to10 mm in diameter and from 2 to 5 mm deep. Of the other abraders, six have only one linear groove, while two have single grooves, running generally parallel to one another on opposite faces. These grooves vary from 6 to 8 mm in diameter and from 2 to 3 mm in depth.

All but one of the abraders came from feature contexts. Feature 134 yielded one abrader fragment, two each were collected from Features 125 and 138, and three were recovered from the floor of the Feature 137 structure.

Flat Abraders. Some ground-stone tool fragments consist of thin pieces of material with evidence of utilization on one or both faces and occasional shaped and/or utilized edges. Nine artifacts shared characteristics of a thin, tabular cross section with ground faces. The evidence of modification includes faces that have been uniformly ground and smoothed, as well as ones that exhibit somewhat irregularly ground surfaces. Although most faces are relatively flat, at least one specimen exhibits a slightly concave cross section. The observed differences in wear patterns may represent differing types of functional use, differing degrees of utilization, or perhaps differences related to the type of stone used for the tool. Raw materials utilized in this category of tools include Dakota sandstone and Ogallala conglomerate.

These artifacts were recovered from a variety of contexts. One was excavated from both Features 125

Table 8. Correlation between Pecked and Ground Stone Tool Types and Raw Material at 14CM407.

Raw Material	Mano	Grinding Slab	Nutting Stone	Shaft	Flat	Block	Multipurpose Abrader	Flintknapping Abrader	Hammerstone	Pipe	Miscellaneous Ground Stone
					Abrader						
Dakota Sandstone	8	10	--	7	6		2	2	–	–	--
Ogallala Conglomerate	--	2	--	1	2	1	--	–	–	–	--
Cheyenne Sandstone	4	1	--	--	--	--	--	–	–	–	--
Dakota Quartzite	1	--	1	--	--	--	--	–	1	–	--
Meta-Quartzite	5	--	--	--	--	--	--	–	2	–	--
Day Creek Dolomite	--	--	--	--	--	--	--	–	1	–	--
Limonite	--	--	--	--	--	--	--	–	–	1	--
Pipestone	--	–	–	--	–	–	--	–	–	–	2

and 134. Four specimens were collected in Feature 137, all directly from the vicinity of the floor of the structure. The remainder came from non-feature contexts in the general excavation of the site.

Multipurpose Abraders. A final abrader category includes two examples that exhibit both V- and U-shaped linear grooves. One tool was recovered near the floor of Feature 137. This irregular Dakota sandstone tool has two U-shaped grooves, measuring 5 mm wide by 2 mm deep. On another portion of the stone, a single V-shaped groove measured 3 mm in diameter and 2 mm in depth. The other tool was shaped from Dakota sandstone. Five U-shaped grooves (6–8 mm wide and 2 mm deep) and one V-shaped groove (4 mm wide by 4 mm deep) appear on the faces of the stone.

Hammerstones. Three hammerstones were recovered from the site. One was of Day Creek chert. The remaining two, recovered from the floor of Feature 137, were fist-sized patinated cobbles of an unidentified quartzite that may be a component of the Ogallala formation but is not necessarily Ogallala quartzite.

Miscellaneous Ground Stone. This category includes a portion of a limonite pipe bowl and two spalls of red pipestone, exhibiting facets and faint striations. The pipe bowl fragment was collected from Feature 134, and one pipestone fragment came from the area of Feature 137.

Faunal Remains

The faunal collection from 14CM407 has been formally analyzed and is published in this volume. A few notes on the assemblage are included here as an overview of the faunal collection. Briefly the taxa identified consist of bison (MNI = 6), deer (MNI = 2), turtle (MNI = 2), bird (MNI = 1), and shellfish (MNI undetermined). Small faunal remains are conspicuously absent (Beaver, personal communication). It is believed that this apparent under-representation is linked to the excavation strategy at the site.

Breakage of the bison remains in the assemblage is high. The largest single specimen is only about 25 cm long, and the largest complete bone is a bison calcaneus. Furthermore, the breakage appears to be mostly cultural, correlating rather strongly with marrow utility. This is further supported by a high level of consistency in breakage points of bison long bones.

A small collection of bone tools includes at least one and possibly two broken tibia digging stick tips, ribs exhibiting incised lines, a bone handle, and a pin or awl (Beaver this volume, Figure 10). No scapula hoes were identified in the collection, although some bison scapulae fragments exhibit breakage patterns consistent with reduction of the element for use. This includes glenoid and scapular spine removal and reduction of existing scapular margins. No evidence of use was present, although both breakage and root etching may have contributed to a poorly preserved surface finish.

Floral Remains

The excavation strategy limited the degree to which the floral material can provide insight into this aspect of the subsistence pattern of the site's inhabitants. Specifically, the lack of flotation and systematic sampling were considered to be major contributors to the low frequency of floral remains from the site. A handful of charred plant material was collected during the excavation of features, with all features yielding minimal numbers of specimens. These remains are discussed primarily to depict at least some of the diversity expected at the site and to provide information for a larger picture of subsistence by noting the presence of gathered wild species and identifying likely garden crops. Frequencies of occurrence and estimation of the contribution of an individual species to the diet are not made here, since the collection simply does not allow for these more specific discussions.

Gathering

Evidence of gathered wild foods are limited to hackberry *(Celtis* sp.), a member of the *Prunus* genus, and possibly goosefoot (*Chenopodium* sp.). At least one of the identified hackberry fruits displayed some evidence of charring. Hackberry would be expected as a component of the riparian woodland setting along Mule Creek in the vicinity of the site. Indeed, this tree was one of the more frequently noted species along Mule Creek by General Land Office surveyors in the early 1870s.

Several small fragments and at least one almost complete pit are attributed to a species of *Prunus*. The nearly intact pit closely resembles examples of collected chickasaw or sand plums. On this basis the single specimen is identified provisionally as this variety of plum. A modern setting noted to be prime habitat for sand plums includes sandy soils, which dominate the uplands south of Mule Creek, the sandy lowlands and terraces, primarily associated with draws and intermittent drainages south of the creek, and the Mule Creek bottoms approximately one mile downstream.

Goosefoot is a weedy annual that occurs in disturbed areas such as open wooded edges, abandoned fields, and around the margins of habitation areas. The species, although occurring in the wild, was also cultivated as a garden crop by at least some Plains horticultural societies. Whether the remains are of the wild or domesticated variety could not be determined.

Horticulture

Evidence of maize (*Zea mays*) was sparse, although its broad occurrence in feature contexts indicates that it was present at the site in some abundance. Every feature yielded at least one or two maize fragments, typically cupule fragments. Little information can be derived from these remains beyond the fact that they confirm the presence (and probable cultivation) of maize at the site. Evidence of other crops was not identified in the small collection.

14CM406 —The Booth Site

Society archeologists originally visited 14CM406 in 1984, and they gained access to the site in the early spring of 1989. Using Oakfield coring tools, the presence of subsurface remains was confirmed. At least one feature, later identified as part of Feature 101, was discovered along the southeastern margin of the broad, south-trending upland ridge spur where the site lay.

The Kansas Archeology Training Program was conducted from June 3 through 18, 1989. Excavation focused on the previously identified subsurface feature, as well as adjacent uninvestigated areas of the site.

A total of 37, 2 x 2-m units was opened to investigate what amounted to several subsurface soil stains and areas in between those features (Figure 18). A series of excavation units, creating a checkerboard pattern, were opened in a narrow band across the narrow ridge spur. All areas investigated were included in Area 891 ("89" for the year and "1" for the first area of investigation at the site that year). Initially one unit was established over the relatively large potential feature along the west end of the block. Other units were scattered to the east of this spot, where occasional cultural features were identified below the plow zone during the course of the project. Excavation across the site indicated a very consistent depth of the plow zone at approximately 15 cm. The plow zone was typically a medium brown to dark grayish brown soil. In non-feature areas the underlying soil was a light reddish brown to tan with caliche gravels scattered throughout. Caliche generally became more prevalent with increasing depth.

Standard 10-cm levels were excavated throughout the block excavation, including the plow zone. Vertical measurements were recorded as depth below the nearest ground surface, except in feature contexts where depths were recorded below the southwest corner elevation. Balk walls of 20 cm were maintained between units.

Shovels and trowels were utilized during the excavation of the various units and features. Trowels and other small hand tools were used to expose delicate artifacts and define feature boundaries. Shovel skimming was actively employed along with trowels to remove other areas of fill, particularly from the upper 20 cm or so across the block excavation. Soil excavated from the units was passed through ¼-inch mesh hardware cloth to recover small materials. Flotation samples of approximately five gallons were taken from the southwest corner of excavation units, as well as from every 10-cm level in features. Artifact densities were generally low across the excavation block outside of feature contexts.

Features were excavated as they were identified, with all features being cross sectioned to expose profiles (Table 9). The first half of this cross-section excavation was carried out in 10-cm levels. The remaining half was removed as a single unit. Diagnostic artifacts and other unique items that were found in situ, including those that might be especially important to site interpretation, were given feature numbers and discussed in some detail as they were removed in the field.

There was no evidence of features except a possible intact living surface, consisting of a broad scatter of tools and debris in the vicinity of Units 215 and 216. A lithic cache (Feature 65), which lacked evidence of being placed in a hole, was recovered from this area as well. The debris scatter occurred from 15 to 20 cm bgs. Evidence of this horizontal debris scatter was noted in Units 203–207, 215, 216, 217, 219, 221, 223, and 248. Debris became more sparse and occurred at deeper levels toward the east. Contact with sterile soil generally occurred at deeper levels in units across this portion of the site, suggesting a general shallow dip in the occupation horizon toward the east.

Features

Feature 192 was defined in the northeast corner of Unit 247 at approximately the 30-cm level as a dark brown stain with rich cultural mix (Figure 19,

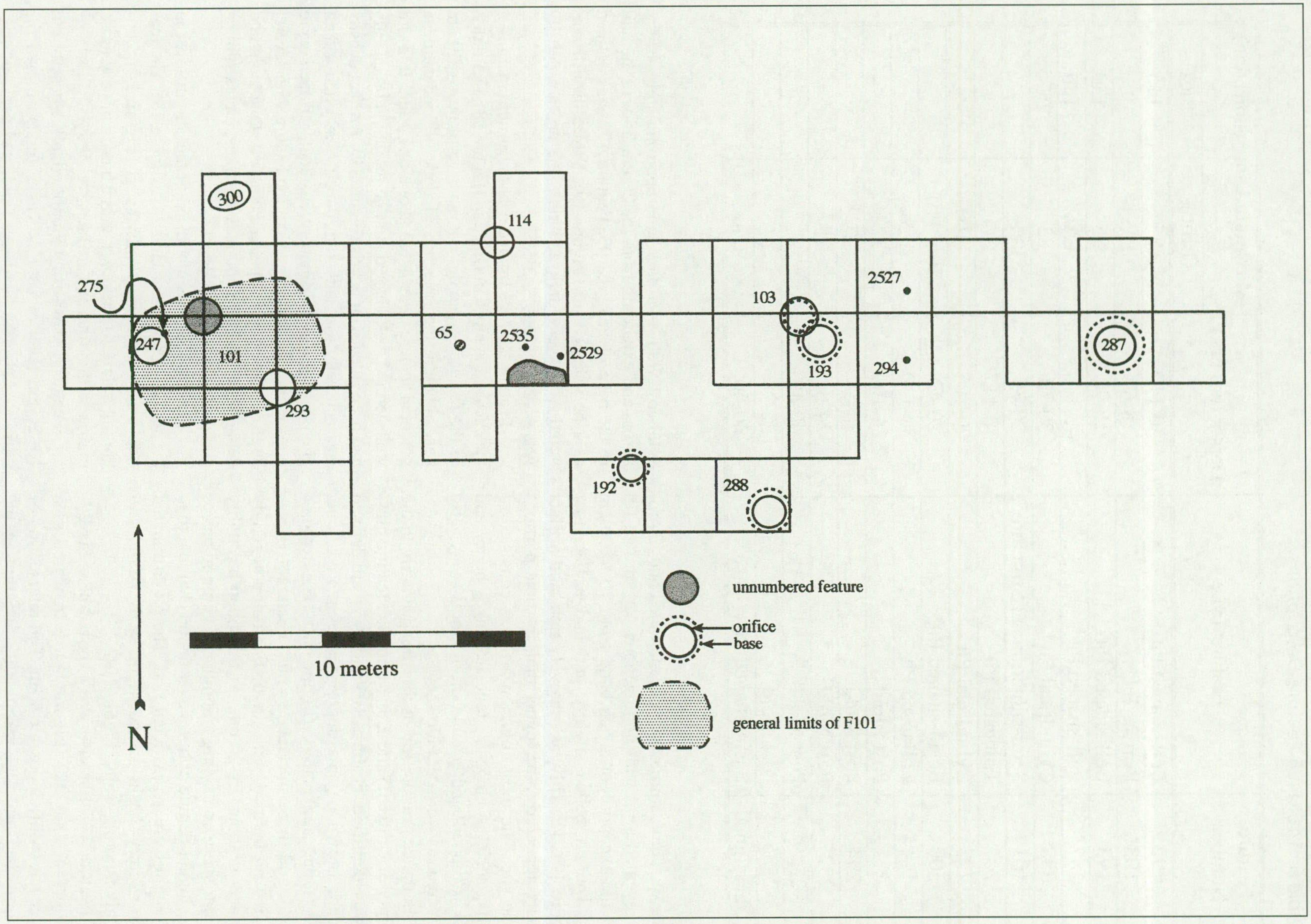

Figure 18. Excavation plan view of 14CM406.

Table 9. 14CM406 Feature Descriptions.

Feature Number	Feature Type	Depth (cm bgs)	Maximum Dimensions (cm)	
			Orifice	Base
192	Bell-shaped Pit	30-110	85	115
103	Borrow Pit	18-67	105	95
193	Bell-shaped Pit	18-90	85	130
287	Bell-shaped Pit	40-170	120	180
288	Cylindrical Pit	30-70	83	2575
101	Semi-subterranean Structure	20-75	500+	–
247	Truncated Pit	70-117	100	47
293	Cylindrical Pit	20-105	110	–
300	Basin-shaped Pit	20-42	70 x 110	–
114	Collapsed Pit	30-130	225	–
275	Post Mold	76-109	22	–
294	Post Mold	34-54	27	–
2527	Post Mold	24-62	25	--
2529	Post Mold	40-49	7	--
2535	Post Mold	22-38	7	--
Unassigned	Basin-shaped Pit	30-60	n/a	--

Table 9). The feature was cross sectioned and in profile revealed a pit with homogenous dark brown fill with the exception of a rich band from 70 to 90 cm bgs. The pit belled slightly and had a flat floor (Figure 19). The fill was relatively rich, and artifact density appeared to be higher than in some portions of the site. The most common artifacts consisted of debris, such as chipped stone debitage, bone, and shell. Chipped and ground lithic tools were also recovered, as were ceramic sherds.

In the central portion of the site, primarily in the vicinity of Units 205 and 220, a complex feature cluster was identified. Features 103 and 193 were defined as dark brown organic stains with scattered bone, shell, stone, and pottery (Figure 18). The features were found to be intersecting pits. Feature 103 was the first pit defined, with the orifice being generally outlined at about 15–20 cm. At this point a roughly circular stain, containing a number of ceramic pieces and a higher degree of burned earth and charcoal than surrounding areas, was identified. The pit terminated in a slightly basin-shaped floor with straight to slightly tapering walls (Figure 19).

Feature 193 likewise was exposed near the 20-cm floor of Unit 220 (Figure 18). It appeared as a lighter but still rich organic stain. The intersection of Features 103 and 193 was readily apparent in the southeast wall as a dark area approximately 40 cm across and extending from the 20-cm floor of the unit to the base of Feature 103. Feature 193 was defined as a bell-shaped pit (Figure 19). While the fill was noted to be very dark and rich, the artifact density was generally low.

Feature 287 was located near the eastern margin of the excavation block in Unit 224 (Figure 18). Definition of the feature orifice did not occur until nearly 40 cm bgs, although the presence of dark fill, indicating a potential feature, was noted above this point. It was a well-defined, bell-shaped storage pit that subsequently had been filled with debris (Figure 19). Artifact density was generally low, although the fill was often a dark grayish brown with abundant charcoal. Artifacts were prevalent in the lower levels of the feature with several large caliche boulders, pottery, chipped stone tools, and debitage (including a complex of flakes, representing a dump of debris on the floor).

Feature 288 was identified at the 30-cm level in the southeast corner of Unit 249 (Figure 18). The feature was a shallow cylindrical pit (Figure 20), containing a dark to very dark grayish brown, very loose matrix with numerous artifacts.

Feature 101 was first identified at the base of the 10–20-cm level of Unit 213 as a grayish brown fill with occasional artifacts and cultural debris.

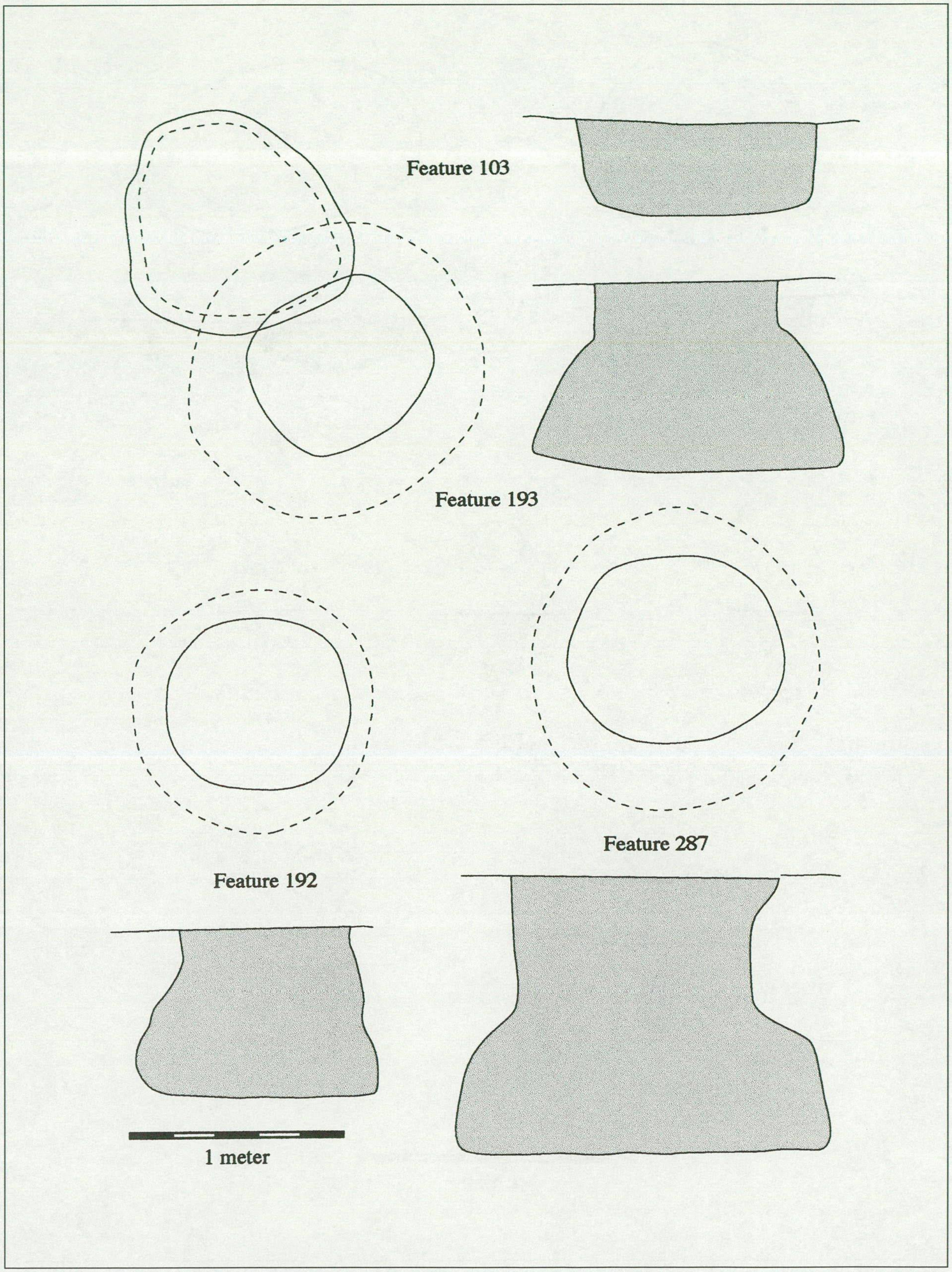

Figure 19. Plan views and profiles of Features 103, 192, 193, and 287.

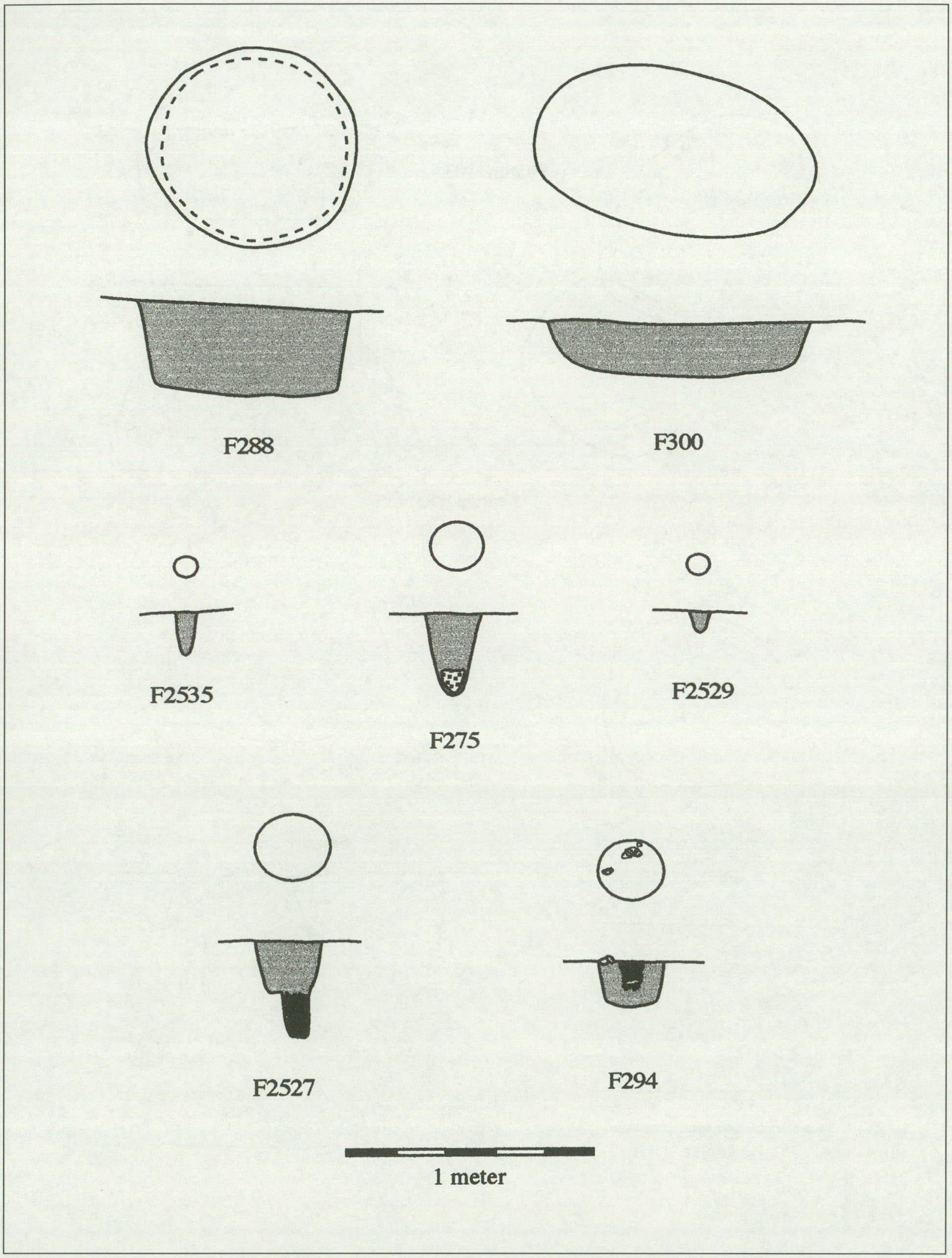

Figure 20. Plan views and profiles of Features 275, 288, 294, 300, 2527, 2529, and 2535.

Additional investigation of this feature occurred in Units 196–198, 211, 212, and 226–228 (Figure 18). In general artifact density in the upper levels was fairly low with the exception of several discrete debris complexes (containing bone scraps, shell, debitage, potsherds, etc.), which appeared at various levels throughout the Feature 101 vicinity. Artifact densities in the feature typically rose with increasing depth. The feature was found to have a relatively flat floor at around 70–80 cm bgs, especially across most of Units 211 and 212 with some extension into adjacent units. An abrupt edge to the larger fill was noted in most cases, although more gently sloping margins were indicated along the east and northeast edges (Units 197, 198, and 213). Extensive rodent disturbance made portions of this area difficult to define.

As excavation of this area neared completion, it was speculated that there was a series of intersecting features. In short a number of storage pits appeared as dark rings in the broad floor of Feature 101, including Features 247 and 293. An additional one or two features were noted in unit profiles or as undifferentiated portions of the larger Feature 101 fill. In some instances these features were truncated by Feature 101, while other examples appeared to have been excavated into the Feature 101 fill. The general homogeneity of the fill in all features in this area made insolation of any particular feature difficult until Feature 101 was completely removed. All of the features noted here are discussed in greater detail below. Besides these smaller features, the gently sloping area, which occurred along the north and east margin of the feature, was identified as a potential borrow area that had further disturbed the original Feature 101 fill.

The primary Feature 101 was identified tentatively as at least a portion of a severely disturbed house structure. Evidence to support this interpretation included a nearly flat floor at approximately 75 cm (Figure 21). At this point at least one truncated storage pit feature was encountered. A post mold was identified near the 75-cm level, partially intersecting the truncated feature. One additional indirectly supportive line of evidence was the presence of several blocky zones of dense caliche mix that were noted in profiles in two areas of this complex west end. The first area occurred in the northwest corner of Unit 197. Here in the north and west profiles a caliche-rich zone occurred between approximately 30 and 50 cm bgs. It is speculated that these zones represent points of intersection of relatively linear secondary deposits of caliche-rich soil. A similar occurrence of material was noted in the central portion of the east wall of Unit 212 and the north wall of Unit 228. These areas are noted specifically because they are reminiscent of Hughes' description of possible wall fill, located along the margins of structures in the Buried City complex (Hughes and Hughes-Jones 1987:102).

Feature 300 was identified in Unit 182 at 20 cm bgs as an ovoid area of mixed dark soil containing bone, stone, and charcoal (Figure 18). Upon excavation the feature was determined to be a shallow elongated basin (Figure 20).

Feature 114 was located in portions of Units 185, 186, and 201 (Figure 18) between 30 and 40 cm bgs. It appears to represent a storage pit, possibly bell-shaped, in which one or more episodes of slumping obliterated the original walls. Excavation profiles indicated that the feature was subject to deposition of cultural debris before and after slumping.

Feature 247 was defined during the course of Feature 101 excavation in Unit 211 at 70 cm (Figure 18). A dense complex of mussel shell and bone fragments, interspersed with lithic and ceramic artifacts, was identified within a circular area of very dark grayish brown soil. In profile the feature appeared to represent a straight-walled, flat-floored pit. Its relationship with Feature 101 is not well understood. However, the fact that the concentration and relatively discrete stain, defined as Feature 247, appeared prior to the "bottoming out" of Feature 101 in the rest of the square may indicate that the feature simply could not be distinguished from the larger Feature 101 fill until the base of that feature was approached.

Feature 293 was defined during excavation of the Feature 101 area in the northwest corner of Unit 228 at a depth of 57 cm bgs. The feature, situated near the intersection of Units 212, 213, 227, and 228 (Figure 18), was interpreted as a storage pit that was relatively cylindrical in form (Figure 21). The dark brown loose fill contained an abundance of materials, including bone, shell, pottery, chipped and ground stone tools, and debitage. Evidence in unit profiles indicated that this feature likely was excavated into the larger Feature 101 fill.

Feature 275 was a post mold near the northeast margin of Feature 247 at 76 cm bgs (Figure 18). The feature consisted of a dark soil stain that tapered to a rounded base (Figure 20). A mass of fibrous material, which appeared to be decayed wood, was located near the base that was disturbed by rodent activity.

Feature 294 was identified in Unit 221 at 34 cm bgs (Figure 18). The feature was an area of dark soil containing small potsherds, mussel shell, and bone fragments. A number of stone chunks also were associated with the feature, particularly along the

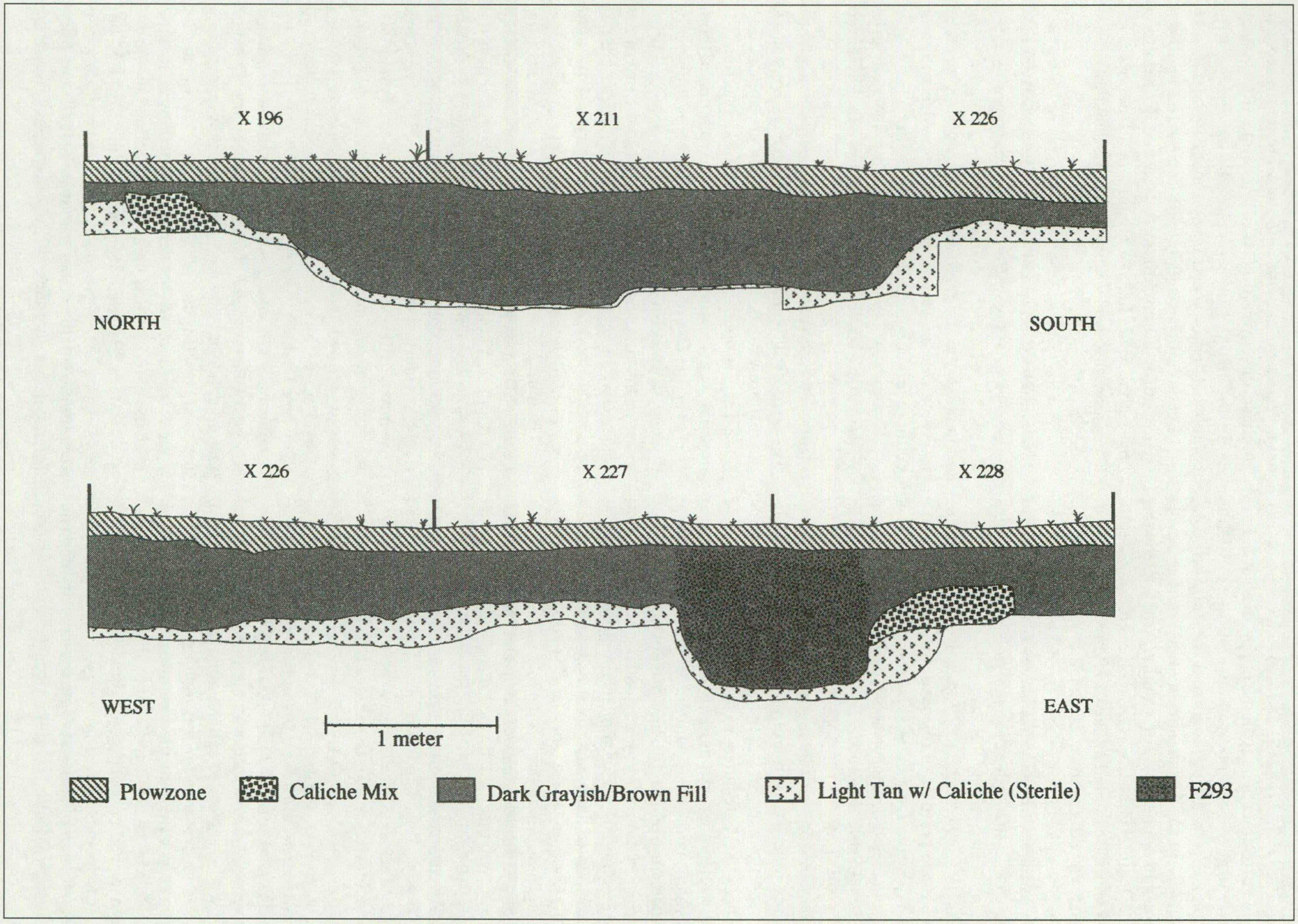

Figure 21. East wall profile of Units 196, 211, and 226 and north wall profile of Units 226, 227, and 228 showing Feature 101

margins and near the base. The feature measured 27 cm in diameter and approximately 20 cm deep with a slight degree of tapering to a relatively flat base (Figure 20). Within this larger area of fill, one spot near the center of the cross section contained more abundant charcoal flecks. This charcoal-infused fill was situated above a stone that lay approximately half of the distance down the cross-section face. It is believed that this zone represents the remains of the post, whereas the larger Feature 294 possibly represents an excavation for setting the post.

Immediately to the north in Unit 206 was Feature 2527, a similar feature (Figure 18). Here a dark circular stain, measuring 25 cm in diameter and containing rich mix, bone fragments, and debitage, was excavated to 21 cm bgs. At this depth a smaller circular stain, measuring 12 cm in diameter, continued along the eastern margin of the feature. This extension continued another 17 cm downward, at which point the charcoal-rich stain ended in a rounded base (Figure 20). The feature as a whole may consist of a post excavation as well as the remains of the post set in the hole.

Features 2529 and 2535 were post molds, identified in Unit 216 (Figure 18). Both were relatively small and may be associated with an adjacent unnumbered basin (Figure 20). Feature 2529 was identified near the 40-cm level, whereas Feature 2535 was defined at approximately 22 cm bgs. Near the end of the fieldwork an unnumbered shallow basin was investigated in the southern one-half of the unit, extending from 30 cm to 45–60 cm bgs, and continuing south and east out of the unit. Both post mold features were situated along the northern perimeter of this feature, although their relationship with the poorly described basin is not understood.

Radiocarbon Dates

A radiocarbon sample from Features 103 was sent to Beta-Analytic (Beta-35477) shortly after the 1989 field school. A radiocarbon age of 400 B.P. ± 100 was obtained from the sample (Table 10). The date was calibrated using CALIB 3.0.3 to provide a corrected age of 504 calBP (Stuiver and Reimer 1993).

In 1999 a second sample was submitted with the intent of obtaining a date with a more refined standard deviation that would be more reliable, allowing for a better understanding of the site chronology. Charcoal for this sample was acquired from Feature 287, which contained scattered amounts of solid wood charcoal. The sample was analyzed by the Illinois State Geological Survey (ISGS-4242). A radiocarbon age of 430 ± 70 B.P. was obtained (Table 10). Calibration yielded a corrected age of 501 calBP (Stuiver and Reimer 1993).

Ceramic Artifacts

The Booth site ceramics artifacts were recovered from a variety of contexts including the general level excavation and cultural features, primarily Features 101 and 287. Cross-fitted rimsherds revealed that Features 192 and 247 were contemporaneous. Feature 247 was truncated prehistorically by Feature 101. Hence, it, and by association Feature 192, are considered to have existed prior to the creation of Feature 101. How much older they are is not known at this time; however, local and exotic (Puebloan) ceramic sherds argue for a single cultural association. The ceramic data presented here strongly favor the assumption that a single cultural group was responsible for the materials deposited at the site.

A total of 51 rim sherds, or groups of rims from a single vessel, were analyzed. In addition to rims, 79 body sherds, measuring more than 3 cm^2, were studied. Vessel rims range in height from 1.5 to 6.4 cm with an average height of 3.3 cm. Rims are typically oriented vertically (35 percent) or at a slightly everted angle (38 percent). Rims with everted orientations (15 percent) are less frequent, as are examples with flaring angles (8 percent). One example with a constricting or insloping rim (3 percent) accounts for the remainder of the collection.

Vessel orifices range from 7 to 22 cm, averaging about 15 cm. A majority of the vessel orifices range from 16 to18 cm. Vessel lips are either rounded (69 percent) or flattened (31 percent), although both were recognized occasionally on single-rim sherds. Sherd thicknesses range from 2.9 to 13.1 mm (generally 4.5–6.5 mm) and average 5.7 mm among body sherds and rim sherds. The thickest sherds often come from the neck/shoulder junctures and lower body portions, including the base. Untempered sherds are the thinnest sherds on average in both categories, although the small sample of shell-tempered body sherds is thinner by as much as 1 mm on average. However, the small sample size of shell-tempered ceramic sherds overall does not lend itself to reliable comparison with other categories.

Cordmarked ceramics dominate the collection, accounting for 73 percent of the analyzed materials. Cordmarking is generally at least partially smoothed (64 percent) with a small quantity of unmodified cordmarks (9 percent). The degree of smoothing varies on

Table 10. 14CM406 Radiocarbon Dates.

Sample	^{14}C Age	95.4% (2 Sigma) Cal Age Ranges	Relative Area under Distribution
B-35477	400±100	cal A.D. 1307-1363	.06
		cal A.D. 1377-1661	.94
ISGS-4242	430±70	cal A.D. 1407-1638	1.00

some larger sherds and reconstructible sections, exhibiting both unmodified and obliterated cordmarking. Manufactured plain-surfaced ceramics or perhaps completely smoothed sherds account for 27 percent of the collection. Cordmarks are randomly oriented across the bodies, with occasional vertically oriented cordmarks on some vessel necks. Rim sherds exhibit a lower occurrence of unmodified cordmarks, with a correlating increase in the number of plain or completely smoothed specimens indicating that the rims and even shoulders of vessels were frequently subjected to extensive modification of their exterior surfaces after application of cordmarking.

Tempering agents include sand and shell, although a significant number of sherds do not contain any identifiable tempering agents. Approximately 20 percent of the collection consists of a very silty clay paste with no evidence of temper. Sand is by far the most commonly recognized additive, found in 76 percent of the ceramics at the site. Shell is noted in only 4 percent of the sample. Particle size varies widely from under 1 mm to over 3.5 mm. Typically, sand particles average 1–1.5 or 2 mm in size and are generally well sorted within individual sherds.

Decoration is frequent on rim sherds (Figure 22). A variety of decorative treatments are present on a small collection of body sherds. Rim decoration of some sort occurs in 70 percent of the sample. Often this decoration is limited to the lip of the vessel. Punctated lips (27 percent) are most common, although diagonally incised (16 percent) and impressed (13 percent) lips are frequent as well. The diagonal impressions are exclusively created on lips that are rolled to create a thickened zone. Lip incising also occurs in a zigzag form (2 percent). Other isolated decorative techniques include an example of vertical tool impressions (2 percent), visually similar to the finger pinching technique, and a thin red film (2 percent) applied to one rim. Applique nodes and lip tabs are each noted in 4 percent of the sample. Lip tabs in the Booth site collection are incised. Handles are not common; however, when present, they are often decorated with rows of incised lines. One handle has parallel incised lines with adjacent rows of punctates. All handles and handle fragments are of the strap variety and are attached at the lip or upper portion of the neck and the shoulder.

Apart from the rims, decorations are limited to the shoulders of the vessels (Figures 16 and 22), where parallel rows of incised lines are used to form roughly triangular zones. The parallel lines are further offset from adjacent groups by placement at opposing angles. At least three body sherds have this decorative technique. A similar pattern, consisting of at least two and often more parallel incised lines in chevron patterns, is present on three examples. In two instances it is associated with punctates, placed in a row parallel to the incised lines. Other incised sherds are too fragmented to identify even a portion of the original designs. Typically, the incised lines are created in the clay prior to drying, although at least two examples exhibit lines that were incised after the clay became leather hard.

Sherds in surface collections reveal another variation, consisting of groups of parallel incised lines with clusters of nested punctates. Most of these fragments are quite small, making it difficult to obtain an image of complete elements or motifs. However, the patterns are reminiscent of Oneota-like decorative treatments in general. Spatially the closest examples are associated with the White Rock phase of north-central Kansas. Temporally this phase is also the most likely candidate for contact with the people of the Wilmore vicinity.

A small collection of ceramic material was identified with Puebloan origins. Nine pottery sherds were recovered from a variety of contexts, including the general level excavation and Features 101, 192, and 287. A portion of a ceramic pipe, recovered from Feature 193, is of a tubular "cloud-blower" form, similar to those illustrated and discussed by Kidder (1932). The pottery includes several apparent varieties, based on surface decoration and distinctions of

Figure 22. Examples of rim sherds from 14CM406.

temper and paste. However, the specific types are not believed to necessarily be the mid- to late-seventeenth-century and early eighteenth-century varieties that were identified previously (see Lees 1991). The dates do not conform with the general parameters of the identified indigenous ceramic tradition nor are the date ranges for most of the Southwestern ceramics comparable to the radiocarbon dates from the site. Several of these ceramic specimens likely cannot be confidently assigned to specific types and would instead yield identifications of such broad scope as to be of little value. The fact that most of these Puebloan ceramics were collected from a number of features attests to their widespread, if limited, occurrence throughout the general habitation debris of the site.

Lithic Artifacts

Debitage

The Booth site yielded a diverse collection of raw materials as the debitage clearly demonstrates. Those raw materials that were available in the vicinity include Dakota and Ogallala quartzites and Day Creek chert, as well as chalcedony and a glassy quartz that may be associated with Ogallala formation materials. These relatively local materials account for 40 percent of the chipped stone debris at the site. Dakota quartzite is the most common local lithic type at 36 percent. Each of the remaining types account for less than 2 percent of the sample in each case. Ogallala quartzite and the general quartz material were identified in frequencies of 1.4 percent and 1.7 percent, respectively. Day Creek chert and chalcedony make up 1 percent of the collection overall.

Non-local materials came from a number of locations, although materials were obtained primarily from sources to the southwest of the site area. Alibates agatized dolomite from the Texas panhandle region is the most frequent lithic type at the site, accounting for 46.1 percent of the debitage. Obsidian is the second most common non-local raw material in the debitage category with 6.1 percent. A sample of the obsidian debitage has been sourced to localities in the Jemez Mountains of New Mexico, specifically from Obsidian Ridge and Cerro de Medio. While only a small fraction of the material has been sourced, all identified samples have a Southwestern origin. For this reason it is assumed that most, if not all, obsidian at the site originated from the Southwest, although isolated specimens from the Northwest (Idaho and Wyoming, for example) might be revealed if all samples were analyzed. Smoky Hill jasper from northwest Kansas accounts for 3 percent of the debitage. A small amount of lithic material was obtained from the Flint Hills region of eastern Kansas. Florence varieties A and C and Wreford chert are all represented in small numbers, combining for only 1.6 percent of the collection. In addition, 1.7 percent is miscellaneous unidentified lithic materials.

Based on the presence of cortex or hardened rind on dorsal faces of debitage, only 5 percent of the material at the site likely was produced early in the reduction process. The majority of cortex was found on locally occurring lithic types (Dakota and Ogallala quartzite and quartz). Also noteworthy, however, is the fact that approximately one-third of the small collection of Alibates flakes with some type of exterior material exhibited hardened rinds indicative of recovery from secondary deposits. The availability of Alibates agate in stream gravel contexts has been noted previously, and its presence at the Booth site indicates that, while Alibates was obtained primarily from bedded deposits (either through direct procurement or exchange), at least some material also came from downstream sources.

The supposition that chipped stone raw material was entering the area in an at least partially reduced form also is justified by the high proportion of intermediate-to-late stage biface reduction flakes in the collection. Debitage associated with this component of reduction accounts for 94 percent of the material, whereas blocky core and/or early biface reduction flakes were noted in only 6 percent of the collection (Table 11). Only the three most common lithic types (Alibates agate, Dakota quartzite, and obsidian) exhibit evidence of both early and late stage reduction flakes. Seven cores or core fragments were collected from the site. Material types include Dakota quartzite (4), Florence C chert (1), quartz (1), and an unidentified material (1).

Chipped Stone Tools

The raw materials recognized in the various tool classes include most of those recognized in the debitage class with the addition of Day Creek chert (Tables 12 and 13). Alibates agate (63.8 percent) is a common material among both formal and informal tools. The only other relatively frequent material types include Dakota quartzite (14.8 percent) and Smoky Hill jasper (10.7 percent). Other materials that were noted infrequently include obsidian (3.1 percent) and Florence cherts (4.5 percent). By variety Wreford chert accounts for 2.5 percent, while Florence A and C each were noted in 1 percent of the collection. Isolated amounts of chalcedony (1 percent), miscellaneous unidentified stone (1.5 percent), Ogallala quartzite and Day Creek chert (.3 percent each) also are found.

Forty-six bifaces and biface fragments were categorized as projectile points (Figure 23). Slightly less than one-third of these were recovered from cultural features. The remainder were scattered across the various excavation units of the site. Feature 101 yielded more than half of the arrow points recovered from feature contexts. Side-notched triangular arrow points of the Washita type (26) are most common. Plain triangular arrow points of the general Fresno type (11) were also identified. Approximately half of the bifaces classified as projectile points consist of proximal, medial, or distal portions of the tools. Evidence of impact fracturing, resulting in broken distal portions or, in isolated instances, major flake removals along the axis of the blades, was noted on a small number of specimens. The collection of arrow points, regardless of type, yielded similar ranges of variation among metric and edge angle measurements (Table 14). Raw material utilization was likewise similar, with Alibates agate common among both point types and several other materials, including Smoky Hill jasper, Dakota quartzite, chalcedony, obsidian, and Florence chert represented as well.

Four alternately beveled knives, manufactured from several material types, were collected (Table 12, Figure 23). Two were recovered from feature contexts (Features 101 and 114). Edge angles along the steeply beveled lateral margins range from 47 to 70°, with three of the four specimens having retouched edges between 47 and 54° (Table 13). Metric measurements of the small collection were hampered by the broken nature of the tools, but available measurements did indicate relatively uniform dimensions when observed.

Bifacial knives are not limited to these alternately beveled examples. A larger sample of bifaces was identified as simple bifacial knives on the basis of their generally ovate form and typically non-beveled lateral margins (Table 12). Half of the collection consists of Alibates agate examples. The remaining tools are Dakota quartzite and Smoky Hill jasper (Table 12). These tools were distinguished from potentially unutilized biface blanks and preforms on the basis of more extensive marginal retouch and what was interpreted as probable use-related modification of the tool edges. The relative lack of complete tools limited determinations of length, although measurements of

Table 11. Correlation between Reduction Strategy and Raw Material Type at 14CM406.

Raw Material	Blocky Core/ Early Biface Reduction	Intermediate/ Late Stage Biface Reduction
Dakota Quartzite	30	305
Alibates Agatized Dolomite	21	582
Obsidian	4	98
Smoky Hill Jasper	--	36
Ogallala Quartzite	--	10
Day Creek Dolomite	--	15
Flint Hills Cherts	--	21
Quartz	--	16
Edwards Plateau Chert	--	3
Chalcedony	--	1

width and thickness indicate a fairly narrow range of variation (Table 14). Features 101 and 288 each yielded two of these artifacts, while an additional one was recovered from Feature 192. The others were collected from various proveniences primarily in the west end of the block excavation.

Only 4 of 15 bifacial blanks were collected in features, two from Feature 288 and one apiece in Features 101 and 287. Utilized raw materials are restricted to Alibates agate and Dakota quartzite (Table 12). Edge angles on the collection of blanks vary from 35 to 77° and average 52°. The collection was marked by wide variation in length and width dimensions (Table 14). Only six preforms were recovered, and they tended to come from feature contexts. Three preforms were found in the Feature 101 fill, while a fourth was collected from Feature 192. The materials from which these preforms were created vary widely but consist primarily of the most common lithic types at the site (Table 12). Edge angles vary from 29 to 56° with an average of 40°. Blanks and preforms were relatively easy to distinguish from utilized tools overall.

Drills from the excavated collection include a variety of types (Figure 23). Single examples of broken tools were recovered. One has an expanding stemmed base, while another exhibited a refined T-shaped base. Three ensiform or cigar-shaped drills also were found. Two of these are complete and exhibit heavily utilized bits on opposite ends of the narrow biface. Both complete drills came from feature contexts (Features 101 and 288). Finally a small medial portion of a drill bit also was collected. Five drills are Alibates agate, and a sixth is Smoky Hill jasper (Table 12). Edge angles average about 70° with a variation of 65–74°.

A unique implement is an elongated biface, manufactured from Dakota quartzite (Figure 23). One fragment was recovered during excavation of the truncated base of Feature 247, and the remaining two-thirds of the biface was recognized in a donated collection from the site. It is assumed, for lack of evidence to the contrary, that this fragment was collected from the surface. The tool exhibits extensive abrasion of flake scars, particularly along ridges near the distal and proximal ends of the tool. Occasionally the flake scars are nearly obliterated. Lateral margins are heavily rounded through use. Under magnification (40–50X) numerous striations occur roughly parallel to the long axis of the tool, although some striations are readily apparent to the naked eye. Based on this information the tool is considered to be a pick-like digging instrument.

The largest uniface class consists of informal flake tools, classified on the basis of edge angles as informal flake knives and scrapers. As a whole both categories exhibit wide variation in tool size, leaving little indication of the process of selection (Table 15). In fact the variability may indicate that there was little discrimination beyond a determination of the general suitability of a flake for a particular task at hand. The relatively low degree of modification indicates that the class was used with little if any modification prior to use and were often discarded without rejuvenation. Raw material types include a large amount of Alibates agate (48) with smaller amounts of Dakota quartzite (12) and Smoky Hill jasper (9). Examples of obsidian, varieties of Florence chert, Day Creek

Table 12. Correlation between Biface Type and Raw Material at 14CM406.

Raw Material	Washita	Fresno	Miscellaneous Arrow Point	Bifacial Knife	Alternately Beveled Knife	Drill	Digging Tool	Blank	Preform
Alibates Agatized Dolomite	20	6	5	5	2	5	–	8	2
Florence A Chert	1	1	–	–	1	–	–	--	--
Obsidian	–	1	–	–	–	–	–	--	1
Dakota Quartzite	3	–	–	3	1		1	7	--
Smoky Hill Jasper	–	3	2	2	–	1	–	--	2
Chalcedony	2	–	–	–	–	–	–	--	--
Unidentified	–	–	–	–	–	–	–	--	1

Table 13. Correlation between Uniface Type and Raw Material at 14CM405.

Raw Material	End Scraper	Scraper	Knife	Informal Flake Knife	Informal Flake Scraper	Multipurpose Tool
Alibates Agatized Dolomite	14	4	2	42	7	–
Florence A Chert	--	--	–	–	1	–
Florence C Chert	1	--	–	1	--	–
Wreford Chert	--	2	1	2	--	–
Obsidian	--	1	–	3	--	–
Dakota Quartzite	--	--	2	7	4	1
Smoky Hill Jasper	--	--	–	8	1	–
Ogallala Quartzite	--	--	–	1	--	–
Day Creek Dolomite	--	--	–	–	1	–
Chalcedony	--	--	–	–	--	–
Unidentified	1	--	–	1	1	–

chert, Ogallala quartzite, and unidentified material were rare (Table 13). Most of these flake tools (approximately 63 percent) were recovered from non-feature contexts, although nearly all features yielded these tools as well.

Flake knives that had been fashioned into more formalized shapes were noted in the collection. These have many of the same characteristics as the informal tools, except that the metric variation is comparatively narrow and the tools have a more refined appearance

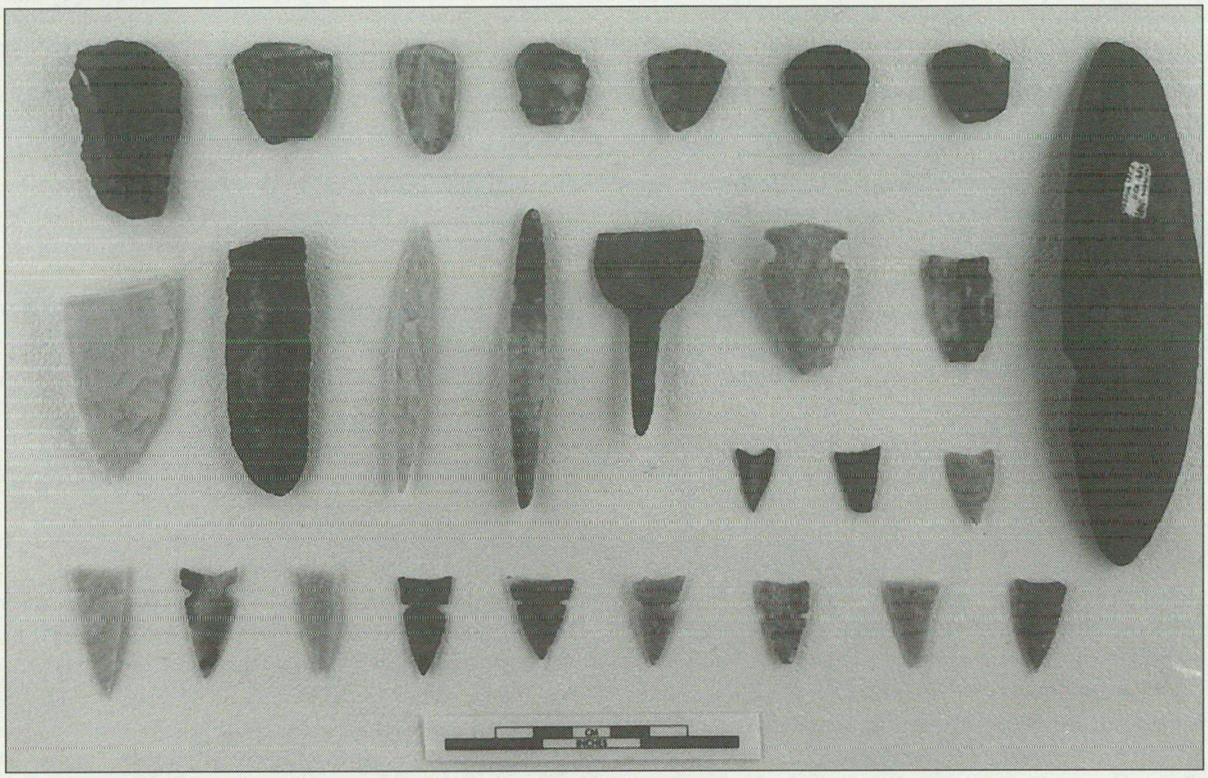

Figure 23. Examples of chipped stone tools from 14CM406.

Table 14. Measurement Ranges among Biface Classes at 14CM406.

Tool Type	Length	Width	Thickness	Edge Angle
	Range (mean) (cm)			
Washita	15.7-35.8 (23.9)	10.5-17.5 (13.9)	2.0-3.7 (2.9)	25°-40° (32°)
Harrell	17.8-26.4 (22.9)	10.5-18.0 (14.2)	2.1-3.8 (3.0)	27°-38° (33°)
Preform	26.0	17.7-29.6 (23.1)	4.0-8.0 (5.8)	29°-56° (41°)
Blank	60.8-82.5 (71.7)	26.2-43.6 (35.4)	9.2-18.8 (13.4)	35°-77° (52°)
Bifacial Knife	43.7	22.4-27.9 (25.4)	6.9-8.7 (7.8)	35°-62° (48°)
Alternately Beveled Knife	n/a	27.9	6.4-10.5 (8.2)	50°-70° (56°)

overall (Table 15). The majority of them were manufactured from Alibates agate (Table 13). There is a nearly even division between examples from non-feature contexts and cultural features, particularly Feature 287.

End scrapers are rare by comparison. This formal tool form includes 17 broken to complete specimens from the excavation (Figure 23). The group does not present a very consistent size overall, being marked instead by fairly wide variation among metric measurements and estimation of edge angles (Table 15). Nearly all end scrapers were manufactured from Alibates agate and were recovered from Feature 101 (Table 13).

Flake tool fragments, which are not necessarily informal expediency tools and cannot be positively classified as end scrapers, were grouped in a nonspecific scraper category. Measurement was limited due to the fragmented nature of the sample overall (Table 15). Alibates agate is the most common lithic type in this tool class of seven specimens (Table 13). About half of the artifacts in this class came from feature contexts, notably Features 101 and 287, although Features 247 and 293 also yielded specimens.

Pecked and Ground Stone Tools

The collection of pecked and ground stone from the Booth site is composed primarily of fragments indicative of a variety of activities. They are grouped into domestic processing and tool manufacture and maintenance categories. Functional classes within each general type are discussed below. Dakota sandstone is the most common raw material in this category, with 46 percent of the various tools manufactured from this stone (Table 16). Ogallala conglomerate (18 percent) and Cheyenne sandstone (16 percent) were recognized in similar frequencies. Ogallala quartzite makes up 11 percent of the collection. Other quartzites were noted in a few instances, including Dakota quartzite (2 percent) and metamorphic quartzites (5 percent). Hematite (2 percent) was found in isolated instances.

Domestic Processing Tools

Grinding Slabs. Specimens are small fragments, including several with evidence of utilization on opposite faces. When both faces have been utilized, one face occasionally appears to have more extensive grinding. A nearly equal number of specimens have only one utilized face. All fragments exhibit flat faces with no evidence of troughing. Dakota sandstone (56 percent) is the most frequently selected material for these tools. Examples of Ogallala conglomerate and Cheyenne sandstone were identified in equal frequencies of 22 percent. The fragments came from a number of proveniences and were nearly evenly divided between feature (5) and non-feature (4) contexts. Features 101, 192, 193, and 247 produced grinding slab fragments.

Manos. Sixteen manos were collected from the site. Specimens typically exhibit convex faces (10), although several manos have both flat and rounded faces (5). Tool margins are typically rounded, and the ends of the ovoid stones occasionally exhibit more intensive battering. Dakota sandstone accounts for 50 percent of the manos. Cheyenne sandstone (25 percent) and Ogallala conglomerate (19 percent) are present in similar frequencies. One specimen was manufactured from a metamorphic quartzite.

Nutting Stones. Two pitted stones were collected from the excavation. Both exhibit single pits and were created using stones that served another purpose. One was fashioned on an otherwise flat Dakota sandstone abrading tool; the other was made from a large Ogallala conglomerate mano fragment. The observed pits are similar in size: 15 mm in diameter and 3–4 mm in depth.

Mauls. A single dumbbell-shaped piece of Ogallala quartzite was fashioned into a crude but presumably effective maul. The tool exhibits extensively battered ends, indicative of its use as a pounding implement. Additional evidence of modification is found in pecking near a natural constriction of the mid-section to facilitate hafting.

Tool Manufacture and Maintenance

Flintknapping Abraders. Three items were identified as potential flintknapping abraders, based on the presence of narrow V-shaped notches. One was manufactured from an irregular piece of Ogallala formation conglomerate. A second was fashioned from a large mano fragment. The third appears to have been utilized originally as a shaft abrader. The flintknapping use occurs near the broken end of this artifact. Grooves in the specimens range from 3 to 6 mm wide and from 3 to 4 mm deep.

Arrow Shaft Abraders. The collection includes four fragments of shaped Dakota sandstone. Cross sections include ovoid and rectangular forms. All

Table 15. Measurement Ranges among Uniface Classes at 14CM406 .

Tool Type	Length	Width	Thickness	Edge Angle
	Range (mean) (cm)			
End Scraper	21.5-49.5 (32.0)	12.7-30.3 (21.4)	5.2-11.2 (7.6)	48°-84° (64°)
Scraper	n/a	18.9-33.1 (27.4)	4.6-14.3 (9.1)	58°-68° (64°)
Knife	28.7	26.1-29.8 (27.8)	2.9-10.3 (6.9)	43°-52° (48°)
Informal Flake Knife	26.3-55.2 (37.1)	17.4-59.6 (27.9)	2.2-13.3 (5.5)	29°-55° (41°)
Informal Flake Scraper	26.0-60.5 (42.5)	19.1-67.2 (34.5)	3.5-15.9 (7.9)	55°-79° (60°)

exhibit at least one U-shaped groove, with only one example having multiple (three) grooves. One additional fragment was notes above as having another function. Grooves range from 5 to 12 mm wide and from 2 to 5 mm deep. Narrower grooves are typically the most shallow, whereas the widest grooves correspond to the deepest marks.

Flat Abraders. Eight artifacts consist of thin slabs of relatively coarse stone with evidence of utilization on one or both faces and occasionally shaped and/or utilized margins. Evidence of modification includes faces that have been uniformly ground and smoothed, as well as ones that exhibit irregularly ground surfaces. The class is typically much thinner than flat grinding slabs. Raw materials utilized in this category of tools include Ogallala formation conglomerates, Cheyenne sandstone, and several examples of Dakota sandstone. These tools were recovered in identical numbers from feature and non-feature contexts, with no more than one coming from any particular feature and most non-feature examples coming from a possible living surface in the central portion of the site.

Hammerstones. Eight hammerstones were recovered from the site. Material types consist of a variety of dense quartzitic stones, including Dakota quartzite, Ogallala quartzite, and meta-quartzite cobbles, which likely were collected from Ogallala formation outcrops. Three were collected from features, and the rest were scattered across the excavation block. One was recovered from the vicinity of the Feature 65 lithic cache in association with a large maul.

Miscellaneous Ground Stone. This category includes several small faceted fragments or spalls of ground stone. Also included is a single piece of hematite that exhibits extensively ground faces with smoothed edges and light striations.

Faunal Remains

A small but diverse collection of faunal remains were identified. The greatest concentration and diversity came from feature contexts. A total of 440 specimens, representing 33 taxa, were identified primarily to species level. More generalized identification to the level of order, family, or (in the case of fish remains) class was sometimes the only standard measure of identification (Table 17). The collection has a generally good degree of preservation. Overall the remains of smaller animals were more intact or at least consisted of portions that were identifiable. Larger mammals probably are under-represented to some degree, using either NISP or MNI, as many of the more massive elements were systematically reduced, probably for marrow extraction. This particularly may be the case here considering that the bulk of the faunal material consists of variously sized shaft fragments that were not analyzed for identifiable portions. Certainly a more intensive, less time-restricted faunal analysis would contribute more identifiable specimens to the collection.

Table 16. Correlation between Pecked and Ground Stone Tool Types and Raw Material at 14CM406.

Raw Material	Mano	Grinding Slab	Nutting Stone	Shaft Abrader	Flat Abrader	Flintknapping Abrader	Hammerstone	Maul	Pigment	Miscellaneous Ground Stone
Dakota Sandstone	8	6	1	4	4	2	--	--	--	1
Dakota Quartzite	--	--	--	--	--	--	1	--	--	--
Ogallala Quartzite	--	--	--	--	--	--	5	1	--	--
Cheyenne Sandstone	4	2	--	--	2	--	--	--	--	1
Ogallala Conglomerate	3	1	1	--	2	1	--	--	--	1
Meta-Quartzite	1	--	--	--	--	--	2	--	--	--
Hematite	--	--	--	--	--	--	--	--	1	--

Table 17. Fauna by NISP and MNI at 14CM406.

Taxon	NISP		MNI	
	#	%	#	%
Shellfish				
Anodonta grandis (floater mussel)	72	16	39	39
Uniomerus tetralasmus (pond-horn mussel)	12	3	7	7
Subtotal	84	19	46	46
Fish	27	6	1	1
Reptile				
Terrapene ornata (ornate box turtle)	35	8	4	4
Kinosternon flavescens (yellow mud turtle)	1	0	1	1
Chrysemys picta (painted turtle)	1	0	1	1
Snake sp.	13	3	2	2
Subtotal	50	11	8	8
Bird				
Ava (undetermined)	4	1	1	1
Passeriforme (perching birds)	1	0	1	1
Icteridae (black birds)	2	0	1	1
Fringillidae (sparrows and finches)	2	0	1	1
Anatidae (ducks)	3	1	1	1
Anatinae (surface ducks)	2	0	1	1
Teal sp.	2	0	1	1
Anas discors (blue-winged teal)	3	1	1	1
Buteo sp. (hawk)	1	0	1	1
Buteo jamaicensis (red-tailed hawk)	1	0	1	1
Subtotal	21	4	10	10
Mammal				
Reithodontomys megalotis (western harvest mouse)	1	0	1	1
Perognathus hipsidus (hipsid pocket mouse)	1	0	1	1
Sigmodon hipsidus (hipsid cotton rat)	2	0	1	1
Neotoma sp. (woodrat)	1	0	1	1
Geomys bursarius (plains pocket gopher)	64	15	2	2
Dipodomys ordii (ord's kangaroo rat)	1	0	1	1
Cynomys ludovicianus (black-tailed prairie dog)	26	6	5	5
Ondatra zibethicus (muskrat)	1	0	1	1
Sylvilagus floridanus (eastern cottontail)	10	2	3	3
Procyon lotor (raccoon)	1	0	1	1
Taxidea taxus (badger)	15	3	2	2
Lynx rufus (bobcat)	4	1	1	1
Canis sp. (canids)	3	1	2	2
Antilocarpa americana (pronghorn)	19	4	3	3

Odocoilus sp. (deer)	2	0	1	1
Pronghorn/Deer	8	2	1	1
Bison bison (bison)	102	23	8	8
Subtotal	258	59	35	35
Total	440	100	100	100

Identified Remains

Mammals (59 percent) constitute the majority of the NISP and represent more than half of the identified taxa. They are followed in NISP frequency by shellfish (19.1 percent), reptiles (11.2 percent), fish (6.1 percent), and various birds (4.4 percent). Bison (23.2 percent), floater mussel (16.4 percent), and plains pocket gopher (14.5 percent) dominate the collection of identified specimens. The pocket gopher sample, however, is comprised almost entirely of one largely articulated individual from a feature context. Therefore, the corresponding low MNI (n = 2) illustrates the potential for skewing analysis results if the nature of the remains are disregarded and the contribution of a particular faunal type is overemphasized. In this case the pocket gopher was recovered in an area of extensive rodent disturbance and probably was not associated with the cultural aspect of the location.

Shellfish have the highest representation of MNI with a total of 46, compared to 35 individual mammals representing a diverse array of species. The most common species include floater and pond-horn mussel, bison, prairie dog, ornate box turtle, pronghorn, and cottontail (Table 17).

All large mammal MNI calculations rely on elements whose utility is increased due to their suitability for bone tools. For bison scapulae were most common, whereas the metapodial was responsible in part for MNI calculation of smaller ungulates (metatarsal for deer, metacarpal for pronghorn). Bison scapulae used for MNI calculation were typically reduced considerably, but the patterns of reduction and occasional forms of surface modification on individual elements contributed to the possibility of differentiating distinct portions and individuals. The assemblage of six adult bison left scapulae used for tools was supplemented by at least one juvenile or sub-adult (based on the occurrence of unfused and small scale element portions) from Feature 293 and isolated element portions comparable in size to a newborn calf or late-term fetus from Feature 288.

Procurement, Processing, and Diet

The MNI determination for bison was used as a means of calculating the relative frequency of occurrence by element in the sample. This relationship was identified by dividing the observed frequency (fo) of a particular element by the expected frequency (fe), a factor of the MNI (Table 18). A Recovery Index (RI) was then calculated where RI = fo/fe x 100. RI determinations were made for each element observed in the collection. These individual indices were then combined to project the index to bison skeletal portions, including axial skeleton, upper and lower portions of the fore and hindquarters, and feet. Upper limb elements from the fore and hindquarters dominate the assemblage with corresponding low frequencies of lower appendicular elements in each case. Particularly frequent are scapula (high tool utility) portions among upper appendicular elements, although in no instance is the actual number especially high. Overall, axial and lower appendicular elements occur in similarly low frequencies, while foot bones are the least recovered portion at the site.

The absence of skulls and cervical vertebrae suggests their discard at kill sites. Pelves are represented by portions of acetabula, which may have entered the site as remnants attached to femurs, the remaining portions being chopped off and discarded in the field. This suggests that at least some kills were made within a short distance from camp, with these low utility elements being carried onto the site prior to complete dismemberment and subsequent discard.

The low frequency of identifiable remains may be explained with two variables in mind. First, the low representation of small elements such as carpals, tarsals, sesamoids, and phlanges suggests that these elements were not being brought into camp as riders on higher utility elements. Some of these lower-limb elements may have been removed with the hide, while others simply were removed and discarded at the kill site through a processing strategy that involved at least partial "boning out" of the carcass prior to transport back to camp. Metapodials, while still part of the lower limb, have RI values similar to

Table 18. Bison Recovery Index by Element at 14CM406.

Element	Expected Frequency	Observed Frequency	Recovery Index
Skull	8	0	0
Mandible	16	2	13
Cervical Vertebra	56	0	0
Thoracic Vertebra	104	6	6
Lumbar Vertebra	48	3	6
Caudal Vertebra	128	0	0
Pelvis	8	3	38
Sacrum	8	1	13
Rib	104	5	5
Scapula	16	9	56
Humerus	16	2	13
Radius	16	1	6
Ulna	16	2	13
Carpal	96	2	2
Metacarpal	16	2	13
Femur	16	2	13
Tibia	16	3	19
Metatarsal	16	2	13
Tarsal	96	5	5
Phalange	192	18	9
Sesamoid	192	4	2

many upper appendicular elements. They may have been subjected to processing trajectories similar in many regards to the upper limbs, i.e., intensive marrow extraction rather than discard at kill sites.

While among the most frequently noted skeletal portions at the site, the still-low representation of long bones or upper appendicular elements is considered to be related to a process wherein these elements were systematically reduced to extricate valued marrow. The large sample of shattered bone from the site bears witness to the demise of a sizeable proportion of the long bone elements through this process. While the shaft fragments themselves are not quantified and discussed in detail here, it should be noted that the largest complete element is a bison metatarsal, and the largest broken portion is the distal half of a bison humerus. Both elements stand out from the vast majority of the sample, which consists of much smaller splinters of bone. The most common complete bison bones are limited to the lower appendicular region (phlanges, sesamoids, carpals/tarsals).

The collection of shattered bone may provide some evidence of patterning in the marrow extraction process. Essentially this involves the consistent placement and appearance of blows to the proximal or distal regions of the shaft. More extensive investigation may delineate a reduction pattern unique to particular elements, as suggested by a detailed analysis of the faunal remains from the Bell site (Beaver this volume). While bone grease production also may have occurred, some evidence argues against this as a frequent practice. There is a low degree of pulverized or otherwise highly reduced bone fragments, as well as a low occurrence of specimens of any size, which exhibit chalky or exfoliated surfaces that might be associated with boiling or immersing bone fragments in water to extract bone grease.

The possibility of marrow extraction at kill sites, as well as the potential for dismemberment and discard of long bone elements for a number of reasons, including season of the year and distance from camp, cannot be addressed with the data at hand but also may be responsible for the biased faunal record at 14CM406. The fact that the bison MNI is based on an element with a high tool utility points to the certainty of an under-representation of bison remains in the collection regardless of the reason for the low occurrence.

Beyond marrow extraction, modification of bone is limited primarily to bones of larger mammals, although occasional modifications were identified on other animals, including badger, prairie dog, cottontail, duck, and possibly bobcat. Among the ungulates cut marks occur on ribs as both single marks and groups near the head and along the shaft, often set perpendicular to the length of the element. Proximal and distal portions of long bones also exhibit occasional cut marks, occurring in a manner that suggests disarticulation of long bone elements or perhaps removal of meat from articular portions of the carcass. Casual observation of undifferentiated shaft fragments likewise indicates butchering marks. Occasionally cut marks are recognized on carpals, tarsals, sesamoids, and phlanges in the collection.

Other modification of bone is limited to occasional burning of elements and unidentifiable fragments. Burned bone of smaller species include duck and teal, prairie dog, wood rat, and turtle. Evidence of noncultural bone modification, such as occasional rodent and carnivore gnawing and root etching, was found on some material throughout the excavation, although root-etched bone surfaces were generally limited to the upper 20–30 cm of fill across the site.

The faunal material from the site can be used to depict resource exploitation across local environmental zones (Table 19), and three broadly defined zones were recognized. The first is the nearby riverine setting of Mule Creek and any associated oxbow lakes or other marshy areas. The second is the adjacent riparian woodland setting along the creek, as well as tree- or brush-lined draws in the dissected areas along Mule Creek and its intermittent drainages. This also includes the important edge ecotone, separating this area from the more open grasslands, which constitute the third zone. These divisions are used here simply to identify the most likely habitats in which particular species might be encountered. Indeed, several species might be expected in a variety of settings, particularly in the grassland/upland environment that dominates the few miles surrounding the 14CM406.

Based on consideration of MNI and general ability of a particular species to contribute to the diet of the site inhabitants, it is apparent that, while important resources were procured from each setting, upland game contributed the most by far to daily subsistence. Shellfish and waterfowl were important resources collected from riverine settings, and cottontail was well represented from the riparian/edge/brushy draw habitat.

Small mammals from this same setting may be important, despite their size, for their potential acquisition in a garden-hunting procurement strategy. Western harvest mouse and cotton rat in particular occupy disturbed areas, such as field edges — ideal habitat created by human activity. Other small mammals, including cottontail, prairie dog, wood rat, kangaroo rat, and pocket mouse, might take advantage of similar local settings, and their remains may represent garden-hunting activities.

Species diversity among features at the site was quite variable (Table 20). Grouping some remains into more inclusive types, such as raptors, waterfowl, or other bird, rodent, and turtle, was accomplished with little apparent effect on the overall comparison and resulted in a potential number of 21 taxa for purposes of this correlation. A diversity index (DI) was established for each feature by dividing the number of identified species in a particular feature by the number of possible taxa. Overall diversity measures seem to correlate with feature type, although the comparative sample is admittedly quite small. Species diversity is highest in Feature 101 (80.9), where a house structure might have been intermingled with other cultural features. Otherwise bell-shaped pits have the highest diversity with the exception of Feature 193 (14.3), which was sparsely filled with debris. Bell-shaped pits, Features 287 and 192, had much higher diversity measurements of 61.9 and 52.4, respectively. Cylindrical pits, Features103, 293, and 288, had identical diversity indices of 23.8. Finally, the two basins, Feature 300 and the unnumbered Feature X, yielded the lowest diversities of 9.5 and 14.3, respectively. Other features, which were either collapsed or truncated, included Features 114 and 247 with diversities of 28.6 and 23.8. Species representation from the general block excavation had a DI of 33.3.

Seasonality

The collection produced several examples of fauna that are useful for determining at least rough approximations of seasonality of kills and occupation in general. First, the harvesting of fish and shellfish typically is best accomplished in warm weather due to the probability that the collectors will be in contact with the water for some period of time. Likewise, the collection of turtles might be expected to correspond

Table 19. Habitat Settings in the Vicinity of 14CM406.

Riverine (Creeks and Wetlands)	Riparian/Edge/Brushy Draws (Valley Floor and Broken Terrain)	Grassland (Upland)
Muskrat	Deer	Bison
Duck	Bobcat	Pronghorn
Teal	Cottontail	Coyote*
Painted Turtle	Raccoon	Pocket Gopher
Yellow Mud Turtle	Woodrat	Prairie Dog
Fish	Hipsid Cotton Rat	Ord's Kangaroo Rat
Shellfish	Western Harvest Mouse	Hipsid Pocket Mouse
	Red-tailed Hawk	Box Turtle
	Blackbird	Sparrow
*Coyote not confirmed in collection, merely canid.		

Table 20. Faunal Diversity by Feature at 14CM406.

Fauna	101	287	192	193	293	103	288	300	no #	114	247	Block
Bison	X	X	X	X	X	X	X		X	X	X	X
Pronghorn	X	X	X							X		X
Deer	X						X					
Pronghorn/ Deer	X											
Canid		X			X							
Bobcat			X									
Badger	X	X	X								X	
Raccoon					X							
Cottontail	X	X										
Muskrat	X											
Prairie Dog	X	X	X				X	X		X	X	X
Pocket Gopher	X	X										
Other Rodent	X							X	X	X		
Raptor	X											
Waterfowl	X	X	X									X
Other Bird	X	X	X									
Snake	X											X
Box Turtle	X	X	X	X	X	X		X	X	X	X	X
Other Turtle		X	X									
Shellfish	X	X	X	X	X	X	X			X	X	X
Fish	X	X	X			X			X			
Diversity Index	80.9	61.9	52.4	14.3	23.8	23.8	23.8	9.5	14.3	28.6	23.8	33.3

with the warm season, since they are more difficult to procure during hibernation.

The presence in the collection of several waterfowl bones indicate occupation during spring and fall migrations, although waterfowl residency and nesting during the summer months have been recorded at least irregularly for the area (Flowers 1995; Thompson and Ely 1989). Depending on the weather in any given year, their presence was limited to early spring through late fall. It is doubtful that waterfowl wintered in the area except in rare cases.

A number of juvenile mammals confirm a period of occupation that spanned at least the majority of the year. An immature prairie dog of about half adult size or slightly larger would represent an early summer capture, assuming both a typical reproductive cycle and birth in mid-spring. Of course, this also assumes that the individual was part of the cultural component at the site rather than a natural occurrence.

A bison calf, probably less than six months old, was represented by a limited number of bones. Assuming a typical calving period in late April or early May, this would correspond to a fall kill. Remains of a bison fetus indicate procurement in late winter to early spring.

Other immature mammals are more problematic for seasonal determinations. A juvenile bobcat is of limited value, as bobcats may deliver any time during the first nine months of the year, although peak activity tends to be from late winter to late spring. If the individual were produced as a result of this early year activity, it likely represents a kill from the latter half of the year, although this determination is tentative. Minimal evidence of an immature, small canid is of limited usefulness, primarily because it is not possible to determine whether it represents a domesticated dog or a coyote.

While not specifically related to seasonality, several gastropods that are useful for inferring microenvironments were identified from feature contexts. The typically isolated examples of the various gastropod species are discussed with reference to their habitats and their contexts in the site. Members of the species *Succinea* are closely associated with relatively permanent sources of water. However, at least one species (*Succinea concordialis*) may be found in drier environments, where water is not constant (Leonard 1959:139–159). A single specimen was collected from the 40–50-cm level of Unit 213 in the Feature101 fill. *Helisoma trivolvis lentum* is generally associated with still, shallow water, such as may occur in quiet pools, in permanent or intermittent drainages and ponds (Leonard 1959:57–59). This gastropod came from Feature 114 at a depth of 40–70 cm. *Pupoides albilabris* occurs in a variety of settings, ranging from the moist wooded areas of eastern Kansas to relatively arid sagebrush flats in the western part of the state (Leonard 1959:181–182). *Hawaiia minuscula* may be found in a variety of habitats, generally under debris, such as rocks, logs, or grass clumps, in floodplain and upland settings (Leonard 1959:120). Examples were collected from Feature101, Unit 212, 50–60-cm level and from Feature 288, 50–70-cm level. *Hawaiia minuscula* was also collected from Features 275 and 287. In addition, Feature 287 yielded an example of the gastropod *Lymnaea parva* from the 100–110-cm level. Individuals in this group are often found in close association with water, on debris or mud along stream banks and ponds, or among sedges and other marsh grasses in the same setting (Leonard 1959:55–56). A single specimen of *Gastrocopta procera* also was recovered from Feature 287. This gastropod typically is found in the leaf mold and rotting logs, associated with relatively permanent stands of trees, although it has been noted in more open areas (Leonard 1959:180). This shell was recovered from the 160–170-cm level of the feature.

The collection of analyzed gastropod shells consists of forms that occur in the region today. In this sense the general environment of the prehistoric site locale probably was similar in many respects to the modern environment. Most species are restricted to near-water situations, typically within a few feet of a fairly reliable source of moisture, such as Mule Creek and its associated tributaries and oxbow cutoffs. Others are confined to settings with dense to open woods that might be expected in a floodplain riparian woodland. The occurrence of most species could be explained simply as a part of the natural setting of the site, while others may be described as having entered the site deposits through cultural means, possibly as coincidental riders on any number of materials coming to the site from their customary habitats.

Worked Bone and Shell

Twenty-six worked bone and shell objects were recovered primarily from feature contexts, namely Feature 101, 287, 193, and 103. Combined, artifacts from these proveniences account for 81 percent of the collection. As with the butchered faunal remains, items from the upper 20–30 cm of the excavation tend to exhibit moderate amounts of root etching, which obscures signs of use.

A single shell tool, recovered from a non-feature context, was manufactured from locally available mussel (*Uniomerus tetralasmus*). The shell exhibits a moderately to heavily rounded ventral margin, with the most noticeable modification occurring toward the anterior end. The posterior end is broken, removing portions of the ventral and dorsal margins. The tool edge generally maintains a rounded shape consistent with the original configuration of the ventral margin. The shell may be a green corn sheller, although the ventral border of this tool type is often more flattened through modification, particularly toward the posterior rather than anterior end. A more arching margin may be indicative of use as a pottery scraper, but due to the fragmentary nature of the object, it is identified simply as a scraper (Figure 24).

The remainder of the modified shell represents ornaments (Figure 24). A single *Olivella* shell bead fragment was collected from Feature 101. Three additional beads, recovered from the lower portion of the Feature 193 fill, were disk-shaped pieces of marine shell.

Bone tools include digging implements (hoes and picks) and perforating instruments (awls and needles). A single pronghorn metacarpal (distal portion) exhibits notching for an undetermined purpose. The bone exhibits a single linear groove on the center of the anterior face that parallels the long axis of the bone, similar to the placement of the vascular groove present on metatarsals. Perpendicularly intersecting this groove a short distance from the distal end are a series of 13 smaller, more shallow linear grooves. A splintered, green bone break occurs across the last few linear marks, indicating that additional marks on the missing portion were likely. Little evidence of wear is indicated on the bone, as the surface had been eroded somewhat and has spalled moderately to severely in the area of the perpendicular notches.

Bison scapulae were utilized for the production of digging implements, primarily hoes (Figure 24). Eleven complete or fragmented examples were recovered from feature contexts. While generally fragmented, the collection exhibits a uniform method of manufacture. Reduction of a scapula to create a desirable tool form included removal of the glenoid head by fracturing the bone at the neck while green. There is no evidence of cutting or grooving the bone as a means of facilitating removal. In addition to glenoid removal, the spinous process was snapped off, resulting in a ragged edge that was only rarely ground down. The ridge at the posterior border was trimmed, and part of the scapula blade near the vertebral edge was removed by a groove-and-snap method. Examples of the discarded portions from this procedure are limited to an occasional glenoid, scapular spine, or vertebral border fragment. Tools with intact proximal ends show occasional patchy rounding of the break, accompanied by light to moderate abrasive polish that infrequently continues along the remainder of the neck and upper portions of the posterior and anterior borders. The distal tool margin is typically angled toward the posterior border rather than perpendicular to the long axis of the scapula. This modification may have sought to take advantage of the more rigid posterior edge, creating a stronger point toward which the primary use impact could be directed.

Evidence of utilization includes light to occasionally heavy polish along distal and lower lateral margins and light to moderate striations on the blade parallel to the long axis of the tool. One section of worked scapula exhibits typical hoe reduction in addition to a grooved and snapped break along the scapular blade. Striations present on the blade are consistent with those occurring on scapula hoes, so it is inferred that this object functioned initially as a hoe with subsequent reduction/removal of a portion of the blade, followed by discard of the remaining tool section. Another scapula has a significantly reduced blade, accompanied by a narrow pick-like extension along the anterior margin. The distal margin of this projection exhibits a rounded but not heavily worn surface with some use-related polish. The remainder of the blade likewise shows evidence of utilization in the form of light to moderate polish and striations.

Another bison bone tool is an ulna with a snapped distal end, creating a relatively short pick. The implement does not exhibit evidence of heavy utilization as the distal tip is not heavily worn. Light to moderate edge-rounding is accompanied by light polish. Small amounts of abrasive polish also occur on the proximal end, perhaps as the result of hafting.

Awls in the collection were manufactured from deer or pronghorn metapodials or from splinters of bone. Metapodial awls often consist of a splintered proximal or distal end that subsequently was shaped to a sharp point. Polish is most prominent on the distal half of the tool with occasional lighter, more patchy polish on the proximal end. Splinter awls include one fashioned from a bison rib edge and another (distal tip) from an undetermined element. A possible perforating tool consists of a reduced bison hyoid. This broken implement exhibits a highly polished shaft with minimal striations. One additional tool is classified as a needle, based on its more refined form, being both the longest and most narrow perforating instrument identified in the collection (Figure 24). Some longitudinal striations are still

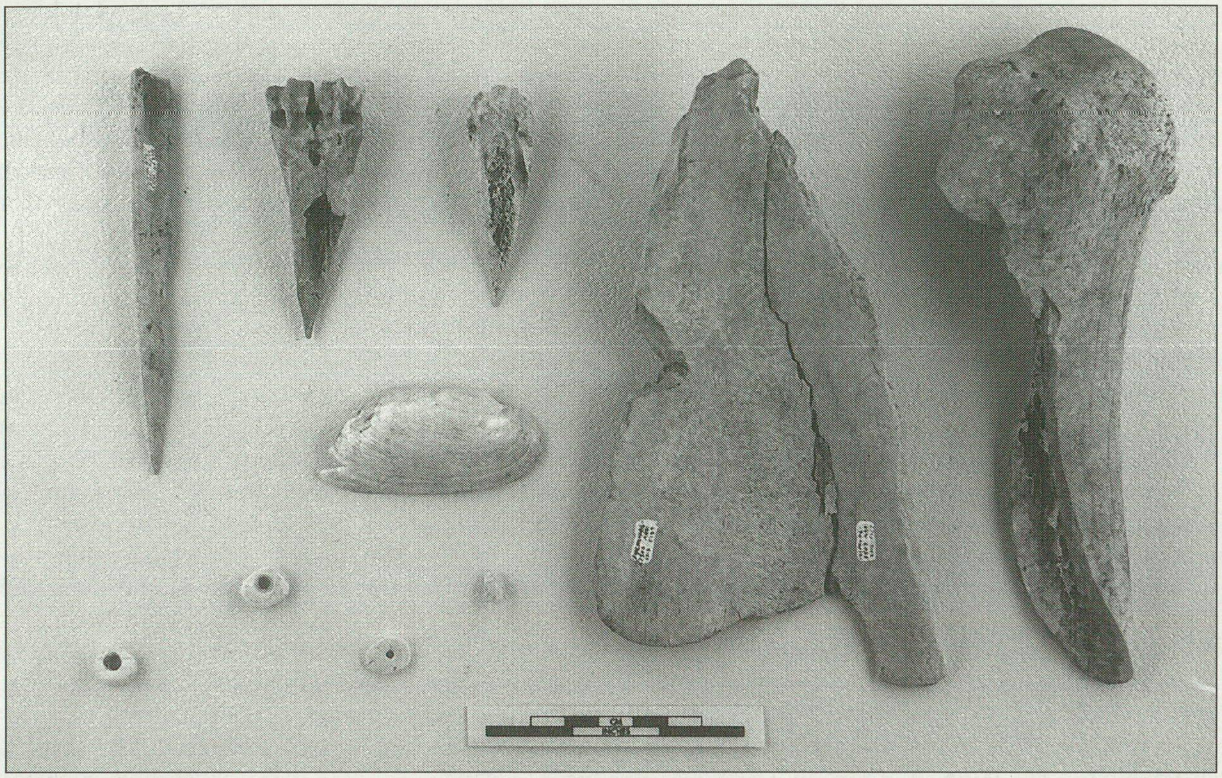

Figure 24. Worked bone and shell objects from 14CM406.

evident, even though root etching is extensive on the tool, which was recovered at or just below the plow zone in Unit 249.

Floral Remains

A limited quantity of floral remains were recovered from feature contexts. Systematic flotation from proveniences at the site provided a larger sample of charred specimens that otherwise might have been lost. This analysis sought to identify the potential diversity in the collection as it relates to the contribution of gathering and horticulture to the daily subsistence of the site's inhabitants. Individual species frequencies, as well as their contribution to the diet, are not estimated here.

Gathering

Evidence for wild plant gathering includes several genera. Examples of *Prunus*, typically small pit fragments of no specific species, occurred in a number of features. The nearby environment would be expected to produce several *Prunus* species, including chickasaw/sand plum, American/wild plum, and chokecherry. These trees or shrubs likely would have grown along Mule Creek and the lower portions of its intermittent tributaries, where riparian woodlands, wooded edges, and sandy lowland/terrace soils are found. Sand plums also were adapted to upland settings, where sandy soils occur. Several hackberry (*Celtis* sp.) seeds were identified in the collection. None is charred, so it is not certain that the seeds were a component of the prehistoric habitation, although it is presumed that hackberry fruit was available for collecting then, as it is now, along the wooded areas of Mule Creek.

Horticulture

Several weedy annuals were identified, including goosefoot (*Chenopodium* sp.), pigweed (*Amaranthus* sp.), and sunflower (*Helianthus annuus*). These plants occur in open woods and edge settings, low areas, and disturbed locales, such as fields or habitation areas (Kindscher 1987). All three could represent wild or domesticated plants, but the current analysis was not conducted with this focus in mind.

Besides these possible cultigens, at least one certain horticultural product was identified in every wild or domesticated plants, but the current analysis was not conducted with this focus in mind.

Besides these possible cultigens, at least one certain horticultural product was identified in every feature at the site. Evidence of corn (*Zea mays*), primarily in the form of minuscule cupule fragments, was scattered throughout the fill of the various features. Occasionally whole kernels, highly fragmented kernel portions, and small cob segments were recovered.

14MD306 —The Lundeen Site

The Kansas Archeology Training Program was conducted at 14MD306 from June 6 through 14, 1998. The excavation focused on two of the large areas of cultural fill and a potential feature, partially exposed during excavation of a test unit in the central portion of the site. A total of 18, 2 x 2-m units were opened to investigate various subsurface soil stains and areas in between potential features (Figure 25).

Prior to excavation a series of soil cores were placed across the site, using an Oakfield probe. Primarily these followed a northeast/southwest-trending line, which roughly paralleled an agricultural terrace, located several meters to the northwest of the transect. Coring occurred at 1–2-m intervals, although distances were shortened across potential features, especially large ones, in order to estimate their dimensions. Holes were flagged, and core profiles were described to record depth of sterile subsoil, general soil color and/or consistency, and presence and approximate depths of charcoal, burned earth, bone, shell, or other cultural materials. Where cores were particularly rich, numerous short lines of cores were run perpendicular to the main transect to determine the general feature boundaries. This procedure allowed for more precise placement of excavation units.

During initial investigation soil cores revealed that modern agricultural activity had disturbed the site to a depth of approximately 15–22 cm, so shovels were used to remove the top 20-cm level. Additional levels below the plow zone were removed in 10-cm increments. In general a technique of shovel skimming at a steep angle across excavation units was employed, supplemented by troweling in all instances when more refined technique was necessary. When features were encountered, excavation proceeded in one of two ways. Once defined, small features, such as post molds, basins, and storage pits, were cross sectioned and excavated in halves using trowels. Fill was treated as a single unit. Portions of two large features were excavated, with work proceeding in 10-cm levels. Shovel use was encouraged when prudent to expedite removal of undifferentiated fill.

Excavated fill from the first level (0–20 cm) was sifted through ¼-inch mesh hardware cloth. All fill from each subsequent level was screened with the exception of a two-gallon soil flotation sample, which was taken from the northwest corner of the unit. Within large features this strategy was continued, with the sample being taken from the northwesternmost extent of the feature within the particular excavation unit. Smaller features were sampled for flotation purposes, with especially small features being subject to total flotation.

Features

Feature 251 appeared as a poorly defined dark soil at approximately 30 cm in early testing at the site. It was identified during excavation in Unit N62, E34 at the 40-cm level (Figure 25). The feature is a shallow, straight-walled pit (Figure 26, Table 21). Only a little cultural material came from this pit, including bone, shell, ceramics, lithic debitage, and chipped stone tools. Fill varied from dark grayish brown loose soil to light yellowish brown dirt and contained a small amount of caliche.

Feature 252 lay near the center of unit N50, E26 (Figure 25). It appeared as a poorly defined stain at approximately 30 cm bgs, but was not well defined until the 30–40-cm level had been completed. It was a shallow, cylindrical storage pit (Figure 26), containing relatively homogenous grayish brown fill with caliche, particularly in the lower portion. Cultural material was sparse, consisting of small bone fragments, shell, chipped stone tools and debitage, ceramics, and possible ground stone materials. The east edge of Feature 252 intersected Feature 268. Feature 252 probably was more recent than Feature 268, as the orifice of Feature 252 appeared to cut into the Feature 268 arc.

Feature 200 was a compact layer of mottled clay soil and caliche, encountered at 81 cm bgs in unit N66, E40. The zone extended for 10 cm below this point. Beyond the margins, as well as below the compacted layer, dark, loose cultural fill was encountered. The feature had roughly linear edges that converged to create a "corner" (Figure 26). In this corner a large post mold (Feature 275) was defined (Figure 26, Table 21). Feature 276 is another smaller post mold (Figure 26, Table 21).

Also associated with Feature 200 was Feature 269 in the southeast quarter of N64,E42 (Table 21). Feature 269 appeared to be a prepared house floor that intersected and possibly truncated another cultural feature (Feature 279). Feature 279 was a sterile-looking

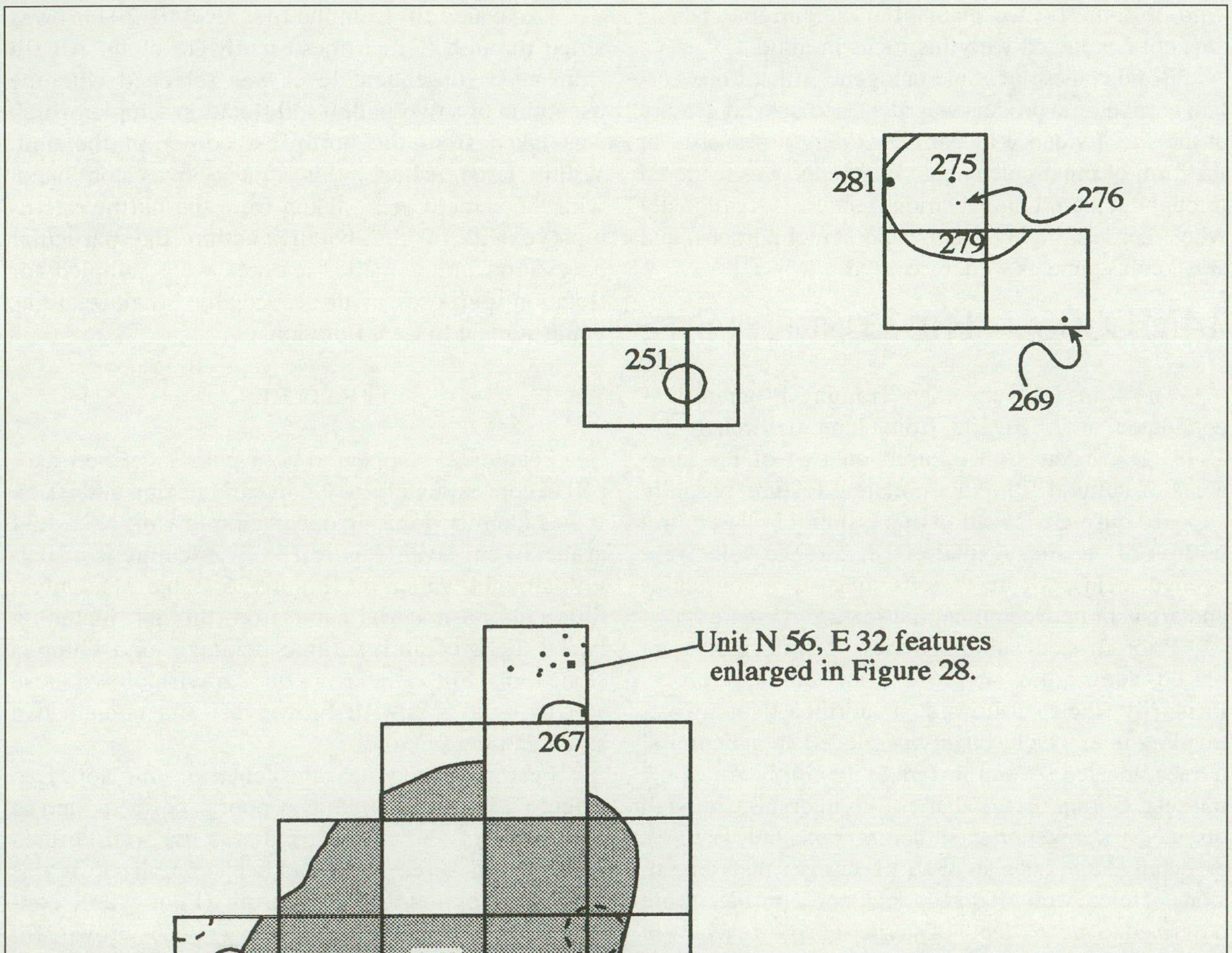

Figure 25. Excavation plan view of 14MD306.

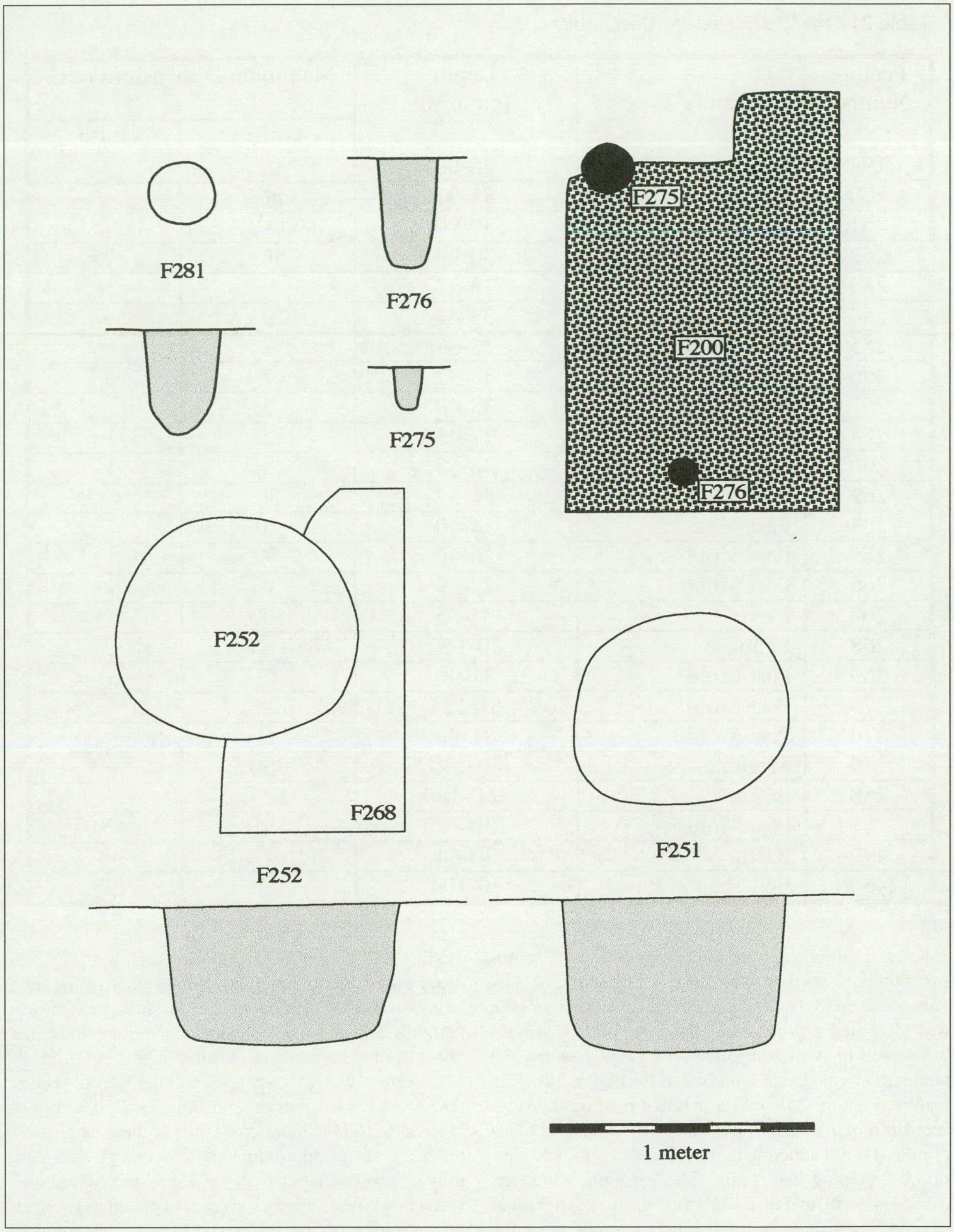

Figure 26. Plan views and profiles of Features 251, 252, 281, and 200, including associated Features 275 and 276.

Table 21. 14MD306 Feature Descriptions.

Feature Number	Feature Type	Depth (cm bgs)	Maximum Dimensions (cm)	
			Orifice	Base
194	Historic Post Mold	28-60	22	
200	House Floor	81-91	n/a	
251	Cylindrical Pit	30-90	90 x 83	
252	Cylindrical Pit	30-90	90	75
253	Post Mold	33-42	9	
254	Post Mold	33-42	9	
255	Post Mold	33-38	7	
256	Post Mold	33-37	7	
257	Post Mold	33-40	5	
258	Post Mold	37-45	7	
260	Historic Post Mold	36-55	26	
262	Post Mold	34-52	30	
263	Post Mold	34-40	10	
265	Post Mold	36-46	7	
266	Post Mold	34-39	9	
267	Basin	35-55	100	
268	Pithouse	30-160	880 x 660	
269	Post Mold	81-96	17	
275	Post Mold	81-124	20	
276	Post Mold	81-96	8	
279	Megapit	80-140	300	
280	Basin	160-180	125	
281	Post Mold	130-170	30	20
299	Basin	30-64	116 x 105	
No #	Bell-shaped Pit	30-104	75	95

zone that continued across Unit N64, E42 to the southeast without interruption, although an undulating surface occurred in the west part of that unit. Another post was identified as a large circular zone of dark grayish brown soil in sterile subsoil at the base of Feature 279 along the west edge of Unit N66,E40 (Figure 26). This feature, Feature 281, was a massive post mold, excavated through a nearly solid mass of caliche cobbles (Table 21). Fill adhering to the sides was removed simply by tapping the walls. The ensuing vibrations caused the fill to fall away from the rough textured caliche. The size of the post mold is reminiscent of the massive supports described from Buried City structures (Hughes and Hughes-Jones 1987:101). While difficult to directly tie to the Feature 200 house floor, Feature 281 is most likely associated with it. The post mold may have escaped detection higher in the unit, being masked by the Feature 279 fill. In any case it was certainly a large support post for a structure and is not considered to be related to Feature 279.

Feature 268 was assigned to an apparent feature that appeared to span several units in the vicinity of N48-52,E28-34 (Figure 25). Units in the area encountered the fill at approximately 25 cm bgs as a dark grayish brown matrix that was loose and rich in artifacts. Some units were excavated to 40 cm to gain better definition of the feature perimeter. The southern perimeter was not explored. The feature was ovoid, with its long axis extending approximately 8.8 m in a northeast-southwest direction (Table 21). It was approximately 6.6 m wide and had relatively vertical walls, which had slumped, especially along the northern perimeter. Feature fill was composed of numerous smaller fill episodes interspersed among several larger fill zones, which were most apparent in wall profiles (Figure 27). Most of the artifacts at this site came from this feature. The nearly flat floor lay at 140 cm bag. Masses of caliche pebbles formed a nearly continuous sheet.

At the east end of Feature 268 and roughly perpendicular to its long axis was a 30-cm-tall bench, which appeared in the north wall profile of Unit N50,E32 (Figure 27). Only a small portion of this bench was defined; hence, little can be discussed of its relationship to Feature 268. Feature 280 was located along the south wall of Unit N48,E28 near the west end of the oblong feature. This shallow basin had an irregular, sloping floor and must have been open during the initial filling of Feature 268, as an ashy lens near the floor of Feature 268 dips down into this basinlike area.

An unnumbered feature was identified within the boundaries of Feature 268. In the north and east walls of Unit N50,E32, portions of a distinct fill were used to identify a previously unrecognized bell-shaped pit (Figure 27). The arc of this pit encompassed the northwest corner of Unit N50,E34, and fill from that part of the unit, although designated as Feature 268 fill, likely came from the later bell-shaped pit feature. The color of the fill was very similar to the grayish brown fill of Feature 268. However, the pit fill was homogeneous, whereas the fill of Feature 268 was strongly stratified with various fill episodes.

Feature 279 represented the remains of a megapit, measuring approximately 3 m across (Table 21). As the name implies, these features are pits of large size, typically having round to ovoid forms and relatively straight walls. The megapit appears to be restricted to Southern Plains Late Prehistoric cultures, having been originally defined at several sites in western Oklahoma and the Texas panhandle (Drass 1997). Definition of Feature 279 was incomplete, as only three units exposed the western and southern edges. The feature was discovered when excavation into the Feature 200 floor revealed an arc of dark fill in the northwest corner of N64,E42 and northeast edge of N64,E40 (Figure 27). Excavation in N66,E40 showed a dark stain beyond and below the perimeter of Feature 200. Feature 279 likely was at least partially truncated by the preparation of a semisubterranean house, recognized by the prepared floor at the 80-cm level. Overall artifact density appeared to be higher in Feature 279 than in Feature 200 with the exception of the proveniences near the Feature 200 floor.

Feature 267 was a shallow basin, situated near the northern perimeter of Feature 268 (Feature 28, Table 21). Rodent activity obscured portions of the edge and base, and the east edge was truncated by a post mold (Feature 194) of modern origin. Feature 267 may have been associated with a cluster of small post molds, located approximately 60–100 cm to the north of the basin. A limited amount of material was recovered from the loose brown fill.

Feature 299 was a deep basin, the eastern margin of which was partially obscured by Feature 268 (Figure 25, Table 21). Which features cut the other could not be determined. Immediately to the north, Feature 252 was partially superimposed on the west margin of Feature 268. This may be a similar situation to Feature 299, although it could not be ascertained due to the nearly identical color of the fill in Features 268 and 299.

A cluster of post molds just north of Feature 267 in Unit N56,E32 represent the shallow, truncated bases of small posts used to create a lightweight structure or windbreak (Figure 28, Table 21). Features included in this cluster are Features 252–258, 265, and 266. Diameters ranged from 5 to 9 cm. Depths ranged from 4 to 10 cm. Those post molds with extremely shallow depths appear to represent the truncated remnants of posts. Each feature was comprised of relatively dark brown to grayish brown fill, which contrasted well with the surrounding light reddish brown caliche-rich subsoil. Together the series of posts created a short arc. There was some evidence of pairing of posts, especially apparent with the Features 253 and 254. The small diameters of the posts seem to argue for a lightweight structure, drying rack, or some other construction associated with an outdoor activity area. A small cluster of lithic artifacts, including several sizeable flakes and stone tools (primarily bifacial knives), removed from the east wall of the unit where the posts were defined, may suggest activities occurring in the immediate vicinity of the post features.

Two posts molds near the cluster were differentiated by their larger size and general characteristics of form and fill. Features 194 and 260 were considered to be modern posts on the basis of a generally clayey, mottled sterile fill and, in the case of Feature 260, a nearly square planview. No historic period materials were recovered from the fill of these features.

Two posts, located along the southeast perimeter of Feature 268 in Unit N50,E34, may represent another surface post-supported feature, which was not

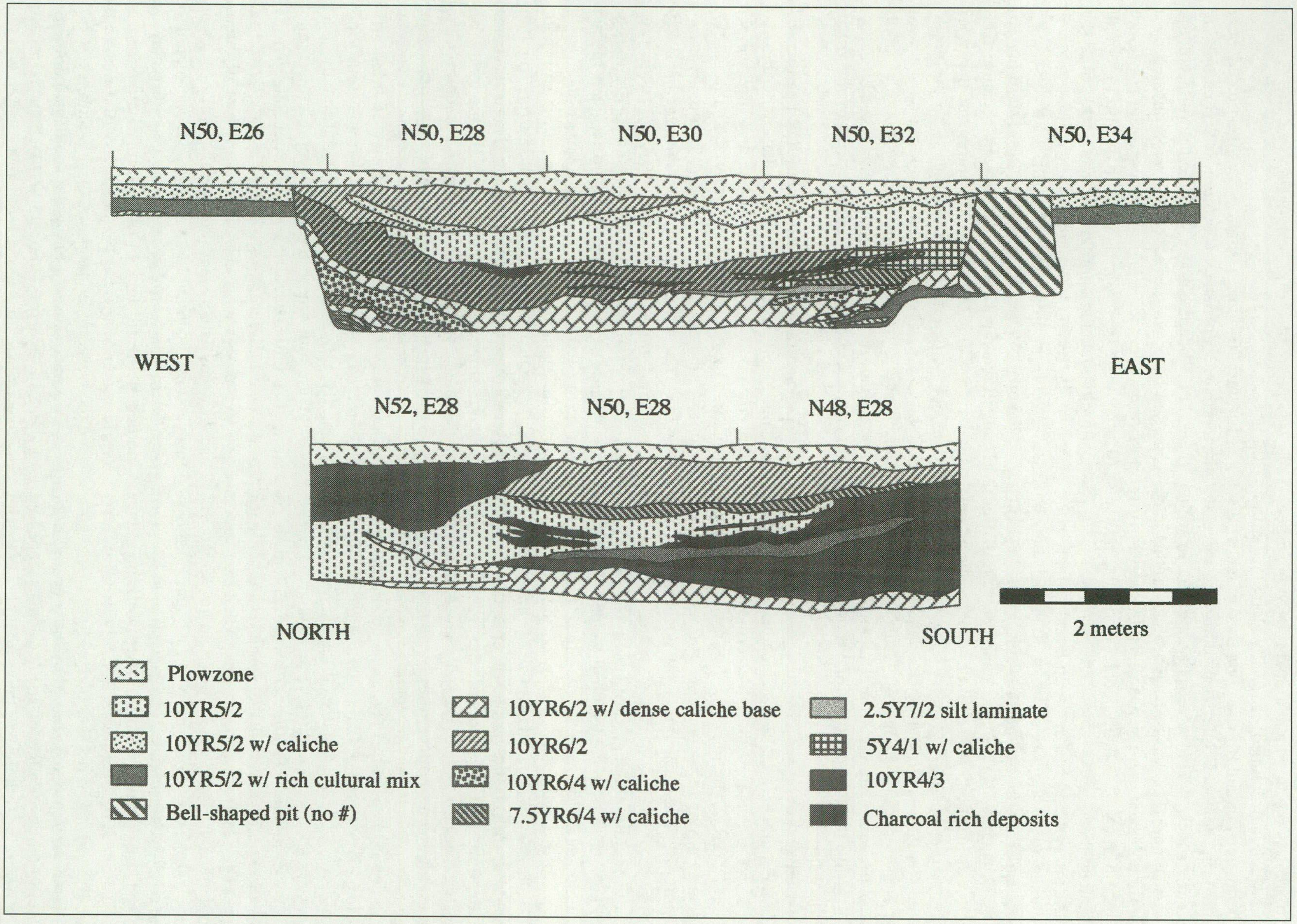

Figure 27. North wall profile of Units N50,E26 through N50,E34 and east wall of Units N52,E28 through N48,E28 showing Feature 268.

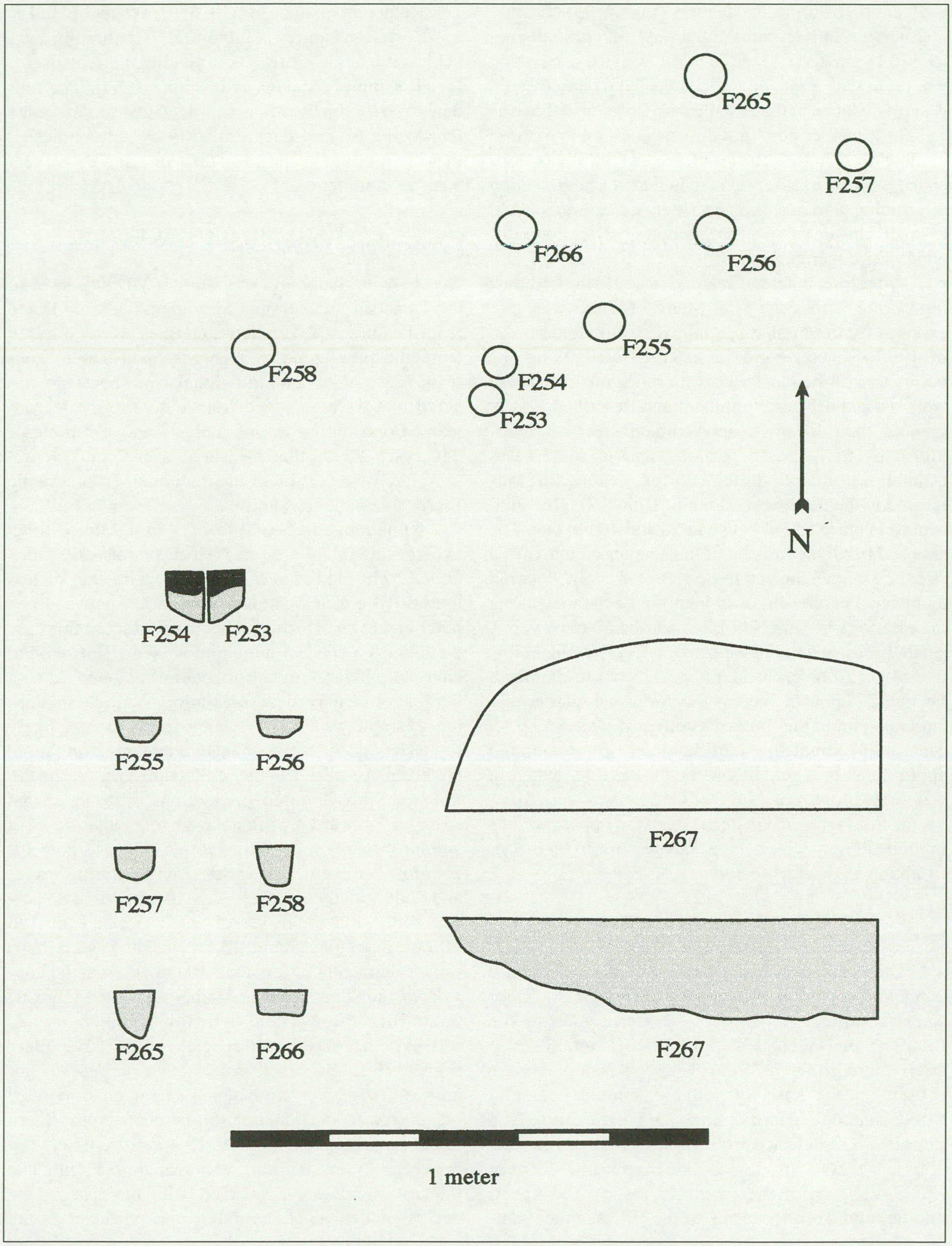

Figure 28. Plan views and profiles of features identified at approximately 35 cm bgs in Unit N56,E32.

well defined during excavation (Figure 25). Feature 262 was a relatively substantial post, 30 cm in diameter and 18 cm deep (Table 21). Fill from the excavation was dark, with a rich mix of charcoal and burned earth. A short distance to the east, Feature 263 was defined as a slightly smaller post with dimensions similar to those in the Unit N56,E32 cluster (Table 21). Artifacts associated with the excavation here included a large section of grinding slab near the perimeter of Feature 268 and a small cluster of quartzite cobbles, at least two of which were hammerstones.

Numerous potential features were identified during coring across the site. Many of these were not exposed by the limited spatial excavation undertaken in 1998. Several were partially defined along the perimeters of the block excavation (Figure 25). These were assigned feature numbers and described briefly to note their location, approximate sizes as determined by the exposed portions, and in some cases estimations of depth through coring. Feature 261 was located in the northwest corner of Unit N60,E26, adjacent to Feature 252 at between 30 and 40 cm bgs. The exposed portion consisted of the southeast quarter of a circular stain, estimated to be approximately 90 cm in diameter. Feature 201 was identified primarily along the east edge of Unit N48,E24 near the 40-cm level. A small basin, extending approximately 30 cm below the 40-cm floor, measured about 75 cm in diameter. Feature 278 was defined as the northwest quarter of a circular stain in the southeast corner of Unit N50,E34. The approximately 1-m-diameter pit extended approximately 82 cm below the 40-cm floor, where it was first recognized. None of the features were excavated, although some material from the upper portions of their fill may have been removed prior to their confirmation as discreet features.

Radiocarbon Dates

Three samples from various depths of Feature 268 and one from the fill above the Feature 200 floor were submitted. All samples were processed by the Illinois State Geological Survey (ISGS-4006-4009) after return from the field. Charcoal samples were chosen on the basis of suitable amounts of solid wood charcoal (approximately 3-5 g). Feature 268 samples were selected from levels 40–50 cm (ISGS-4007), 90–100 cm (ISGS-4006), and 140–150 cm (ISGS-4009) with the intent of testing the upper, middle, and lower portions of the fill. Another sample, collected from the 60–70-cm level in Unit N64,E40, was used to date fill immediately above the Feature 200 floor.

Radiocarbon ages of 630, 670, 600, and 670 B.P. ± 70 were acquired (Table 22). Calibration was achieved using CALIB 3.0.3, yielding corrected ages for all samples (Stuiver and Reimer 1993). The four dates were subjected to a simple T-test to determine the degree of statistical similarity. Results indicated that the four are statistically the same at a 95 percent level of confidence.

Ceramic Artifacts

As with many artifacts from 14MD306, most of the Lundeen site ceramic specimens were collected from Feature 268. Limited quantities were collected from the plow zone or otherwise non-feature contexts. A total of 244 individual rim sherds or rim sherd lots were analyzed from the various site contexts. Contributing to the analysis was a sample of 234 body sherds that measured over 3 cm^2, representing only a portion of the total number of ceramic sherds available for study.

Rims range in height from .8 to 4.9 cm with an average height of 2.8 cm. Most vessels with rims under 2 cm high also have orifice diameters of less than 8–10 cm, indicating a correlation between rim height and vessel size, characteristics that in this case distinguish a class of miniature vessels. Rims tend to have an outward-angled orientation as opposed to a vertical or near-vertical orientation. A single in-sloping example was noted among the rims and likely represents an instance of inadvertent rim formation. Nineteen percent of the collection has vertically oriented rims. Everted orientations with somewhat stronger outward positions were encountered in a similar frequency. Slightly everted rims (42 percent) are most comment. Rims with strongly flaring angles and wide-mouthed orifices were identified on 23 percent of the collection. Vessel orifices range from 5 to 28 cm, averaging about 15 cm. Eight vessels have orifice diameters of less than 10 cm and may be considered miniature forms, possibly with functions different from those served by many of the larger vessels. Whether they served specialized utilitarian functions or were manufactured for other purposes is not known. Vessel lips are beveled (2 percent), rounded (42 percent), and flattened (56 percent) types. Sherd thicknesses range from 3.1 to 13.4 mm, generally fall between 4.5 and 6.5 mm, and average 6.5 mm. The thickest sherds are associated with the area of the neck/shoulder juncture and lower portions of the body, including the base.

The typical vessel form represented at the site is a globular jar with constricted orifice, rounded to

Table 22. 14MD306 Radiocarbon Dates.

Sample	^{14}C Age	95.4% (2 Sigma) Cal Age Ranges	Relative Area under Distribution
ISGS-4006	670±70	cal A.D. 1237-1416	1.00
ISGS-4007	630±70	cal A.D. 1280-1429	1.00
ISGS-4008	630±70	cal A.D. 1280-1429	1.00
ISGS-4009	600±70	cal A.D. 1288-1435	1.00

slightly angular shoulders, rounded base, and neck of medium height (Figure 29). Most reconstructed vessel portions and many smaller sections indicate a common size, ranging from 2 to 5 liters, although examples of smaller vessels with capacities of less than 1 liter and larger vessels with capacities of more than 8 liters are present. Also identified was a small constricted orifice bowl or jar that lacked a neck. When a general size could be ascertained, it is typically less than 1 liter, approximately .5 liters. Several bowl sherds consist of sparsely and/or coarsely tempered, poorly fired ceramics with reddish interiors, suggesting not only a special function for the class of vessels but unique manufacturing preferences as well.

More than 93 percent of the sherds have some form of cordmarking. The cordmarks were at least partially smoothed (80 percent) in most cases, with a significantly smaller proportion having unmodified cordmarks (13 percent). Other sherds are plain surfaced (7 percent). In many cases cordmarks are randomly oriented across the bodies and onto rims of vessels. Occasionally rim sherds exhibit vertically oriented cordmarks. Some ceramic sherds, identified as plain ware, instead may be completely smoothed forms of cordmarked ceramics. Reconstructible vessel portions exhibit a range of cordmarking modification across the bodies with patches of unmodified cordmarks and partially smoothed cordmarks and extensively smoothed zones near vessel bases and along the necks of some vessels.

Identified tempers include sand, bone, shell, and perhaps caliche. In addition, a small number of sherds with silty pastes has no apparent tempering additives (2.1 percent). Shell tempering accounts for less than 1 percent of the collection. Crushed burned bone (58 percent) is the most common tempering agent. It is the only temper in 34 percent of the collection, a component mixed with rounded sand particles in 1.5 percent, and associated with small caliche pellets in 22 percent. Sand was recognized as a single tempering component in 28 percent of the sherds and is mixed with caliche in another 4 percent. Sand particles range in size from around 1 mm to as large as 3.5 mm. The most common sand temper consists of particles near 1 mm in diameter. Particles more than 1.5 mm in size are rare and in every instance are mixed with smaller materials. Finally, trash temper (inclusions of bone, sand, and caliche with occasional shell fragments) was used in 7.5 percent of the ceramics at the site.

The presence of caliche pellets in the paste, mixed with either sand or bone, was noted in a little more than 25 percent of the assemblage. It is possible that caliche was a natural inclusion in one particular clay source near the site, with most ceramics being made from a clay not containing the caliche pellets. Many heavy fraction flotation samples from the site yielded caliche pellets similar to those found in the pottery, so comparable materials occur naturally in the soils near the site.

Decorated rims or occasionally strap handles are common on ceramics vessels. Strap handles are not common in the collection, although several were found. Attachments were made at the lips or upper necks and the shoulders. Decoration on handles include rows of vertical or diagonal incised lines. Overall, rim decoration was found on 40 percent of the collection (Figure 30). Finger pinching is the most frequent decorative technique at 17 percent. Single rows of finger pinching are often a short distance below the lip (approximately 5–8 mm). Placement also occurs along the neck base, at mid-neck, and immediately below the lip. Similar patterns of fingernail impressions are on another 2 percent of the collection. Diagonal lines on the lip are the next most common decorative trait. Both incised (7.4 percent) and impressed (1.6 percent) lines were identified. Diagonal marks also were noted on a small number of

Figure 29. Reconstructed vessel from 14MD306.

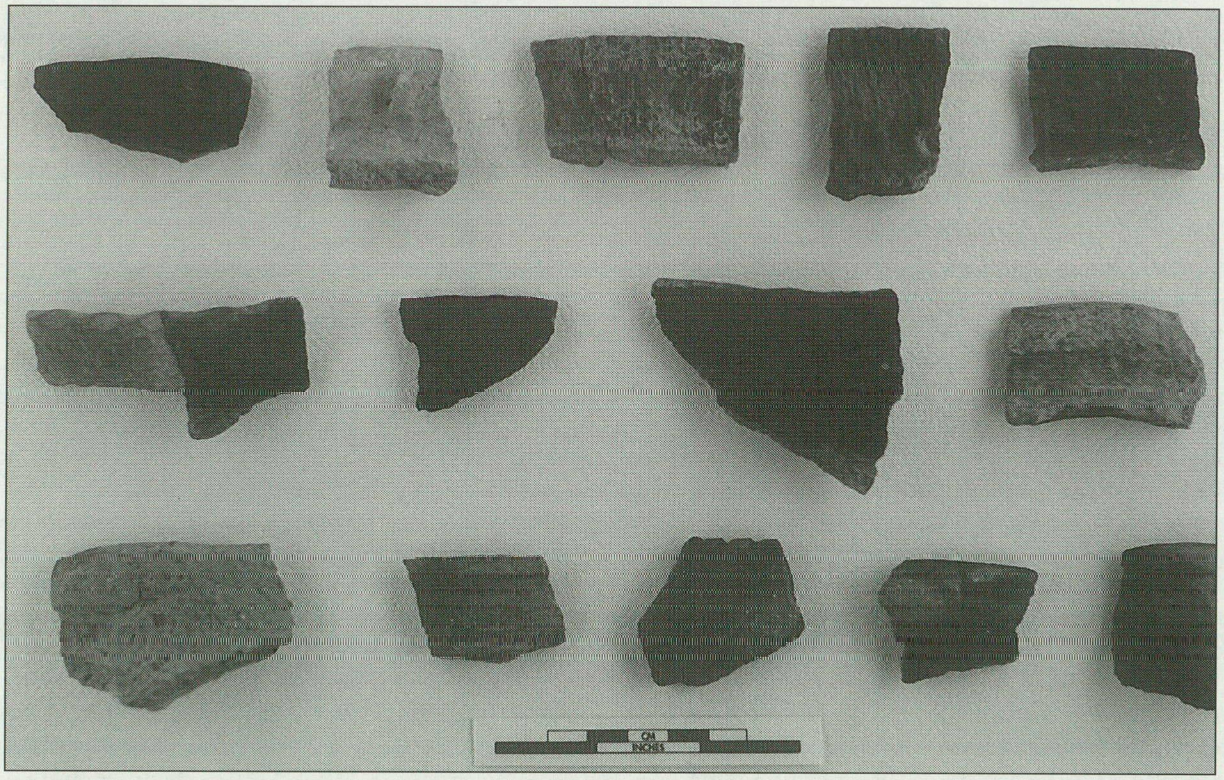

Figure 30. Examples of rim sherds from 14MC306.

rolled lips (1.6 percent). Tool-impressed decorative elements, consisting of broad, shallow ovoid impressions immediately below the lip, comprise 4.9 percent of the collection. A similar number of rims exhibit punctations in the lip or on the exterior of the neck (3.3 percent). Other decorative techniques were identified in isolated instances: a washed-out red film on the interior and exterior surfaces of a bowl lip, a narrow horizontal applique band on the mid-neck of a jar, grooved lips on two sherds, and diagonally incised lips and an incised zigzag band on the neck of two sherds. The zigzag decoration is on the exterior of one rim and on the interior of another strongly flared rim.

Besides ceramic vessels, other objects of fired clay were found in limited numbers (Figure 31). Of particular note are eight ceramic disks. Interestingly, nearly half of these objects were recovered in the immediate vicinity of the southwest corner of Unit N52,E34. This spot was encompassed by the unnumbered feature intrusive to Feature 268 that was identified during profiling. Manufactured from body sherds, most exhibit central perforations, created by drilling, often from both sides. Typically the disks exhibit ground and finished margins, although two still bear roughly broken margins. The function of these perforated pottery disks is typically attributed to use as spindle whorls, and it is certainly possible that they were created for that purpose. Two rough ceramic disks exhibit partially drilled holes near their centers. Each has evidence of drill marks on opposite faces that would not intersect. Whether these objects represent partially finished disks or objects with some other function, such as socketed bases for bow drills, is not known. It is difficult to understand why such implements would be discarded simply because initial drilling failed to create a clean perforation.

Several items were identified as bowl and possibly stem fragments of ceramic pipes. No complete or even relatively complete specimens were found, but the fragments suggest an elbow form. One specimen exhibits vertical rows of horizontally oriented fingernail indentations; otherwise the fragments were undecorated. As a whole this class of artifacts appears to be untempered, although occasional sand grains and/or fragments of bone were identified in the paste.

At least three ceramic objects were identified as clay beads. One is ovoid and approximately 1 cm long. The others are partially flattened balls of clay about 2 cm across. Each has a small central perforation about 1–2 mm across.

Lithic Artifacts

Debitage

Debitage analysis reveals a moderate diversity of raw materials with a low occurrence for all but two non-local material types. Those raw materials that were available in the vicinity include Dakota and Ogallala quartzites, chalcedony, and possibly a basaltlike material, which may be associated with Ogallala formation materials. These relatively local materials account for only 3 percent of the chipped stone debris at the site. Each type accounts for 1 percent or less of the sample, with Ogallala quartzite being the most common.

Non-local materials were acquired from a number of locations, although primarily from sources to the north and south of the site area. Alibates agatized dolomite (60.2 percent) is the most common debitage type at the site. Smoky Hill jasper from northwest Kansas accounts for another sizeable proportion, as 35.7 percent of the debitage was identified as this typically yellowish brown stone. A small sample lithic material was obtained from the east in the Flint Hills region of eastern Kansas. Florence varieties A and C and Wreford cherts are all represented in small numbers. Combined, these cherts account for only 1.3 percent of the debitage.

Cortex or hardened rinds were noted on 5.7 percent of dorsal faces of debitage. These products of early stage lithic reduction are most common on flakes of Smoky Hill jasper. Most other stone categories exhibit at least isolated examples of cortical surfaces. Weathered rinds are present on 38 percent of the small collection of cortical Alibates agate and 5 percent of the Smoky Hill jasper debris. These hardened rinds are indicative of recovery from secondary deposits, perhaps as weathered cobbles near outcropping material or as gravel deposits from drainages that cut through the source areas of the stone. The limited quantities of cortical material demonstrate the likelihood that raw material was entering the site in at least a partially reduced form.

This assumption also explains the extremely high proportion of intermediate to late-stage biface reduction flakes in the collection. Debitage associated with this aspect of the reduction process accounts for 99 percent of the material, whereas blocky core and/or early biface reduction flakes are nearly absent, accounting for only 1 percent of the debitage. Only the two common lithic types (Alibates agate and Smoky Hill jasper) exhibit evidence of both early- and late-stage reduction flakes (Table 23). The nine cores or core fragments in the sample are Smoky Hill jasper. Most are blocky, bifacially flaked margin fragments from large bifacial cores.

Chipped Stone Tools

The raw materials identified in the various tool classes include most of those recognized in the debitage class with the addition of Day Creek chert (Tables 24 and 25). Alibates agate (79.7 percent) was the dominant lithic type among both formal and informal tools. The only other relatively frequent material is Smoky Hill jasper (17.6 percent). The remaining 2.7 percent is divided among 11 stone categories, including a group of unidentified materials. These include probably locally available Dakota and Ogallala quartzites, chalcedony, petrified wood, and possibly basalt. Most of the limited frequency lithic types are considered exotic materials, including Florence (isolated amounts of varieties A and C) and Wreford cherts from the Flint Hills, Edwards Plateau chert from central Texas, and obsidian (at least one tool). Examples of the various biface classes are shown in Figure 32.

A total of 239 bifaces and biface fragments was categorized as projectile points. Feature 268 yielded 50 percent of the arrow points recovered from the site, nearly evenly divided between side-notched and unnotched forms. Feature 279 contributed an

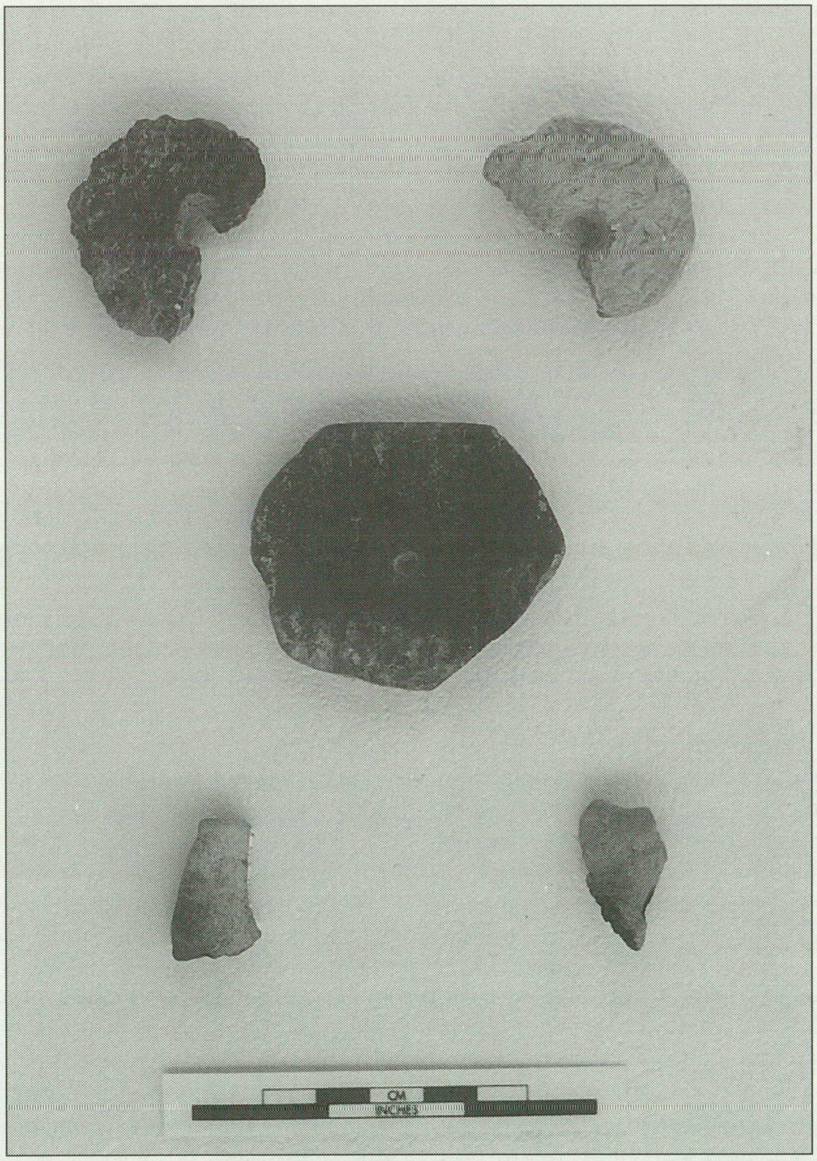

Figure 31. Examples of other ceramic artifacts from 14MD306.

Table 23. Correlation between Reduction Strategy and Raw Material Type at 14MD306.

Raw Material	Blocky Core/ Early Biface Reduction	Intermediate/ Late Stage Biface Reduction
Dakota Quartzite	--	22
Alibates Agatized Dolomite	12	1071
Obsidian	--	1
Smoky Hill Jasper	4	629
Ogallala Quartzite	--	24
Basalt	--	6
Flint Hills Cherts	--	24
Chalcedony	--	7
Unidentified	--	8

additional 16 examples, with smaller numbers coming from other pit features and the general fill above the proposed house floor, Feature 200. The remainder were recovered from 0 to 30 cm bgs, where feature definition was vague. Slightly more than half of the bifaces classified as projectile points are proximal, medial, or distal portions of the tools. Evidence of impact fracturing, which resulted in broken distal portions or elongated flake removals along the axis of the blade, was noted occasionally. Despite some variation among the projectile point types, the projectile point category is a very homogenous class from the standpoint of metric ranges and edge angles, particularly when compared to intermediate and late-stage bifaces, discussed here as blanks and preforms (Table 26). Lithic types consist of a high percentage of Alibates agate with less Smoky Hill jasper and isolated examples of most other raw material types.

A total of 52 alternately beveled knives was collected, and nearly half came from Feature 268. All complete examples exhibit a diamond shape, and 81 percent were manufactured from Alibates agate. Those complete examples with relatively short lengths may represent expended and discarded tools. Edge angles along the steeply beveled lateral margins average 63° (Table 26). Those specimens with the steepest edge angles typically exhibit the highest degree of rejuvenation.

Bifacial knives also include a class of ovate examples that do not exhibit steep retouch along lateral margins. The group of 39 tools and tool fragments was differentiated from bifacial blanks based on the appearance of edge wear and retouch along the margins. Otherwise blanks and bifacial knives are quite similar in form. The category is distinctive in that it is one of the only tool classes not dominated by Alibates agate. While 49 percent of the tools were manufactured from Alibates agate, 44 percent were fashioned out of Smoky Hill jasper. This increased utility of the Smoky Hill material among ovate bifacial knives likely correlates with the consistent tabular nature of the stone, which was reduced to thin bifaces with comparatively little effort. Edge angles reflect the limited amount of retouch and beveling of margins, averaging only 46° (Table 26). Again, nearly half of the tools were collected from Feature 268. The remainder was divided between non-feature contexts and other features — 267 and 279 and the fill above the Feature 200 probable structure floor. Interestingly, several knife fragments were recovered from the general excavation levels in the vicinity of Feature 251.

Twenty-four bifacial blanks were recovered from the site, the majority (63 percent) from Feature 268. An additional 25 percent were collected from non-feature contexts, perhaps associated with debris scattered across the original living surface of the site among the various physical features. As with simple bifacial knives, Smoky Hill jasper is a common lithic type, accounting for 50 percent. Alibates agate by comparison was noted in 42 percent of the class. Edge angles on the blanks average 50°, identical to the collection of bifacial knives (Table 26). The similarities of these two classes may indicate that these presumed blanks, which lack the evidence of utilization that differentiates the bifacial knives, represent unused or lightly used bifacial knives rather than partially reduced or formed raw material.

Preforms typically are Alibates agate (81 percent), with Smoky Hill jasper noted in only 15 percent of the class. These artifacts for the most part

Table 24. Correlation between Biface Type and Raw Material at 14MD306.

Raw Material	Washita	Fresno	Miscellaneous Arrow Point	Bifacial Knife	Alternately Beveled Knife	Drill	Perforator	Blank	Preform
Alibates Agatized Dolomite	93	61	35	20	42	8	7	10	74
Wreford Chert	1	--	--	--	--	--	--	1	--
Florence C Chert	1	1	--	--	1	--	--	--	--
Basalt	--	--	--	1	--	--	--	--	--
Dakota Quartzite	--	--	--	--	--	--	--	--	1
Smoky Hill Jasper	23	7	4	17	9	--	2	12	14
Chalcedony	2	2	--	--	--	--	--	--	1
Edwards Plateau Chert	1	1	--	--	--	--	--	--	1
Petrified Wood	--	--	--	--	--	--	--	1	--
Unidentified	4	--	1	--	2	--	--	--	--

Table 25. Correlation between Uniface Type and Raw Material at 14MD306.

Raw Material	End Scraper	Scraper	Knife	Informal Flake Knife	Informal Flake Scraper	Multipurpose Tool	Graver	Perforator
Alibates Agatized Dolomite	116	52	17	69	38	22	5	6
Florence A Chert	--	1	--	--	--	--	--	--
Florence C Chert	1	2	--	2	1	--	--	--
Dakota Quartzite	--	1	--	1	--	--	--	--
Smoky Hill Jasper	14	9	4	23	3	6	1	1
Ogallala Quartzite	--	--	1	--	--	--	--	--
Basalt	--	1	--	--	--	--	--	--
Edwards Plateau Chert	--	--	2	--	--	--	--	--
Chalcedony	--	--	--	--	--	1	--	--

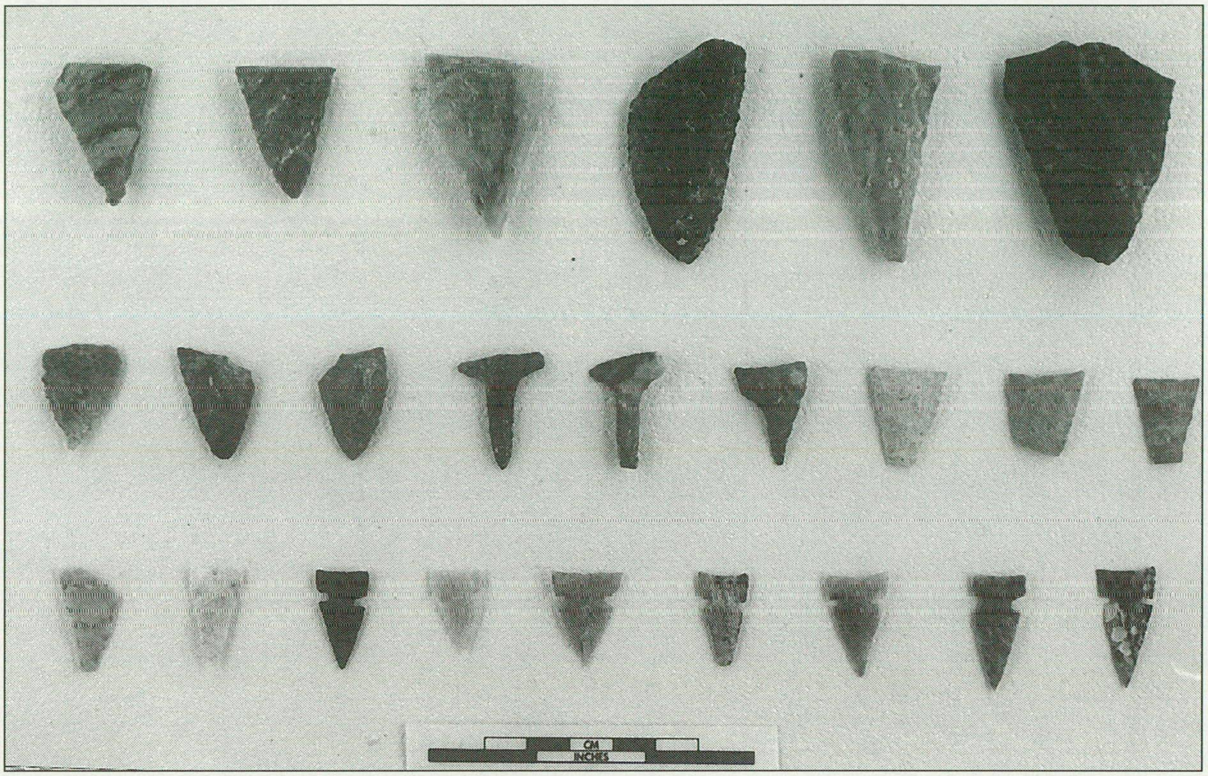

Figure 32. Examples of bifaces from 14MD306.

were associated with features, including Feature 268 (42 percent), Feature 252, Feature 279, and the fill above the Feature 200 house floor. The average for preform edge angles is 37° (Table 26).

Drills and perforators were differentiated on the basis of edge angle measurement (Feature 53). Perforators have angles less than 57°, while drill angles are greater than 64° (Table 26). The classes also were separated by modification of the lateral and distal margins. Perforators typically exhibit less intensive lateral edge rounding and have distal ends that are not extensively rounded. Drills exhibit significant grinding and edge rounding on lateral margins. Expanding-stem bases are common and include those with relatively unmodified flake bases and those with more refined, retouched bases that occasionally form a T-shape. All but one of the drills were recovered from feature contexts, namely Features 268, 279, and 200. Perforators were evenly divided between Feature 268 and non-feature contexts. All drills and most perforators (77 percent) were manufactured from Alibates agate.

Unifacial tools are almost entirely of Alibates agate and Smoky Hill jasper (Figure 33). The class is dominated by scraping implements. Scrapers exhibit moderate to severe edge wear along their margins, accompanied by moderate to heavy retouch that produced angles averaging 64° (Table 27). On end scrapers heavy wear is restricted to the rounded distal margin. Other complete scrapers exhibit the heaviest wear on lateral margins, often continuing around the distal end. Additional tool fragments, grouped in this general scraper category, represent portions of either end- or side-scraping implements for which further differentiation was not possible. Besides these formal tool types, several informal flake tools were identified, based on the presence of relatively steep edge angles (62°), as likely to have performed scraping functions.

Most of the informal flake tools are expedient knives, with edge angles averaging 41° that made them suitable for cutting functions. Typically these tools exhibit light to moderate edge modification or retouch, especially along lateral margins. The class is marked by widely varying lengths, widths, and thicknesses, with no apparent pattern of selection. Flake knives, fashioned to more formal shapes, were also noted in the collection. These have many of the same characteristics as the informal tools, but the metric variation is more restricted and the overall

Table 26. Measurement Ranges among Biface Classes at 14MD306.

Tool Type	Length	Width	Thickness	Edge Angle
	Range (mean) (cm)			
Washita	15.1-33.2 (22.8)	9.9-18.4 (13.5)	1.9-3.8 (2.8)	25°-44° (32°)
Harrell	20.1-25.3 (22.6)	10.9-16.1 (14.3)	2.1-3.5 (2.9)	27°-41° (32°)
Fresno	15.9-27.5 (22.2)	9.5-19.6 (14.8)	1.8-4.5 (2.9)	25°-41° (31°)
Preform	18.2-41.8 (27.1)	12.7-24.8 (17.0)	2.1-5.1 (3.4)	25°-55° (37°)
Blank	29.6-69.3 (34.6)	20.4-68.3 (36.1)	5.6-14.8 (9.8)	35°-74° (50°)
Bifacial Knife	52.6-98.1 (68.7)	19.5-51.2 (34.5)	4.8-15.9 (9.0)	31°-72° (50°)
Alternately Beveled Knife	45.8-98.3 (70.3)	21.3-44.2 (32.6)	6.4-10.5 (8.2)	48°-78° (63°)

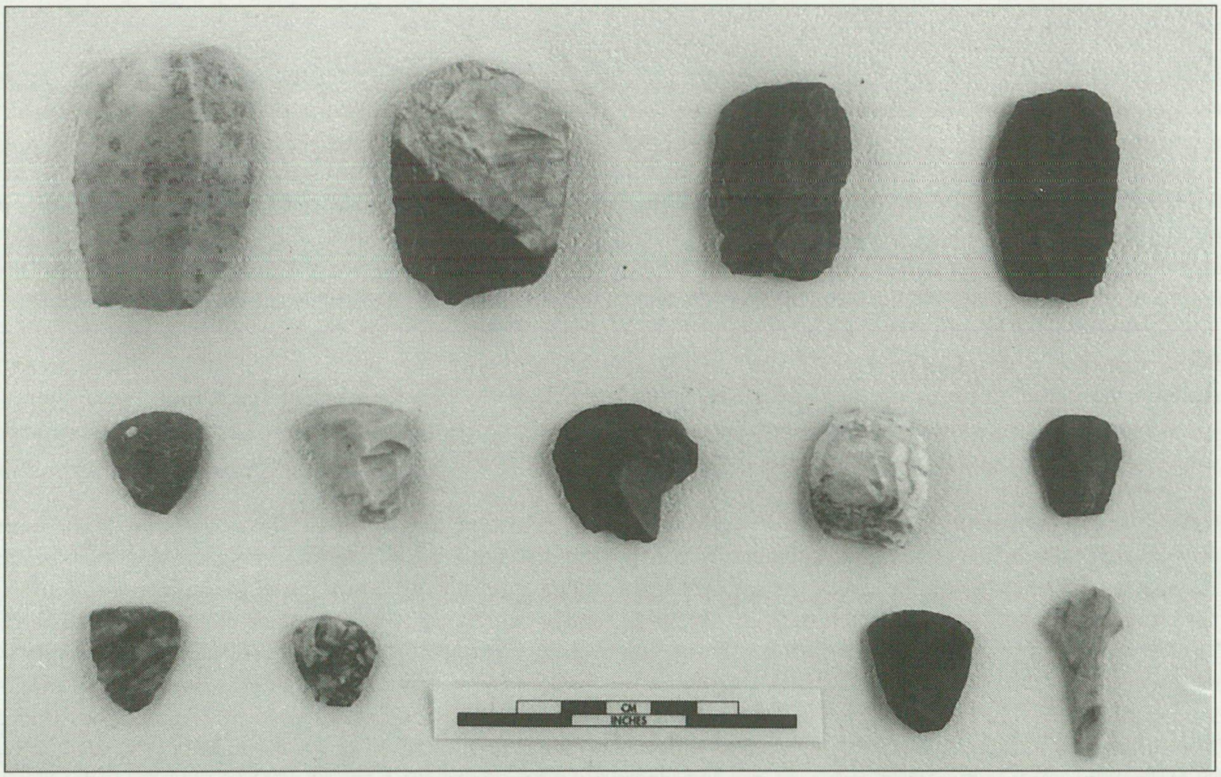

Figure 33. Examples of unifaces from 14MD306.

appearance is more refined. Edge angles among these flake knives average 47° (Table 27).

A small group of flake tools have a variety of angled edges that appear to have performed different functions. These multipurpose tools have at least one lateral margin with a shallow angle suitable for cutting and a steeply beveled margin more suitable for scraping. Other small classes of unifaces include gravers and perforators (Table 27).

Pecked and Ground Stone Tools

The collection of pecked and ground stone, although consisting primarily of fragments, indicates that a variety of activities occurred at the site. These activities are grouped into domestic processing and tool manufacture and maintenance categories, and artifacts further sorted into functional classes. The Ogallala Formation was the preferred source for raw material, with at least 56 percent of the specimens manufactured from stone acquired from this geologic formation (Table 28). For this analysis densely cemented conglomerates were divided between those with poorly sorted material, often with larger grains (Ogallala conglomerate) and the majority with a homogenous particle size (Ogallala sandstone). Other than particle size, these materials are similar in appearance. Ogallala quartzite is another diagnostic material of the formation, but it was found in only limited amounts at the site. Other notable geologic formations that provided raw material included the Dakota Formation (sandstone and quartzite) and the Cretaceous Cheyenne sandstone. Pipestone (which may be Kansas pipestone), red siltstone, and meta-quartzite were noted in small quantities. The quartzite cobbles may be included with general Ogallala Formation gravels, having their origin in the compact layers of Rocky Mountain outwash.

Domestic Processing Tools

Pipes. Pipes are represented by one complete pipe and several pieces. Three fragments, representing two pipes, were manufactured from a red pipestone, similar to Kansas pipestone. Four others were created from a red siltstone material of unknown provenience.

On the complete pipe the stem is 3.15 cm long and 1.74 cm in diameter with a maximum wall thickness of slightly more than 4 mm. Exterior measurements of the bowl indicate a height of 4.58 cm and maximum breadth of 2.26 cm. The bowl walls are up to 5.5 mm in thickness. The bowl has a slightly incised and constricted ring at the lip and bulges somewhat at its mid-section. The bowl and stem join at a 75° angle.

Two cross-fitting pipestone fragments exhibit zigzag incised zones on probable collared bowls. The pieces were widely separated, with one recovered from the site surface and the other from the 80–90-cm level of Feature 268. This second fragment exhibits a more deeply incised collar area, evidence of burning, and a deeply incised groove on the bowl interior. In short, the evidence points to an almost certain secondary function of this particular fragment prior to deposition in a feature context, shared by only one of the other pipe fragments. All remaining pipe fragments were recovered from surface and plow zone proveniences.

Grinding Slabs. No complete specimens were recovered from the site, although a large section was found in Unit N50, E34 near the southeast margin of Feature 268. Its context suggested that it may have been resting on a portion of the original living surface of the site. Most fragments were collected from Feature 268, although several were collected from the fill near the Feature 200 floor, as well as from Feature 279, lying below this floor. The collection of 38 specimens is comprised mostly of relatively small portions of grinding slabs. Troughing or dishing of the primary working side is common, with occasional specimens exhibiting light troughing of the opposite face. More often the opposite side is merely ground flat. Other sections have only one modified face. Ogallala sandstone is the dominant material, selected for 62 percent of these implements. Ogallala conglomerate was identified in 23 percent of the specimens. The remainder consist of isolated examples of Dakota Formation material and Cheyenne sandstone. While overall measurements could not be acquired, thicknesses were measured on larger specimens with intact faces. These measurements show a wide variation (25.6–93.1 mm), although most fell near the average of 48.5 mm.

Manos. A total of 34 manos were collected from the site. All have rounded or flat faces, with some having these variations on opposite faces. Tool margins are typically rounded. The ends of the ovoid to squarish stones occasionally exhibit intensive battering. Material types include all those present among grinding slabs in similar frequencies. A small number of meta-quartzite cobbles with ground faces is also present. The class ranges from 84.5 to150.6 mm (average 118.8 mm) long, 75.2 to 102 mm wide (average 84.8 mm), and 25.3 to 73.3 mm (43.9 mm) thick.

Table 27. Measurement Ranges among Uniface Classes at 14MD306.

Tool Type	Length	Width	Thickness	Edge Angle
	Range (mean) (cm)			
End Scraper	21.1-59.1 (35.7)	15.4-40.2 (24.9)	4.2-25.9 (7.8)	47°-78° (64°)
Scraper	32.1-79.8 (47.1)	18.6-42.1 (27.9)	4.3-13.7 (8.6)	54°-80° (64°)
Knife	38.6-64.4 (49.9)	23.0-33.4 (28.6)	3.9-11.9 (6.9)	37°-54° (47°)
Informal Flake Knife	34.9-72.6 (39.9)	12.9-52.9 (23.7)	2.0-23.4 (5.1)	24°-52° (41°)
Informal Flake Scraper	26.8-82.1 (41.1)	17.4-56.6 (26.3)	2.8-12.1 (5.9)	54°-75° (62°)
Multipurpose Flake Tool	29.6-84.5 (49.5)	16.2-34.9 (24.5)	2.9-20.1 (7.5)	32°-52° (43°) 54°-78° (65°)
Graver	52.6-98.1 (68.7)	19.5-51.2 (34.5)	4.8-15.9 (9.0)	31°-72° (50°)
Perforator	45.8-98.3 (70.3)	21.3-44.2 (32.6)	6.4-10.5 (8.2)	48°-78° (63°)

Tool Manufacture and Maintenance

Flintknapping Abraders. A single artifact, manufactured from Ogallala sandstone, was identified tentatively as a flintknapping abrader. The specimen exhibits several shallow, parallel grooves, less than 1 mm deep and 2–3 mm wide, that are reminiscent of modification created through use as a flintknapping abrader.

Arrow Shaft Abraders. The collection includes 11 specimens of U-shaped arrow shaft abraders. These abraders are highly fragmented, limiting discussion to some of the general characteristics of the grooves and the material from which they were made. Examples typically have single grooves, although some multiple-grooved specimens were noted. There are at least two examples with two grooves on a single face and one where four grooves overlap. The majority were manufactured from Ogallala sandstone with isolated examples of other sandstone or conglomeritic material. Two specimens were made from broken fragments of tools: a mano and a grinding slab. Grooves range from 6 to 11 mm wide by 2 to 6 mm deep. Narrower grooves are more shallow, whereas the widest groove is the deepest. Shaft abraders were recovered primarily from Feature 268 and the Feature 200 fill with isolated examples from Feature 279 and non-feature contexts.

Abrader Blank. A single loaf-shaped form that lacks evidence of use-related modification was defined as an abrader blank. This specimen may be a shaft abrader similar to those described above. Ogallala sandstone was extensively shaped to create a desired form, but the piece lacks grooves from use. This is the only complete specimen, so its size is useful for understanding the potential original size of many of the fragments discussed above, which apparently continued to serve useful functions after initial breakage. The blank measures 144 mm long, 30 mm wide, and 22.9 mm thick.

Flat Abraders. Fifteen artifacts consist of thin pieces of material with evidence of use on one or both faces and occasionally shaped and/or utilized margins. The evidence of modification includes uniformly ground and smoothed faces, as well as irregularly ground surfaces. Raw materials utilized in this

Table 28. Correlation between Pecked and Ground Stone Tool Types and Raw Material at 14MD306.

Raw Material	Mano	Grinding Slab	Abrader Blank	Multipurpose Abrader	Shaft Abrader	Flat Abrader	Flintknapping Abrader	Hammerstone	Pipe
Dakota Sandstone	6	3	--	1	2	6	--	--	--
Dakota Quartzite	2	1	--	--	--	--	--	--	--
Ogallala Quartzite	--	--	--	--	--	--	--	3	--
Cheyenne Sandstone	2	2	--	1	1	1	--	--	--
Ogallala Conglomerate	7	9	1	1	1	2	1	--	--
Ogallala Sandstone	14	23	--	2	7	--	--	--	--
Meta-Quartzite	3	--	--	--	--	--	--	3	--
Pipestone	--	--	--	--	--	--	--	--	3
Red Siltstone	--	--	--	--	--	--	--	--	4

tool category are, in order of frequency, Ogallala sandstone, Dakota sandstone, and Ogallala conglomerate. These tools were recovered mostly from features (80 percent), including equal numbers from Features 268 and 279 and slightly fewer from the Feature200 fill.

Multipurpose Abraders. A final abrader category includes five examples with flattened surfaces and occasional light striations. They were made from a variety of materials, including Dakota sandstone, Cheyenne sandstone, and Ogallala conglomerate or sandstone. One specimen has a U-shaped groove on one edge, measuring14 mm wide and 6 mm deep. All other items have shallow, curved grooves, ranging from 3 to 9 mm wide and from 1 to 3 mm deep.

Hammerstones. Six hammerstones were recovered from the site. They are made of Ogallala quartzite and meta-quartzite cobbles, which may have been collected directly from Ogallala formation outcrops or from secondary deposits in the vicinity of Crooked Creek. Features containing these tools include 252, 268, 200, and the vicinity of 268.

Faunal Remains

The extremely large collection of faunal material came primarily from feature contexts, particularly Feature 268. In order to reduce the sheer numbers of specimens to be studied, a sample was selected: Units N50,E30 and N48,E28 in Feature 268; Unit N66,E40 in the vicinity of Feature 200; and parts of Features 279, 251, 252, 267, and 280. Other identified and excavated features either did not contain faunal remains, as was the case with the post molds, or were defined late in their excavation, such as Feature 299 superimposed with Feature 268. Even with this sampling, a total of 6,835 individual bones and fragments, representing 69 taxa were identified. Most specimens were identified to species level, although for some only more generalized identifications were possible to the level of order, family, or, in the case of fish, class (Table 29). The collection as a whole is in an excellent state of preservation. However, a sizeable quantity of large mammal remains are so fragmented, possibly through systematic marrow extraction, that they were not analyzed. Smaller fauna are also represented by somewhat fragmented remains, although larger percentages of unbroken long bones are present than for the large mammals.

Identified Remains

Fish remains constitute the majority of the NISP (43.4 percent). These remains were not identified beyond the class level. Many of the remains appear to be comparable to the Ictaluridae family. A crude measure of the individuals represented by the large, undifferentiated sample is presented in Table 29. The table information is an estimate of the number of complete individuals represented by the total number of fish remains. This conservative estimate yielded a count of 22 individuals.

Mammals have the next highest NISP frequency (32.5 percent), followed by shellfish (11.2 percent), birds (6.6 percent), and reptiles (6.2 percent). Individual species that dominate NISP frequencies include prairie dog (12.2 percent), bison (9.8 percent), pronghorn (4.8 percent), ornate box turtle (2.7 percent), and floater mussel (7.5 percent). Shellfish have the greatest MNI by far with a total of 401 individuals.

Mammals by comparison are represented by 116 individuals with a greater diversity of species. The sheer numbers of prairie dog specimens (831) and MNI (49) argue for the presence of non-cultural, intrusive remains occurring naturally on the site. Others that are charred, cut, or broken badly may represent inclusion in the fill by the site's inhabitants. Large ungulates are well represented overall and represent a subsistence resource. At least ten bison are represented in the sample: seven adults, one sub-adult, and two fetuses. Thirteen pronghorn are represented by a similarly diverse assortment of individuals, including nine adults, one sub-adult, a juvenile, and two fetuses. An MNI of six deer include four adults, a juvenile, and a fetus.

Procurement, Processing, and Diet

Recovery indices (RI) were generated for bison as a means of better understanding the procurement and processing strategy implemented at the site. This class, while not the most numerous overall, certainly contributed the bulk of food at the site. RI determinations were made for major element types in the collection (Table 30). It is apparent that members of the axial skeleton are noticeably absent when compared to any other major skeletal portion. One exception is the occurrence of at least five pelves as acetabulum fragments. These portions may represent the shattered remains of the pelvis socket, created when hindquarters were separated from the axial members. These pieces were then transported from the kill sites as riders on the appendicular sections. Appendicular

Table 29. Fauna by NISP and MNI at 14MD306.

Taxon	NISP		MNI	
	#	%	#	%
Shellfish				
Anodonta grandis (floater mussel)	516	8	271	41
Uniomerus tetralasmus (pond-horn mussel)	253	4	130	20
Subtotal	769	11	401	60
Fish	2,996	43	22	3
Reptile				
Testudinata	60	1	5	1
Terrapene ornata (ornate box turtle)	180	3	22	3
Kinosternon flavescens (yellow mud turtle)	9	0	4	1
Chrysemys picta (painted turtle)	12	0	3	0
Chelydra serpentina (common snapping turtle)	41	1	3	0
Trionyx sp. (softshell turtle)	25	0	3	0
Graptemys sp. (map turtle)	31	0	4	1
Pseudemys scripta (elegant slider)	22	0	6	1
Snake sp.	44	1	2	0
Subtotal	424	6	52	8
Bird				
Ava (undetermined)	147	2	6	1
Passeriforme (perching birds)	1	<0.1	1	0
Sturnella sp. (meadowlark)	2	<0.1	1	0
Turdus migratorius (American robin)	2	<0.1	1	0
Colaptes auratus (northern flicker)	4	<0.1	1	0
Melanerpes carolinus (red-bellied woodpecker)	3	<0.1	2	0
Colinus virginianus (northern bobwhite)	1	<0.1	1	0
Meleagris gallopavo (wild turkey)	10	0	2	0
Corvus brachyrynchos (American crow)	42	1	6	1
Cornus corax (common raven)	14	0	4	1
Strigidae (owl)	1	<0.1	1	0
Otus asio (eastern screech owl)	4	<0.1	1	0
Athene cunicularia (burrowing owl)	1	<0.1	1	0
Bubo virginianus (great horned owl)	4	<0.1	1	0
Anatidae (duck)	21	0	3	0
Anatinae (surface duck)	14	0	4	0
Teal sp. (teal)	28	0	3	0
Anas discors (blue-winged teal)	41	1	5	1
Anas crecca (green-winged teal)	12	0	4	1
Anas cyanoptera (cinnamon teal)	3	<0.1	1	0
Anas platyrhnchos (mallard)	37	1	6	1
Anas clypeata (northern shoveler)	5	<0.1	1	0

Bucephala clangula (common goldeneye)	3	<0.1	2	0
Bucephala albeola (bufflehead)	2	<0.1	1	0
Rallidae (rails and coots)	1	<0.1	1	0
Fulica americana (American coot)	17	0	5	1
Podilymbus podiceps (pie-billed grebe)	5	<0.1	3	0
Botaurus lentiginosus (American bittern)	6	<0.1	1	0
Accipitridae (kites, hawks, eagles)	9	0	1	0
Accipiter cooperii (Cooper's hawk)	2	<0.1	1	0
Icitina mississippiensis (Mississippi kite)	1	<0.1	1	0
Haliaetus leucocephalus (bald eagle)	3	<0.1	1	0
Buteo sp. (hawk)	4	<0.1	1	0
Buteo jamaicensis (red-tailed hawk)	2	<0.1	1	0
Falco sparverius (American kestrel)	6	<0.1	1	0
Falco mexicanus (prairie falcon)	1	<0.1	1	0
Subtotal	397	7	56	8
Mammal				
Mammalia (undetermined)	51	1	3	0
Reithodontomys megalotis (western harvest mouse)	1	<0.1	1	0
Spermophilus sp. (ground squirrel)	1	<0.1	1	0
Sigmodon hipsidus (hipsid cotton rat)	1	<0.1	1	0
Neotoma sp. (woodrat)	1	<0.1	1	0
Geomys bursarius (plains pocket gopher)	8	0	2	0
Dipodomys ordii (Ord's kangaroo rat)	3	<0.1	1	0
Cynomys ludovicianus (black-tailed prairie dog)	831	12	49	7
Mephitis mephitis (striped skunk)	1	<0.1	1	0
Ondatra zibethicus (muskrat)	17	0	4	1
Lepus californicus (black-tailed jackrabbit)	40	1	4	1
Sylvilagus floridanus (eastern cottontail)	35	1	5	1
Procyon lotor (raccoon)	18	0	2	0
Taxidea taxus (badger)	22	0	3	0
Vulpes velox (swift fox)	7	0	2	0
Canis sp. (canids)	19	0	3	0
Antilocarpa americana (pronghorn)	331	5	13	2
Odocoilus sp. (deer)	65	1	6	1
Pronghorn/Deer	102	2	4	1
Bison bison (bison)	668	10	10	2
Subtotal	2,222	33	116	17
Total	6,835	100	666	100

Table 30. Bison Recovery Index by Element at 14MD306.

Element	Expected Frequency	Observed Frequency	Recovery Index
Skull	10	1	10
Mandible	20	2	10
Cervical Vertebra	70	6	9
Thoracic Vertebra	130	4	3
Lumbar Vertebra	60	2	3
Caudal Vertebra	160	13	8
Pelvis	10	5	50
Sacrum	10	0	0
Rib	130	19	15
Scapula	20	7	35
Humerus	20	8	40
Radius	20	6	30
Ulna	20	11	55
Carpal	120	53	44
Metacarpal	20	15	75
Femur	20	6	30
Tibia	20	10	50
Metatarsal	20	12	60
Tarsal	120	38	32
Phalange	240	177	74
Sesamoid	240	49	20

portions (upper and lower limbs and feet) are present in similar frequencies, although the lower forelimb portions are the most frequent. This is due primarily to the fact that 75 percent of the expected metacarpals are present in the collection. Also conspicuous is the widespread occurrence of phalanges, with nearly 75 percent of the expected numbers of these elements present in the sample.

The low representation of axial elements, particularly vertebrae and skull portions, suggests that kills were made at some distance from camp, creating issues of transport for these portions. Appendicular elements likely were transported largely intact, since they occur in higher frequencies overall. Elements in these categories are notably comprised of marrow-rich units, which may have made their transport to camp for intensive processing an economically worthwhile venture. The high occurrence of phalanges, as well as the presence of other relatively intact small elements such as carpals and tarsals, may be due to their transport into site as riders on largely intact limb sections.

The occurrence of a large sample of shattered bone at the site is surmised to represent the byproducts of intensive marrow extraction. The largest intact elements from the site consist of a metatarsal and a metacarpal. Metapodials in general exhibit fragmentation similar to most upper limb elements, indicating the likelihood that they were reduced for marrow. The most common complete bison bones are from the lower appendicular region, particularly small, dense elements, such as phalanges and carpals and/or tarsals. The high percentage of intact phalanges and the low occurrence of specimens of any size that exhibit chalky or exfoliated surfaces indicative of boiling or immersing in water demonstrate that bone grease extraction was not practiced at the site.

Bone in the collection exhibit other modifications, including occasional cut marks and burning. Bison, pronghorn, and deer remains exhibit some charring and burning. Notable smaller species that show some evidence of burning include shellfish, duck and teal, prairie dog, turtle, cottontail, and jackrabbit. Little if any burning was noted on fish remains, but this may reflect preservation bias. Burned fish bones might have disintegrated or been reduced to such an extent that they were not readily identifiable in the archeological record. Evidence of non-cultural bone modification, such as rodent and carnivore gnawing and root etching, was found on some material throughout the excavation. Parallel cuts on ungulate rib shafts and heads, as well as multi-angled marks in proximal and distal regions of most long bone categories, are the most common areas where cut marks were noted. Occasionally cut marks were recognized on carpals, tarsals, sesamoids, and phalanges. Other fauna with cut marks include turtle, particularly the larger species, many small mammals, and birds. These cut marks appear to have occurred during processing activities, such as disarticulation of long bone elements or defleshing portions of the carcass.

The faunal material from the site can be used to depict resource exploitation across local environmental zones (Table 31). Three broadly defined zones were recognized in the site area. The first is the nearby riverine setting of Crooked Creek, associated floodplain wetlands, and relatively permanent lakes fed by seeps and springs within a few miles of the site. Playas in the nearby uplands probably provide seasonal habitat for some species that might otherwise be associated with the wetland setting. A second zone includes the adjacent broken riparian woodland along the creek and tree- or brush-lined draws in the limited dissected areas in the site vicinity. This setting is most important as an edge ecotone, separating it from the third zone: the broad grasslands that dominate the landscape. It should be noted that these habitat distinctions are not meant as rigid boundaries for particular species. Many species, including various birds and larger mammals in particular, might be expected to be relatively widespread, particularly considering the limited spatial area of woodlands compared to the expansive floodplain wetlands and broad, dry upland grasslands that dominate the local surroundings within a few miles of the site. The general habitats defined here should be viewed more as the primary environs in which particular species might be encountered.

Based on consideration of MNI and general ability of a particular species to contribute to the diet of the inhabitants of the site, it is apparent that, while important resources were procured from each setting, upland game contributed the most to daily subsistence. By sheer weight of usable products, bison was a major contributor to the inhabitants' subsistence. Pronghorn from the same setting were important as well, being more numerous than deer at the site by a ratio of nearly 2:1. Other faunal resources likely procured from a grassland setting include box turtle, coyote, badger, jackrabbit, and swift fox. While absolute numbers of prairie dog remains may appear to indicate an important resource, many of these remains probably represent naturally deposited individuals. Prairie dog did have some role in the diet of the site inhabitants, however, as at least some remains display burning and occasional cut marks on limb elements.

The wetland setting was an important habitat because it contained a high diversity of subsistence fauna that were readily exploited by the site inhabitants: several species of aquatic turtle, fish, shellfish, and waterfowl. From local wooded settings and adjoining prairies came deer, cottontail, and turkey in some numbers. Smaller mammals from these same settings were important not for their size but for their potential acquisition in a garden-hunting procurement strategy. Western harvest mouse and cotton rat in particular occupied disturbed areas, such as field edges — ideal habitat created by human activity. Other small mammals including cottontail, prairie dog, wood rat, and kangaroo rat also may represent garden-hunting activities.

Species diversity varies considerably by feature (Table 32). A diversity index (DI) was established for each feature by dividing the number of identified species in a particular feature by the number of possible taxa, which for the purposes of this comparison was established at 52. Overall, diversity measures seem to correlate loosely with feature type. Species diversity is highest (94.1) in Feature 268, a massive midden. Only three species are not represented in that feature. The feature yielded the majority of the immature mammalian specimens, particularly those of the ungulates. The DI drops sharply to 49.0 in the fill above the Feature 200 house floor. Another marked decrease in diversity results in the grouping of smaller features at the site, consisting of basins and cylindrical pits, although diversity varies from 5.9 to 25.5 overall. These feature types do not display discriminating differences in diversity, which may be explained by their relatively small size and short period of time it would take to fill these features with habitation debris upon abandonment. All of these smaller features have lower measures of diversity compared to that recognized among the non-feature proveniences across the site. Species representation from the general block excavation indicated a DI of 31.4.

Table 31. Habitat Settings in the Vicinity of 14MD306.

Riverine (Creeks and Wetlands)	Riparian/Edge/Brushy Draws (Valley Floor and Broken Terrain)	Grassland (Upland)
Muskrat	Deer	Bison
Snapping Turtle	Raccoon	Pronghorn
Elegant Slider	Cottontail	Coyote*
Softshell Turtle	Western Harvest Mouse	Badger
Map Turtle	Cotton Rat	Jackrabbit
Painted Turtle	Wood Rat	Swift Fox
Yellow Mud Turtle	Striped Skunk	Prairie Dog
Teal	Turkey	Plains Pocket Gopher
Mallard	Bobwhite	Ground Squirrel
Shoveler	Great Horned Owl	Ord's Kangaroo Rat
Goldeneye	Screech Owl	Box Turtle
Bufflehead	Cooper's Hawk	Prairie Falcon
American Coot	Red-tailed Hawk	American Kestrel
Pie-billed Grebe	Mississippi Kite	Burrowing Owl
American Bittern	Red-bellied Woodpecker	Raven
Fish	Northern Flicker	Crow
Shellfish	Robin	Meadowlark
*Coyote not confirmed in collection, merely canid.		

Seasonality

The collection produced several faunal remains that may be useful for approximating seasonality of kills and of occupation in general. Gross measures include fish and shellfish, which are attributed to warmer weather due to the high probability that the hunters will be in contact with the water for some period of time. Seasonal and/or annual flooding likewise may have affected the harvesting of these fauna. The collection of turtles also might correspond with the warm season, since they are more difficult to procure when they are hibernating. Smith (1975:102) suggests that turtles could be collected in the warm season, during egg laying or when dry conditions persist, or during the winter, when cold weather spurs hibernation and aggregation of at least some species. Styles (1981:95) opts for the egg-laying season, when many aquatic species are susceptible to capture.

The presence in the collection of several waterfowl remains may indicate occupation during the spring and fall migrations, although scattered summer residency and nesting have been recorded in the county (Flowers 1995; Thompson and Ely 1989). Depending on the weather in any given year, their stay likely was limited to early spring through late fall. The Bufflehead and Common Goldeneye are currently rare visitors or residents in Meade County during the winter months from late October to mid-March and from late November into December, respectively. The Bald Eagle is another winter resident of the area, while the Mississippi Kite is there from late spring to early fall, based on modern records.

Conspicuous among the ungulate remains are fetal and other non-adult bones. These indicate widespread procurement during the winter or early spring, when females were carrying late-term calves, and later in the year, when immature individuals were vulnerable.

While not specifically related to seasonality, several gastropods that are useful for inferring microenvironments were identified from feature contexts. These isolated examples are discussed below with reference to their habitats and their contexts within the site.

Lymnaea bulimoides cockerelli is generally associated with shallow depressions that form seasonally

Table 32. Faunal Diversity by Feature at 14MD306.

Fauna	268	251	252	267	279	280	200	Block
Bison	X	X	X	X	X	X	X	X
Pronghorn	X	X	X	X	X		X	X
Deer	X				X		X	
Pronghorn/Deer	X				X		X	X
Canid	X						X	X
Cotton Rat	X							
Kangaroo Rat	X							
Badger	X				X		X	
Raccoon	X		X					X
Cottontail	X		X				X	X
Muskrat	X				X	X	X	X
Prairie Dog	X		X	X	X		X	X
Pocket Gopher	X							
Ground Squirrel	X							
Striped Skunk							X	
Jackrabbit	X			X				
Swift Fox	X						X	
Wood Rat	X							
Harvest Mouse	X							
Mallard	X		X		X		X	X
Teal	X		X			X	X	X
Shoveler	X							
Bufflehead	X							
Goldeneye	X							
American Bittern	X							
Pie-billed Grebe	X					X		
American Coot	X							
Turkey	X					X		
Bobwhite	X							
Red-bellied Woodpecker	X						X	
Northern Flicker	X							
Robin	X							
Meadowlark						X		
Crow	X							
Raven	X						X	
Eagle	X							
Burrowing Owl	X							
Screech Owl	X					X		
Great Horned Owl	X							
Red-tailed Hawk	X				X			
Cooper's Hawk							X	

Mississippi Kite	X							
Box Turtle	X		X		X	X	X	X
Elegant Slider	X				X		X	
Snapping Turtle	X					X	X	X
Mud Turtle	X						X	
Softshell Turtle	X						X	
Map Turtle	X							
Painted Turtle	X							
Snake	X						X	X
Shellfish	X	X	X	X	X	X	X	X
Fish	X		X		X	X	X	X
Diversity Index	94.1	5.9	19.6	9.8	25.5	21.6	49	31.4

wet pools (Leonard 1959:51). Such depressions frequently dry up during the summer and fall, so even though the species prefers moist conditions, it can exist in quite dry settings for part of the year. This gastropod came from the 110–120-cm level of Feature 268.

Physa anatina and *hawnii* most commonly are found in shallow water where abundant vegetation (both dead and living) occurs. While favoring permanently moist settings, individuals have been recorded in western Kansas in small streams and ephemeral ponds that frequently become dry during arid periods (Leonard 1959:45–47). The *Physa anatina* example came from the 80–90-cm level of Feature 268. *Physa hawanii* was collected from the 50–60-cm level of the same feature.

Promentus umbilicatellus prefers shallow marshy lakes or swales with abundant aquatic vegetation. It is highly tolerant of periodic water level fluctuations, as indicated by Leonard's (1959:65–66) habitat examples of Miami County State Lake and Cheyenne Bottoms. This specimen was collected from the 70–80-cm level of Feature 268.

Analyzed gastropod shells consist of species that occur in the area today. The prehistoric environment of the site was probably similar in many respects to the that of the late-nineteenth and early twentieth centuries. Most species favor near-water situations, like those provided by spring-fed Crooked Creek, shallow lakes and swales, and playas. Likewise, Feature 268, from which all of the described individuals were collected, offered a suitable habitat. Although it is not known if the open hole held water for any length of time, but the loose fill of the relatively deep pit would have remained moist much of the time.

Worked Bone and Shell

The collection of worked bone and shell includes 187 objects that were assigned to general functional classes. As with the butchered faunal remains, items primarily from the upper 20 to 30 cm of the excavation occasionally exhibit root etching, which obscures signs of use.

The dominant tool type in the collection is of shell. Thirty-four specimens of local freshwater mussel (*Uniomerus tetralasmus*) exhibit moderate to heavy modification of the ventral shell margins (Figure 34). Wear takes the form of edge rounding and straightening of the ventral border, most intensive in a limited zone just posterior to the midpoint of the ventral margin. This often is accompanied by a slight concavity, which on some specimens is prominent enough to create the appearance of a slight hook toward the posterior border. A few also have shallow notches along the anterior end of the ventral margin and on the lower anterior margin. Those on the ventral margin occasionally exhibit reduction through use, while those on the anterior margin remain unmodified for the most part. The notches are about 1 mm deep and are spaced from 3 to 4 mm apart. These notches on the lightly used anterior ends may be remnants of the original modification of the shell edges. Subsequent utilization abraded the notches in the most intensively used areas, leaving only residual notches on the anterior. These objects were identified as corn shellers.

Other shell artifacts include four items of various shapes (trianguloid, trapezoidal, diamond-shaped) that were cut from the broad, thin portions of freshwater mussels. Seven shell fragments exhibit notches

Figure 34. Examples of worked shell and bone objects from 14MD306.

along the lower portions of the anterior margins down onto the ventral margins. These notches are set about 4 mm apart and are about 1 mm deep. These fragments appear similar to the notched specimens in the corn sheller category.

A class of ornaments includes several marine shell items (Figure 34). Fifteen beads are *Olivella* shell. Columella shell was fashioned into two beads, a bell-shaped pendant, and a small rectangular specimen that may represent an inlay. A small marine shell pendant has two drilled perforations, small punctations, incised lines, and several shallow notches along the distal margin.

Two turtle carapace fragments are classified as ornaments. Both of these pendants have perforations (4 mm in diameter) at one end with little additional modification aside from cut and ground margins on one specimen (Figure 34). A rectangle cut from the blade of a large mammal scapula (probably bison) may represent the initial reduction of bone for ornamentation. Two short lengths of extensively modified bones are identified tentatively as the ends of pins, possibly hair pins (Figure 34). The bones are heavily striated from shaping into a cylindrical form. One specimen has a bluntly pointed end that swells near the tip to a diameter slightly greater than that of its shaft. The other is a short portion of cylindrical shaft that angles outward briefly before hooking back to a point.

The most common bone tools are perforators, most defined as awls (Figure 34). Awls in the collection were made of deer or pronghorn metapodials or splinters of bone. Eleven metapodial awls consist of splintered proximal or distal ends, shaped to sharp points. Polish is most prominent on the distal halves of the tools, although a few display patchy polish on the proximal ends, particularly on articular projections, such as the condyle ridges of distal metapodials. Eight splinter awls were manufactured from green bone fragments of large mammals; at least two of these were recognized as bison rib edges. Four other similar bone splinters were extensively shaped into cylindrical forms. They exhibit rounded proximal ends and bluntly pointed distal ends. Light polish was observed on two tools, with the other two lacking polish. One grooved-and-snapped deer proximal metacarpal is characterized as an awl blank, since the general form is identical to other metapodial awls; the specimen simply lacks evidence of utilization.

Several tools of similar shape were identified tentatively as basketry and/or grassing needles. One thin, flat tool is the proximal portion of a deer or pronghorn rib with a 3-mm perforation near the proximal end and polish and shallow, elongated striations on the shaft. The medial portion of a probable bison rib edge exhibits edge rounding and numerous lengthwise striations. This specimen is similar in form to those identified at 14RC306 as grassing needles. A third item was fashioned from the distal portion of a pronghorn metatarsal. The shaft is flattened with a blunt, highly polished distal end. The polish continues along the shaft onto the external condyle surface.

Three perforating implements were differentiated from awls on the basis of their more refined, delicate distal ends (Figure 34). One was made from a pronghorn proximal metatarsal; two from unidentified mammal bone splinters. Distal halves of all specimens have moderate polish.

Two potential hide-working implements were identified in the collection. One pronghorn distal metacarpal was snapped to create a working margin along the shaft. This edge exhibits use-related edge rounding and polish. The shaft apparently fractured from the distal end to near the condyles while the bone was still green. This fracture may have been related to tool use. The second tool is a narrow section of the posterior border of a deer scapula. It exhibits extensive rounding of reduced blade margins, accompanied by a moderate amount of polish, with the polish continuing across the medial face of the tool.

Digging implements are numerous and include a variety of forms, primarily bison tibia digging stick tips and bison scapula hoes. A single item was classified tentatively as a pick. This narrow, relatively thick bone section exhibits a battered, rounded tip, rounded adjacent lateral margins, and striations on flattened faces. Digging stick tips are represented by three relatively complete specimens (Figure 35) and a total of six proximal and distal sections. Reduction was accomplished by snapping or cleaving the element at a point along the proximal portion of the shaft above the mid-line. The distal end was retained, and the shaft break was extensively ground and shaped prior to use. A hafting element was created in the distal articular end by making a socket in the center of the articular face. Sockets in the tool collection were a uniform 32 mm in diameter. Extensive wear is evident on the tool shafts, particularly along the flattened, sharpened distal ends. At least one almost complete specimen was rejuvenated after a longitudinal break removed approximately half of the blade. The tool continued to perform a useful function for quite some time; the break exhibits extensive polish, although the wear is noticeably less than that on adjacent original surfaces.

Scapula hoes are represented by two basically complete examples (Figure 35) and 11 portions, consisting of proximal pieces, lateral margins, and blade fragments. Together they illustrate the reduction pattern common among these tools at the site. The standard method of scapula reduction included removal of the proximal ends by snapping the glenoids free along the necks. Apparently there was no standard point at which this break would occur. Examples range from nearly complete necks to only short necks immediately above the blade region. The posterior borders were split to reduce margin thickness. The scapular spines were cleaved, producing ragged breaks down the lengths of the tools. In at least one case this break was ground flat. Grinding also was noted along the posterior border, particularly toward the distal end of the specimen. On the unbroken tools the anterior borders were reduced partially through a system of grooving and snapping longitudinally along the blade. This method also was used to remove as much as one-third of the scapula blades toward the vertebral borders. The distal ends show some evidence of edge angling toward the posterior borders, which generally provided a more rigid tool portion.

Use-related wear consists of light to moderate amounts of polish along the distal and lower lateral margins. Light to moderate striations run parallel to the long axes of the tools along the thin portions of the blades. Proximal ends show patchy rounding of the breaks, accompanied by light to moderate abrasive polish, infrequently continuing along the remainders of the necks and upper portions of the posterior and anterior borders. This is typical hafting-related wear, although the exact hafting method of these scapula tools is not known.

Other scapula tools include two spatulas. One is a large posterior portion of a scapula that has had the glenoid and spine removed and the posterior border reduced. The margins show no evidence of utilization. The second specimen is a small shaped blade segment with a bluntly pointed proximal end and broader beveled working end. The ends show the most edge rounding and polish, although the entire tool bears evidence of utilization. A third object consists of a scapula blade in the vicinity of the spine. Use wear is restricted to the anterior border margin, where extensive polish appears along the mid-section of the existing margin with less toward the proximal and distal ends.

The site produced 13 notched ribs of an undetermined function. Some exhibit notching along the edges, while others have incised lines across the rib faces. These zones of modification are not combined on any specimens, so it is assumed that each had its own exclusive purpose. Only edge-notched ribs show polish, always associated with the notches and occasionally located across adjacent rib faces as well. Notches are 1–2 mm wide and occur 5–11 mm apart on both types.

Three arrow shaft wrenches were found. One segment of a probable bison rib shaft has notches on the intact distal end and one lateral margin, as well as incised lines that circumscribe that portion of the tool. The circular perforation is 11 mm in diameter. The use of the rib is problematic, since the bone does not appear rigid enough for the proposed function. Perhaps the tool served as a measuring device, wherein shaft candidates were passed through the aperture to identify areas that needed to be reduced to create a uniform shaft. Two artifacts were identified with near certainty as shaft wrenches. One is essentially complete. Both were manufactured from tibiae, one deer and the other pronghorn. Perforations were estimated to be 11 mm. One tool has 11-mm wide elongated holes, while the second has partial holes

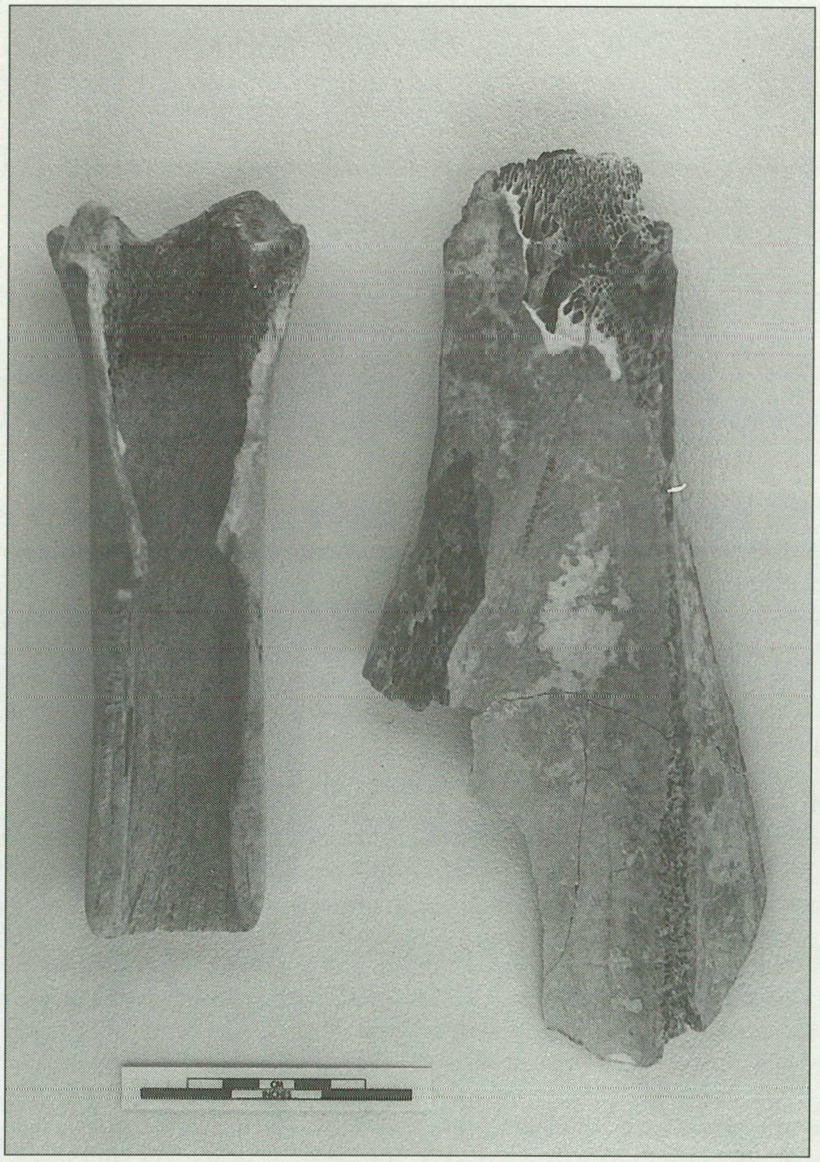

Figure 35. Digging implements from 14MD306.

that could not be measured accurately. Both tool shafts exhibit a moderate to high degree of polish.

Worked antler items include two tine flakers. Both specimens have roughened, cut tips and are believed to be pressure-flaking implements for chipped stone tool late-stage reduction and maintenance. Two portions of antler beams were identified as potential handles. Both are short sections of antler with ground ends and little evidence of additional modification. One example is part of an antler butt; the other is a cut-and-snapped mid-section.

Floral Remains

Abundant floral remains were recovered from feature contexts. Feature 268 was the principal source of charred botanical remains, yielding large amounts of charcoal, charred corn cobs, and other burned floral material from a broad, roughly concave band in the middle (40–50 cm bgs) to lower levels (120–140 cm bgs). Flotation samples, systematically collected from excavation unit levels, and large amounts of fill from cylindrical pit Features 251 and 252 provided much of the charred material that otherwise might have been lost. Identified remains allow a glimpse into the gathering and horticultural practices of the site inhabitants and provide some information on species present in the local natural setting.

Gathering

The greatest diversity of floral remains are attributable to gathering activities. Species producing late summer or early fall fruits, including ground cherry (*Physalis heterophylla*), wild grape (*Vitis* sp.), chokecherry (*Prunus virginiana*), wild plum (*Prunus* sp.), and hackberry (*Celtis reticulata*), were present in a number of features, usually in the form of small pit fragments. Ground cherry likely occurred primarily in the sandy prairie soils east of the site. The plant prefers disturbed areas, such as those associated with field edges and habitation sites (Kindscher 1987:161–164). Wild grape and chokecherry probably were restricted to the banks of Crooked Creek where there were stands of trees, primarily cottonwood and willow. The plum pits likely represent either chickasaw/sand plum or American/wild plum varieties, which potentially had a broader distribution in sandy soils near Crooked Creek, along draws, and even unsheltered upland settings east of the creek. At least one or two burned hackberry fragments were recovered. Hackberry would be expected in limited numbers along the creek, particularly along protected portions of meanders.

Another tree that possibly occurred in protected niches along Crooked Creek is black walnut (*Juglans nigra*). Isolated charred shell fragments were identified during excavation of Feature 268, but no walnut remains were among the charred botanical specimens viewed for this analysis. Stands of walnut and green ash trees are present today along protected stretches of streams, especially major drainages like Crooked Creek and Bluff Creek, located southeast of the site. In fact one large black walnut tree, estimated to be more than 500 years old, has been recorded in the area.

A limited number of flotation samples from Feature 268 contained grass seeds. While species identifications were not attempted, at least two varieties probably are present in the collection. These seeds may not relate to subsistence practices, since grasses probably served as roof construction material and other uses that could account for their presence among the charred remains. Certainly several varieties of grass were present in the vicinity that were used historically by Native Americans, including eastern gamagrass (*Tripsacum dactyloides*), sand dropseed (*Sporobolus cryptandrus*), tall dropseed (*Sporobolus asper*), and Canada wildrye (*Elymus canadensis*). These varieties occurred historically in the Crooked Creek valley (Tomasu 1977). The presence of sedge (*Carex* sp.) in the floral remains is not surprising, considering the broad wetland habitat in place during the time of occupation.

Weedy annuals in the floral collection include goosefoot (*Chenopodium* sp.), pigweed (*Amaranthus* sp.), sunflower (*Helianthus* sp.), and possibly ragweed (*Ambrosia* sp.). These plants thrive in disturbed settings, such as those produced by extended habitation and associated gardening activity. Feature 268 in particular probably supported a micro-community of various wild plants and perhaps volunteer domesticates, since it was open to extensive filling with rich organic materials for an extended period of time. Some of the massive amounts of charred material from the feature appear to be burned pithy stalks of weedy plants. A few proveniences yielded tens of grams of such material. Relatively dense lenses of charred plant material may represent episodes when weeds in the open pit were burned, either intentionally or through inadvertent discard of live ashes that set the plants ablaze. In any case wild seed-bearing annuals likely played some role in site subsistence. All four have been identified as potential cultigens at Woodland and Middle Ceramic period sites in the region. Therefore, it is conceivable that some of the remains represent domesticated strains rather than wild varieties.

Horticulture

Besides these possible cultigens, at least one certain horticultural product was abundant at the site: corn (*Zea mays*). Maize was found in large quantities in Feature 268, primarily as large cobs and cob fragments with less frequent kernels. Other features yielded more limited quantities. Larger cob portions indicate a wide variation in cob diameter. Several cobs had diameters of approximately 2.4–2.6 cm, while many others had diameters of 1.2–1.6 cm. The general appearance of these smaller examples suggests the harvesting of green corn. Interestingly, these likely green corn specimens were collected in proveniences where there were many of the edge-modified mussel shell tools, identified on the basis of their form and wear as corn shellers. Additional evidence of variation, which may represent differences of maturity, variety, or other measures, includes row numbers. Cobs exhibit from 8 to 12 kernel rows.

Other tentatively identified potential crops include charred rind and possible seed fragments of squash. These remains actually may represent a cultivated, domesticated squash (*Cucurbita* sp.) or wild buffalo gourd (*Cucurbita foetidissima*). Some charred seeds in Feature 268 led to the provisional identification of tobacco. The presence of several smoking pipes indicates that the site inhabitants smoked something like tobacco.

Inter-Site Comparison and the Wilmore Complex

Each of the sites considered here has been included in the provisional Wilmore complex. Formal analysis has revealed that each site can be distinguished from the others at some level. House form, ceramic decoration, raw material utilization, and the presence and frequency of various exotic materials (generally of Southwestern origin) all contribute to the apparent differences among the sites. Some variation may reflect an intensifying exchange pattern on the Southern Plains during the Late Prehistoric period with an orientation toward areas southwest of the complex area including, but certainly not limited to, Puebloan and Antelope Creek phase peoples. Distinctions between the Bell and Booth sites in Comanche County and the more westerly Fowler-area sites, represented by the Lundeen site, may be related to archeologically distinct cultural groups that shared the same cultural tradition.

Architecture

Wilmore complex architecture is different from other architectural forms in the region. Structure floors appear to be mostly, if not entirely, subterranean. All three sites have at least semi-subterranean structures. Excavated areas adjacent to structures exposed potentially associated pits and work areas. However, variation is apparent among features identified as structures within the Wilmore complex.

At the Booth site extensive block excavation revealed pits and post molds across a ridge toe. Identified post molds often were loosely grouped, and no specific surface structure was defined. These posts may represent external work areas, possibly drying racks, lightweight wind breaks, or open-air arbors. A lithic cache and lithic debitage, attributable to extensive biface reduction, were identified on a probable intact living surface across the central and eastern portions of the site in the vicinity of several identified post mold groups.

Even though the structure area at the Booth site was imperfectly defined, sufficient evidence exists to make some comparisons with the house at the Bell site. The house at 14CM407 was essentially square with slightly rounded corners. It was constructed in a shallow (approximately 30-cm-deep) pit with relatively straight walls. The Booth site structure floor likely was somewhat deeper, perhaps 50 cm bgs. Both houses were fairly small, having areas of approximately 5 m^2 within the confines of the house pits. A poorly defined ramp in the southwest corner of the Bell site structure was the only evidence of entry. This possible entryway was oriented toward the creek and down the terrace slope away from the more open part of the terrace. Walls were oriented along approximate north-south and east-west axes. At both sites evidence of structural posts was limited, although at least one large support post was identified in each structure. Extensive rodent activity in the vicinities of the structures may have completely obliterated or compromised the integrity of post molds, especially smaller posts that would be expected along house perimeters, making differentiation from adjacent rodent burrows impossible. In addition, associated cultural activity appears to have had a significant impact on much of the original structure area at the Booth site. The large interior post in the Bell site structure was slightly offset from center, where a central hearth was defined.

Daub was common in the fill above the Bell site structure. Impressions indicated small diameter poles, ranging from 2 to 4 cm, in conjunction with grass blades and small stems. Impressed daub was not abundant elsewhere in the house pit fill or in other contexts at either site, pointing to a pole framework over which layers of fairly lightweight poles and grass were attached. At least portions of the roof and possibly the walls were plastered with clay or mud, although the limited amounts of daub suggest that the structures were not entirely covered with the material or that it was not applied in massive quantities. No facilities, such as storage pits or shallow basins, were associated with the house proper.

A partially defined house at the Lundeen site yielded evidence of a shallow pit structure. A packed floor of mottled sterile soil and caliche pebbles was identified at 80 cm bgs. Three interior posts were exposed across portions of this floor, including one corner. In addition, a very large posthole was excavated into cultural and sterile deposits a short distance to the west of the packed floor/post feature. This large post almost certainly represented a massive support member that implied a much heavier roof than those in the Comanche County site structures. Support posts in Buried City structures are of comparable size (Hughes and Hughes-Jones 1987:101). No edges of this Lundeen site structure were defined, as excavated units apparently were situated in the house interior. The squared-off nature of the packed floor suggested a square or rectangular structure. The fact that the exposed structure covered an area up to 3.5 m to the southeast with no defined limits attested to a much larger structure than those at the Bell and Booth sites.

At the Lundeen site a larger structure with a flattened ovoid rather than rectangular form was excavated. Feature 268 was of a size suitable for a habitation; however, it lacked definitive architectural features, such as an internal hearth or posts. Furthermore, a lack of comparable house forms elsewhere in the region led to some hesitancy in calling it a structure. Recent excavation in the Oklahoma panhandle at the Odessa-Yates site (34BV100) revealed similar structures. One well-defined structure had an ovoid form, measuring approximately 4 m wide by 5 m long and 1 m deep. Another area had overlapping features of similar or perhaps larger size. The identification of these structures in the region lends some support to the classification of the ovoid feature at 14MD306 as a large, deep pit structure, although the scale of the Lundeen site feature is unprecedented in the area.

Among internal features that were partially investigated was a 30-cm-high bench in the southeast part of Feature 268. The orientation and substantial nature of the bench led to the supposition that the it may have extended across the entire eastern end of the pit structure. A shallow basin was partially exposed near the west end of Feature 268. Approximately half of the basin was excavated, revealing an arc that continued into the adjoining unit toward an unexposed portion of the structure wall. A possible correlate to this basin feature was identified in an ovoid pit structure at the Odessa-Yates site. The purpose of this particular feature is unknown.

Ceramic Artifacts

Ceramics of the Wilmore complex fall within a regional Late Prehistoric ceramic tradition, shared with other archeological complexes, including the Buried City complex of the Texas panhandle and sites in northwestern Oklahoma and the Oklahoma panhandle, which were either previously affiliated with the Zimms complex or have not yet been attributed to a specific cultural taxon.

An important characteristic of this tradition is cordmarking on vessels. Cordmarks are often at least partially smoothed over, with some being nearly obliterated. Individual pots can exhibit a wide variety of surface treatments, with unmodified to nearly obliterated cordmarks on various vessel portions. Manufactured plain wares are present, although their frequency is obscured by the gradation into smoothed cordmarked ceramics, and appear to increase in frequency at late sites, such as the Booth site. Typical vessels are medium-sized with capacities of 2–5 liters. Smaller pots, occasionally consisting of neckless jars or constricted orifice bowls, are present in more limited numbers. The presence of large containers with capacities of up to 8 liters is demonstrated by several large-orifice vessel sections in the collections and a largely reconstructed vessel from the Lundeen site. The dominant vessel form is a globular, constricted-orifice jar, often with rim oriented at an outward angle. The only identified base form is rounded and often thicker than adjacent portions of the body. Red-filmed surfaces are associated with the neckless jar/constricted orifice bowl form. Rim decoration is relatively common, with 40–75 percent of the collection exhibiting some form of decoration. Temper varies among sites. This may reflect the local availability of clays and their natural inclusions, as well as preferences for particular tempering agents.

The dynamics of time and space are likely contributors to ceramic and other variation in the aggregate sample. While three sites admittedly is a small group for such a discussion to carry much weight, apparent differences among the sites (temper, surface treatment, rim orientation, and decorative technique) may represent changes in the ceramic tradition of the Wilmore complex area through time, as well as variation between the Comanche County sites and the more westerly Lundeen site. These particular traits are compared and contrasted to depict the variation, which may or may not be related to the relative ages and locations of the sites.

Temper in Booth site pottery is dominated by sand, with shell being the only other material represented (Table 33). It is noteworthy that the few shell-tempered sherds all fell into the plain ware category. A noticeable amount of untempered fine silty paste pottery points to use of a specific locally available clay variety. In some instances large sand temper was added to the silty clay. This clay type also was identified in a slightly larger frequency at the nearby Bell site. Temper in the 14CM407 ceramic collection is more variable, with a large number of bone-tempered sherds and often bone combined with sand to form a tempering conglomerate (Table 33). Sand as the sole temper is noticeably reduced. At the Lundeen site bone likewise is commonly identified as the only temper in sherds. It also is recognized in combination with sand and occasionally caliche. Caliche in the paste is believed to be an intentional, perhaps opportunistic, tempering agent, as it is present in about one-third of the site's ceramic collection. A naturally occurring material might be expected to be more pervasive, although the possibility that the caliche incorporated in the paste represents a particular clay source in the vicinity (much like the silty clay from near Wilmore) cannot be entirely ruled out. Also used at the Lundeen site was a trash temper that contains all major tempers from the site. This is seen as an opportunistic or unpatterned method of ceramic tempering. In comparing the sites, then, the Booth site exemplifies a more standardized pattern of tempering: sand-tempered clays or untempered silty clays. The limited quantities of shell-tempered plain wares may represent a specialized ceramic type produced at the site or a trade ware of unknown source. The earlier Bell and Lundeen sites are characterized by a preponderance of bone-tempered ceramics and a greater variety of combinations, indicative of a non-standardized pattern of ceramic tempering.

Vessel surface treatment at the Booth site consists of a high proportion of cordmarking that often is partially smoothed, often to near obliteration. Unmodified cordmarks appear on less than 10 percent of the collection (Table 34). Plain surface ceramics, identified here as manufactured plain wares, account for 27 percent of the material. The Bell site provides excellent comparable data: a high ratio of cordmarked sherds with few (6 percent) unmodified examples and a notable amount (23 percent) of plain ware. The two Comanche County sites together contrast sharply with the Lundeen site ceramic collection, where only 7 percent of the sample is characterized as plain ware. Unmodified cordmarks are more common, although still significantly fewer than partially smoothed cordmarks. The variation seems to be more related to spatial factors, with the temporally distinct Comanche County sites sharing similar ceramic characteristics that differ from those of the Lundeen site pottery.

Rim orientation trends toward vertical at the Booth site, where 35 percent of the rims have nearly straight orientations. Rims with slightly outward alignments are somewhat more common, while strongly outward-oriented rims are infrequent

Table 33. Ceramic Tempering Frequencies by Site.

Temper	14CM406	14CM407	14MD306
Sand	77.2	35.5	27.5
Bone	0	23	34.4
Bone/Sand	0	13.2	1.5
Bone/Caliche	0	0	22
Sand/Caliche	0	0	4.4
Trash	0	0	7.5
Shell	4.1	1.3	0.6
Shell/Sand	0	0.7	0
None	18.7	26.3	2.1

Table 34. Ceramic Surface Treatment Frequencies by Site.

Surface Treatment	14CM406	14CM407	14MD306
Cordmarked	9	6	13
Smoothed Cordmarked	64	71	80
Plain	27	23	7

(Table 35). Bell site rims tend toward slight eversion with fewer vertical rims and comparable frequencies of more strongly everted or flaring rims (Table 35). In contrast, at the Lundeen site everted and flaring rims account for 42 percent of the rims for which orientation could be determined. Thus, there appears to be a temporal trend toward vertically oriented rims at the later Booth site, compared to the Bell and Lundeen site assemblages. However, there is a more substantial distinction between the slightly angled rims at the Comanche County sites and strongly angled rims, creating well defined funnel-shaped openings, at the Lundeen site. Future research will allow for clearer understanding, but it is hypothesized here that both temporal and functional variation are depicted in the present assemblage.

The common occurrence and notable variation of ceramic decoration is a trait attributed to the Wilmore complex from its inception as an archeological taxon. Decorative techniques vary among the sites with some evidence of divergence between the Booth site and the Bell and Lundeen sites (Table 36). Analysis has revealed a number of trends that may be temporally related. Specifically finger pinches or fingernail impressions occur in significant frequencies at 14CM407 and 14MD306, contrasting markedly with the absence of this decorative technique in the 14CM406 collection (Table 36). The frequency of undecorated rim sherds at the Bell and Lundeen sites is similarly high when compared with undecorated category at the Booth site. The Booth site is dominated by frequent decoration of lips, particularly diagonally incised or impressed lines and punctations of the lip face (Table 36). Again, the limited number of sites involved in this analysis restricts the definite formulation of a trend in decoration over time; however, the observed decorative variation between earlier and later sites is difficult to dismiss. The dynamics of rim decoration through time start in early sites with an abundance of finger pinching, accompanied by lower frequencies of fingernail incising, while at later sites these decorative techniques become absent or extremely marginal. Increasing use of the lip as a decorative zone is a corresponding trend. Diagonal lines and punctates are common elements of decoration at the later Booth site. Future research should seek to determine if this observed variation is actually temporally related or attributable to some unrecognized factor.

Exotic ceramics consist of several potsherds and a decorated pipe fragment of Southwestern origin. The pottery includes several varieties, although specific types may not be those that have been previously identified to mid- to late-seventeenth-century and early eighteenth-century ceramic production in the Rio Grande district.

A small sample of body sherds are decorated with chevrons, rows and nested punctates, triangular zones of parallel incised lines, and isolated applique fillets and nodes. Most of these incised ceramics were excavated at the Booth site. Isolated elements were identified at the Bell site. As previously noted, the techniques are generally reminiscent of Oneota-like decorative treatments. Spatially the closest examples are associated with the White Rock phase of north-central Kansas. Temporally this phase is also the most likely candidate for contact with the people of the Wilmore vicinity. Specifically, identified traits appear closely related to shoulder decoration in the Walnut Decorated Lip type, defined by Ruscoe (1960:30). Marshall (1969:39–49) described a larger sample of Walnut Decorated Lip pottery from the Glen Elder site. Particularly noteworthy are trailed or incised lines forming blocks of opposing diagonals and occasional incised lines bordered by rows of punctates (Marshall 1969:42). In addition to the Bell and Booth sites, other sites in the area have produced similar shoulder-decorated ceramic vessels in small numbers (Figure 16). At least two large rim sherds from 14KW311 exhibit Oneota-like decorative motifs, including trailed lines and punctates, on the interiors of flaring rims. While many ceramic pieces bearing these decorative elements appear to be of local origin, others may represent non-local pottery. It is argued that this decorative form was not a local development but came into the area either through the exchange of

Table 35. Rim Sherd Orientation Frequencies by Site.

Orientation	14CM406	14CM407	14MD306
-5 º to -1º (Insloping)	3	0	1
Near 0º (Vertical)	35	17	16
1º to 15º (Slightly Everted)	38	56	42
16º to 20º (Everted)	16	12	19
Over 20º (Flaring)	8	15	23

Table 36. Rim Sherd Decoration Frequencies by Site.

Decoration	14CM406	14CM407	14MD306
Zigzag Incised	2.2	0	0
Diagonally Incised/Impressed	28.9	0	10.7
Tool Impressed	2.2	0	4.9
Red Filmed	2.2	1.6	0.5
Punctated	26.7	3.2	3.3
Appliqued	4.4	9.7	0.5
Incised Lip Tab	4.4	0	0
Finger Pinched	0	25.8	17
Fingernail Impressed	0	3.2	2.1
Diagonally Incised Lip/ Zigzag Incised Neck	0	0	0.8
Grooved Lip	0	0	0.8
None	28.9	56.5	59.4

material goods or at least the exchange of ideas. Petrographic analysis of a sample of diagnostic sherds from excavated contexts would be useful for answering questions about ceramic trade.

Lithic Artifacts

The chipped stone tool assemblages indicate that a wide variety of activities were being conducted at the Bell, Booth, and Lundeen sites, as would be expected with relatively long-term habitation locales. Overall the toolkit and relative frequencies of bifacial and unifacial tools are similar among the three sites, suggesting a broad correspondence of tasks and tools considered suitable for performing those tasks (Tables 37 and 38).

Raw material variation among the sites provides for a basis for discussing utilization patterns, as well as topics of trade and exchange, since significant amounts of non-local lithic materials were identified at all sites. It is maintained that this variation can be attributed to the accessibility and quality of relatively local raw materials and, in the case of non-local materials, to the orientation of exchange relationships. The direction of exchange relationships may have shifted significantly during the Late Prehistoric period (Baugh and Nelson 1987), a period spanned by the sites discussed here. Major differences in raw material types, particularly conspicuous between the Bell and Booth sites, may represent shifting and intensifying exchange associations. The temporal variation between these sites has been considered in relationship to other aspects of the material culture, and it is recognized as a potential factor here.

In broad terms the Bell site materials demonstrate a strong orientation toward non-local lithic sources, with stone from the east matching the frequency of local material (Table 39). The non-local stone is dominated by Flint Hills cherts but includes rare examples of Boone chert. Local material in the Comanche

Table 37. Biface Type Frequencies by Site.

Biface Type	14CM406	14CM407	14MD306
Projectile Point	52.3	46.8	45.2
Bifacial Knife	11.4	0.0	8.7
Alternately Beveled Knife	4.5	21.9	11.3
Drill	6.8	0.0	1.7
Digging Tool	1.1	0.0	0.0
Blank	17.0	21.9	5.2
Preform	6.8	9.4	19.7

Table 38. Uniface Type Frequencies by Site.

Uniface Type	14CM406	14CM407	14MD306
End Scraper	15.3	21.2	32.8
Scraper	6.3	3.8	16.5
Flake Knife	6.3	0.0	6.0
Informal Flake Knife	58.6	50.0	23.8
Informal Flake Scraper	12.6	25.0	10.5
Multipurpose Flake Tool	0.9	0.0	7.3
Graver	0.0	0.0	1.5
Perforator	0.0	0.0	1.8

County area consists primarily of Dakota quartzite with occasional chalcedony, Ogallala quartzite, Day Creek chert, and other materials. Non-local material from the north, namely Smoky Hill jasper, occurs in about the same frequency as material from the south, including Alibates agatized dolomite and Edwards Plateau chert. Despite these overall statistics, more chipped stone tools were made from Alibates agate than from any other stone. Other lithic types have more comparable ratios between debitage and tool categories. The locally derived Dakota quartzite is represented by relatively few tools for the amount of debitage present at the Bell site. It is important to note that the procurement areas for the common non-local stones (Florence cherts, Smoky Hill jasper, and Alibates agate) are roughly equidistant from the Comanche County vicinity. This being the case, some variable other than simple distance to source is required to explain the preference for Flint Hills cherts, which typically are present in more limited quantities at Late Prehistoric sites in the region.

The greater reliance on non-local lithic sources continues at the Booth. Locally occurring raw material frequencies are comparable between the sites (Table 39). However, the orientation for and subsequent frequency of non-local stone shift toward the south and southwest. Raw materials of eastern origin are extremely rare, creating the perception that the area in general and/or the material in particular were not important to the site's inhabitants. Eastern stones, chiefly in tool form, are exclusively Flint Hills cherts. Smoky Hill jasper from the north has a similarly low occurrence. On the other hand, there is a substantial increase in lithic materials from the Southern Plains and Southwest. This includes an abundance of Alibates agate among tool and debitage classes and the presence of obsidian in an atypically high frequency, when compared with sites in the region. Obsidian was identified primarily as debitage, often as small flakes and broken fragments that can be characterized as products of relatively late-stage lithic reduction. Several obsidian tools were also recovered. A sample has been traced to the Jemez Mountains of north-central New Mexico. Specific sources include Cerro del Medio of the Valle Grande locality complex and Obsidian Ridge in the Cerro Toledo locality complex, as defined by Baugh

Table 39. Frequencies of Raw Material Utilization by General Direction from the Sites.

Raw Material	14CM406	14CM407	14MD306
Local	38.7	37.5	1.9
Non-local (East)	1.9	38.5	1.4
Non-local (South/West)	53.5	13.7	66.3
Non-local (North)	3.5	9.2	29.8

and Nelson (1987). While the possibility exists that isolated lithic materials in the collection come from places outside of the Southwest, the high percentage of obsidian, the results of source analysis restricted to two localities in New Mexico, and the late date of the Booth site all point to the obsidian being of New Mexico origin.

Baugh and Nelson (1987:322–326) propose a shift in orientation and intensity for obsidian exchange around A.D. 1450. Apparently a number of widespread procurement areas, including Utah and Idaho, were abandoned in favor of Southwestern sources, particularly Valle Grande and Cerro Toledo localities, by inhabitants of sites dating after approximately A.D. 1450. This shift in orientation was accompanied by an intensification of exchange within an increasingly closed system, allowing for larger quantities of goods to enter the Southern Plains (Baugh 1984; Baugh and Nelson 1987:325–326). The general system of down-the-line exchange with decreasing abundance of commodities, correlated with increasing distance from the point of origin, does not seem appropriate for the Booth site with regard to the high frequency of obsidian. The approximate A.D. 1500 date of the Booth site, coupled with the notable influx of Southwestern goods, are submitted as evidence of an intensifying connection with Southwestern and Southern Plains societies.

Lundeen site lithic artifacts are almost entirely of non-local stone (Table 39). Local materials are derived primarily from the Ogallala formation. A reliable source of quality raw material does not occur in the Fowler vicinity in contrast to the situation at Wilmore, where at least some sizeable lithic sources are nearby. Material from the south or southwest is more than twice as common as that from the north. Nearly all stone from the southerly direction is Alibates agate, which accounts for a greater percentage of tools than debitage. Small quantities of Edwards Plateau chert and obsidian also were identified. The origin of the obsidian has not been traced, and, considering the period of site occupation (late-thirteenth through early fifteenth century), it may come from a non-Southwestern source. Smoky Hill jasper constitutes the material from the north. It constitutes a higher proportion of debitage than tools, although it is second only to Alibates agate in both categories.

Worked Bone and Shell

Work in bone includes the ubiquitous bison tibia digging stick tip and scapula hoe. Scapula hoes were fashioned in a single, diagnostic manner, consisting of removal of the articular or glenoid end and reduction of the scapular borders to create a compact tool form. Glenoid removal is the characteristic trait shared by all tools from all three sites. Ribs and occasionally other elements, bearing notches on edges and across faces, are present at sites throughout the area. Perforating instruments or awls were made from pronghorn or deer metapodials and from splinters of unidentified bone and bison rib edges.

Local freshwater mussel shells occasionally were utilized as scraping implements. A function of green corn shellers has been proposed for the described form. Other modified shell artifacts are ornaments fashioned from exotic materials. A few marine shell disk beads and *Olivella* shell beads have been recovered, not only at the excavated sites but also at other sites, such as 14KW301, that currently are attributed to the same cultural tradition. Only the Booth and Lundeen sites yielded marine shell artifacts. Site 14CM406 yielded a single *Olivella* shell bead fragment and three disk beads of unidentified species from a single feature. From the general midden fill at the Lundeen site came 15 *Olivella* shell beads, two conch columella beads, a possible *Conus* tinkler, and two items of unidentified marine shell: a possible rectangular inlay and an incised pendant. Elsewhere in the region such marine shell ornaments have been associated strictly with mortuary contexts (see Hughes and Hughes 1987:96, 104). The fact that these items were collected in association with general habitation debris may have some significance, although there are no data on period burials in the area for comparison. The exotic shell material can be attributed to Puebloan sources, providing additional evidence of exchange well beyond the Plains margins whether through direct or down-the-line trade.

Subsistence

The sites appear to have similar generalized subsistence economies. The Bell site is an exception to this, although it is apparent that the assemblage is biased toward larger mammal, specifically ungulate, remains. By sheer weight of useable products, bison dominate the faunal collections. However, numerous species were exploited from nearly all local environmental zones. This reliance on a diverse array of species and habitats is indicative of the proposed diffuse subsistence strategy.

The high degree of diversity found in the Lundeen faunal material reflects the large wetland component of the Crooked Creek valley. This unusual setting makes direct comparison with sites in less abundant environments difficult. It may be sufficient to say that this rich habitat was exploited most efficiently through an established generalized subsistence economy, which on a broad scale also was employed farther to the east in the Comanche County area.

The divergent collection methods, as well as the degree of analysis achieved here, restrict comparisons of the floral remains among the three sites to a very general level. At least corn and possibly other crops, such as sunflower and goosefoot, were cultivated at all three sites. Squash and tobacco have been tentatively identified at the Lundeen site. Goosefoot, sunflower, wild plum and/or chokecherry, groundcherry, hackberry, walnut, and a variety of grasses and sedges are likely products of gathering. Undoubtedly extensive gathering of a wide variety of locally and seasonally available floral resources supplemented procurement of wild game and cultivation of crops.

Wilmore Complex

The term "Wilmore complex" originally was proposed to distinguish a series of sites, newly identified on the basis of surface collections and limited excavations for which only preliminary interpretations had been made. The sites yielded many decorated ceramics, which was unusual compared to other known sites and archeological complexes in the region.

For the purposes of this discussion, a complex is defined as "an artifact assemblage with one or more diagnostic traits which, while consistently associated, may or may not have been integrated into a system of phases due to the incomplete nature of the data" (O'Brien 1984:20). To date the provisional complex designation has served a useful purpose as an archeological marker, loosely associating sites in an area where research historically has been limited. Now formal analysis has revealed several potentially significant distinctions among the sites, including apparent temporal and spatial variations that have a bearing on taxonomic discussions. Based on these differences, it is believed that future comparisons would be made more practically at a basic, concrete level of archeological understanding.

A Late Prehistoric component has been identified at each site. In fact both the Booth and Lundeen sites contain intersecting features that attest to multiple components. However, associated artifacts indicate that these components were produced by single cultural manifestations. Until additional research is conducted in the area, allowing for a more definite determination of relationships among groups of sites that maintain strong temporal associations and demonstrated spatial limitations, comparisons should be directed to individual sites. To continue to use the Wilmore complex designation in the face of noted dissimilarities could lead to the inaccurate assumption that a single, coherent cultural entity, comparable to an archeological phase, is present across the region.

A Proposal — The Plains Border Variant

This discussion focuses on the variability present within the small sample of sites and argues that the diversity among the sites prevents their inclusion within a single, narrowly defined taxonomic unit at this time. According to Willey and Phillips (1958:22), a phase may be defined on the basis of a single component with the expectation that additional similar sites will be identified in the future. This is not attempted here, due in part to the paucity of fieldwork in the area and also the belief that the region encompasses temporal and spacial variables that are highly complex and not easily identified or managed with the data set currently available. However, the demonstrated diversity does not restrict their affiliation with a broader taxonomic position.

Collectively the Wilmore complex sites fit within the broader parameters of the Plains Village tradition, although settlement appears to consist primarily of isolated habitation sites that may or may not be part of an extended community of coeval dwellings, scattered along drainages in a particular area. In a broad sense these scattered communities may be considered villages, since they constitute a population and imply a relationship.

At a more specific level the sites may be included as otherwise unaffiliated components of an undefined variant in the region. The definition of variant has been adopted from Lehmer (1971:32):

> a reasonably uniform expression of a cultural tradition which has a greater order of magnitude than a phase, and which is distinguished from other variants of the same tradition by its geographic distribution, age, and/or cultural content.

Plains Village tradition manifestations in what amounts to a Plains Border region during approximately A.D. 1100–1500 appear to have similar subsistence economies, based on horticulture, gathering, and hunting. Settlement consisted primarily of extended communities of dispersed individual habitations. Scattered hamlets and occasional small villages also occurred. The settlements typically were located along stretches of perennial streams, fed at least in part by abundant groundwater resources.

Architectural forms varied throughout the region; however, structures usually exhibited some type of subterranean floor. This may take the form of a central channel, as in most Buried City complex structures, or semi-subterranean house floors, such as those at the Bell and probably the Booth and Hedding (34WD2) sites. For the most part the structures were square to rectangular. Varying from these rules, House 1 at the Hedding site had a packed clay foundation and a keystone shape. Recently another excavated house form has been identified at the Lundeen and Odessa-Yates sites: a genuine pithouse of oval to flattened ovoid configuration.

The material culture includes a common ceramic tradition, characterized by decorated rims on smoothed cordmarked vessels. Reconstructed vessel sections display a high degree of variation of surface modification. In addition to cordmarked vessels, manufactured plain wares occur in varying frequencies of up to 25–30 percent. Temper is primarily sand, although bone and occasional shell tempers are noted. Combinations of tempering agents are also common. Untempered silty pastes and some forms of apparent temper may have local significance, related at least in part to material availability. Vessels are commonly medium sized, having volumes of 2–5 liters. Smaller pots, some of which may be specialized miniature forms, and larger vessels also are represented. Constricted orifice bowls, also known as neckless jars, are present in limited numbers. Other ceramic items include ceramic elbow pipes, rounded beads, and perforated pottery disks that are made from body sherds.

Bone tool inventories contain perforators, such as awls and needles, formed on a variety of elements, including pronghorn or deer metapodials, bison rib edges, and other unidentified bone splinters. Ribs with evenly spaced notches along the edge or across the face have undetermined and possibly multiple functions. Occasionally similar incised marks are found on other elements. Bison tibia digging stick tips and scapula hoes are numerous. Scapula hoe manufacture includes a distinctive removal of the glenoid head in addition to other forms of blade reduction. This trait is associated with all scapula tools in the southwest Kansas sites and has been seen in collections elsewhere in the region. Also recognized at some sites are bison ulna picks. Arrow shaft wrenches often were constructed from pronghorn or deer tibiae and less frequently from bison ribs. While not identified in the sites studied here, deer mandible sickles have been found at some sites, such as those in the Buried City complex. Antler tools include handles and flintknapping implements, such as billets of varying sizes and antler tine flakers. Shell scrapers, linked to corn shelling or possibly pottery working, were recovered in large numbers at the Buried City and Lundeen sites; elsewhere shell scrapers are identified in limited quantities.

Pecked and ground stone tool inventories consist of domestic processing equipment, such as metates (both flat and troughed) and handheld manos, typically made from locally available sedimentary conglomerates and quartzites. Tool manufacturing and maintenance implements include grooved abraders in standard loaf shapes and irregular blocks of sandstone. Variations of the groove cross sections indicate multiple functions. This report proposes functions as arrow shaft abraders and flintknapping abraders. Small flat abraders, possibly associated with bone tool maintenance, and cobble hammerstones are present.

Chipped stone tools include a high proportion of arrow points, including primarily Washita and Fresno types. Harrell points are found in limited numbers overall and may not be present at some sites, particularly those with small artifact inventories. Corner-notched points, typically associated with the Woodland period, are represented infrequently at sites in the region. Other bifacial tools include diamond-shaped beveled and ovate knives and expanding-base flake and T-shaped drills. Occasional ensiform drills were found at one late site. Flake tool types consist of large numbers of informal or expedient flake tools, more formally shaped flake knives and scrapers, and end scrapers. Occasional specialized flake tools, such as gravers and perforators, also have been identified.

Raw material utilization varies considerably within the region. Some sites yield high percentages of locally derived lithic material, whereas others have sizeable quantities of non-local stone. Sites located near quality lithic sources typically have higher percentages of local stone, whereas sites isolated from stone procurement areas have lower percentages. Relative distance to lithic source does not explain all instances, however. High percentages of non-local stone have been recorded at some sites that are near good lithic sources. While these disparities are not clearly understood, it is evident that some sites are more strongly linked to an exchange system than others. This pattern of exchange probably was developing within the region throughout much of the Middle Ceramic period. By the latter part of the period, exchange may have intensified and expanded dramatically. Evidence of a shifting orientation to the Southwest appears during the period, culminating in a nearly exclusive exchange relationship between Southern Plains and Southwestern cultures around A.D. 1450, as suggested by Baugh and Nelson (1987).

Lintz' (1986:24–25) interpretation of the variant taxon is helpful here. He ascribes a flexibility useful for depicting general cultural interrelationships between formal and informal archeological manifestations, while distinguishing them from adjacent cultural phenomenon, especially if the local sequence is poorly understood or a site assemblage shares general attributes with several archeological manifestions in the region. Remains grouped in this manner may represent multiple archeological phases (or conceivably undeveloped phases) with similar adaptations to a regional environment. Relative contemporaneity indicates parallel development on a regional scale, likely with varying degrees of interaction on an intra-variant level, as well as on a broader inter-variant level.

Numerous dates from area sites indicate a common general range, spanning A.D. 1100–1500. Several complexes have been defined in the area of southwest Kansas, northwest Oklahoma, and portions of the Oklahoma and Texas panhandles. These include the Wilmore complex, the Buried City complex, and unaffiliated sites throughout the area, including Lonker (34BV4), Hedding (House 1 and associated remains), Miller (34EL25), and possibly Odessa-Yates in northwest Oklahoma. General similarities of the material cultures have been discussed. Together these complexes and sites comprise a contiguous geographic region — the Plains Border. A variant is proposed that encompasses these broadly similar sites of the Late Prehistoric period, recognized by its association with this physiographic province (Figure 36). Apparent variation within the region is attributed to a number of factors, including period of site occupation, site location in relation to adjacent geographic regions with different resources and cultures, and varying levels of intra- and inter-regional interaction. Continued formal analysis and reporting of excavated sites and more intensive field investigations throughout the region, focusing on the Late Prehistoric period, will allow further refinement of the regional cultural sequence. Distinctions can be drawn among these widely spaced excavated sites and complexes, but the relevance of these distinctions is not fully understood beyond the perception that they in part illustrate the potential for future phase definitions. Additional research in the region will assist in determining whether the recognized regional variation can be isolated to particular localities and periods of time that correspond to the phase level.

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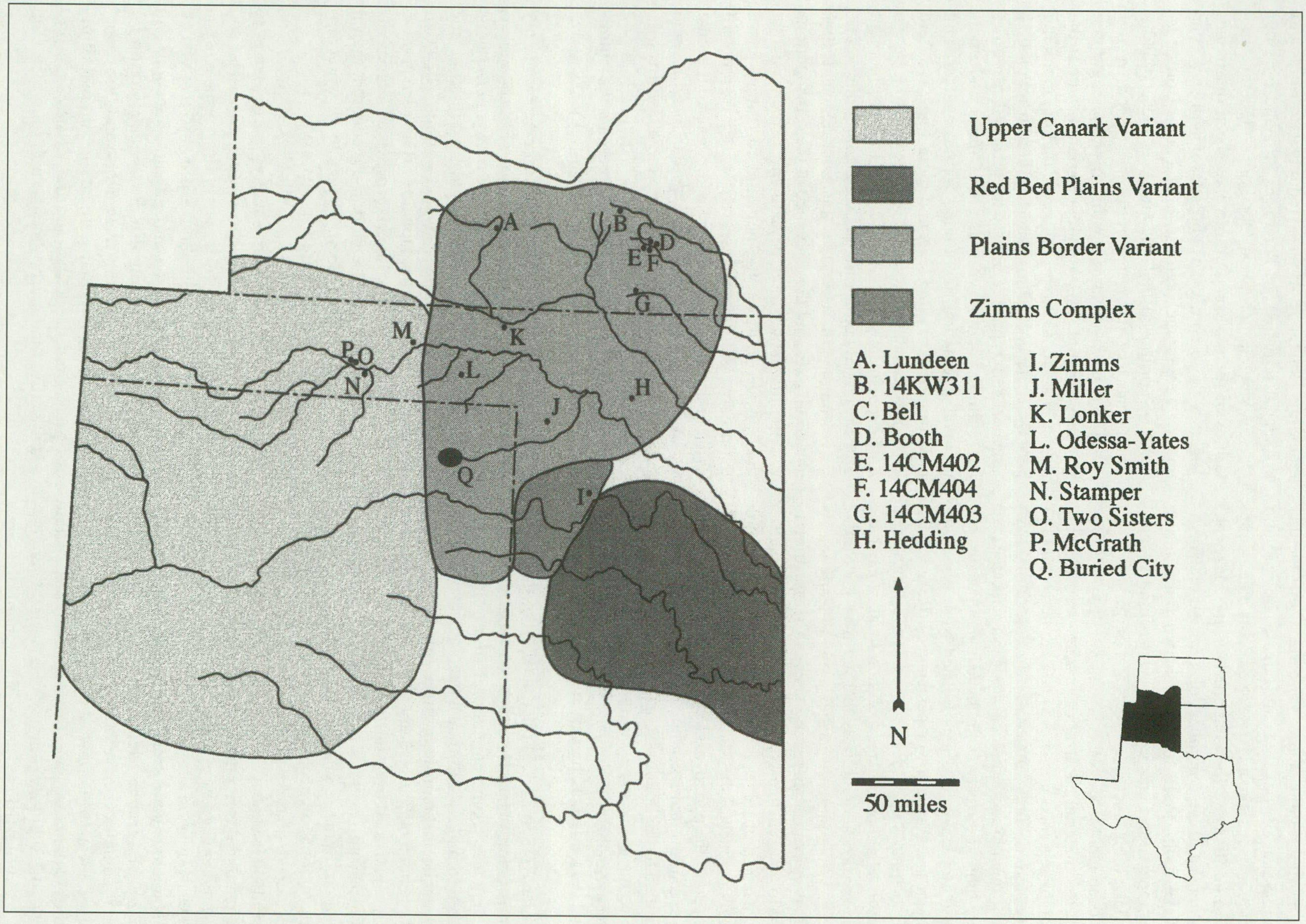

Figure 36. Map of the Southern Plains and adjacent areas showing the relationship of variants and unaffiliated complexes.

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Faunal Analysis of the Bell Site (14CM407): Implications for Wilmore Complex Subsistence

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The faunal assemblage from the Wilmore complex Bell site (14CM407) is reported and analyzed. The collection is dominated by bison and deer but also contains turtle, bird, and shellfish remains. Spatial, taphonomic, economic, bison demographic, and seasonal analyses and their implications for Wilmore complex subsistence patterns are presented. Particular attention is paid to processing of bison bones for marrow extraction. Also presented is the bone tool assemblage. Comparisons are made to faunal assemblages from other complexes, which may bear some similarities to the Wilmore complex.

This paper documents and discusses the faunal remains recovered from the Bell site (14CM407) in Comanche County, Kansas, during the 1984 Kansas Archeology Training Program. The Bell site is believed to represent a Middle Ceramic period occupation (Rowlison 1985), and this attribution is supported by a radiocarbon date (Beta-12650) of 780±160 B.P. (Thies 1985). Middle Ceramic period manifestations appear to represent subsistence patterns based on hunting and horticulture.

The faunal remains from the Bell site are dominated by bison (*Bison bison*). Analysis of the bison bones demonstrated that a minimum of six animals are represented, based on the number of left fourth carpals. Other identified taxa include deer (*Odocoileus* sp.; minimum number of individuals [MNI] = 2, based on left astragali and left scapulae), turtle (Order Testudinata; MNI = 2, based on carapaces), bird (Class Aves; MNI = 1), and shellfish (Class Pelecypoda; MNI undetermined). Genus and species identifications have not been made for the turtle, bird, or shellfish remains. Interestingly, neither rodent nor fish remains were identified during analysis. Whether this is due to their absence at the site or to incomplete recovery is not clear.

More than 400 specimens of bison bone were identified to element, with several dozen more identifiable only as fragments of bison long bones. Sixty-eight deer or deer-sized specimens (potentially pronghorn [*Antilocapra americana*]) were identified to element, and another eight specimens were identified as deer-sized long bone fragments. All deer-sized specimens for which a taxonomic determination could be made were positively identified as deer; therefore, it was presumed that all remains of deer-sized ungulates (mammals with hooves) are deer, not pronghorn. Because of the dominance of the faunal assemblage by ungulates, this analysis dealt primarily with the bison and deer bones. See Table 1 for a summary of the bison and deer assemblages.

Spatial Distribution

The majority of the bison and deer bones excavated at the Bell site were associated with cultural features. The greatest concentration of faunal remains was found in a large, debris-filled borrow pit, located in the northern portion of the main excavation area. Two additional major concentrations of faunal remains were associated with a pithouse, excavated to the southeast of the main excavation area, and with a "concentration of bone, stone, and pottery" (Rowlison 1985:122), located near the western edge of the main excavation area (Figure 1a). Overall the deer and bison bones appeared to be similarly distributed across the site (Figure lb-c).

As some potsherds recovered from the pithouse and the large borrow pit were found to refit, the utilization of the two features as trash pits, and by extension the immediate surroundings, are considered to be contemporaneous (Bevitt 1999, herein). Therefore, the faunal assemblage has been analyzed as a unit.

Subdivision of the deer and bison assemblages produced some interesting results, particularly in the case of the deer bones. Deer axial remains were restricted to the large borrow pit and the pithouse; deer appendicular remains, while concentrated in the trash pit and the pithouse, were also recovered in low numbers across other portions of the site. This pattern may signify a butchering process in which choicer

Table 1. Element representation data for deer and bison; MNE = Minimum Number of Elements, MAU = Minimum Number of Animal Units, %MAU = normalized MAU.
*Due to difficulty of identification, bison distal metacarpals and metatarsals are lumped together as distal metapodials.

	Deer			Bison		
Element	MNE	MAU	%MAU	MNE	MAU	%MAU
Cranium	1	1.00	66.7	1	1.00	22.2
Mandible	1	0.50	33.3	2	1.00	22.2
Atlas Vert.	1	1.00	66.7	1	1.00	22.2
Axis Vert.	0	0.00	0.0	1	1.00	22.2
3rd-7th Cervical Vert.	0	0.00	0.0	2	0.40	8.9
Thoracic Vert.	1	0.08	5.1	4	0.31	6.8
Rib	4	0.15	10.3	20	0.77	17.1
Lumbar Vert.	1	0.17	11.1	2	0.33	7.4
Sacrum	0	0.00	0.0	1	1.00	22.2
Innominate	0	0.00	0.0	3	1.50	33.3
Scapula	2	1.00	66.7	6	3.00	66.7
Humerus						
Proximal	0	0.00	0.0	3	1.50	33.3
Distal	3	1.50	100.0	9	4.50	100.0
Radius						
Proximal	1	0.50	33.3	8	4.00	88.9
Distal	1	0.50	33.3	2	1.00	22.2
Ulna	0	0.00	0.0	3	1.50	33.3
Carpal	3	0.25	16.7	36	3.00	66.7
Metacarpal						
Proximal	2	1.00	66.7	6	3.00	66.7
Distal	0	0.00	0.0	*	*	*
Femur						
Proximal	1	0.50	33.3	4	2.00	44.4
Distal	2	1.00	66.7	2	1.00	22.2
Patella	0	0.00	0.0	6	3.00	66.7
Tibia						
Proximal	0	0.00	0.0	2	1.00	22.2
Distal	0	0.00	0.0	4	2.00	44.4
Astragalus	3	1.50	100.0	8	4.00	88.9
Calcaneus	1	0.50	33.3	6	3.00	66.7
Other Tarsal	0	0.00	0.0	20	3.33	74.0
Metatarsal						
Proximal	1	0.50	33.3	5	2.50	55.6
Distal	1	0.50	33.3	*	*	*
Distal Metapodial	--	--	--	8	2.00	44.4
Phalanx	10	0.42	27.8	57	2.38	52.8

portions, namely limbs, were removed from the carcass and transported about the site, eventually being discarded haphazardly. The remainder of the carcass, presumably after removal of the remaining meat, was tossed into the trash pit. However, it is also conceivable that dogs or other scavengers may have dragged limb bones away from the pit, a possibility that will be discussed further below.

An intriguing aspect of the spatial distribution of the deer assemblage is that left-side and right-side appendicular elements have mutually exclusive distributions. Right-side specimens were restricted to the small borrow pit and the northern half of the large borrow pit. In contrast left-side specimens were present in the southern half of the large borrow pit and in the pithouse, with a small number of additional left-side specimens in the main excavation area south of the large borrow pit. Admittedly this observation is based on an extremely small sample size — only 6 right-side and 12 left-side specimens.

Subdivisions of the bison assemblage did not produce similar results, suggesting that different butchery techniques were employed or that the apparent patterning of the deer assemblage was an artifact of the small sample size. Nonetheless, some interesting variations in the distribution of the bison bones were apparent. Axial and appendicular elements were found in much the same areas of the site but in

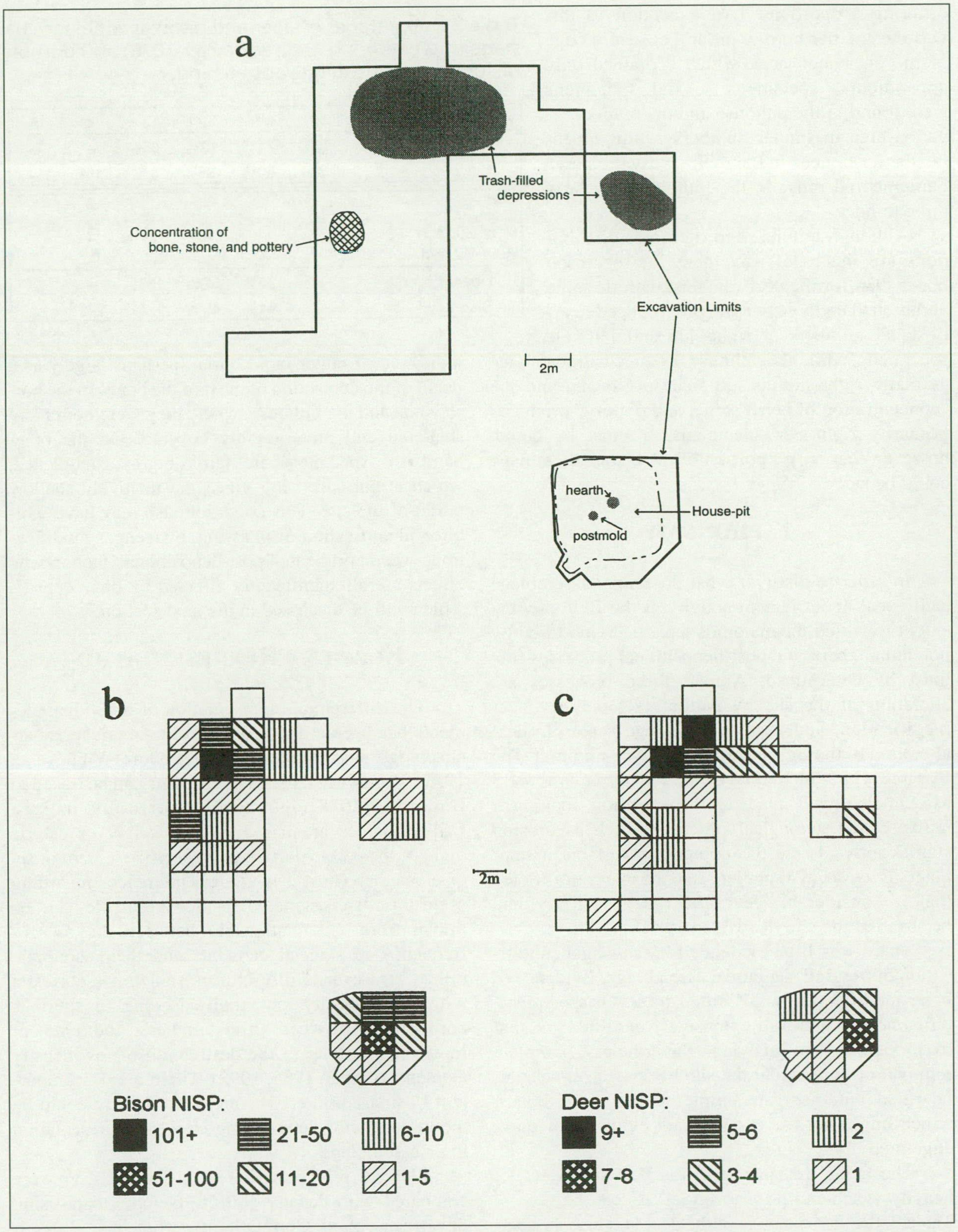

Figure 1. Excavation maps of the Bell site; (a) redrawn from Rowlison (1985), (b) spatial distribution of bison remains, (c) spatial distribution of deer remains; NISP = Number of Identified Specimens per excavation unit.

differing proportions. (An exception to this was the smaller borrow pit at the eastern edge of the excavated area, which contained only appendicular specimens.) Axial specimens were found in the pithouse and the main excavation area in similar numbers, while appendicular specimens in the main excavation area outnumbered those in the pithouse by nearly three to one.

Although left-side and right-side distributions are much less divergent for the bison bones than for the deer remains, there is some variation. The large borrow pit produced nearly equal numbers of right-side and left-side specimens, while the pithouse produced almost twice as many right-side as left-side specimens, and the "concentration of bone, stone, and pottery" produced primarily right-side specimens. It must be noted, however, that only a portion of the bison assemblage could be sided.

Table 2. Percentages of deer and bison assemblages by stage of weathering (Behrensmeyer 1978) and portion of surfaces that exhibit root etching.

Weathering Stage	0	1	2	3	4	5
Deer	13%	71%	10%	6%	--	--
Bison	7%	80%	8%	4%	1%	--

% of Surface Root-Etched	0%	1-33%	34-66%	67-100%
Deer	35%	52%	13%	--
Bison	41%	45%	12%	2%

Taphonomy

In order to discover what the faunal assemblage can reveal about human activity at the Bell site, the extent to which the materials have been modified by nonhuman, peri- and post-depositional processes first must be determined. Among these processes are alteration of the site by natural factors, scavenger modification, and weathering. Large scale physical alteration of the Bell site appeared to be minimal. The features with which most of the faunal remains were associated stayed intact until excavation, making it unlikely that geological processes such as erosion significantly altered the composition of the assemblage. Even so, at a smaller scale the excavators noted that a considerable level of rodent activity had occurred at the site (Rowlison 1985).

There was little evidence for scavenger modification of the Bell site faunal assemblage. Evidence of bone modification was limited to seven specimens, only one of which was extensively modified and that by modern rodent gnawing. Nevertheless, complete removal of bones from the site by scavengers cannot be ruled out, nor can simple scattering of bones, which might not leave significant evidence of scavenger activity.

The faunal remains from the Bell site were not heavily weathered prior to burial. As can be seen in Table 2, the vast majority of the deer and bison assemblages fit into Behrensmeyer's (1978) Weathering Stage 1, with only a very small fraction of the assemblage falling beyond Weathering Stage 2. This is indicative of rather rapid burial, perhaps largely as a result of the deposition of most of the bones in the borrow pits and the pithouse, where they were both more sheltered and more rapidly covered. On the other hand, the specimens are fairly highly root-etched, which is not surprising given the relatively shallow burial of the site. This condition also may have inhibited identification of gnawing. Scavenger modification, weathering, and post-depositional taphonomic effects are all significantly affected by bone density, which will be discussed in the next section.

Element Representation

The differential representation of individual elements has been a major concern in American zooarchaeology since the work of Theodore White (e.g., 1952). Rigorous statistical treatments can be traced to Binford's (1978) introduction of utility indices. Utility indices are based on the weight or caloric yield of the edible portion of a specific element or set of elements. Thus, it is argued, inferences regarding prehistoric subsistence behavior at a site can be drawn from the relationship between the relative frequency of skeletal elements and their economic utility. However, utility indices sometimes correlate with bone density, potentially leading to spurious correlations between utility indices and element representation due to the destruction of low-density elements (Lyman 1985, 1992). Therefore, it is important to first consider whether bone density could be the major factor determining element representation in an assemblage.

Element representation of bison and deer were compared with density and utility index data using Spearman's Rank Correlation Coefficient (r_s), which measures the correspondence between the orders (or ranks) of the element representation data and the density or utility values. This rank coefficient is used because it does not require the assumption of a normal (in the statistical sense) distribution of the population from which the data is drawn. Values for correlation coefficients range from -1 to 1, with -1 indicating a perfect negative correlation, 0 indicating no correlation, and 1 indicating a perfect positive correlation. For each correlation the value of the correlation coefficient is presented along with the number of data points and the significance value (that is, the probability that no correlation whatsoever truly exists and that the apparent correlation is simple the effect of random chance).

A moderate, but statistically significant, positive correlation (r_s = 0.53, n = 28, p = 0.0036) exists between the representation of deer elements at the Bell site and Lyman's (1984) volume density values for deer bone (Figure 2). Thus, it must be concluded that density-related taphonomic effects were probably a major factor in the representation of deer bones at the Bell site. Furthermore, deer element representation correlates very weakly with utility indices for caribou (see Table 3).

A different situation exists with the bison bones. Bison element representation correlates only weakly (r_s = 0. 34, n = 35, p = 0.046) with Kreutzer's (1992) bison bone density values (Figure 3). This raises the possibility that some other factor has exerted greater influence over the variation in element representation present in the bison assemblage. Comparison of bison element representation with several utility indices produced the results in Table 3. Note the moderate negative correlations with Emerson's (1993) Total Products Model and Total Fat Model. Results such as these might be expected of a kill site, where higher utility portions have been transported away. The Bell site, though, was clearly a habitation site at which positive correlations with utility indices would be expected. As can be seen in Table 3 and Figure 4, comparison of bison element representation with Emerson's (1993) Marrow Index resulted in a rather strong positive correlation (r_s = 0.76). In addition to correlating with bone density, as mentioned above, utility indices often correlate with each other. It appears likely that the negative correlation between the Marrow Index and the Total Products and Total Fat Models is responsible for the statistical significance of both the Marrow Index and Total Products Model correlations with skeletal element frequency. Given the more statistically significant result for the Marrow Index, as well as the nature of the Bell site collection as habitation refuse, it seems reasonable to conclude that marrow utility is the major factor influencing element representation in the assemblage. The correlation between element representation and the Total Products and Total Fat Models results at least partially from the correlation of the utility indices.

Element representation at the Bell site suggests that deer were transported to the site largely intact,

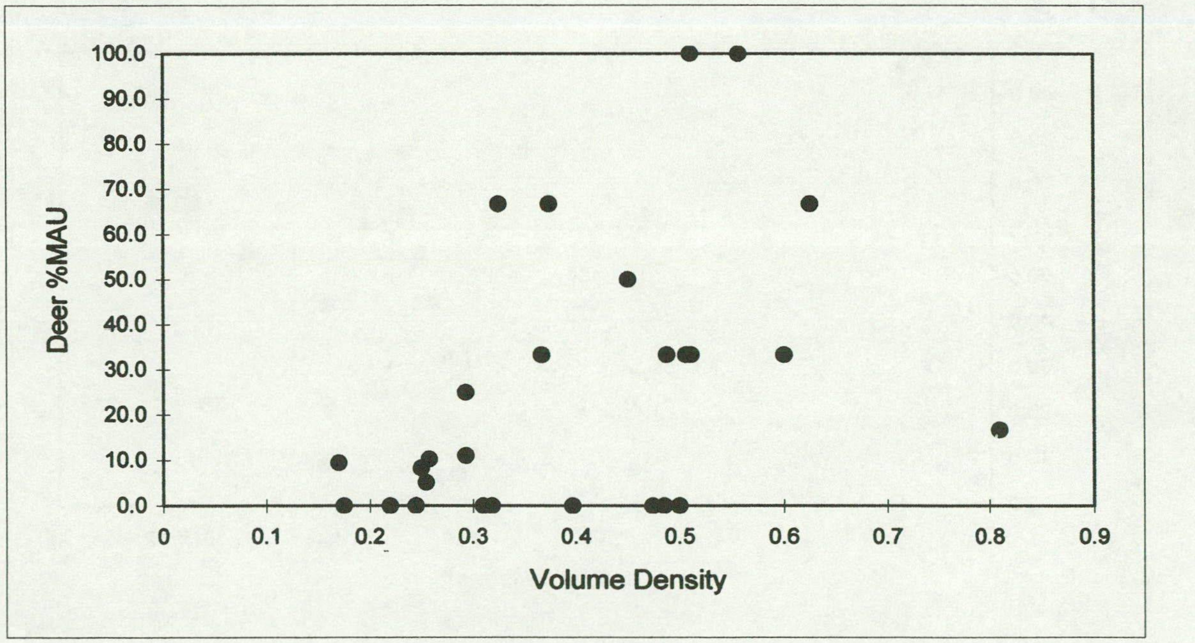

Figure 2. Scatterplot of deer element representation versus Lyman's (1984) volume density data for deer; %MAU = normalized Minimum Number of Animal Units.

Table 3. Comparison of deer and bison element representation with various utility indices; r_s = Spearman's rank-correlation coefficient, n = number of pairs, p = significance level.

Taxon	Index	r_s	n	p	Reference
Deer	Caribou Food Utility	-0.064	24	0.77	Metcalfe and Jones 1988
	Caribou Modified General Utility	-0.16	24	0.44	Binford 1978
	Caribou Meat	-0.12	24	0.55	Binford 1978
	Caribou Grease	-0.022	24	0.92	Binford 1978
	Caribou Marrow	0.19	24	0.37	Binford 1978
Bison	Bison Total Products	-0.54	23	0.0074	Emerson 1993
	Bison Total Fat	-0.46	17	0.065	Emerson 1993
	Bison Skeletal Fat	0.27	22	0.22	Emerson 1993
	Bison Marrow	0.76	17	0.00034	Emerson 1993

with destruction the primary factor producing the differences in element representation. Bison, in contrast, appear to have been at least partially butchered where they were killed, with only selected portions carried back to the site. This pattern reflects the "schlepp effect" (Perkins and Daly 1968), which holds that the larger the animal and the farther from the habitation site it is killed, the lower the proportion of the carcass that is carried back to the habitation site. Furthermore, the portions selected for transport are those with higher utility. At the Bell site the basis for the selection of bison carcass portions appears to have been marrow yield. Therefore, it is to be expected that bison bones at the Bell site will show evidence of having been systematically processed for marrow extraction.

Evidence of Systematic Marrow Extraction

The most immediately noticeable characteristic of the Bell site faunal assemblage is the extremely high level of fragmentation, despite good overall bone preservation. That is, the bones are thoroughly broken but are not falling apart. The largest single specimen is the distal half of a bison left radius, and

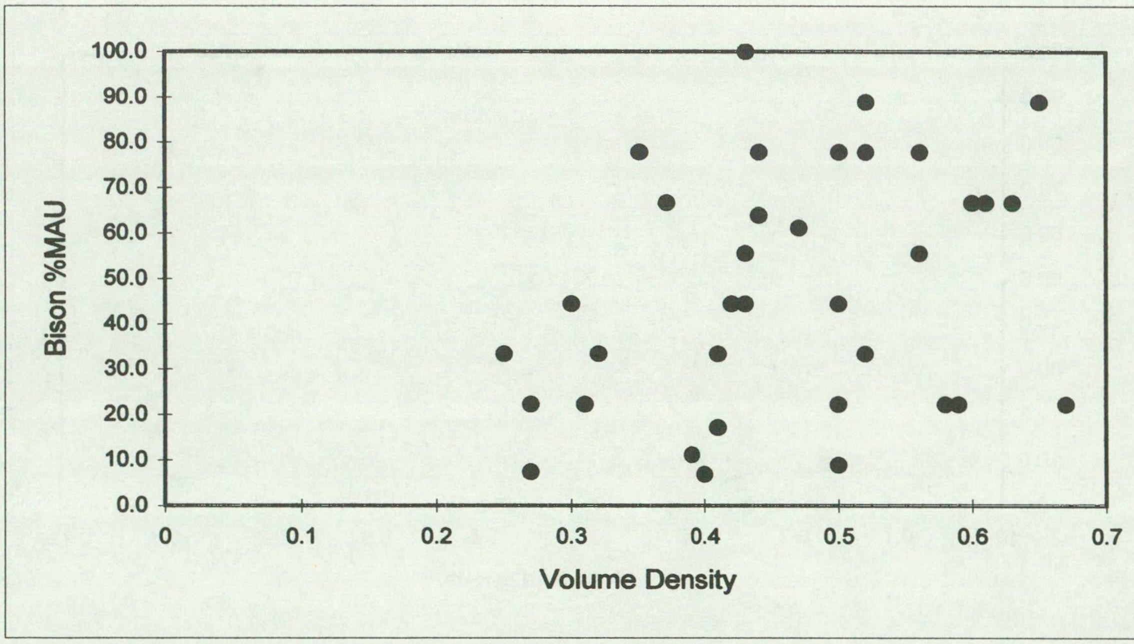

Figure 3. Scatterplot of bison element representation versus Kreutzer's (1992) volume density data for bison.

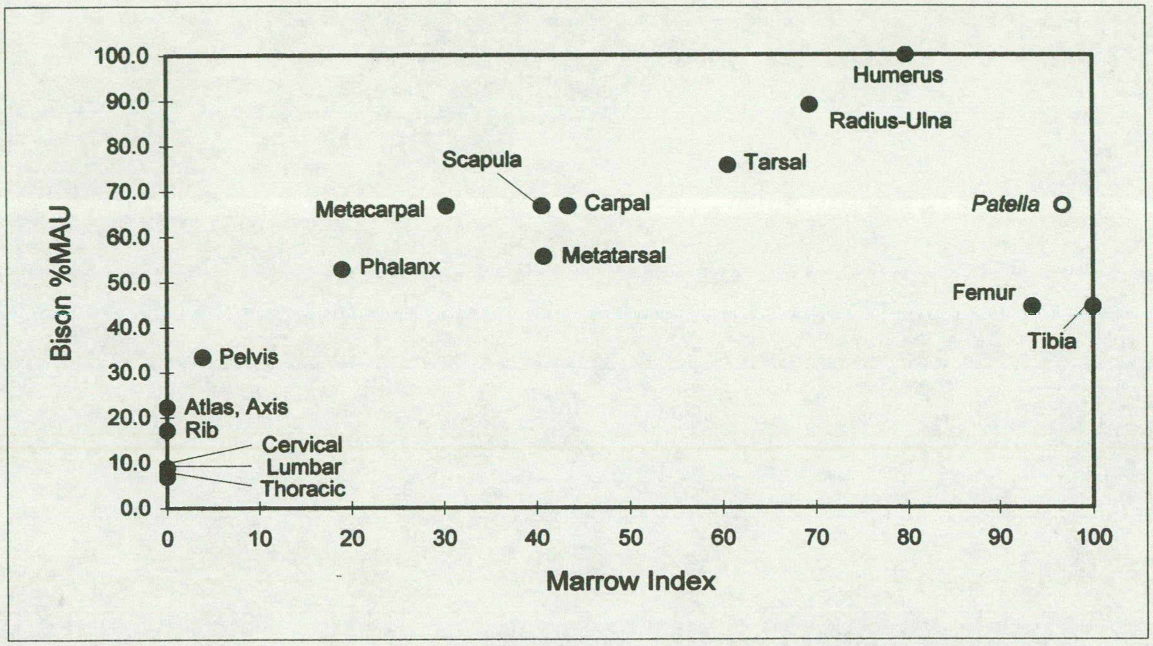

Figure 4. Scatterplot of bison element representation versus Emerson's (1993) Marrow Index for bison ([S]MAVGMAR).

the largest complete bone is a bison calcaneus. Despite this extreme fragmentation (particularly of long bones), a number of fetal bison bones were recovered, many unbroken or only slightly damaged despite their greater fragility. This, combined with the lack of other candidates for breakage and impact fractures on a number of specimens, is believed to affirm that the majority of bone breakage at the site was the result of human action.

Further support for this interpretation is a high level of regularity in the locations of breakage and the positioning of impact fractures. Figure 5 shows this regularity on four proximal radii. Distal humeri, distal tibiae, and proximal metapodials exhibit similar patterns. These high levels of regularity, particularly in the case of impact fractures, are interpreted as evidence of systematic marrow extraction rather than bone cracking subsequent and incidental to meat consumption. However, in the absence of experimental or ethnoarchaeological data relevant to marrow-related breakage of bison bone, this interpretation can only be put forth tentatively. Note that Enloe (1993) has presented relevant ethnoarchaeological data for caribou.

Season of Bison Mortality

Bison dentition frequently has been used to determine the time of year at which human activity occurred at a site (e.g., Frison and Reher 1970; Reher 1974, and others). This procedure is successful primarily when bison kill events are discrete and involve significant numbers of animals. Given the nature of 14CM407 as a habitation site rather than a kill site, the season of bison mortality cannot be assumed to disclose the entire period of human occupation. Instead seasonal patterns of subsistence may be accessible.

Unfortunately, the Bell site faunal assemblage does not include large quantities of material that provide clear indications of seasonality. The deer assemblage produced a single fragmentary mandible, the largely fragmentary teeth of which are well worn, precluding determination of seasonality. In contrast the bison assemblage did produce a few specimens with seasonal implications:

(1) A left mandibular second molar (M2) exhibits wear on cusps I-IV, with the remaining cusps (V-VIII) not yet in wear, revealing an approximate age of a little over 1.5 years. Since bison calving occurs almost solely in the spring, this age means that the animal died during the late fall or early winter (Reher and Frison 1980).

(2) A fragmentary mandible (Figure 6) exhibits a per manent second premolar, preparing to displace its deciduous precursor. The second premolar normally erupts between 2.3 and 2.8 years of age (Reher and Frison 1980). Therefore, this

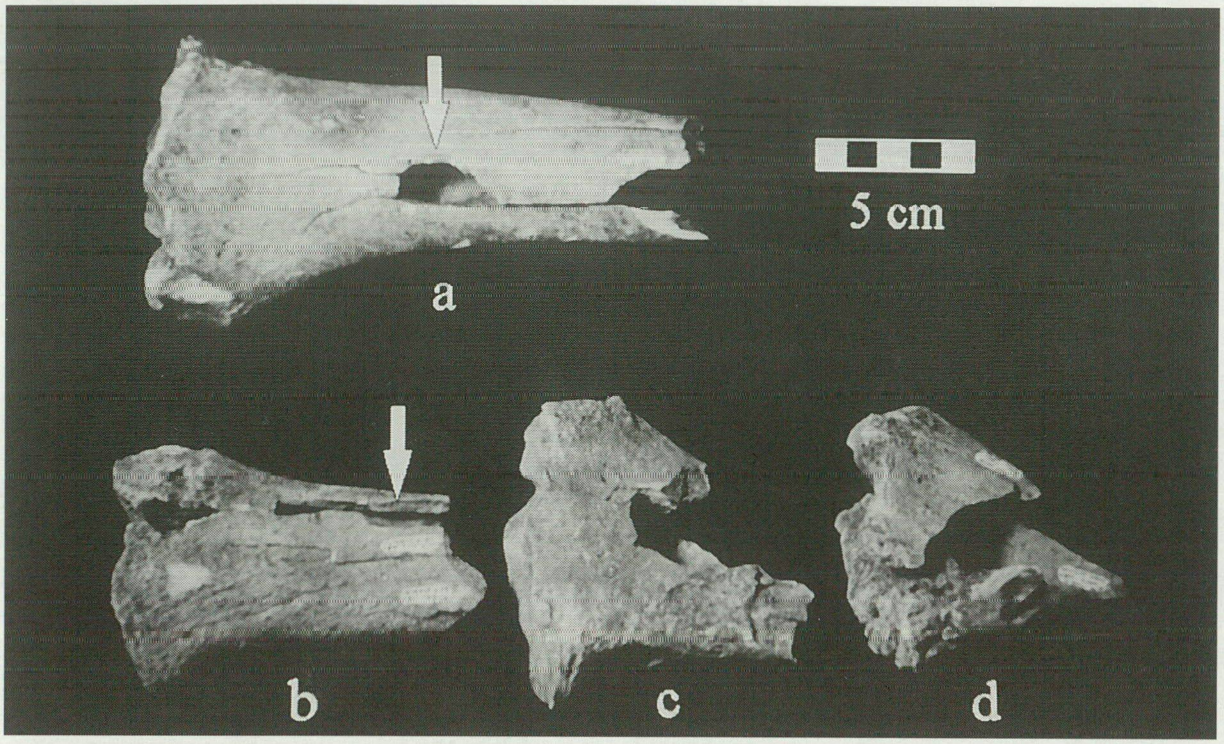

Figure 5. (a) Bison proximal right and (b-d) left radii, showing consistency of breakage. Arrows indicate locations of hammer impact.

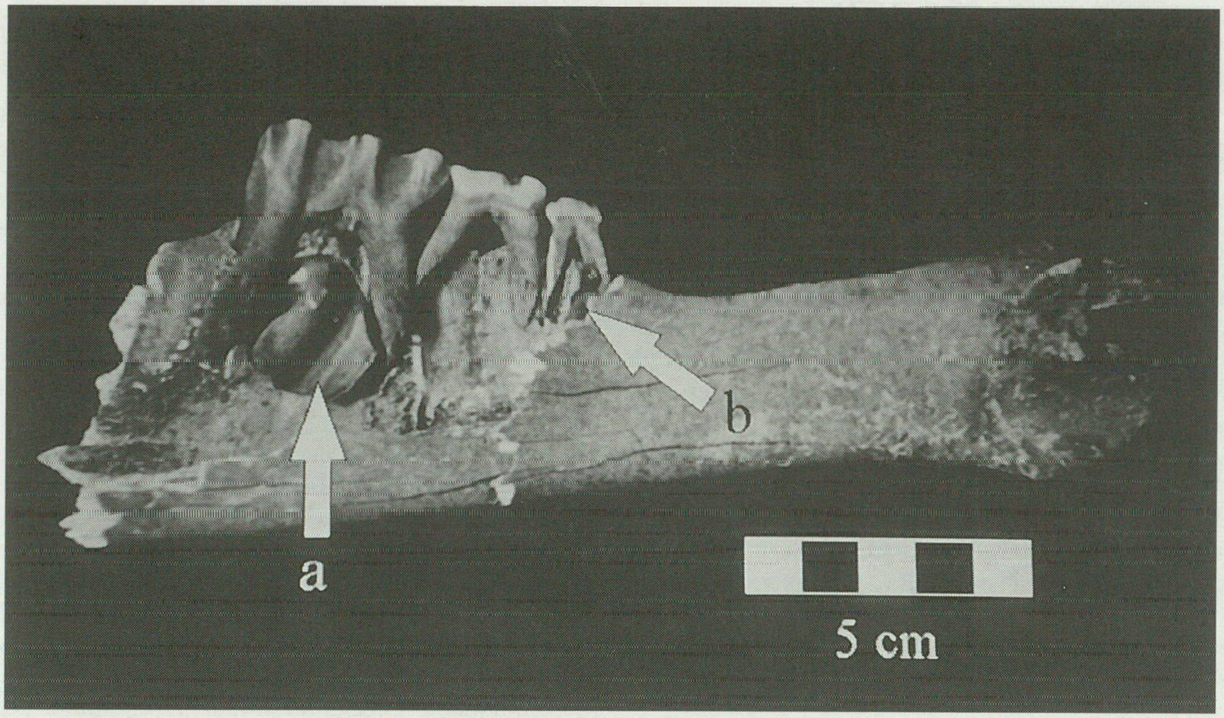

Figure 6. Fragmentary mandible of young bison, showing adult premolars developing below deciduous premolars. The fourth premolar (a) is clearly visible, while part of the second premolar (b) can just be seen at the edge of the break, and the third premolar is missing due to breakage. (Note: Bison do not possess a first premolar.)

mandible represents an animal probably between 2 and 2.5 years of age. This age corresponds to mortality between mid-spring and late fall.

(3) A significant quantity of fetal bison remains were recovered from the Bell site (Figures 7 and 8). Fetal remains tend to be indicative of winter or spring mortality, due to the spring calving period. Bison pregnancies occasionally do occur out of season (Frison 1974, 1991). In the case of the Bell site, the presence of at least two fetal bison and only three identified adult cows (see below) is argued to favor normal season pregnancies.

Taken in sum, these data do not present a definitive seasonal pattern. Season of mortality has been determined with varying levels of precision for at most four of the six or seven (see below) bison. Two of these appear to represent winter or early spring kills, and a third may be attributed to the late fall or early winter. The fourth could have occurred almost any time other than winter, although the variability of premolar eruption (Reher and Frison 1980) makes this last uncertain. The data imply a subsistence pattern in which bison hunting ooccurred primarily between late fall and spring, possibly with some, perhaps opportunistic, hunting during other seasons. This presumes a year-round occupation of the site. If instead the site was inhabited primarily between late fall and spring, possibly with some short-term occupation during other seasons, then bison hunting may have been a year-round activity. In order to determine which of these two possibilities was the case, more extensive and accurate determinations of site occupation seasonality and of bison mortality will be required. Possible avenues of research toward this end include cementum (the hard, bony tissue forming the outer layer of the root of a tooth) analysis and analysis of botanical remains. The first, by analyzing the full sample of bison dentition, would allow examination of the assertion made here of a focus on fall and winter bison hunting. The second would provide data regarding the seasonality of activities not related to hunting at the site, while providing additional subsistence data.

Bison Sex Distribution

The sex distribution of the bison remains from the Bell site was determined through the use of bivariate plots of bone measurements in which

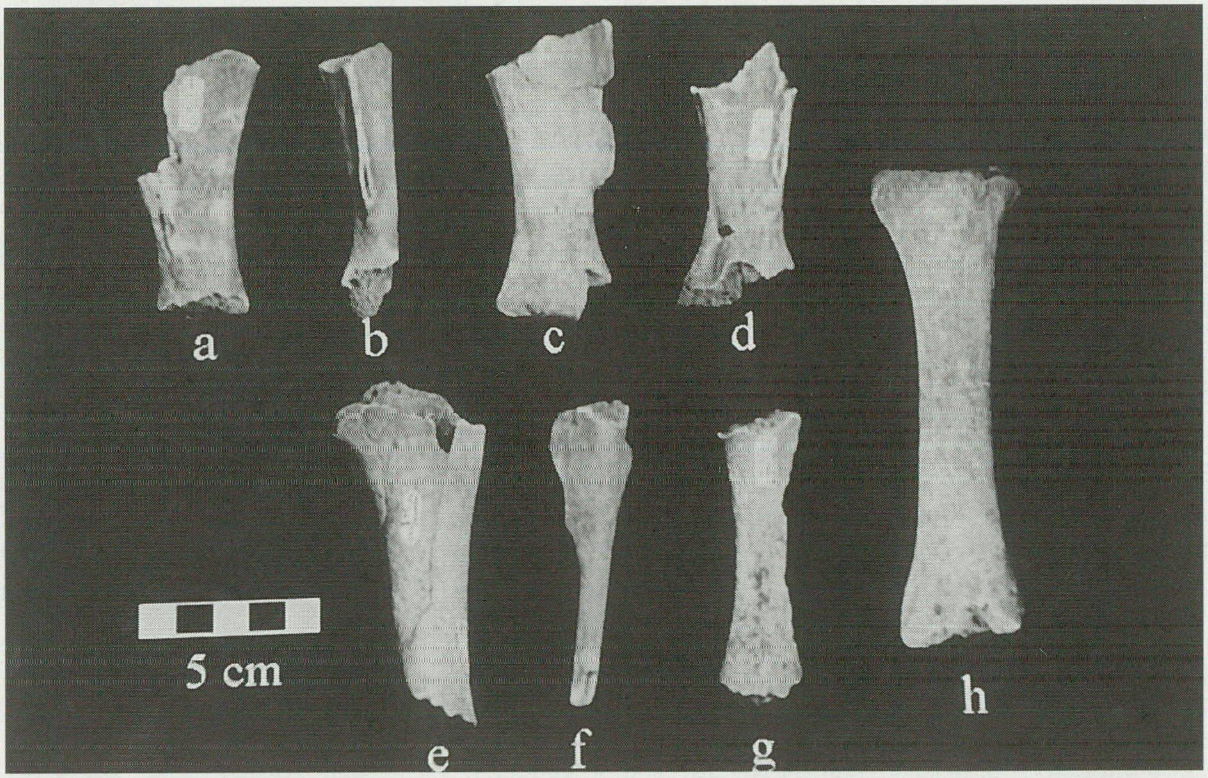

Figure 7. Fetal bison remains: (a-b) left scapulae, (c-d) right scapulae, (e) right humerus, (f) left ulna, and (g-h) radii.

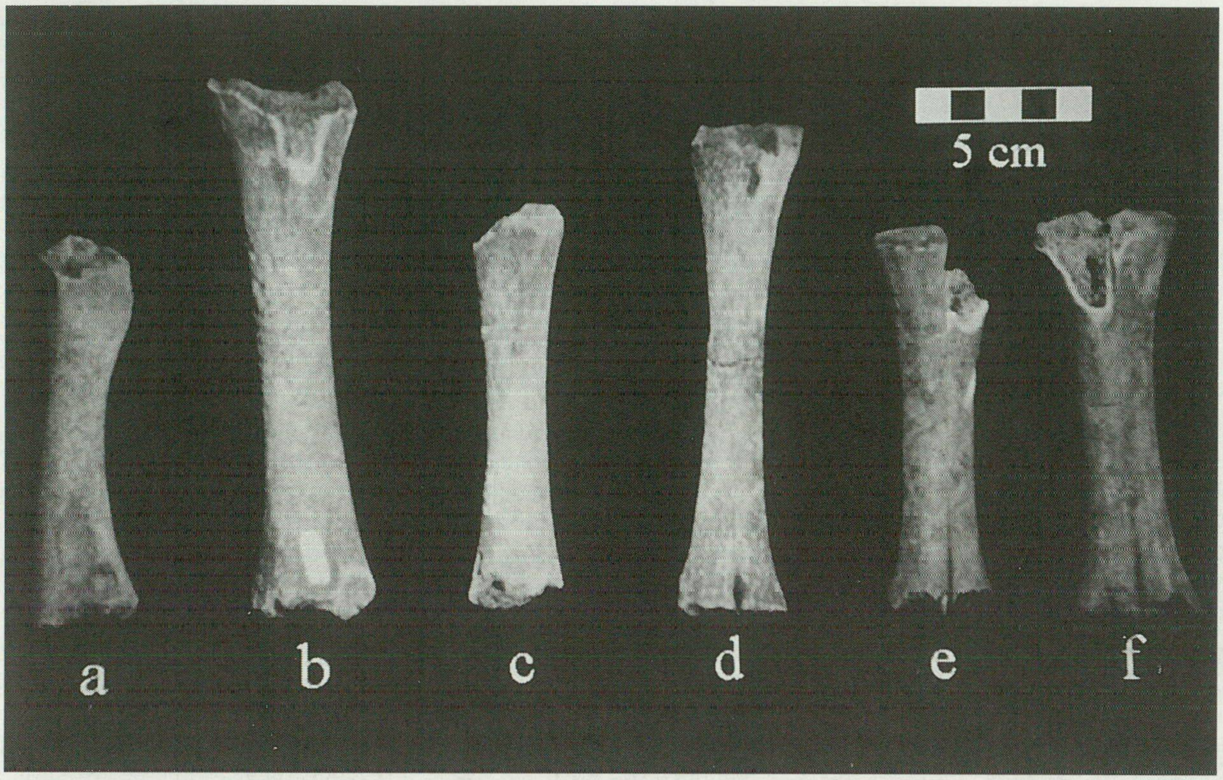

Figure 8. Fetal bison remains: (a) left femur, (b) left tibia, (c) right tibia, (d) metatarsal, and (e-f) metacarpals.

bimodal distributions reflect the high level of sexual dimorphism among bison. The highly fragmented nature of the assemblage places restraints on the number of elements that are useable for determining sex distribution. Only some of the carpals and tarsals, as well as distal humeri, are present in sufficient numbers and degrees of completeness.

Carpal and tarsal measurements, devised by Morlan (1991), allow the division of specimens into two groups: (1) bulls and (2) cows and calves. Cows and calves cannot be separated using carpal and tarsal measurements because, with the exception of the calcaneus, these bones do not exhibit characteristics of immaturity. Measurements on intermediate carpals indicate the presence of four cows or calves, while measurements on astragali suggest the presence of two bulls and probably a third.

Similar results are obtained from measurements made on distal humeri. Measurements HM7 (distal articular breadth) and HM14 (medial articular depth) (Todd 1986, 1987) are shown in Figure 9 with comparative data from modern specimens (Todd 1986). The results are insufficiently bimodal for division into bulls and cows, but comparison with the modern data allows reasonable gender assignments. The specimen that falls short of the range for cows has a distal epiphysis that is only partially fused and thus represents an immature animal, which cannot be sexed. Three specimens fall within the range of cows. Two specimens represent bulls, although one is slightly smaller than the comparative range for bulls and may not have reached its full growth. Additionally, a right distal humerus, which is represented only by the medial portion, has an HM14 measurement of 42 mm. This is above the comparative range for cows and thus may represent a third bull, supporting the astragali data.

These measurements indicate that, at a minimum, two bulls, three cows, and one calf are represented in the Bell site bison assemblage. A third bull is likely represented; if so, it would raise the non-fetal bison MNI for the Bell site to seven. Additional support for this possibility is presented by the measurements on fourth carpals. Although the bimodality for fourth carpals was not definite enough to separate bulls from cows and calves, measurements did suggest that the single right-side fourth carpal may not represent the same animal as any of the six left-side fourth carpals, assuming that the differences in size are real and not due to errors in measurement.

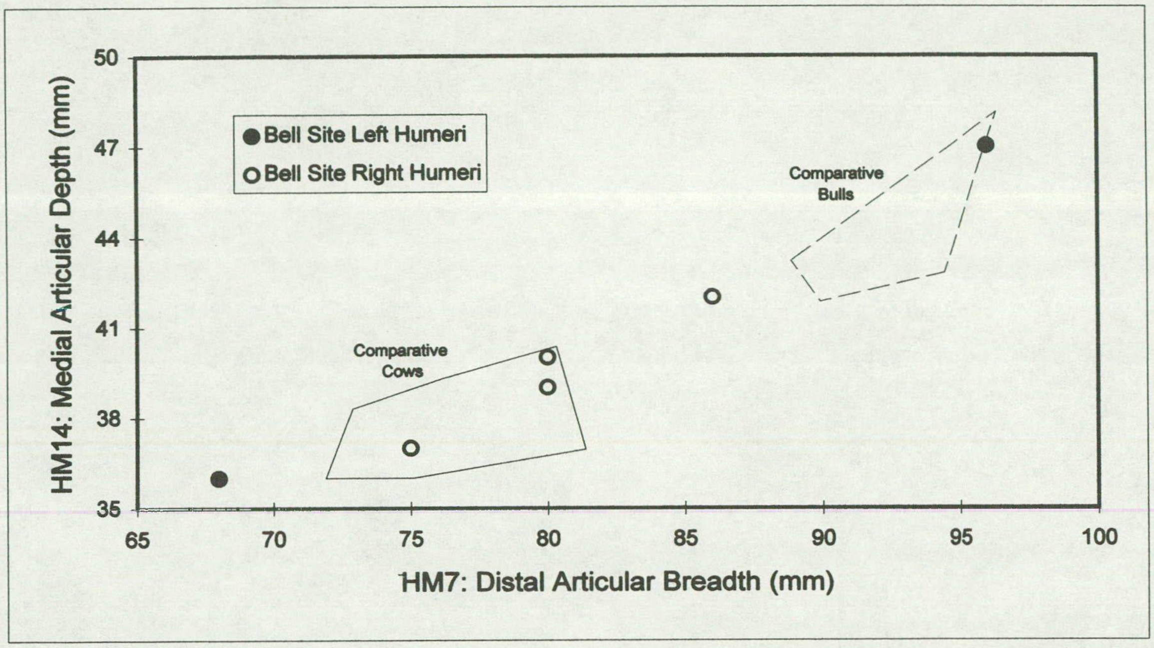

Figure 9. Bivariate distribution of bison distal humeri measurements; HM7 = distal articular breadth, HM14 = medial articular depth. Comparative data are from Todd (1986).

Bone Tools

The bone tool assemblage from the Bell site is relatively small. Rowlison (1985) reported two digging tools, but only one was identified in the extant collection along with a pin, a tool handle (Figure 10), and several scored or grooved ribs (Figure 11). The digging implement, pin, and handle are not unusual for the region or time period. The scored ribs are unusual only in that the grooves are typically on the broad face of the rib rather than on the edge (Rowlison 1985). The function of these objects is not yet known, though they may have functioned as musical rasps.

Fetal Bison

As noted earlier, the remains of a minimum of two bison fetuses are present in the assemblage. Assuming that the bison were, as appears likely, butchered at the location of the kill, the presence of the fetal remains at the site implies that a specific decision to transport the fetuses to the habitation site was made. This is not surprising since "fetuses . . . in addition to being considered a delicacy by many Plains groups, were valued for making soft bags and children's clothing" (Speth 1983:2).

Turtles

The remains of two turtles are present in the Bell site assemblage. It is not clear whether the turtles were part of the "background fauna" of the site or were brought to the site for food or other purposes. Some of the turtle remains are shown in Figure 12.

Comparisons with Other Sites and Complexes

The Wilmore complex has been described as being similar to the Bluff Creek and Pratt complexes (Rowlison 1985; Lees 1991) in Kansas and the Zimms (Lees 1991; C. Tod Bevitt, personal comm unication 1997) and Buried City (C. Tod Bevitt, personal communication 1997) complexes in Oklahoma. It may be useful, then, to compare the faunal assemblage from the Bell site with those from sites of these complexes. Unfortunately, analysis and reporting of faunal assemblages from these sites is highly variable, which limits the extent to which comparisons can be made. Resemblances with faunal assemblages from Central Plains tradition sites in central Kansas and southern Nebraska also will be examined.

Bluff Creek Complex

Some data regarding the faunal assemblages

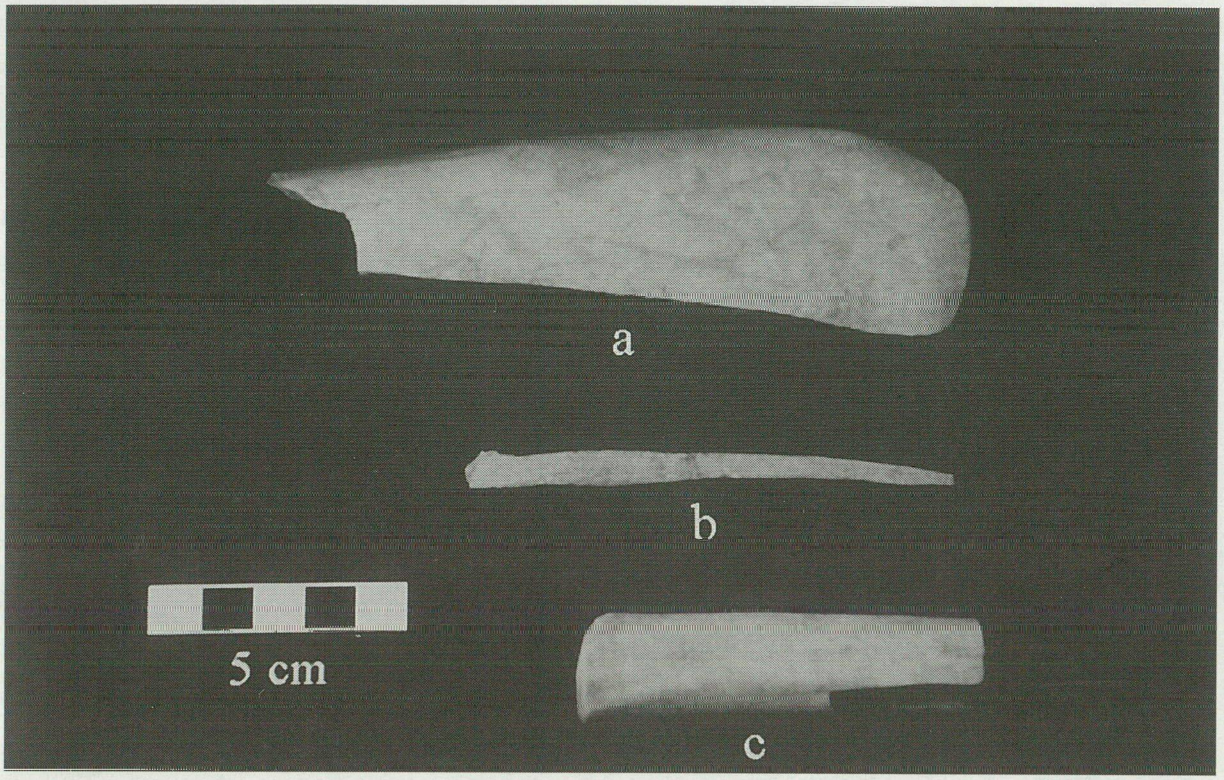

Figure 10. Bone tools: (a) digging implement, (b) pin, and (c) tool handle.

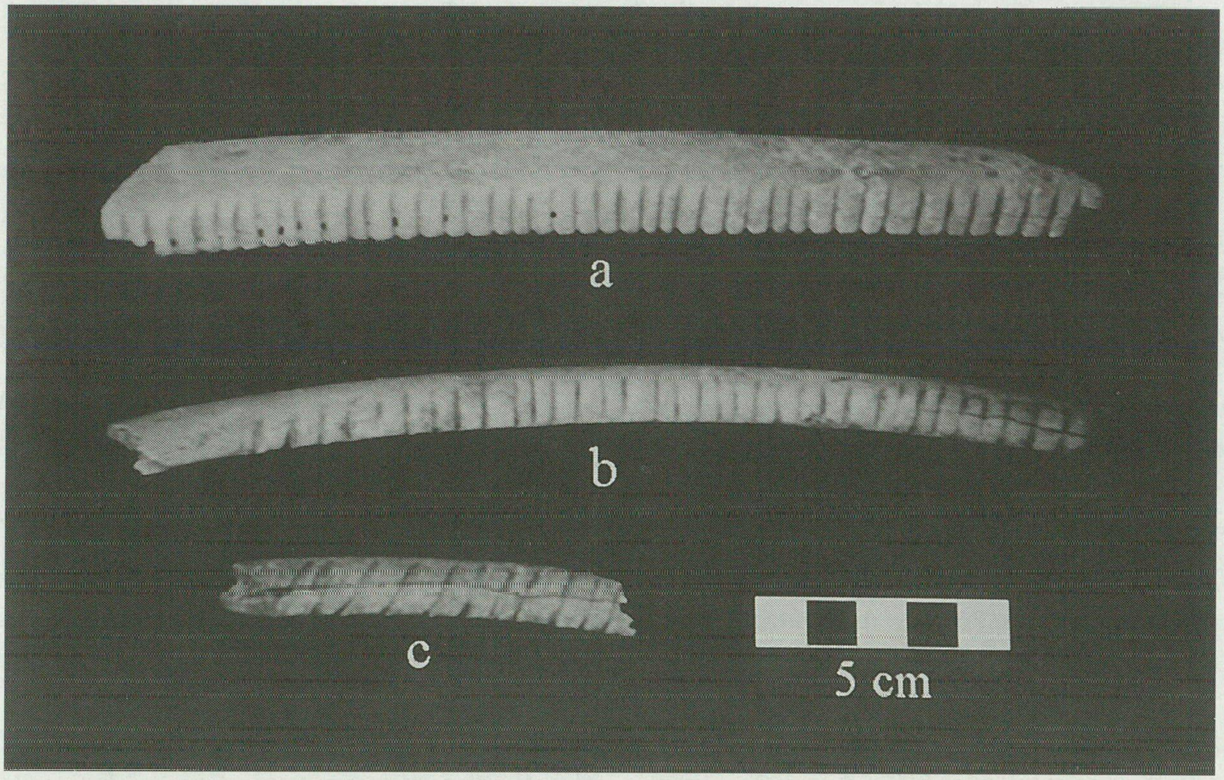

Figure 11. Sample of scored bison ribs. Small holes in (a) are insect burrows.

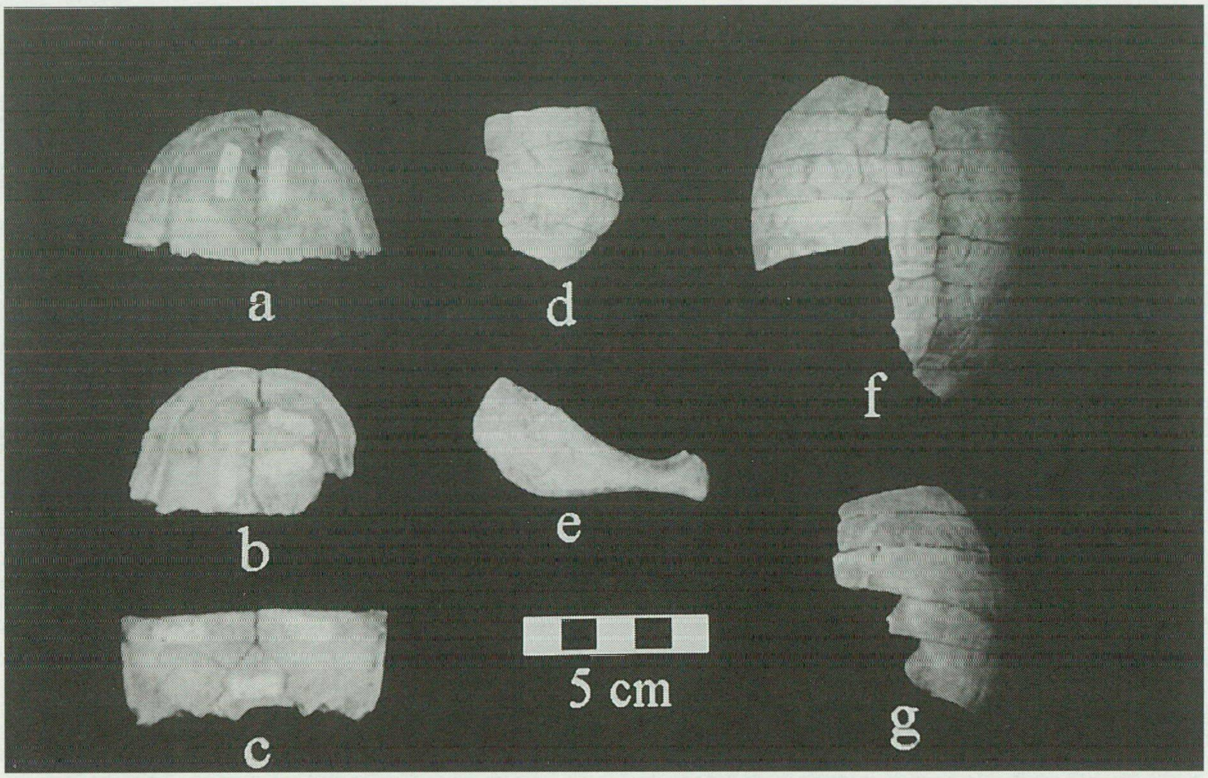

Figure 12. Sample turtle remains: (a-c) plastron fragments, (d, f-g) carapace fragments, and (e) scapula.

from the Armstrong (Gould 1975) and Buresh (Witty 1978) sites are available. As with the Bell site, bison bones dominated these assemblages. The Armstrong site also produced significant quantities of bird and turtle remains. Bone tools were far more common in these assemblages than in the Bell site collection. Both sites produced large numbers of bison scapula hoes and bone awls, along with other tools, including shaft-straighteners.

Pratt Complex

The faunal assemblages of Pratt complex sites are not well reported, but some information is available for the Larned (Monger 1970) and Seuser (Witty 1970) sites. The Larned site contained large quantities of bison and deer bone and small quantities of bird, fish, small mammal, and turtle remains. High levels of bison and deer bone breakage were interpreted by the excavator as indicative of marrow extraction. The Larned site bone tool assemblage included numerous awls, a needle, bird bone beads, scored ribs (with grooves on the broad surface), and other tools, but — as with the Bell site — no scapula hoes. The Seuser site, however, did produce a number of scapula hoes.

Buried City Complex

Very little information is available regarding the fauna from Buried City complex sites. Bone tools included bison scapula and skull hoes, digging sticks, deer metapodial awls, and deer mandible sickles (Brooks 1989). Thus, both bison and deer were hunted, but the importance of hunting in general, and of each species in particular, is unknown.

Zimms Complex

A limited amount of data regarding the faunal assemblage from the Zimms site was presented by Flynn (1984). Bison, deer, smaller mammals, and turtle remains were identified, but data regarding the relative representation of these species was very limited due to the extreme fragmentation of the specimens. The bone tools from the Zimms site comprised two awls, one bison tibia digging stick, and one bison scapula hoe, along with several tool fragments, including two that may have been scapula hoes.

Central Plains Tradition — Smoky Hill Phase

Brown (1982) presented a large amount of data on faunal assemblages from three Smoky Hill sites: Witt (14GE600), 14RY401, and Budenbender

(14PO4). Species represented were bison, deer, elk (wapiti), and pronghorn, as well as many species of smaller mammals, reptiles, fish, and birds. Deer, in particular, were heavily exploited. Marrow extraction apparently occurred routinely, although it is unclear whether this was a major focus of the butchering process. Bone tools included scapula hoes, scapula knives, tibia digging sticks, shaft-straighteners, tool handles of both bone and antler, awls, fish hooks, pins, a deer skull spoon, beads, bracelets, antler pressure flakers, and other miscellaneous bone and antler tools.

Central Plains Tradition — Upper Republican Phase

The faunal assemblage from the Hulme site in south-central Nebraska has been thoroughly analyzed by Bozell (1991). This assemblage consisted primarily of pronghorn and deer, while bison were nearly absent with the exception of scapula hoes. Such a pattern of assemblage dominance by smaller ungulates is unusual for Central Plains tradition sites, pointing out that considerable variation in the composition of faunal assemblages is to be expected. Numerous species of small mammals, birds, and reptiles were also present. The site probably was occupied during the summer and fall. As noted above, large numbers of bison scapula hoes were present, though no other data on bone tools was presented.

Discussion and Conclusions

The faunal data presented here have several implications for Wilmore complex subsistence. Bison and, to a lesser extent, deer provided the majority of the meat portion of the diet. Nonungulate species are rare in the Bell site collection, and even if present in higher numbers, would still constitute only a small fraction of the total quantity of meat. The importance of meat in the diet is unclear. Data regarding the role of botanical resources in the diet will be required to allow the formulation of a general model of Wilmore complex subsistence.

Bison apparently were hunted primarily between late fall and spring, coinciding with the times when plant resources were not readily available. Thus, meat became the primary component of the diet. Diets with extremely high levels of protein, however, are not healthy. In order to maintain health, a significant amount of the diet must consist of carbohydrates or fats (Speth 1983; Speth and Spielmann 1983). In those months when carbohydrate resources (plants) were not available, this portion of the diet had to consist of stored plant resources or of fat.

The dietary stress was greatest in the early spring, since bison that were killed had themselves been under great dietary stress and had depleted much of their fat reserves. The meat was very lean and provided insufficient fat. Furthermore, the fatty marrow also was depleted. As a result, stored supplies of fat would have been of particular use.

An interpretation of the Bell site bison assemblage, which is consistent with these circumstances, is as follows. Bison were killed in the late fall or early winter, when they were in relatively good condition. This was particularly true of the cows, which must have developed extensive fat reserves in order to survive the winter in good enough condition to carry a calf to term and then nurse it. The meat was removed from the bones prior to cooking, and the bones were broken systematically to extract the marrow. The marrow, along with other fat, was then stored, presumably in the form of pemmican. Hunting would have taken place at other times of the year, but the systematic processing of bones for marrow may have been restricted to the fall or winter kills. In any case it must be stressed that this is only a hypothesized bison utilization strategy, one that is consistent with the bison assemblage but not required by it.

The need to produce storable supplies of fat could be offset to an unknown degree by horticulture, which has the potential to produce storable surpluses. Whether horticulture was being utilized at a sufficient level for this by the inhabitants of 14CM407, at the site or elsewhere is unknown.

Relative to the sites discussed earlier, the Bell site faunal assemblage is not particularly unusual in terms of being dominated by ungulate remains, particularly bison. While some sites are dominated by deer or pronghorn rather than bison, these are in the minority. The limited representation of nonungulate remains at the Bell site is unusual, however. While it is possible, even probable, that some such remains were simply missed during the analysis, it is highly unlikely that enough were missed to account for the large differences between the Bell site and some of the sites just discussed. A more likely explanation is a recovery bias.

A very unusual aspect of the Bell site assemblage, relative to those discussed above, is the small collection of bone tools and particularly the absence of scapula hoes. Of the sites reviewed, only the Larned site (Monger 1970) produced no scapula hoes. Most of the other site assemblages contained large numbers of scapula hoes. For example, the Hulme site produced more bison scapula hoes than other specimens of bison bone (Bozell 1991).

Acknowlegments. This analysis resulted from the utilization of the Bell site faunal assemblage as a working sample for a zooarchaeology class, taught by Jack L. Hofman at the University of Kansas in the spring of 1997. I would like to thank Dr. Hofman for enabling me to continue working with the collection the following year and for providing advice and encouragement, both for this project and for archeology generally. Thanks are also extended to Tod Bevitt for his efforts in bringing me up to date on the current understanding of the Wilmore complex. Particular thanks are extended the Matt E. Hill, Jr., for reviewing a previous draft and correcting several errors in reasoning. Any remaining errors are, of course, entirely my responsibility.

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Book Reviews

At the Desert's Green Edge: An Ethnobotany of the Gila River Pima. AMADEO M. REA. University of Arizona Press, Tucson, 1997. xxviii + 430 pp., figures, tables, appendices, bibliography, index. $60.00 (cloth). ISBN 0-8165-1540-9. *Reviewed by* Jim D. Feagins, St. Joseph Museum.

At the Desert's Green Edge: An Ethnobotany of the Gila River Pima contains an encyclopedia of ethnobotanical knowledge gleaned from the Akimel O'odham (Gila River Pima). However, it is much more than simply a study of the tribe's ethnobotany. It contains a tremendous amount of linguistic information, careful documentation of environmental change, the Pima cultural ecosystem, Pima folk taxonomy of plants, past and present Pima dietary reconstruction, and interesting anecdotes on plant usage from the many Pima informants. The volume contributes ". . . to topics in epidemiology, ethnonutrition, archeology, linguistics, environmental history, natural resource management, conservation biology, and ethnology" (p. xvi).

After more than 30 years of research on the Gila River Indian Reservation, Amadeo Rea obviously has produced a work of love in this volume. By training, Rea is an ornithologist and ethnobiologist; however, the reader will soon discover that he has notable expertise in a number of fields. While this reviewer is certainly not an ethnobotanist and is not in a position to judge all the data found in the volume, it is clear that Dr. Rea's scholarship is superb. With its large (9-by-12-inch) format, small print, and many pages, At the Desert's Green Edge contains an impressive amount of information, written in an interesting and most readable manner. The volume's 117 plant illustrations were done by Takashi Ijichi, using the graceful sumi-e style of Japanese painting. A foreword is written by ethnobotanist Gary Paul Nabhan.

At the Desert's Green Edge is an emic approach to the basic ethnobotany, presented from the Akimel O'odhams' viewpoint. Rea has let the Gila River Pima people tell their story of the plants and how they were used. This information is then elaborated upon and compared with scientific botanical studies. Since there are many Pima names for plants and parts of plants in the volume, Rea worked with Culver Cassa, a linguist of Pima and Apache heritage, and 15 other Pima-speaking consultants, who were primarily responsible for supplying the floral information. One complete chapter is devoted to introducing and presenting background information on each of the Pima consultants. The information they supply includes ". . . a familiarity with patterns that one might consider in studies of biogeography, the phenology of flowers and fruits, the ecology of plant populations, the agronomy of drought-escaping crops, the horticultural tending of trees, the management of wildlife in hedgerows, the procurement of medicinal plants, and the fixing of dyes" (p. xvi).

Much knowledge about the natural world has been and continues to be lost by generations of Native Americans. However, "the old saw . . . that the Pima were already too acculturated or 'Coca-Colanized' to be able to offer much of anything fruitful about desert natural history" (p. xvi) is obviously not true. While much has been lost from the Akimel O'odham language, informants could still collectively identify and name 260 native plants, plus many animals. Retaining knowledge of plant taxonomy, they could explain what the plants were used for, what parts of the plants were used, how they were prepared, and when they were to be used.

At the Desert's Green Edge is a gentle tour de force on the ethnobotany of the Gila River Pima. The volume will stand as one of the hallmarks on the subject in the Southwest. It will be **the source** that one must consult. Also there is much of interest for researchers outside the Southwest. It will not only be of tremendous use to ethnobotanists and those in related fields, but present and future generations of the Akimel O'odham people will find the work invaluable.

One could easily overwork the superlatives when describing the research contained in *At the Desert's Green Edge*. It may be obtained through one's local bookstore or from the University of Arizona Press, 1230 N. Park Avenue, Tucson, Arizona 85719.

Surface Archaeology. ALAN P. SULLIVAN III, editor. 1998. University of New Mexico Press, Albuquerque. xiii + 183 pp., 76 illustration, 10 tables, references, index, contributors. $50.00 (cloth). ISBN 0-8263-1852-5. *Reviewed by* Jim D. Feagins, St. Joseph Museum.

Sullivan indicates that the purpose of this volume is to refocus attention on various aspects of surface archeology and its interpretive potential. All too often surface archeology itself is ignored or used to simply locate sites or as a basis to extrapolate from, suggesting where excavation within a site may be most productive. Not to diminish either of these important functions, the authors of this volume collectively contend that surface archeology in its own right may contain data capable of supplying important interpretive value when properly collected and manipulated. They maintain that in the past surface archeology was often assumed to be unimportant, and as a result its potential, or at least its full potential, usually was unexplored. Sullivan states, "If indeed there are limitations in the interpretive value of surface archaeological phenomena, then those limitations need to be demonstrated analytically rather than simply assumed" (p. xii). Furthermore, it was pointed out by several of the authors that the subsurface levels that we all value so highly had to start somewhere — of course, as former surface deposits — and they were also once subject to the cultural and natural events and processes that can occur on and near the surface.

Written by professional archeologists for professional archeologists, the volume would be trying for most general readers to navigate. *Surface Archaeology* is written by 14 authors and contains a preface plus 11 chapters divided into five parts. Most authors use case studies as examples to support various contentions concerning the nature and usefulness of surface archeology. The papers point out that there is not nearly enough time and funding to excavate more than a few of the many sites that can more easily be studied, by various methods, from surface information. The surface data can usually be obtained at a fraction of the cost of excavation and can cover a wider spatial area. We are all readily aware of the many problems inherent with using surface archeological data. However, the authors maintain that much serious, useful archeological information often can be gleaned from the surface and that this type of information has generally been underused in the past.

Part I: "Surface Archaeology of Landscapes" contains two chapters "The Value of Surface Archaeological Data in Exploring the Dynamics of Community Evolution in the Middle Ohio Valley" by William S. Dancey and "Landscape Element Configuration, Lifespace, and Occupation History: Ethnoarchaeological Observations and Archaeological Applications" by LuAnn Wandsnider. Dancey discusses various circumstances leading to the formation of the surface archeological record and how a study of surface (including plowzone) material is an absolute necessity for our understanding of how settlement patterns in an area evolved through time. He illustrates how surface-exposed distributions not only provide necessary augmentation to the excavated data but in many cases also can stand alone. His case studies of surface and plowzone materials are from central Ohio. While plowing certainly disturbs sites, Dancey states, ". . . these postdepositional processes are demonstrable and, therefore, can be evaluated empirically to determine their effects on a specific deposit" (p. 16). Wandsnider uses a study of modern nomadic herders in southwest India to help explain the complexities of the surface archeology of pastoral sites in the area.

Part II: "Surface Archaeological Data and Prehistoric Settlement Dynamics" is divided into three chapters — "Surface Archaeology and Site Organization: New Methods for Studying Urban Maya Communities" by Michael P. Smyth; "Inferring Activities at Middle Woodland Earthworks with Surface Archaeological Data" by Robert P. Connolly and Alan P. Sullivan III; and "The Surface Archaeology of Classic Period Hohokam Community Organization" by James M. Bayman and M. Guadalupe Sanchez. Smyth uses surface archeology to question the concept that monumental Mayan architecture is always associated with urban elite residences. Controlled surface collections at Sayil were used to demonstrate that the architecture of ". . . settlement layout does not necessarily equate directly with settlement function" (p. 56). Connolly and Sullivan demonstrate through surface data that extensive domestic habitation is present at the large Fort Ancient earthwork, which has traditionally been considered a vacant ceremonial center. Bayman and Sanchez document the huge spatial organization of the Classic Period Hohokam political economy. They demonstrate the usefulness of several methods for manipulating the data from surface archaeology. They argue that surface assemblage data is absolutely imperative to understanding communities and their organization in large-scale social formations.

Part III: "Surface Data, Subsurface Data, and the Reconstruction of Depositional Histories" contains two chapters — "Coming Full Circle: Plowzone Assemblages and the Interpretation of Fort Ancient Settlement Structure" by Rebecca A. Hawkins and "The Reliability of Surface Artifact Assemblages as Predictors of Subsurface Remains" by Christian E. Downum and Gregory Burrell Brown. Hawkins presents an excellent case study, which shows that the contents of the plowzone supplied data, obtainable from no other source, crucial for the reconstruction of a Fort Ancient village — the Horseshoe Johnson site. Downum and Brown demonstrate that certain Hohokam artifact classes from the surface sometimes do and sometimes do not reflect (in predictable ways) their abundance in the subsurface. They examine the relationship between surface and subsurface archeology by using a statistical comparison of various types of artifacts.

Two chapters are found in Part IV: "Surface Archaeological Phenomena and Archaeological Methodology." Kenneth L. Kvamme authors "Spatial Structure in Mass Debitage Scatters," and Alan P. Sullivan III and Anthony S. Tolonen wrote "Evaluating Assemblage Diversity Measures with Surface Archaeological Data" Kvamme investigates models that relate to the origins of archeological surface phenomena. His research concerning the factors that influence debitage size-sorting and the formation of large artifact scatters should be read by all researchers interested in surface archeology. While some of the conclusions to his experimental distribution pattern studies may be questioned and are perhaps overly simplistic, they should be thought stimulating. Tolonen and Sullivan explore assemblage variability in relation to sample-size richness or the number of discrete artifact types. The authors use different diversity indices to measure assemblage variability.

The last part, Part V, is titled, "Global Significance of Surface Archaeological Phenomena." It also contains two chapters — "Exposed Fragments, Buried Hippos: Assessing Surface Archaeology" by Alan H. Simmons and "Surface Archaeology: Perceptions, Values, and Potential" by Joseph A. Tainter. This part relates to how the perception of the value and usefulness of surface archaeology greatly affects the way we manage our cultural resources. Simmons presents examples of when small sites (those often thought of in the past as "unpromising") can greatly affect our models of regional prehistory. This realization can help prepare professional archeologists and government officials to better meet the needs of Cultural Resource Management ". . . mandates requiring the examination of a sample of all ranges of cultural materials . . ." (p. 165). Simmons presents examples from Cyprus, Jordan, and Chaco Canyon in New Mexico.

Tainter does a fine job of arguing that our concept of what is an appropriate subject for archeological research influences our evaluation of a site's investigative potential. These concepts (minor paradigms, if you will) are perpetuated by educational and governmental institutions. A greater understanding of how surface archeology can be utilized will cause us to reevaluate the research potential and in turn the increased significance of various sites. Certain of our educational institutions and government agencies should not automatically ignore the information that (with appropriate studies and methods) potentially can be obtained from surface and plowzone contexts.

The authors of these 11 chapters have built a compelling argument (supplemented with the use of case studies from many regions of the world) that surface archeology can and often does provide useful data for certain types of significant archeological research. While surface (including plowzone) archeology has its problems, it is clear that this type of data should not automatically be ignored or disregarded. Archeologists have traditionally focused on the most conspicuous and patterned remains of the archeological record, while shunning the predominant, scattered, surface materials within both small and larger sites. The volume's authors have established that these deposits can be quite educational. Sullivan states, "At the least, *Surface Archaeology* will have had an impact if it simply inspires archaeologists to reflect upon how they might employ this historically abused, though primary, source of data in their research" (p. xiii). This volume may be ordered through your local bookstore or directly from the University of New Mexico Press, 1720 Lomas Blvd. NE, Albuquerque, New Mexico 87131-1591.

Frauds, Myths, and Mysteries: Science and Pseudoscience in Archaeology. KENNETH L. FEDER. 1998 (third edition). Mayfield Publishing Company, Mountain View, California. 304 pp., illustrations. $20.95 (paper). ISBN: 0767404599. *Reviewed by* Marlin F. Hawley.

Kenneth Feder's book *Frauds, Myths, and Mysteries*, now in its third edition, is well on its way to becoming a venerable classic of popular exposition in archeology. With lucid, engaging writing, Feder, an archeologist at Central Connecticut State University, debunks many of archeology's hoary myths and frauds and demonstrates that human prehistory is always interesting and exciting enough without the need to invoke ancient astronauts, psychic archeologists, fossilized giants, errant Norsemen, or other such nonsense. For the third edition, text and references have been updated and new material has been added to virtually every chapter. Even chapters that remain largely intact from earlier editions partake of the latest available research.

The book is divided into 12 chapters. Chapter 1 introduces the topic of pseudoscience, especially in archeology, though Feder presents a long list of books skeptical of "fringe" claims regarding everything from Bigfoot and the Loch Ness monster to crystals and medical "quackery." This is the most personal chapter, as the author relates his initial belief and excitement in fringe claims. There are probably a good many archeologists who read the works of von Daniken or others of the genre in their formative years, only (hopefully) to discard errant beliefs as their knowledge and powers of reasoning increased. Feder presents the results of surveys conducted in 1984, 1994, and 1998, asking college students about the validity of claims about "ancient astronauts," "King Tut's Curse," and the "Lost Continent of Atlantis." Belief in extraterrestrial visitation à la *2001: A Space Odyssey* or *The X-Files* peaked in 1994, when more than 10 percent of the students polled (in Feder's introductory archeology course) accepted it as highly likely. Belief in the curse alleged to surround the opening of Tutankhamen's tomb has remained generally in the 2 to 5 percent range. Atlantis fares better with belief in the 5 to 10 percent range. (And students are not the only ones who accept fringe claims as fact. A friend of mine once encountered a professor of biology at a Midwestern university who was convinced that a thermonuclear war had been fought on Earth 30 million years or so ago [by whom, he didn't say]. He believed that paleontologists and geologists routinely cover up the supporting evidence.)

Chapter 2 briefly covers the epistemology of science or the "how we know what we know." The chapter reviews the basics of science, especially the historical sciences, where the object(s) of study are processes or events that occurred in the past. Paleontology, astronomy, geology, evolutionary biology, and archeology are examples of historical sciences. The chapter relies heavily on a deductive approach to science, leaving little or no room for induction. Overall, it would be a chapter to recommend to the Kansas Board of Education, which recently repudiated evolution and Big Bang cosmology.

Chapters 3 through 11 cover historical and current controversies. These include reviews of the Cardiff Giant, Piltdown, the recent Native American backlash against archeological models of the human settlement of the New World, the alleged movements of Vikings, Welsh, Romans, Chinese fishermen, and others in the New World, the myth of the moundbuilders, Atlantis (and Mu), ancient astronauts, psychic archeology, and New Age mysticism. Along the way, Feder also touches on the emerging assault on science by the "academic left" and the claims of the "Afrocentrists." The claim of the "academic left" is that all science is nothing more than the social production of myth. While no one doubts that the social milieu of a scientist affects his or her work, such claims go too far. Testing and verification of data is a critical element of science and as such ultimately underscores the simplistic nature of such sweeping statements. The Afrocentrists, on the other hand, assert that Western art, science, and philosophy owe everything to Africa. The ancient Hellenes, having invaded Africa, are argued by the Afrocentrists to have appropriated it all and, like any respectable conquerers, presented these things as their own.

Ultimately, it is not that claims of E.T.'s stopping over for a picnic on planet Earth or of a Welsh prince and his followers settling into the Northern Plains are inherently false. They are not per se. What is necessary, though, is a careful consideration of the evidence. The evidence, so-called, for many fringe notions, when dispassionately examined, frequently is found to be seriously wanting. It is easy enough to assert, for instance, that every New England rock with a line on it represents an Ogamic (Celtic) inscription or that certain ancient-appearing sites such as Mystery Hill are evidence of an extensive Hiberno-Celtic exploration and settlement of northeastern North America, but the evidence must be considered. Epigraphers versed in Ogamic (and other ancient European languages) have analyzed the numerous inscriptions reported by Barry Fell (*America B.C.*) and found them to bear no resemblance to the many genuine inscriptions found in western Europe. Many inscriptions are fake; in the immediate post-colonial period Americans were enamored of the antiquities of Europe and the Near East and sought the remains of ancient civilizations on this continent. When none were immediately apparent, some simply resorted to fabricating the evidence. Tangible examples include the Cardiff Giant, the Newark Stone, and the Davenport Stones. The myth of the moundbuilders was the consequence of this need for an ancient past. But aside from the apparent paucity of genuine inscriptions and the evidence for outright fraud in some cases, a more important question comes to mind: where is the artifactual evidence? If there was a substantial Celtic presence in North America, there should be more than the occasional inscription. There should be kitchen middens, burials, pottery, stone and metal tools, the remains of boats, and so forth. Believers point to the architectural resemblances between sites like Mystery Hill and sites scattered across the British Isles and western Europe. Architectural similarities are not enough, however. Mystery Hill looks like an early Celtic structure because the architectural traditions of which it is a part were long-lived. Even into the colonial period, some types of structures in Great Britian and, hence North America, were constructed in similar fashion to much more ancient buildings. The excavations conducted at Mystery Hill attest to this survival of traditions: the site has yielded only colonial or post-colonial artifacts.

Each chapter ends with a brief discussion of current perspectives on topics such as the peopling of the Americas or on the genuine Viking site of *L'anse aux Meadows* in Newfoundland. Chapter 12 presents some real mysteries such as the "Ice Man" (the mummy from the Tirolian Alps), the world of the Paleolithic cave artists, the development of Mayan civilization, and Stonehenge — yet to be fully understood by archeology. Any archeologist could add a score of further examples, for upon close examination, there is precious little that is known about many aspects of the past. Throughout the book, Feder lists websites for those interested in exploring the issues discussed on the World Wide Web; the book has an extensive, up-to-date bibliography for those who still prefer the lure of paper to cyberspace.

Kenneth Feder and Mayfield Publishing should be roundly applauded for this cleanly written, tightly edited, attractively designed book. Although designed for use in introductory college courses, *Frauds, Myths, and Mysteries* is a very approachable book and should have broad appeal for all lay, amateur, or professionals interested in archeology and the way it is presented to and perceived by the public. In the end, while this and other books like it valiantly wage war against folly, people will probably believe what they want to believe. After all, against ignorance, the gods themselves are said to contend in vain. Still, it is better to light a candle or two than to curse the darkness.

Other recommended titles are *Lost Tribes and Sunken Continents* by Robert Wauchope and *Fantastic Archaeology* by Stephen Williams. Recommended websites are:

- www.anthropology.ccsu.edu/fraudsweb/frauds.htm (link to Kenneth Feder's book *Frauds, Myths and Mysteries*)
- www.ameranthassn.org/98pilwin.htm (American Anthropological Association's Annual Piltdown Award for Pseudoscience in Anthropology. The 1998 winner was *The X-File*'s Chris Carter for the movie "Fight the Future," in the early minutes of which we are treated to a heavily glaciated north Texas, apparently inhabited by ice cave-dwelling aliens and Neandertaloid Native Americans 35,000 years ago!)
- www.usd.edu/anth/cultarch/cultindex.html (Larry Zimmerman (UIowa) and Richard Fox's (USouth Dakota) "Fantastic Archaeology" website, subtitled "Lost Tribes, Sunken Continents, and Ancient Astronauts")
- www.swanet.org/anti.html (Southwestern Archaeology website with link to various pseudoscience websites)
- www.lawrence.edu/dept/anthropology/classics.html (Lawrence University website with examples of pseudoanthropology)

Errata

Jane R. Hanks has submitted a note concerning her article, "Response to the Blackfeet Community College Students," in Volume 18, No. 2, of *The Kansas Anthropologist*. On page 73, she stated, "Lucien Hanks' original notebooks are in Ottawa, Canada, in the National Museum, which made the first request."

Dr. Hanks has informed the editor that all the original notebooks of Lucien M. Hanks, Jr., with the data recorded among the Siksika Blackfoot of Gleichen, Alberta, during the years 1938–1941 are no longer in the National Museum in Ottawa. They are now in the Canadian Museum of Civilization, 100 Lawrence Street, P.O. Box 3100, Station B, Hull, Quebec, J8X 4H2, Canada. Inquiries may be made to the attention of Mr. Benoit Theriault; telephone (819) 776-8431; fax (819) 776-7055; e-mail benoit.Theriault@civilization.ca

Dr. Brad Logan has provided a clarification in regard to "Surface Survey in the Clinton Lake Area, 1991-1996" by Daryl Walters and John Peterson, which appeared in Volume 19 of *The Kansas Anthropologist*. On page 87, regarding the Hatcher site (14DO19), the authors state: "Logan (1987) did extensive further testing. Of the sites he tested, he considered 14DO19 to be the best prospect for the National Register of Historic Places but did not recommend it for the register."

According to Logan, this is not the case. Hatcher was one of two sites recommended for the National Register of Historic Places. The other was Richland (14SH101). In the reference cited by Walters and Peterson, Logan states this quite clearly on pages 76 and 272. Pages 274–275 are devoted to research problems that might be addressed during any future investigation at the site.

About the Authors

Joseph E. Beaver
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Joseph E. Beaver is a 1998 graduate of the University of Kansas. He is currently pursuing a master's degree at the University of Tulsa. His interests include the North American Plains, Paleoindians, the Epipaleolithic of the Near East, and zooarchaeology.

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Tod recently completed his M.A. research at Wichita State University; the paper published in this volume represents the results of his thesis. He is currently employed by the Kansas State Historical Society as a Special Projects Archeologist. His research interests include ceramic technology and lithic resource procurement during the Late Prehistoric period on the Central/Southern Plans border.

Jim D. Feagins
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Before Jim became an Archaeological Research Associate with the St. Joseph Museum, he served in the same capacity with the Kansas City Museum (1976–1990). Concurrently, he taught science in the Grandview, Missouri, public school system for thirty years, retiring from that profession in 1995. He received a B.S. degree from Kansas State University at Pittsburg in 1965 and a M.N.S. degree from the University of Oklahoma in 1973. Active in promoting archeological education, he is President Emeritus of the Missouri Archaeological Society. He also has served as president of the Kansas City Archaeological Society and is currently vice president of the Missouri Association of Professional Archaeologists. Jim is a life member and has served as a vice president of the KAA. His current areas of research interest are historic (Native American) archeology and the prehistory of the eastern Central Plains with a focus on the ceramic periods.

Marlin F. Hawley
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Marlin Hawley is a Senior Archaeologist for the Museum Archaeology Program, State Historical Society of Wisconsin in Madison. He is a member of KAA and in 1992 instituted the ongoing series of reminiscences from senior Great Plains archeologists that have greatly enriched *The Kansas Anthropologist*.

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