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The KANSAS Anthropologist
Journal of the Kansas Anthropological Association

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Experiments in the Heat Treatment of Florence A Chert: A Preliminary Report

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The Kansas Anthropologist 22:1-13

The Archeology Office of the Kansas State Historical Society investigated portions of eight large Lower Walnut focus sites near Arkansas City, Kansas. The presence of large quantities of Florence A or Kay County chert, most in thermally altered form, on these sites attests to both the importance of the stone itself and of heat treatment as an integral part of its procurement and reduction into stone tools. Utilizing a Lithic Technology class conducted as part of the 1994 Kansas Archeology Training Program field school at the Killdeer site (14CO501), concurrent exploratory investigations were made at 14CO5, one of the large aboriginal Florence A quarries. Some of the freshly quarried stone was then used for experimental heat treating, both during and after the 1994 project. These experiments suggest a feasible heat treating strategy and document aspects of the physical and chemical changes that this chert undergoes when it is subjected to controlled heat in the 500 to 600° F (ca. 300° C) range for extended periods. Several as yet unanswered questions are posed by the current experiments.

From 1994 through 1996 the Archeology Office of the Kansas State Historical Society conducted large scale salvage investigations of sites near Arkansas City in south-central Kansas. The focus of the work was a complex of eight sites of the Lower Walnut focus of the Great Bend aspect, located on the east edge of Arkansas City in an area that was subject to disturbance by levee and highway construction projects. The Great Bend aspect is an archeologically defined culture that is inferred to be the material remnant of Wichita Indian villages and dates from Late Prehistoric into Historic times (see Wedel 1959; Vehik 1992). Based on radiocarbon dates, artifact inventories, and historical sources, the Great Bend aspect ranges in age from approximately A.D. 1400 to perhaps as late as A.D. 1700 (Stein 2003). Chipped stone artifacts and debris from their manufacture were encountered in great numbers during the work. This paper addresses one aspect of the lithic inventory from these sites, that of thermal alteration or heat treatment of chert.

The Lower Walnut sites have a chipped stone inventory dominated by a single source of raw material. While several cherts are represented in the overall collection, Florence A or Kay County chert accounts for more than 95 percent of all chipped stone tool and debitage classes. Florence A chert is a distinctive gray, banded, fossiliferous chert. It occurs as nodular layers within the Florence Limestone member of the Barneston Limestone formation of the Chase group of the Lower Permian, Gearyan stage deposits in an area that has been identified as the southern portion of the Flint Hills Upland in Kansas and northern Oklahoma. From



Figure 1. Harry Kimball and Martin Stein excavated a unit at the Maple City Quarry during the 1994 Kansas Archeology Training Program field school.

Arkansas City the closest major source of Permian chert is about 14 miles to the east in an area roughly bracketed by the towns of Maple City in Cowley County, Kansas, and Hardy in Kay County, Oklahoma. This is a locus for a particular variety of Florence chert, labeled informally as Kay County flint and more formally as Florence A chert (Bass 1929:76; Sudbury 1971; Haury 1979, 1981).

In this same two-county area are located some of the most extensive prehistoric chert quarries found in either Kansas or Oklahoma (Gould 1898, 1899; Wedel 1959:476-480; Spring 1966:5-11). These quarry sites occur in upland settings where Florence A chert was obtained by extensive open-pit mining practices, performed by people who, inferentially, were the occupants of the extensive sites near Arkansas City and elsewhere in the Walnut River, Grouse Creek, and other drainages of the area. While Florence A chert has been utilized for many thousands of years as a raw material source for making stone tools, Vehik (1986, 1990) has made a convincing case for a Late Prehistoric chronology for the actual quarry activity. Earlier cultures opportunistically exploited the material from residual slope and stream deposits, neither of which involved significant earth or rock disturbance.

The 14CO5 quarry was investigated by Martin



Figure 2. The rock layers were exposed by the excavation efforts shown in Figure 1.

Stein of the Kansas State Historical Society in the 1970s (see Banks 1990:101) and again during the 1994 Kansas Archeology Training Program (KATP) field school. The results of that work showed that the Indians quarried nodular chert with considerable effort by digging pits down through thick limestone caprock or by digging laterally into upland slopes where this same limestone was partially eroded (Figures 1 and 2). The stone was then reduced to portable graded material by a reduction process that involved the creation of large flake blanks and biface cores. A large debitage sample of quarry refuse and rejected early stage debris was collected by Stein from these investigations. The reject material from processing areas, located adjacent to quarry pits, appeared to be exactly the sort of debris that would result from a flake blank and biface core production strategy. Of course, many cortical flakes were present, as well as many tested and rejected nodules. Also present were both reject flake blanks and biface cores and large biface thinning flakes. A small portion of the quarry debitage shows evidence for heat treatment or thermal alteration.

Florence A chert is particularly suitable for heat treatment, and, moreover, heat treatment is readily observable in terms of both color change and material quality improvements, as exhibited by glossiness on

freshly flaked heat-treated pieces. The light gray material, when systematically and slowly heated to 500 to 600° F or ca. 300° C turns red in color. Red shadings of Florence A chert have never been observed for in situ geological deposits. Callahan (1979) has proposed a somewhat impressionistic grading method for expressing flakeability of siliceous rocks. Obsidian, or volcanic glass, is Grade 1.0 in this scheme, and some tough, partially silicified quartzites are Grade 5.0. Most organically derived cherts, like Florence A, fall in the 3.5-grade range, while some fine flints are Grade 2.0. In this scheme Florence A, which is a Grade 3.5 in the raw state, is improved to at least 3.0 when properly heated.

As noted earlier, heat-treated Florence A chert is the single most common lithic material in the Lower Walnut focus sites near Arkansas City. This material is present as finished artifacts of many types, as flake blanks, biface cores, smaller numbers of multi-directional cores, and as several categories of debitage. Conspicuously absent from the Arkansas City lithic assemblages are cortical flakes, either in the raw or heat-treated states. The initial and terminal stages of a lithic reduction continuum are clear. Missing elements of this continuum are evidence of the locales and technology of heat treatment. While the first of these elements can only be addressed by designed field research, the second element can be approached through an experimental process.

Fortunately, the literature on thermal alteration of siliceous materials is a rich one. Within the Flint Hills, J. Mett Shippee, with the assistance of amateur flintknapper Charlie Shewey, investigated and reported on a probable prehistoric heat treatment pit from the vicinity of Tuttle Creek Reservoir near Manhattan, Kansas (Shippee 1963). Pioneering experimentation on heat treatment by Don Crabtree (Crabtree and Butler 1964) and other later experimenters and lithic analysts has further systematized this area of research (e.g., Ahler 1983; Sollberger and Hester 1973; Mandeville 1973; Mandeville and Flenniken 1974; Purdy 1975; Luedtke 1992). At least one experiment on the thermal alteration of Florence A has been published (i.e., Cooper 1975).

Guided by these reports and personal experience, experimental investigation of Florence A was integrated into the 1994 KATP Lithic Technology class. While this background cannot in any way substitute for the life experiences and cultural patterns of the presumed Wichita flintknappers, it does provide a basis for proposing and testing certain rudimentary hypotheses about the heat treating procedures they employed.

In this model Florence A chert was quarried by open pit mining techniques at the quarries in Cowley and Kay counties. This also may have included seasonal, diurnal temperature changes to fracture deliberately exposed caprock. Raw material was immediately reduced to large flake blanks and bifacial cores, presumably by percussion knapping strategies. The resulting flakes and cores were then of known quality and could be easily transported. The smaller size of the material after being trimmed and shaped also rendered it more amenable to the application of even heat. Thin pieces are more easily heated than thick ones. The thick limestone cortex on quarried Florence A would almost certainly have hindered effective heat treatment as well.

The prepared materials are thought to have been heat treated at sites intermediate to the quarries and the main body of Lower Walnut sites at Arkansas City, as features related to thermal alteration have not commonly been recognized in the habitation sites. Furthermore, Spring (1966:10) reported on campsites adjacent to the Hardy, Oklahoma, quarry sites, where he believed lithic reduction was taking place. Presumably, the Lower Walnut/Wichita craftpersons utilized an open firing technique like that documented by Shippee (1963). This would involve 1) the creation of shallow basins, 2) filling of these basins with sand or some other loose matrix, 3) embedding prepared chert specimens in this matrix, and 4) subsequently heating the chert by building fires on top of the matrix. These fires would have had to be maintained for some hours or even days. These assumptions have been effectively tested by many experimenters and guided the experiments reported here. The virtue of this basic framework is that such a low technology approach could have been performed at any locality. For example, loose alluvial sediments near water could easily provide a satisfactory environment for this procedure, while offering access to combustible material resources like wood.

On the other hand, Marlin Hawley pointed out limited evidence of on-site thermal alteration of bifaces at 14CO385 (Hawley and Haury 1994:30). In 1992 a bell-shaped pit (Feature 6) was excavated, yielding a sizable amount of debitage and at least one large biface. The biface was broken, displaying crenallation fractures, which indicate too rapid cooling or some other thermal shock (Figure 3). Hawley (personal communication 2000) hypothesized that the few shallow basin-shaped hearths found in association with structures at 14CO385 could have functioned as heat treatment pits. These basins contained fired earth pellets in a matrix of loosely packed earth. If Lower Walnut peoples were using loose earth or some other matrix to heat bifaces, the features would have very limited archeological visibility.

Two separate experiments were made. The first in June 1994 was quite spontaneous and, hence, lacked rigor. Accordingly, a second experiment with a greater

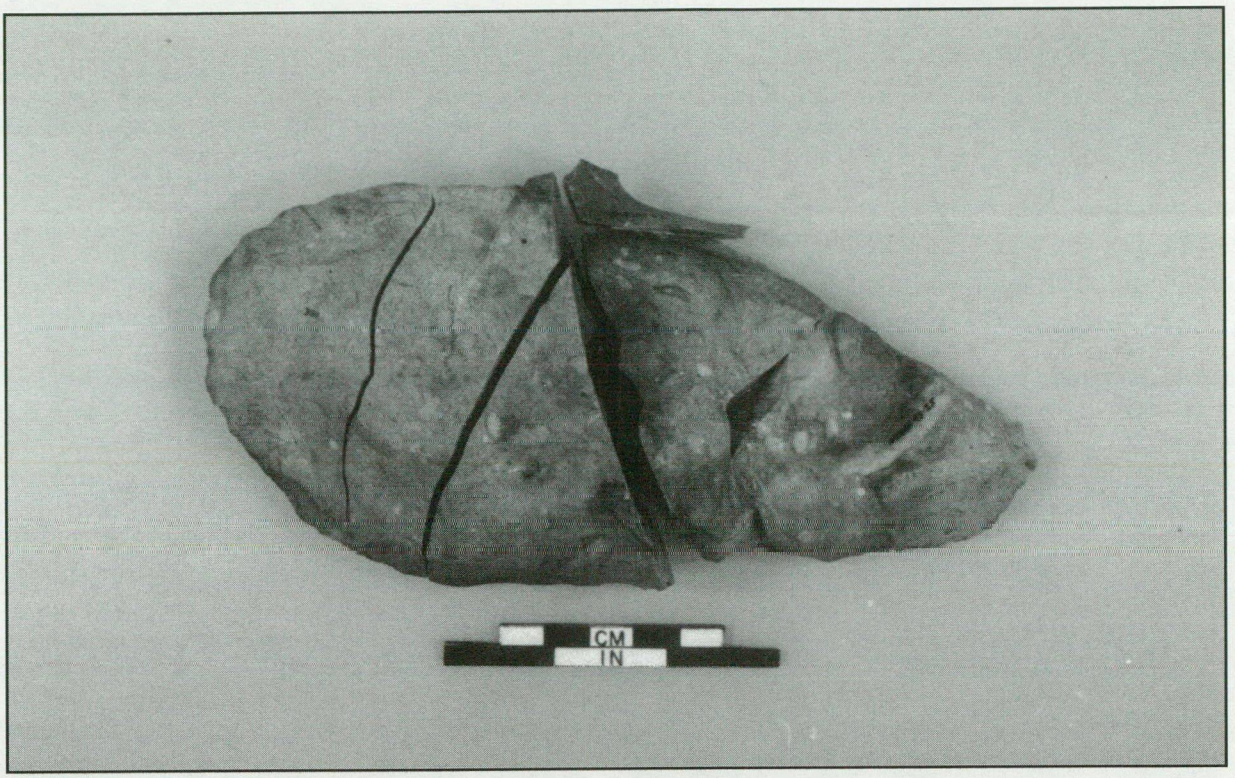


Figure 3. A biface, excavated at 14CO385 in 1992, displays crenallation fractures that indicate too rapid cooling or some other thermal shock.

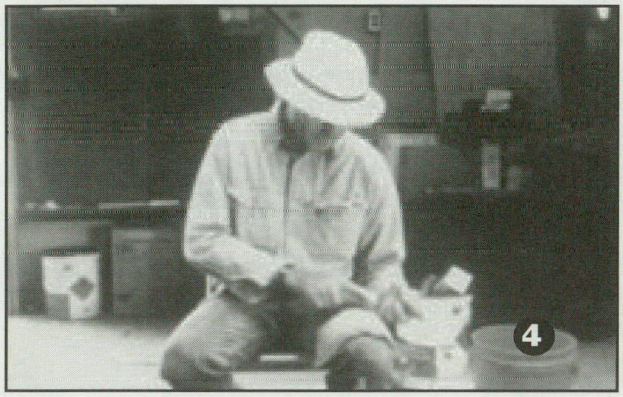
degree of planning was undertaken by the Mud Creek Chapter of the Kansas Anthropological Association in June 1995. Both events proved to be quite useful in answering a few questions and in suggesting directions for future research of this type. Although the following remarks are preliminary in nature and are not the final word by any means on the subject of thermal alteration of Florence A, they do offer some observations made and also suggest additional conditions for future experiments.

The first variable is pit shape. It was unintentionally discovered during the 1994 experiment that the shape of the heat treatment basin may have an effect on the development of heat during firing. Shippee's (1963) prehistoric suspected heat treatment pit was approximately 1 foot deep, but for the experiments reported here, shallower pits were used. In the first experiment two basins were dug. One was a basin 70 cm in diameter with in-sloping sides and maximum depth at the center of 20 cm. The second pit was 60 cm in diameter with straight walls and a flat floor and with a maximum depth of 20 cm.

In both experiments a Thermolyne™ hand-held digital pyrometer was used to measure temperature within the pits during firing (Figure 10). The chert to be heated was shaped into bifaces of a size corresponding to those excavated in 1992 from the Radio Lane site (14CO385) and found on the surface at the 14CO5 quarry. These specimens were placed in a matrix of fine sand in each pit (Figure 6 and Figure 7) so that all were isolated from direct flame but also were within 15 cm of the heat source. Commercial charcoal briquets were used as the combustible material in both years. The amount of charcoal used on each fire was identical, and fires were started at approximately the same time (Figure 8). Measurements were taken in the center of each pit. Nevertheless, during the 1994 experiment a 100° maximum temperature difference was observed between the two pits. The basin with sloping sides had a recorded temperature maximum of ca. 520° F after an elapsed time of six hours, while the straight-sided pit had a recorded temperature of ca. 620° F after six hours. The pattern held for the perimeters of the two features. The maximum perimeter temperature of the straight-sided pit was 410° F, and the maximum perimeter temperature of the sloping-sided pit was 310° F.

The experimental procedure in 1995 was similar to the 1994 test except that the chert was stacked differently and copper pipes were set into the center and four sides of each pit to more carefully control hourly

The 1995 Experiment





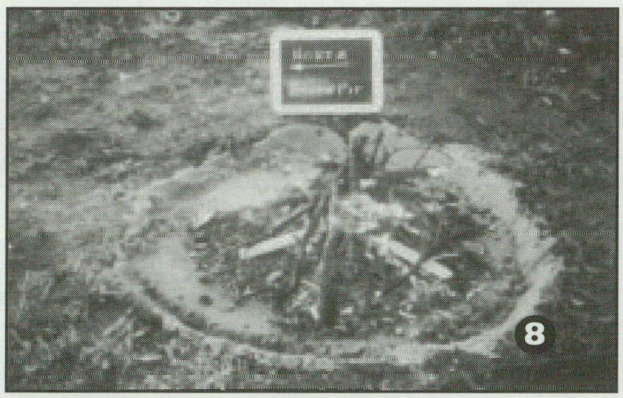
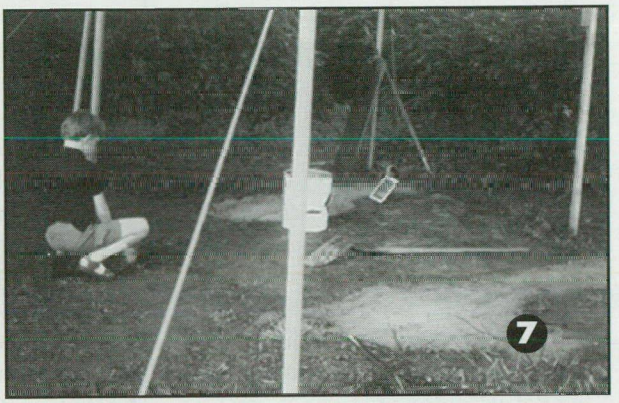


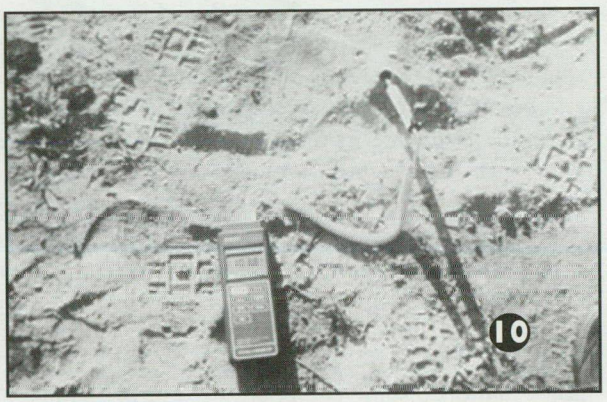


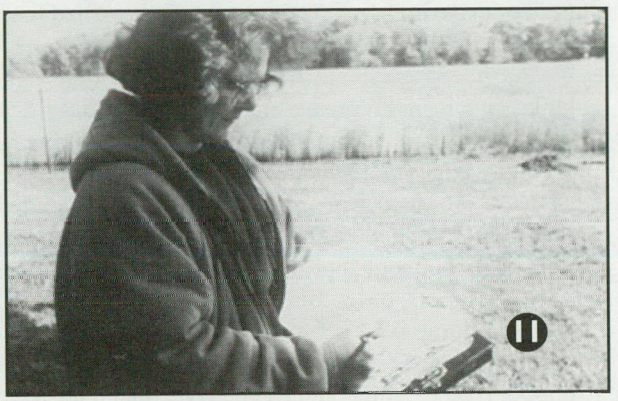
Figure 4. The author, John D. Reynolds, knaps the entire specimen collection heat-treated in the 1995 experiment.
Figure 5. This basin was dug with sloping sides, while another was straight sided.
Figure 6. Unfired specimens were placed on edge in a concentric circular pattern in the sand matrix.
Figure 7. The two pits were located approximately 8 feet apart.
Figure 8. An equal amount of commercial charcoal briquets was used on each pit, and the fires were started at approximately the same time.
Figure 9. Copper pipes were set into the center and four sides of each pit to ensure uniformity of hourly temperature readings.
Figure 10. A handheld digital pyrometer was used to measure temperatures within the pits during firing.
Figure 11. Alice Johnson helped record the temperature readings during the firing cycle.
Figure 12. Anne Wallen and Greg Jackson swept away sand from heat-treated specimens.
Figure 13. The KAA Mud Creek chapter recorded attributes of the heat-treated specimens.

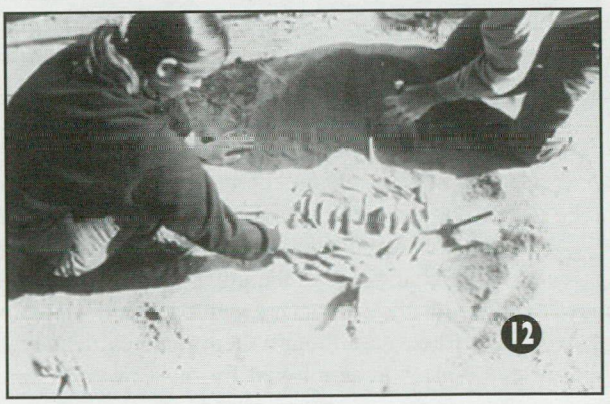
A Step by Step Photographic Review













temperature readings during the firing cycle (Figures 9 and 11). In this experiment the sloping-sided basin (Figure 5) achieved greater maximum temperature (337° F) at the center than did the straight-sided basin (257° F). The reasons for the reversed pattern for maximum temperatures in 1995 have not been isolated, but subtle differences in basin shape may be a factor.

Different types of siliceous rock respond differently to heat. Tough Arkansas novaculite requires temperatures in excess of 1000° F, while some Texas flints, such as Georgetown, are ruined if they are heated above 350° F. Experimentation has indicated that Florence A is best heat treated between 500 and 700° F and that higher temperatures will ruin the stone through cracking. Once cooled, overheated stone will shatter when force is applied to it.

Shallow basins are features commonly encountered on archeological sites in Kansas, going back to at least the Early Ceramic period (ca. post A.D. 1). Their shallowness and often indefinite or irregular floors and walls make them difficult features to excavate with accuracy, but the experiments conducted in 1994 and 1995 suggest that attention should be directed toward subtle differences in basin shape. The shapes may have had functional significance for the original users.

As noted earlier, evidence suggests that flake blanks and biface cores were items commonly heat treated by the Lower Walnut focus peoples. Flake blanks are simply large (more than 5 cm on the long axis) flakes that were removed from single-ended, double-ended, or multidirectional cores and that were intended to be a stage in subsequent tool production (e.g., drills, thin bifaces, scrapers, etc.). Biface cores are large (ca. 10+ cm on the long axis) bifaces that were designed to be used as cores for removing thin, flat, expanding biface thinning flakes, which in turn could be flaked into projectile points and other tools. These two categories comprised the heat-treated samples for both the 1994 and 1995 experiments. However, one knapper (Figure 4) produced the entire sample heat treated during the 1995 experiment, while in 1994 each student enrolled in the class produced his/her own biface. Since most of the students were inexperienced at knapping, consistent bifacial forms were not achieved, and some specimens were probably inappropriate in that they were unlike Lower Walnut focus specimens in overall morphology. Also, in the 1995 experiment all chert used (with the exception of some samples of other chert types from the region) were produced from Florence A that had been quarried by the students and other volunteers at the Maple City quarry in 1994. On the other hand, the 1994 sample included quarried stone, but it also contained some surface collected Florence A chert.

Placement of the pieces to be heat treated during the 1994 test was somewhat haphazard. The individual students placed most specimens in the pits by hand, and most items were arranged horizontally in the sand. Upon completion of the experiment, a breakage rate of at least 10 percent was discovered. It is hypothesized that the exposure of maximum surface area to the fire caused too rapid heating, resulting in fracture. Alternatively, the specimens could have cooled too rapidly, again with fracturing as the result. In 1995 the specimens were all set on edge and, while the maximum temperatures were comparable to those reached in 1994, no significant breakage occurred in either of the two pits (Figure 12).

The primary method for tracking individual items in the heat treatment process was to write a number on each specimen with a magic marker. Each piece was weighed to .1 g and the value recorded on both the object and on paper. Subsequent to heat treatment each specimen was weighed again. During the 1994 experiment a consistent weight loss from virtually every specimen was noted. The 1995 experiment, which was more controlled, confirmed this observation. A consistent weight loss of about .4 percent was reported (Figure 13).

The weight loss can be attributed to evaporation of what Luedtke (1992) terms the free water in chert specimens. Like ceramic clay, chert contains both free and bound water in its structure, and, as when clay is fired, the free water is the first to leave. Potters deal with this by drying the clay thoroughly and heating it at a low temperature before elevating the heat to the high temperature needed for creating functional ceramics. It is possible that prehistoric people utilized a similar procedure with chert heat treatment. Some folk knappers have reported good results with two heat treatment episodes for Florence A chert. Luedtke (1992) notes that once some cherts are fired at low temperature, they can be safely heated to higher temperatures, presumably because the free water is eliminated before the stone achieves its desired heat treatment flaking qualities. Most of the chert samples in the 1994 and 1995 experiments were only partially heat treated, as exhibited by both minimal improvement in flaking quality and a weak red color. Either a second heat treatment episode or higher and longer heat during the first attempt would probably have alleviated this problem.

Finally, it should be noted that during the 1994 experiment several of the chert specimens were covered with clay prior to heating to explore whether such covered pieces would be better insulated from rapid temperature changes than the other stone. The results were inconclusive, and this procedure was not attempted in 1995. However, although there is no evidence that this technique was employed by the Lower Walnut/

Wichita knappers (low-fired, irregular, non-vessel "pottery " has not been reported in the Arkansas City sites), it is a procedure worth exploring.

Acknowledgments. The editor gratefully acknowledges Marlin Hawley for refining the original draft of this paper and Martin Stein for reviewing the final version.

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Appendix: Quarrying and Heat Treatment of Cowley County Flint

Benjamin J. Terrill

Hypothesis:

If flint is quarried, knapped, and heat treated by modern archeologists, then insight may be gained into how prehistoric people carried out those same procedures.

Materials:

1. Freshly quarried flint and flint from the ground surface
2. Abrader stones and stone hammers
3. Sand, 60 pounds of charcoal, and clay
4. Temperature measuring device, scales (heavy and light capabilities), tarps, Ziplock™ bags, goggles, and protective gloves

Procedures:

1. A quarry site (14CO5) used by prehistoric man was located. A new quarry pit was dug in close proximity to older pits, and flint was removed.

2. A work site where it was supposed that the stone gathered from the quarries in the surrounding area was worked into more manageable pieces by prehistoric man was located. This spot was excavated, and debitage found there was collected.

3. Pieces of discarded flint that appeared to be the correct size for heat treatment were collected from the present ground surface.

4. Stones from both the freshly dug quarry pit and from the surface were weighed. The stones were then knapped to suitable size for heat treatment. Hammerstones and abrader stones were used in ways believed similar to the methods used by prehistoric man. All debitage was collected.

5. All debitage and pieces of flint suitable for heat treatment were weighed.

6. The pieces of flint to be heat treated were then buried in sand in one of two heat treatment pits. Four of the pieces to be heat treated were covered with clay before being buried. Pit 1 (west) measured 65 cm in diameter and was 20 cm deep with sides that sloped toward the center at a 105° angle. It received 49 stones, 2 of which were coated with clay. Pit 2 (east) measured 75 cm in diameter and was 20 cm deep. It was basin-like in construction with a rounded bottom and sides. It received 37 stones total, 2 of which were coated with clay.

7. Twenty pounds of charcoal were piled onto each pit and lit. When the coals were white, they were spread to cover the pits completely. Over a three-day period pit temperatures, wind conditions, and the time at which readings were taken were recorded. On the first day, an additional 10 pounds of charcoal were added to both pits 4 hours and 45 minutes after the original charcoal mass had been lit.

8. On the third day the flint was dug out of the heat treatment pits. All pieces that did not shatter during heat treatment were weighed, and the weights were recorded.

9. Percentages were figured for the number of successfully heat-treated pieces that were wrapped in clay versus the number of successfully heat-treated pieces that were not wrapped in clay.

10. Percentages were figured on the number of successfully heat-treated pieces that were from the new quarry versus the number of successfully heat-treated pieces that were collected from the surface.

Data:

1. See Figures 14 and 15 on following page.

2. The number of flint pieces that shattered during the heat treatment process was 7.9 percent of the total.

3. All of the four pieces that were wrapped in clay were successfully heat treated.

Observations:

1. Further testing of heat treatment pit shapes may demonstrate that pits with straight sloping sides and flat bottoms heat more effectively than pits with rounded sides and bottoms.

2. The wind speed was a contributing factor to the temperature of each pit.

3. The success of heat treatment is not greatly affected by using freshly quarried stone versus stone gathered off of the ground surface.

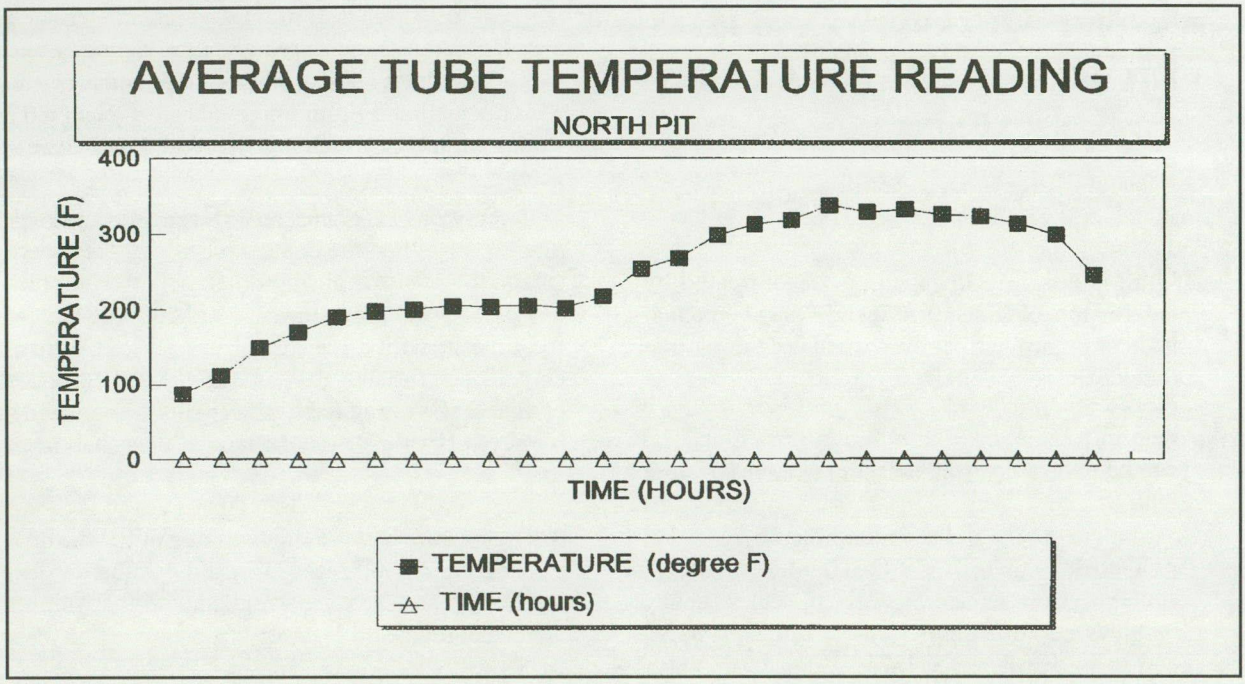


Figure 14. Plotting of temperature readings over time from the sloping-sided basin during the 1994 heat treatment experiment.

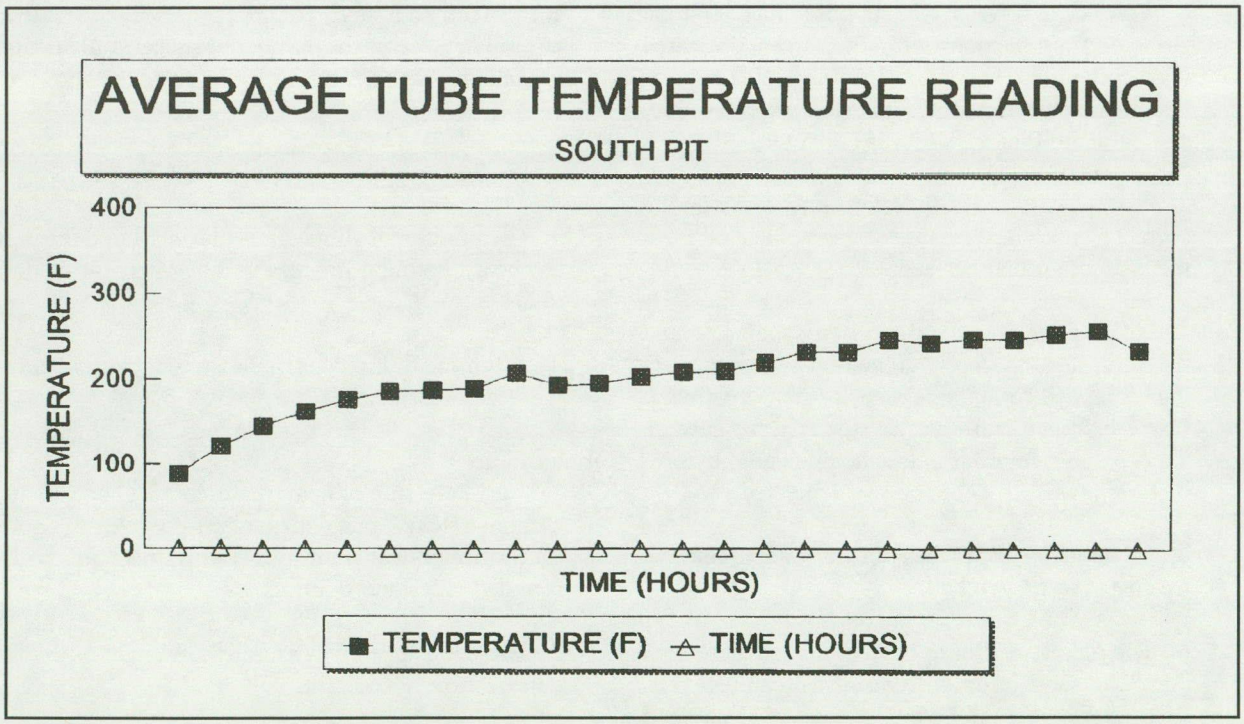


Figure 15. Plotting of temperature readings over time from the straight-sided basin during the 1994 heat treatment experiment.

4. All stones either kept their initial wight or lost some weight during heat treatment; no stones gained in mass. Most stones lost roughly the same percentage of their mass.

Recommendations:

1. Temperatures were not taken every house as they should have been. This problem could be solved by having one person or a group of people resolve to stay by the experiment and take readings every hour. The use of a Verier Program, which plots temperatures at set time intervals, would be helpful. The Temperature Plotter Probe Software can be obtained from Vernier Software, 2920 SW 89th St., Portland, OR 97225.

2. Temperatures were not alwasy taken in the same spots within the pits. This problem could be solved by placing metal tubes in each pit at set positions and reading the temperatures from the probe inserted into the tubes. The error also could be corrected by using the Temperature Plotter Probe Software, wince the probes could be left in position through the length of the experiment.

3. Not all rocks were marked and weighed before being placed in the heat treatment pits. More care should be taken to label and weigh all rocks before putting them in.

4. The rocks were not taken from the pits in a way that allowed for all their positions to be recorded. All rocks whould be taken out by one person, and a recorder should be present to plot locations on a diagram of each pit.

5. Not all shatter was recovered from the pits, making masses impossible to calculate with any degree of accuracy. The sand should be sifted as it comes of of each pit to recover all shattter fragments so that each shattered rock could be reconstructed and weighed.

(Note: Benjamin J. Terrill was a Kansas Anthropological Association member and student involved in the 1994 heat treatment experiment. His observations recorded much relevant information about the experiment.)

NOTES

Cache or Trash? The Characteristics of Two Lithic Features from the Booth Site (14CM406), Comanche County, Kansas

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The Kansas Anthropologist 22:15-32

Excavations conducted at the Booth site in 1989 recovered what were then identified as two lithic caches composed primarily of Alibates flakes. Caches may be generally described as stores of resources that are hidden from view for the purpose of concealment and preservation until such time as the materials are recovered by their owners.

In the context of habitation sites, the determination of the nature of flake groups is difficult due to the presence of other cultural debris but can be rewarding if the opportunity for analysis and cross comparison presents itself. Additionally, the habitation site cache allows comparisons with the general debris of the habitation.

This paper seeks to determine the validity of the cache designations of two features through analysis of their respective settings within the site and comparison of the characteristics of the individual lithic specimens within each feature. Flake analysis also provides useful data for determining the particular reduction strategy that created the flakes.

The Booth site represents a late Middle Ceramic period occupation in southwest Kansas. Radiocarbon dates suggest that the site was occupied during the mid-1400s A.D. In 1989 work at the Booth site (14CM406) yielded additional data on the complex. Commonly associated features include shallow pit structures, bell-shaped and cylindrical storage pits, and irregularly shaped shallow basins (Lees 1991:256). Lithic artifacts from the Booth site, specifically related to two features, are the focus of this discussion.

Feature 65 consisted of a group of 91 lithic specimens recovered from Excavation Unit 215 (X 215) in the central area of the block excavation (Figures 1 and 2). The cache apparently was not placed within an excavation as no organic staining, cultural mix, or other diagnostic characteristics of a feature or container were defined. The pieces were stacked neatly in a compact cluster (23 x 17 x 5 cm), which appeared to have a dish-shaped base as shown by the general orientation of flakes at the bottom of the pile (Figure 3).

Feature 2701 consisted of a loose cluster of 51 lithic artifacts (50 flakes with 2 broken flakes refit and 1 biface), lying on the floor of Feature 287, a bell-shaped pit (Figure 4). The pit was defined in X 224 in the eastern part of the main block excavation (Figure 1). The lithic collection, measuring approximately 15 x 11 x 2-3 cm, was located primarily within the western margin of the bell of the pit, 173 cm below the southwest corner ground surface elevation, below a caliche boulder. The pit otherwise was sparsely filled throughout with occupational debris, including butchered bone, shell, ceramic fragments, lithic debitage, and assorted tools.

Background

The analysis of these features sought to determine two things: 1) the viability of designating either cluster as true lithic cache and 2) whether or not specific reduction strategies could be determined with any degree of confidence for either feature.

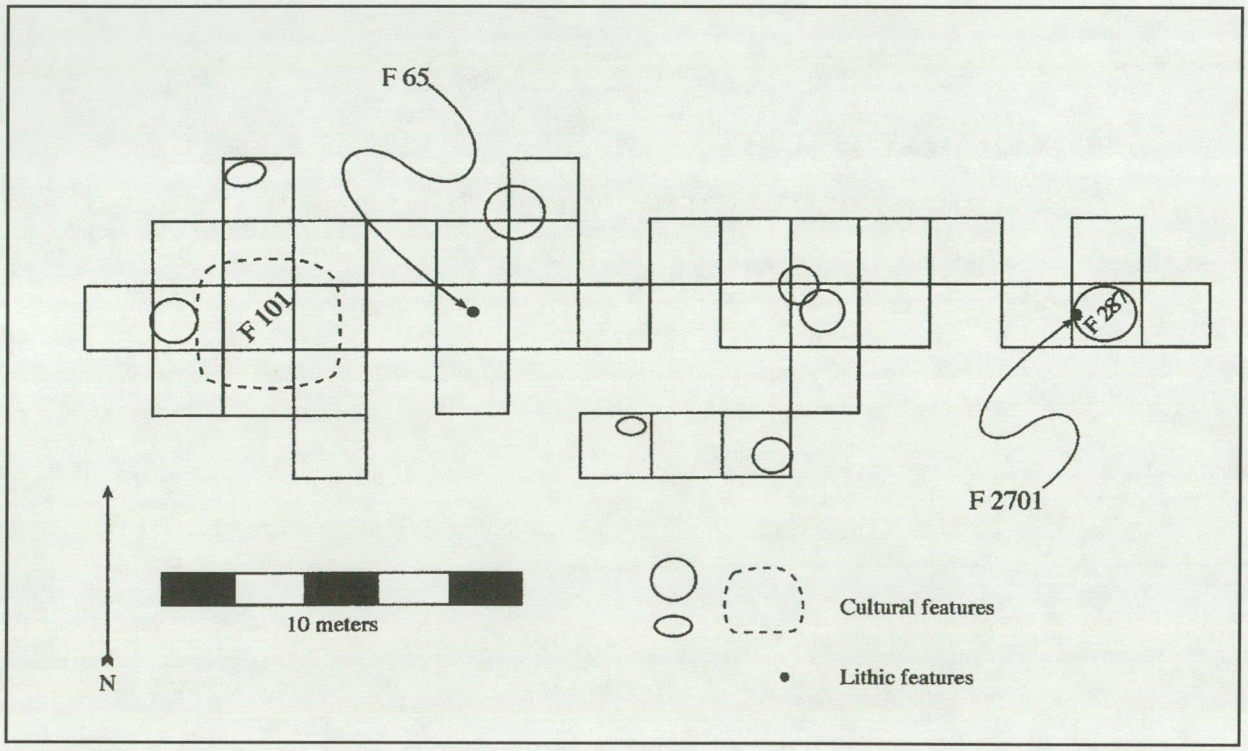


Figure 1. Plan view map of 14CM406 excavations showing locations of Features 65 and 2701.



Figure 2. Feature 65 lithic artifacts.

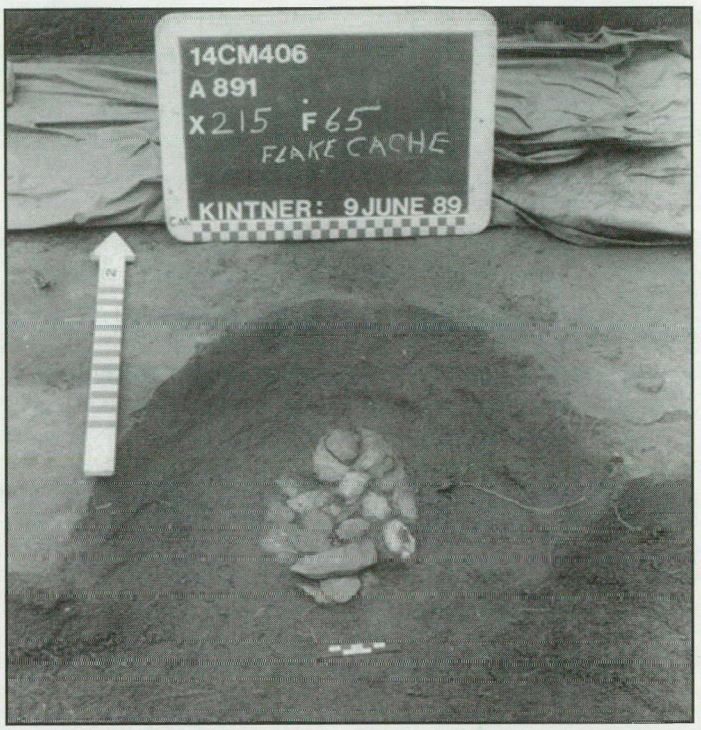


Figure 3. Feature 65 lithic artifacts in situ at 14CM406.

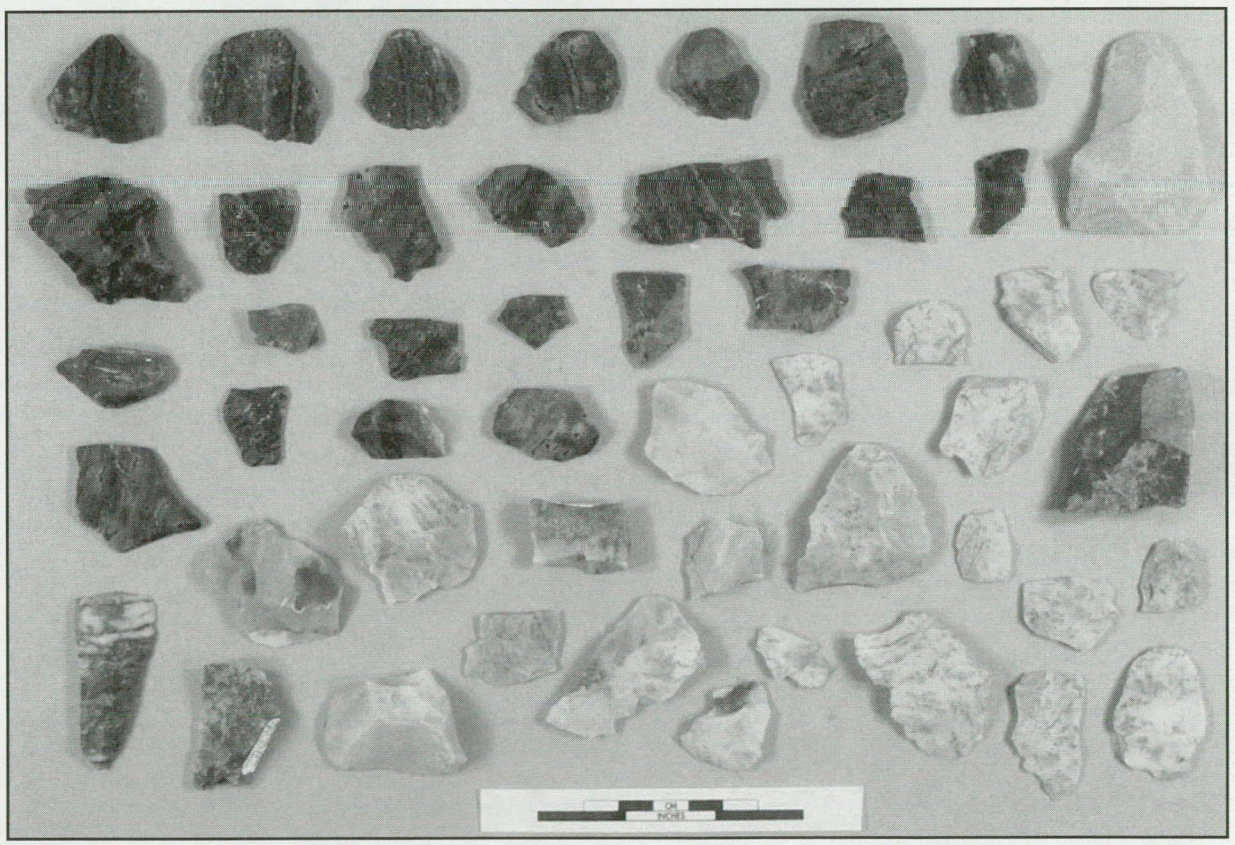


Figure 4. Feature 2701 lithic artifacts.

Typically caches are isolated features, not associated with habitation areas (Tunnell 1978:1). These features have been viewed as unique opportunities to study the individual in prehistory from the perspectives of style (Hegmon 1992) and skill (Reynolds 1990). The isolated nature of the typical cache reduces the possibility that its integrity has been compromised by later occupants of the same locality and makes for a practical study. However, the study of caches within habitation sites can be equally beneficial, allowing for comparisons between the cached materials and those recovered elsewhere in the site. Regardless of the nature of the cache location, caches can provide unique perspectives about raw material preferences based on quality and/or availability, general reduction strategies/trajectories, and the types of fabricators employed at various reduction stages, as well as insights into larger questions of settlement and subsistence strategies and regional exchange.

Habitation site caches raise the question of what actually constitutes a cache. This dilemma has been termed the "cache-trash problem" by Brown (1985:78). The advantage of finding caches in isolation as a means of identifying individual knappers has been recognized (Bement 1991; Ballenger 1996). While identifying raw material or tool collections in isolated areas as caches is relatively easy, the presence of clusters of materials in habitation sites is not always easily associated with caching behavior. The situation can be particularly problematic when dealing with flakes, which might be dismissed as debitage were they not found in a discrete group.

Caches are an aspect of prehistoric cultural assemblages that can reflect a range of culturally patterned choices as they relate to the behavior portrayed by the caching of items. They also may provide a glimpse of individual action, which is, after all, the origin of the material culture that archeologists study (Cross 1983:88). Specifically applied to the realm of lithic analysis, topics such as craft specialization (Reynolds 1990) and idiosyncratic behavior as it relates to flintknapping (Gunn 1975) have significance to the individual in prehistory. Likewise, episodes of caching may be considered to be a construct at the level of the individual, where resources are placed together in a particular location during a brief interval of time by one or more individuals (Tunnell 1978:1).

Besides the assumption that relatively few individuals would be associated with any particular cache, a couple of inferences can be made about caching behavior in general. The act of caching implies an increased level of value toward the goods. Tunnell (1978:53) noted a correlation between the value of stone and distance to its source. The caching act also implies an intent to retrieve the contents at a later time. Obviously, the recovery of the cache in present time indicates that this intent was not always realized.

Caches may be generally described as stores of resources that are hidden from view for the purpose of concealment and preservation until such time as the materials are recovered by their owner. Caches have been discussed in reference to the storage of foodstuffs (Binford 1980). They also are more explicitly described in the archeological literature with reference to their contents, such as "tool caches" (Slesick 1978; Brown 1985; Kornfeld et al. 1990) and "blade" and "biface" caches (Wycoff 1984; Young and Collins 1989; Miller et al. 1991). Elsewhere, efforts have been made to create a standard terminology that differentiates caches based on their contents, such as "food cache," "equipment cache," and "raw material cache" (Wilke and McDonald 1989:50-51).

It is well known that the process of flintknapping is one of successive reduction (Crabtree 1972). The operation is both culturally patterned and naturally restricted. It is culturally patterned because the individual flintknapper was inherently influenced by the cultural environment in which he lived. The artifacts that archeologists study then may be considered the "products of a dynamic system of behavior" (Yerkes and Kardulias 1989:90). The operation of reduction is also limited by the natural properties of the raw material and by general laws of physics, involving variables such as the application of force at certain angles and rates of speed with objects of variable densities and mass to produce energy that travels through the raw material so as to remove flakes. Cotterell and Kamminga (1979, 1987) have studied the mechanics of flintknapping in detail, and the reader is directed to their discussions as this is not the focus of the research here.

Lithic analysis has progressed from a primarily classificatory tool, used to define and differentiate between archeologically defined cultures, to a more dynamic method involving study of the mechanics of the manufacturing process and determination of tool use (for example, Callahan 1979; Hayden 1979; Keeley 1980; Flenniken 1985). While archeology certainly still utilizes chipped stone tools as cultural markers, it is the inquiry into behavior that differentiates the lithic analysis of the present time (Henry and Odell 1989:ix).

Through a sequence of cognitive steps, the flintknapper reduces a piece of raw material to a preconceived end. Trajectories in which bifacial tools are the primary result of the reduction process may be distinguished from trajectories where the production of flakes for tools is the basis for reduction (compare

Collins 1975; Odell 1989). Studying individual flake attributes can provide information necessary for determining the trajectory that produced the material at hand and may help determine whether or not a particular group of flakes represents a cache or some other single episode deposition, such as a dump. The attributes utilized in this study are outlined below, with notes on the results of the analysis following each attribute's discussion. While these and other variables have been used in similar studies, those used in this analysis were thought to provide a sufficient amount of data for determining the reduction trajectory through which individual flakes were produced.

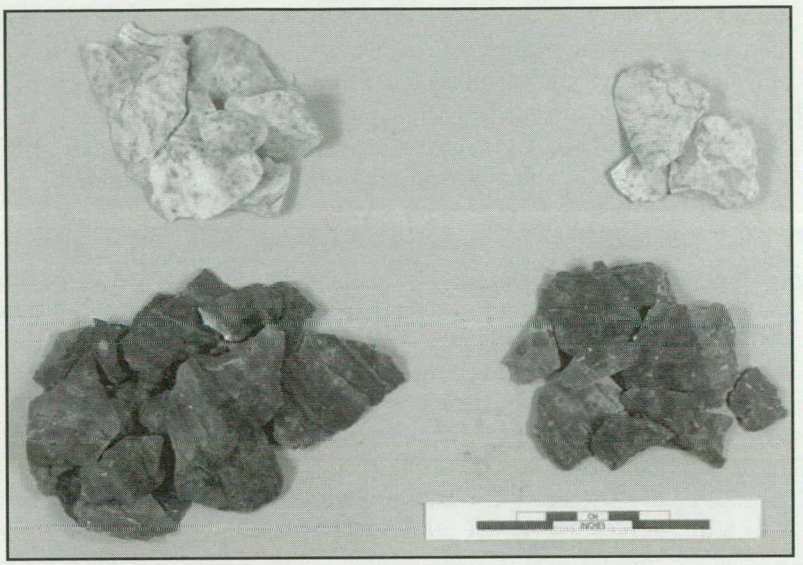


Figure 5. Flakes representing Feature 2701 core groups on the left and similar flakes recovered from the general fill of Feature 287 on the right.

Analysis

Raw Material

Topics of exchange and mobility can be addressed to some degree through the determination of raw material type. Relative distance to source is an important variable in the discussion, as is the potential for resource control by certain groups. Regional examples of possible lithic resource control during the Late Prehistoric period include the relationship between the Lower Walnut focus (protohistoric Wichita) and Florence A chert (Vehik 1985) and the link between the Antelope Creek phase and Alibates agatized dolomite (Bandy 1976; Lintz 1986). This latter relationship in particular has bearing on the current discussion as both caches are almost entirely comprised of Alibates.

The presence of cortex 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 the cortex on the 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 for determining acquisition locale (primary versus secondary deposits) and by inference may provide information about exchange patterns (see for example Wyckoff 1993).

Feature 65 was composed entirely of Alibates agatized dolomite. Identification was based on a combination of the author's familiarity with the material, comparison with source samples, and conversations with other researchers familiar with the variation present in the material. At least 11 core groups were recognized on the basis of the general similarity of flake color, texture, and pattern. Within these core groups, two pairs of flakes were refitted, suggesting that at least these groups of flakes were produced by one individual.

Alibates occurs as an in situ bedrock formation in exposed Permian deposits along the Canadian River breaks in the northern Texas Panhandle (Bowers 1975:1; Banks 1990:91). It also is a component of gravel deposits downstream along the Canadian River, making it a dependable local resource for the inhabitants of western Oklahoma and perhaps beyond (Banks 1990:91; Wyckoff 1993:52-53).

The primary source area lies approximately 200 miles southwest of the Booth site. One flake in Feature 65 exhibited cortical material in the form of a chalky rind along one lateral margin, implying that at least some of the material came directly from the source area. Additional comparison of average flake size with average clast size from collected gravel deposits (compare Wyckoff 1993) would indicate that most, and probably all, of the material was derived directly from bedded deposits.

Feature 2701 contained a variety of material types, although 48 pieces of Alibates comprised 96 percent of the total. Two distinct core groups were separated from the general collection of Alibates flakes (Figure 5). The first group (core group #1) was identified as a very light gray material with a limited amount of discontinuous

reddish banding. Speckled dark imperfections and patches of pinkish shading near bands were also indicative of this group, which accounted for 26 percent of the Alibates total. A second group (core group #2) that consisted of a dark gray material with banding in varying grays, reds, and tans comprised 48 percent of the Alibates.

Refitting of flakes was accomplished among both core groups. Core group #1 had one complete flake with an intact platform, one complete flake with a collapsed platform, one proximal portion with an intact platform, and one distal fragment. Core group #2 had two complete flakes with intact platforms that were refitted successfully. Both groups included numerous other flakes that could not be refitted.

Evidence of quarry cortex and river cobble rind was found among the Alibates flakes. Three instances of chalky cortical material were noted. Two flakes exhibited small amounts of cortex near their lateral margins at the proximal ends of the flakes. On the third flake cortex was limited to the platform area. Two other Alibates flakes exhibited a weathered or stream-rolled rind, possibly indicating that at least some of the material was acquired from secondary deposits in stream beds rather than directly from bedded deposits.

Isolated examples of Dakota quartzite and Day Creek dolomite were noted. Dakota quartzite, actually an orthoquartzite, occurs within the Dakota formation. Previously noted outcrops, utilized in prehistory, occur in southeastern Colorado (Banks 1984:71) and western Kansas (Martin Stein, personal communication 1999). In fact, workshop localities are present in Comanche County along Indian Creek just a few miles from the Booth site.

The Day Creek dolomite is a lateral equivalent to Alibates but for the most part can be readily separated from higher quality Alibates. The northern extremity of Day Creek dolomite lies across Clark County, approximately 30 miles west of the Booth site. While the material bears similarities in color to Alibates, Day Creek dolomite contains moderate amounts of internal fracturing and tends to have a coarser texture overall. A light gray-bluish gray variety predominates in Clark County. While good quality stone is present among Day Creek materials, its limited occurrence likely confined it to local utilization. During the Late Prehistoric and Protohistoric periods, when more expansive exchange systems were in place, exploitation may have been particularly limited. None of the isolated examples in Feature 2071 had evidence of cortex or otherwise weathered exterior surfaces.

Analysis of the chipped stone from the Booth site in general provided raw material frequencies that could be compared with those from the two lithic features. Alibates comprised approximately 46 percent of the sample, while Dakota quartzite was noted in nearly 36 percent. Obsidian made up 6 percent of the collection. Samples of the obsidian have been traced to a source in the Jemez Mountains of New Mexico. Smoky Hill jasper made up 3 percent. Limited quantities of Flint Hills cherts were dominated by the Florence A variety. Day Creek dolomite was noted only rarely, accounting for only 1 percent of the chipped stone material at the site.

Flake Condition and Dimensions

The general conditions of the flakes, whether complete or proximal, medial, or distal portions, were recorded as comparative measures. The "complete" category included flakes with intact platforms and feathered or hinged terminations. From this variable inferences were drawn about flake selection and frequencies of post-removal breakage. In addition data on post-deposition breakage were gathered if flake fragments were recovered in association.

In Feature 65, 66 percent of the specimens were complete flakes. Proximal and distal fragments made up slightly more than 14 percent each of the total number of flakes. Medial portions, which are likely indicators of post-removal breakage, were rare, accounting for only 4 percent of the lithic sample. One example of a longitudinal break was noted in the collection.

Only 33 percent of the flakes in Feature 2701 were considered complete. Proximal portions, exhibiting platforms and a sharply angled breaks or step fractures, comprised 22 percent of the sample. Distal ends with either feathered or hinged terminations were identified in 20 percent of the specimens. The remaining 24 percent of the flakes were considered medial portions with steeply angled detachment points on both ends.

Maximum dimensions were recorded on specimens that had intact, measurable proportions of length, width, and thickness. Maximum length was measured from the center of the platform to the distal end, down a line perpendicular to the platform plane. Maximum width was based on a perpendicular of the length line. In addition, each item was weighed and its weight recorded in grams.

Feature 65 flake lengths ranged from 29.29 to 89.44 mm with a mean of 48.46 mm. Widths varied from 20.87 to 64.13 mm with a mean of 33.23 mm. Thicknesses ranged from 2.83 to 17.36 mm and averaged 7.39 mm. Feature 2701 flake lengths fell between 17.74 and 60.17 mm, a mean of 33.03 mm. Widths

varied from 13.82 to 44.76 mm, an average of 28.26 mm. Average thickness was 4.87 mm, with actual measurements ranging from 2.19 to 13.75 mm.

Flake Termination

Flake terminations were classified as feather, hinge, and step or break types. Feather terminations are generally the desired outcome of a flake removal. Flake separation occurs as the force of the percussor blow continues out of the material in an even manner, producing a thin, tapered edge across the distal end. A hinged removal occurs when the force of the percussor blow angles sharply upward out of the objective piece, creating a slightly hooked termination. Step flakes may be difficult to distinguish from broken flakes as both have terminations at 90° angles to the original direction of removal force. While step terminations result in perpendicular detachments, the removal force may continue through the material and may or may not complete flake removal (Whittaker 1994:19). Hinge and step removals are typically undesirable since they can contribute to future flake removal difficulty. The causes of these removal types may be considered rough indicators of the general skills of the knappers. The angle and force of the blow, as well as the general motion of the blow, may contribute to an unsuccessful flake removal (Whittaker 1994:109).

Flake terminations were recorded on all flakes. In Feature 65, 61 percent of the flakes exhibited feathered terminations. Step terminations or breaks were identified in 16 percent of the sample, leaving 23 percent of the flakes with hinge terminations. Interestingly, hinge terminations were not nearly as prevalent as hinge fractures on the dorsal faces of the flakes. Step terminations, on the other hand, were significantly more common, indicating the probability that there was a significant amount of post-removal breakage in the sample.

Fifty percent of the flakes from Feature 2701 had feathered terminations. A large percentage of flakes exhibited stepped removals, accounting for 44 percent of the total. Hinge terminations were observed on only 6 percent of the specimens. The high percentage of apparent stepped examples would argue for almost certain high occurrences of breakage after flake removal. The low frequency of hinged removals may be a subtle expression of the percussor type or removal angle or both.

Dorsal Features

In addition to ascertaining the presence and type of cortex on flakes in both groups, dorsal flake features were analyzed. This provided complementary data to the flake analysis since scars on dorsal surfaces reveal characteristics of previous flake removals. Specifically, the direction of previous removals can yield evidence of the type of reduction continuum that produced the flake. In this analysis terms used to differentiate removal direction included unidirectional, slightly multidirectional, and pronounced multidirectional.

Dorsal scar counts have been proposed as a means of inferring reduction trajectory and stage of reduction (Magne 1985; Odell 1989). Dorsal scar complexity also has been recognized as a factor, although it is considered redundant to some degree and may be more difficult to measure (Mauldin and Amick 1989). The measurement utilized here was a simplified assessment of the complexity of the scar patterning on the dorsal faces. Essentially unidirectional orientations yielded lower numbers of scars than multidirectional orientations. Flakes with slightly multidirectional orientations were expected to overlap somewhat with the unidirectional category. It was believed that this generalized assessment would provide a reasonable indicator of reduction type, whether from core reduction or biface technologies, particularly when viewed with other variables used in this analysis. In addition, dorsal flake scars were studied for previous flake termination types following the categories discussed previously.

In Feature 65 dorsal face flake scar orientations were 43 percent unidirectional, 33 percent slightly multidirectional, and 24 percent pronounced multidirectional. Only 8 percent of the flake scars in Feature 2701 were unidirectionally oriented. Flakes exhibiting a pronounced degree of multidirectional orientation accounted for 52 percent of the sample, while slightly multidirectional scars were noted in 40 percent of the collection.

Another feature on the dorsal faces provided a relative measure of the knapper's ability to remove desirable flakes—those with feathered terminations. Flakes in Feature 65 exhibited errors in the form of hinges and occasional steps on 45 percent of the sample. Hinged terminations were by far the most common and were recognized on 44 percent of the sample. Step terminations were identified on only 1 percent of the flakes. Previous removal scars on specimens in Feature 2701 indicated that errors in some form affected 38 percent of the sample. Hinged removals were present on 30 percent of the flakes. The remaining 8 percent exhibited both hinged and stepped failures.

Ventral Features

Ventral face features were related to flake removal, including the presence of bulbs of percussion,

concentric ripples, eraillure scars, platform lipping, and small flake removals (Figure 6). Ventral features also included natural characteristics, such as the presence of crystalline imperfections and fracture planes. Landmarks created during flake removal are often indicative of the general percussion method used (i.e., hard hammer versus soft hammer). For example, pronounced bulbs of percussion or force are generally associated with hard hammer percussion. Conversely, flattened or diffuse, D-shaped bulbs of percussion are typical results of soft hammer percussion. Eraillures, recognized as small flake scars on the bulbs, more often may be associated with hard hammer percussion methods, although this is not always the case (Hayden and Hutchings 1989). Platform lipping is diagnostic of biface reduction in general, as the lip is a remnant of the bifacial margin that ideally is isolated through platform preparation. This attribute of ventral face lipping at the platform is especially characteristic of soft hammer reduction (Crabtree 1970:150).

Ventral surface features were common on flakes in Feature 65. Noted attributes were frequently found in combination on individual flakes, particularly combinations involving eraillures, prominent concentric ripples, and bulbs of percussion. Eraillures were recognized on 47 percent of the flakes. Concentric ripples and bulbs of percussion were recorded in frequencies of 64 percent and 62 percent, respectively. Prominent bulbs of percussion were noted slightly more often than diffuse or nearly flattened bulbs. A significantly low number of flakes exhibited platform lipping. Only 15 percent of flakes with intact platforms demonstrated overhanging platforms. Other features related to reduction were hinged removals that typically occurred across the bulbar region. While small, these removals may represent relatively unsuccessful attempts to thin the area of the bulb. Finally, natural features of the stone were noted during analysis of the ventral faces. Small crystalline imperfections were observed in 11 percent of the assemblage. The majority of these were limited to one or two examples of pockets up to 3-5 mm in diameter. Naturally occurring internal fractures were found on 7 percent of the flakes. These fractures were typically small and did not affect the removal of the flake. Isolated examples indicated that at least part of the force of the removal traveled along the plane of fracture, creating separation at that point.

Ventral features were recorded frequently in Feature 2701 also. Combinations of attributes often included concentric ripples and notable bulbs of percussion and platform lips and prominent bulbs of percussion, although examples of nearly any combination of traits did occur in the assemblage. Eraillures were distinguished in only 5 percent of the sample. Diffuse bulbs of percussion were common, being identified on 62 percent of the flakes. Concentric ripples and platform lips, while rarely noted in association, were found in 49 percent and 41 percent frequencies, respectively. Small hinge and step flakes were noted in isolated instances (5 percent of the specimens) and do not appear to have been associated with bulb thinning as the examples in Feature 65 may have. Natural features of the stone, consisting of crystalline imperfections and natural fissures, were present on 11 percent of the flakes.

Platform Attributes

Platforms were analyzed when present for a series of variables. Platforms can provide important data that help determine the reduction trajectory and percussor method. Attributes used in this study include the platform condition (present/absent/collapsed), modification, removal angle, and maximum dimensions of width and thickness. Platform alteration, 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). Modifications recognized in this study included grinding and dorsal trimming, as well as combinations of these types, which are associated with preparation and stabilization of the surface prior to flake removal. The lack of platform modification also was recorded because absence is as important as the type of modification when considering reduction trajectories. Removal angle is difficult to measure within a degree of accuracy. However, apparent angles were recorded rather than rounded to the nearest 5°, for example. This straightforward representation of the perceived platform angle was believed to be at least as helpful as rounded measurements. 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. Finally, the maximum width and depth dimensions of the platform were recorded.

Platforms were absent on only 22 percent of the Feature 65 flakes. Collapsed or partially collapsed platforms were noted on 10 percent of the sample, leaving 68 percent of the collection that could contribute additional data on platform modification and provide reasonably accurate measurements. Slightly more than half (52 percent) of the platforms showed no signs of modification. Platform edge grinding was noted on 43 percent of the collection. A combination of dorsally trimmed and edge-ground techniques were identified on 5 percent of the platforms. Platform dimensions

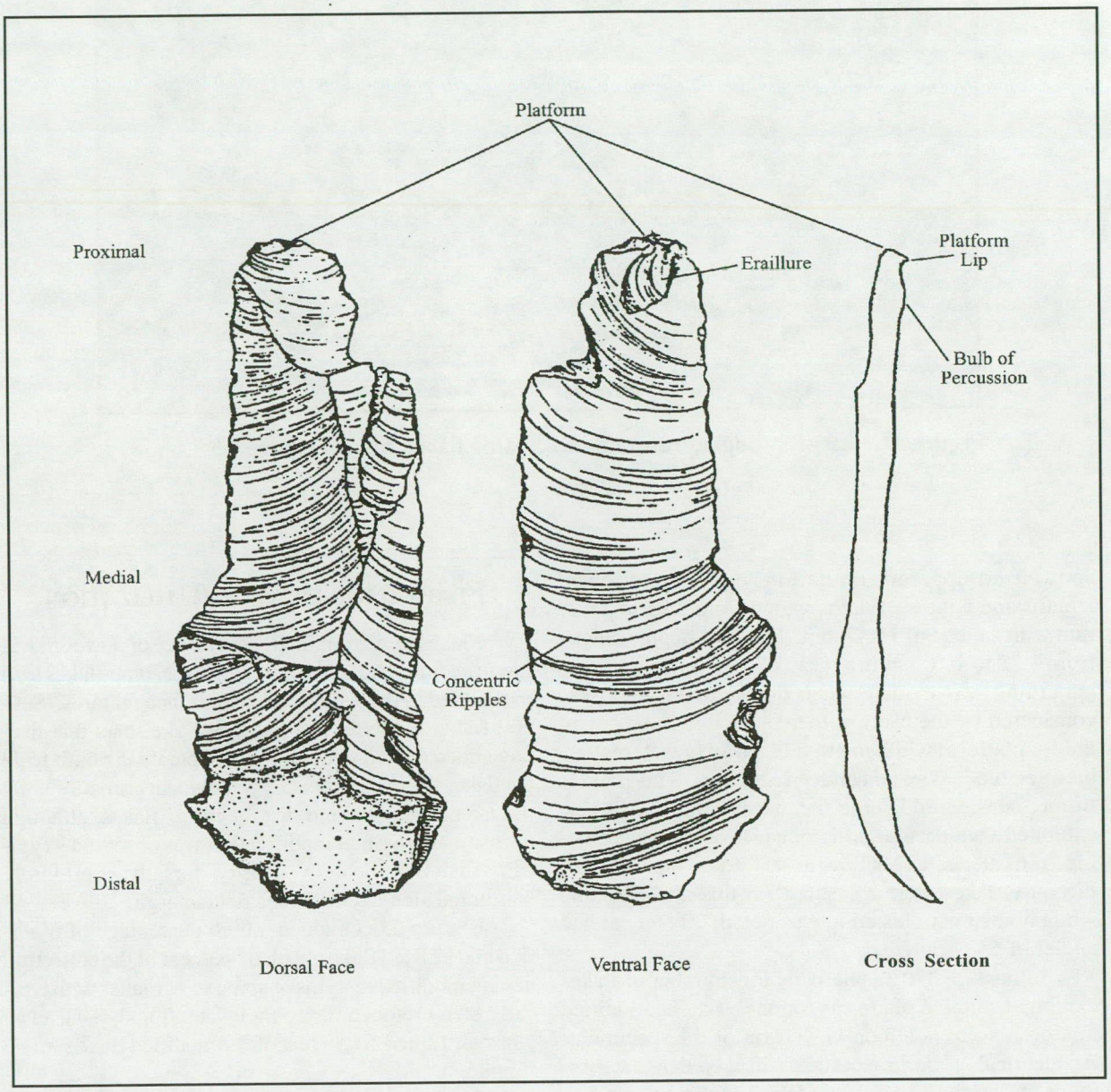


Figure 6. Key terms and features discussed in the text.

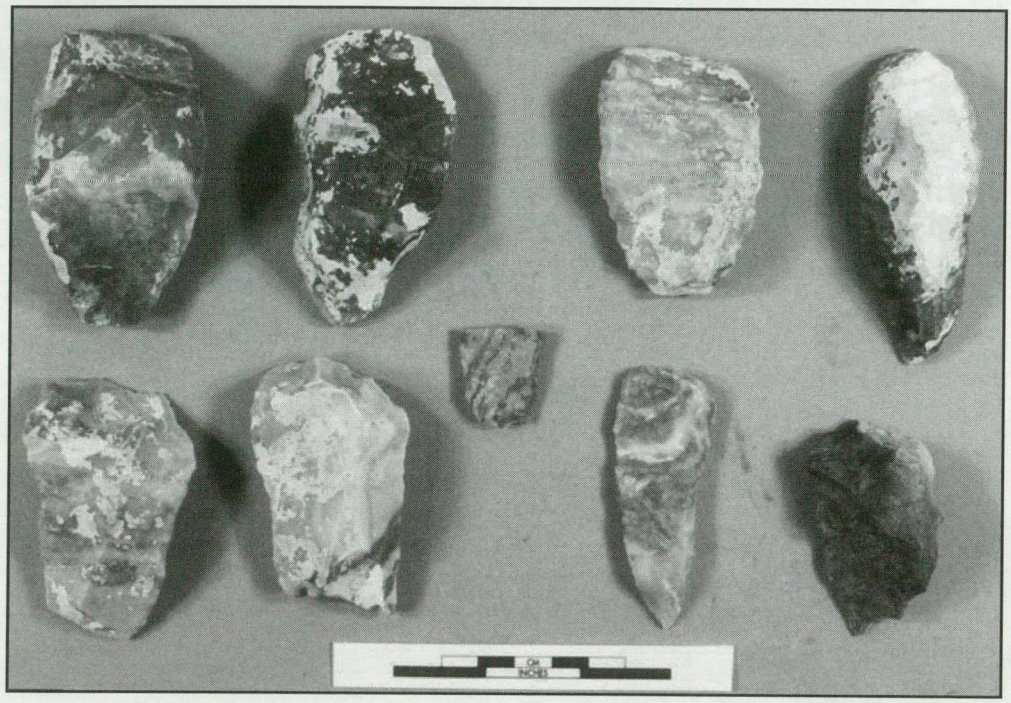


Figure 7. Large modified/retouched Alibates flakes from Feature 65.

showed no apparent limitation to the variation of lengths and widths. Widths varied from 3.95 to 28.27 mm with a mean of 11.47 mm. Platform depths ranged from 1.22 to 10.06 mm, a mean of 4.16 mm. While no patterning was evident when these dimensions were considered by themselves, there appeared to be potential for platform width to provide a way to differentiate between block core and biface reduction. This point is further considered later in the discussion. Flakes also exhibited a wide variation among platform angles, ranging from angles as shallow as 45° to as high as 86°. Fifty-six flakes were measured for this attribute, and while no distinct clustering was noted, 70 percent had angles of 65° or greater.

In Feature 2701 a relatively low number of flakes exhibited suitable platforms for analysis. Unmodified platforms were noted on 11 percent of the specimens. An identical proportion of flakes displayed dorsal trimming and ground platform edges. Platform grinding was most common with an incidence of 78 percent. Platform widths varied from 1.62 to 20.43 mm with a mean of 10.44 mm. Depth of platforms ranged from .83 to 7.98 mm, a mean of 2.87 mm. A small number of flakes provided data on platform angles, which varied from 46° to 82°. Of the 15 flakes with measurable angles, 11 (73 percent) had angles under 65°.

Flake Modification/Utilization

Flakes were examined for evidence of post-removal modification. An alteration noted on some flakes was mentioned in the section on ventral face features. Several flakes exhibited ventral face flake scars that may have been related to attempts to separate the bulb from the flake. Other modification was evident primarily along the lateral margins and distal ends of flakes, although occasional proximal modification was observed. Typically such modification occurred dorsally, but it rarely was noted along ventral face flake margins as well.

Feature 65 contained a high percentage of modified and utilized flakes, with 62 percent of the collection having modified margins of some sort. Flakes with typically steep retouch along their lateral and distal margins constituted 16 percent of the modified flake sample (Figure 7).

By contrast Feature 2701 yielded only four flakes with any form of modification, accounting for 8 percent of the total collection. Two flakes exhibited minor utilization along their lateral and distal margins. The other two flakes had retouch along their lateral margins (Figure 8). In addition to these flake tools, a broken biface of an unidentified chert was also included in the feature (Figure 8). The marginal retouch on this biface created



Figure 8. Retouched flake and biface from Feature 2701.

an alternately beveled appearance, particularly near the distal tip.

Comparisons

The analysis revealed several potentially significant variables that seemed to differentiate the two features. Instead of simple direct comparisons between the two features, Feature 2701 was compared to groups of flakes from Feature 65 that were separated on the basis of the same attributes. This cross-feature comparison indicated the likelihood that both block core and biface reduction flakes were represented in the collections as a whole.

While many flakes from Feature 65 appeared to exhibit significant distinctions from those in Feature 2701, a similar number of Feature 65 flakes had some attributes that were quite comparable to their Feature 2701 counterparts. Specifically, characteristics associated in some way with the platforms, including depth, angle, and edge modification, were particularly diagnostic of this deviation. The relative orientation of flake scars on the dorsal faces yielded additional evidence of the apparent diversity within the collection. This variation was used to confirm one goal of this research—the differentiation of reduction trajectories.

Platform depth represents the distance between the impact point of the removal blow and the platform margin. Feature 2701 yielded a mean depth of 2.87 mm, while Feature 65 collectively averaged 4.16 mm, indicating a measurable degree of diversity between the two features in general. When Feature 65 flakes were separated on the basis of a variety of variables, including platform depth, two averages were obtained from the feature. Group A, composed of 27 flakes, averaged a platform depth of 2.62 mm. Group B contained 39 flakes and yielded an average depth of 5.10 mm (Figure 9).

Platform angle measurement in Feature 2701 averaged 58°. With consideration of all flakes, Feature 65 averaged approximately 65°. Again, some contrast was noted, even when Feature 65 was not divided. Splitting Feature 65 specimens into Groups A and B, internal variation was considerably larger than the variation between Features 65 and 2701. Group A platform angles averaged 56°; those in group B averaged 79° (Figure 10).

Platform modification, which—aside from isolated dorsal trimming—essentially was defined as the presence or absence of platform margin grinding, was a third significant variable of distinction. In Feature 2701, 22 flakes exhibited ground platforms, while 3 others had evidence of both grinding and dorsal trimming. Thus, 89 percent of the specimen platforms were modified.

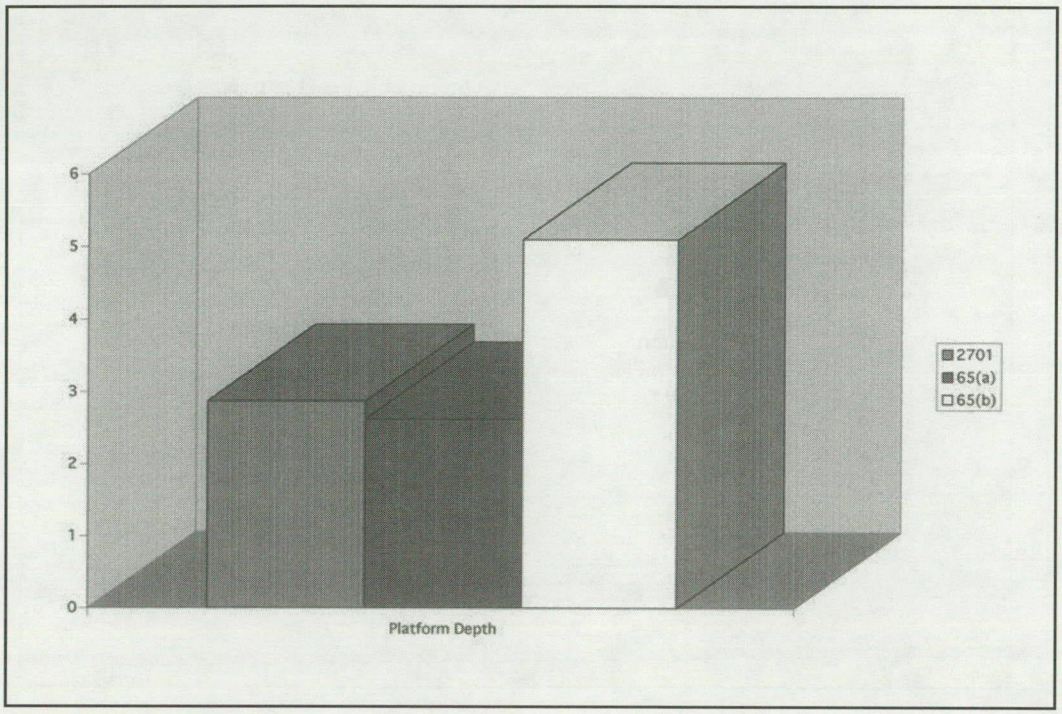


Figure 9. Chart illustrating average platform depth variation among Feature 2701 and Feature 65 Groups A and B.

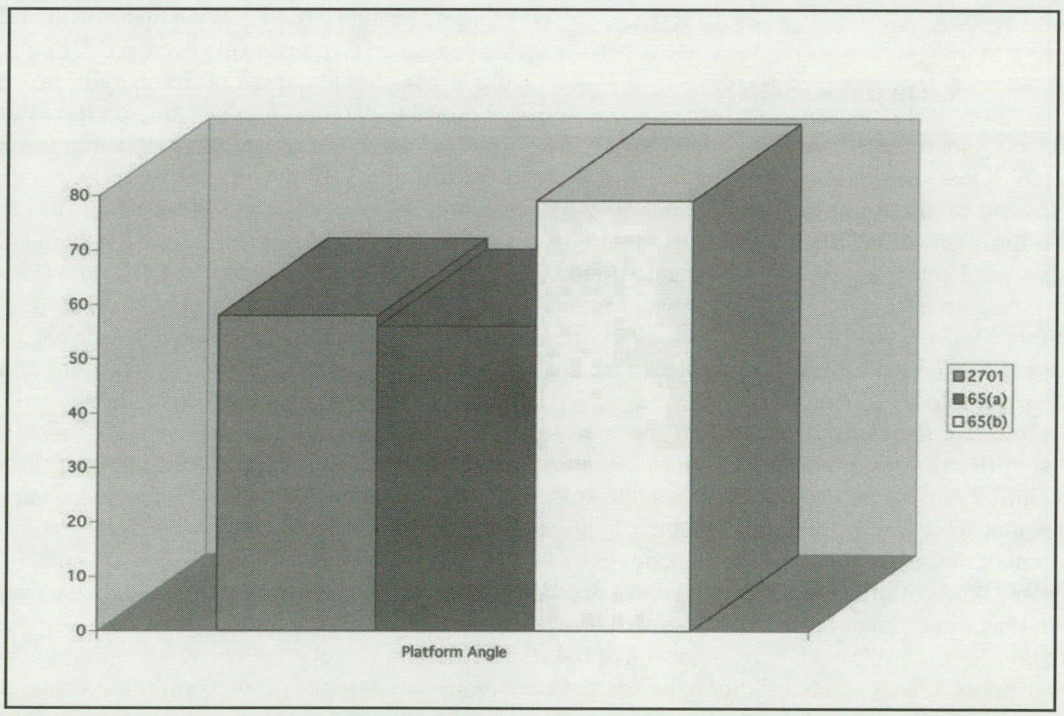


Figure 10. Chart illustrating average platform angle variation among Feature 2701 and Feature 65 Groups A and B.

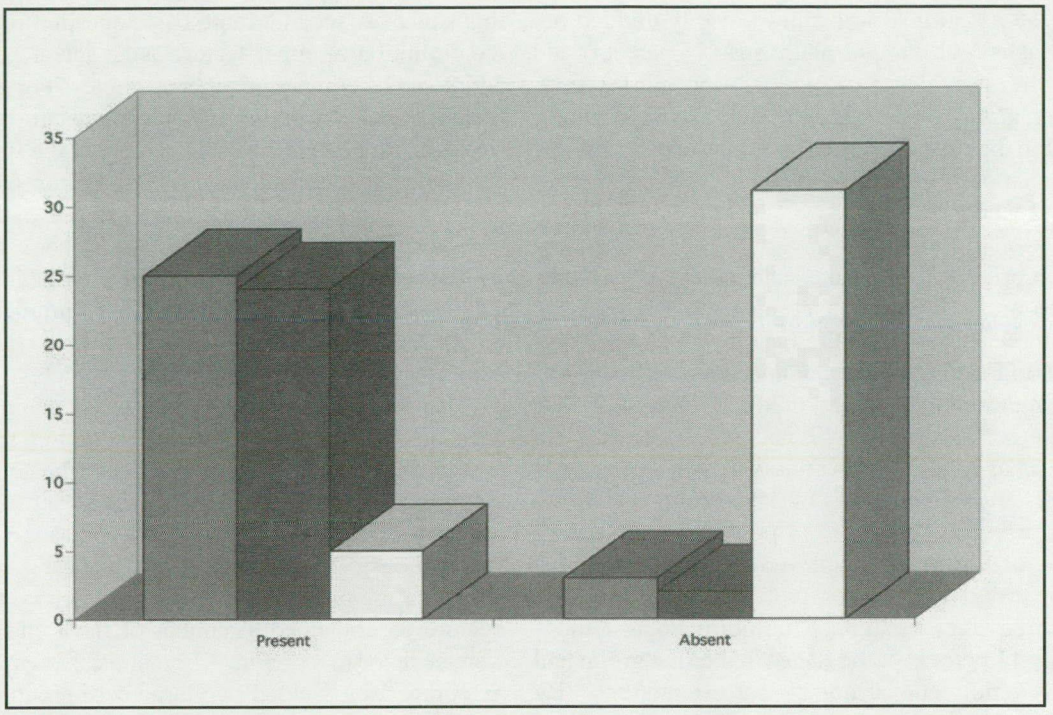


Figure 11. Chart illustrating variation of platform modification among Feature 2701 and Feature 65 Groups A and B.

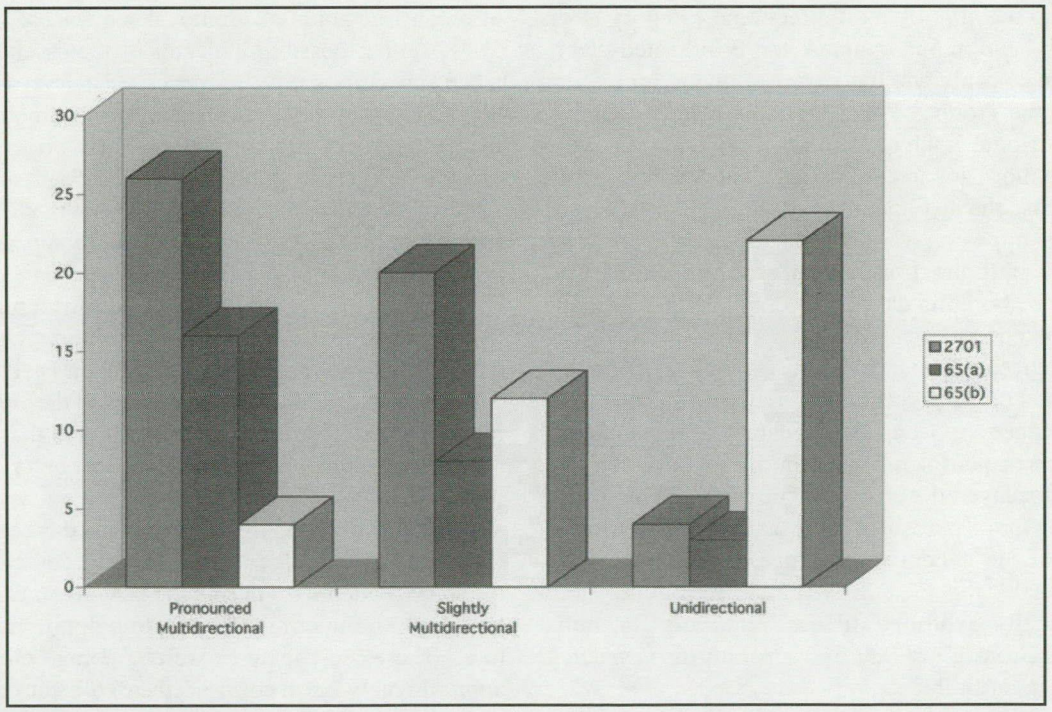


Figure 12. Flake scar orientation noted in Feature 2701 and Feature 65 Groups A and B.

Feature 65 as a whole was almost evenly divided between flakes with ground platforms (47 percent) and those with no evidence of modification (53 percent). However, group division again demonstrated the diversity within the collection. Group A platforms exhibited 92 percent modification. Group B platforms, on the other hand, were modified only 14 percent of the time (Figure 11).

The orientation of flake scars on the dorsal face provided another aspect of comparison between the two features and between the Feature 65 groups (Figure 12). In Feature 2701 pronounced multidirectional, slightly multidirectional, and unidirectional categories tallied percentages of 52, 40, and 8, respectively. In Feature 65 as a whole, both multidirectional categories were present in frequencies of 31 percent. Unidirectional scars were found on 38 percent of the flakes. Group A of Feature 65 displayed a 59 percent occurrence of pronounced multidirectional scars and a 30 percent frequency of slightly multidirectional removals. Only 11 percent of the flakes in the first group had generally unidirectional dorsal scar orientations. By comparison Group B again showed distinct patterning. Unidirectional removals were most common, being noted on 58 percent of the flakes. Pronounced multidirectional removals were recorded for only 10 percent of the lithic specimens. Slightly multidirectional scars were exhibited on 32 percent. The low degree of reliability for using the slightly multidirectional category to distinguish Feature 65 Groups A and B indicated that the attribute possibly was too vague, allowing for overlapping of the groups. Perhaps a more standard analysis of an attribute, such as number of dorsal scars, would reveal a more apparent difference between the groups. In any case the distinction was much clearer when considering opposing variables of unidirectional versus strongly multidirectional dorsal scar orientation.

Corroborating data from ventral surface attributes were limited; however, platform lipping appeared to have significance in distinguishing the groups. This attribute was noted on 62 percent of the flakes in Feature 2701. By comparison Group A of Feature 65 contained all evidence of platform lipping in the feature. Thirteen flakes displayed the characteristic overhanging lip, accounting for 48 percent of the group. In addition examination of the general appearance of bulbs of percussion revealed that Feature 2701 and Group A of Feature 65 typically exhibited diffuse, relatively flat bulbs, whereas Group B of Feature 65 generally displayed more conspicuous bulbs.

The above comparisons were useful for distinguishing the reduction strategies represented in the features, which was one of the primary questions posed in this study. A second, more basic question relating to the definition of either feature as an actual cache was addressed by comparing other attributes. For example, flake terminations presented some interesting comparative data. In Feature 2701, 44 percent of the specimens exhibited step terminations or breaks. Feature 65 Groups A and B had only 19 percent and 16 percent of this flake type, respectively. Were they really caches? The high incidence of apparent stepped terminations in Feature 2701, compared to the relatively low occurrence in Feature 65, suggested that Feature 2701 simply represented a dumping episode of biface reduction debris.

Another perspective is that the apparent difference between the two features was due to a more discriminating manner of flake retention in Feature 65, resulting in the presence of essentially intact flakes and the near absence of broken flakes or flakes with step terminations. This second viewpoint may be supported by the nature of the raw materials in the two features. Feature 65 contained a number of flake clusters that were believed to represent different cores. Feature 2701 by comparison yielded two large core groups, identified as distinct varieties of Alibates. The large number of core groups represented in Feature 65 might have been due to a combination of selection prior to creation of the cache and perhaps subsequent retrieval of pieces from the collection, creating both the variation within the collection as a whole and the relatively low number of reconstructable flake removal sequences.

Another possible indicator of the essential character and purpose of the individual features was the degree to which flakes subsequently were modified, either as a result of utilization or alteration prior to further reduction into formal tools. Previous discussion of the features pointed out a high percentage of modified flake margins in Feature 65, especially when compared to that present in Feature 2701 (62 percent versus 8 percent). Furthermore, flakes that displayed edge trimming, more likely related to an additional preparatory stage rather than to utilization, were not identified in Feature 2701. This provided additional evidence of the distinctive nature of each feature and further argued that perhaps only one actual episode of caching behavior was present.

One final comparison dealt with the contexts of the features themselves rather than the contents. Feature 65 was identified during the general block excavation with no direct relationship to a non-portable feature. The closest features were a storage pit, located approximately 2.5 m north-northeast of Feature 65, and a possible semi-subterranean pit structure about 4 m to the west. Feature 2701 was identified on the floor of a bell-shaped storage pit that was filled with an assort-

ment of cultural debris, including discarded tools, debitage, ceramics, butchered bone, and a number of caliche chunks and boulders up to 30+ cm in diameter. The flakes were discovered below one of the large caliche boulders. Feature 2701 might have been a cache of flakes forgotten at the bottom of a storage pit that was abandoned for its original purpose and subsequently filled with refuse. However, the lithic feature's overall dissimilarity with Feature 65 led to the conclusion that it more likely represented the discard of a handful of lightly used expedient flake tools and flakes related to a limited number of reduction episodes.

Summary and Conclusions

This analysis had two principal subjects of inquiry. One was to ascertain the prospects of either feature representing a definitive episode of caching. While flake clusters like Features 65 and 2701 might be considered caches without much corroborating evidence if found in isolation, their presence in habitation sites (and one in a trash-filled storage pit) made it necessary to demonstrate the likelihood that the flakes were placed together with the intent of recovery rather than through an act of waste disposal. Second, the analysis sought to determine the manufacturing technology that created the flakes in both features. Post-removal characteristics also were studied as a means of lending support to the determination of the features' purpose. To this end, the study outlined a series of flake attributes that would assist in the inquiry.

Analysis revealed that Feature 65 contained evidence of two manufacturing technologies: blocky core and biface trajectories. Characteristics of blocky core technology were found to include a high correlation of the following factors: generally unidirectional dorsal surface flake scars, salient bulbs, steep platform angles (averaging more than 65°), a lack of platform edge modification, and depth of platform (deep compared to biface flakes). Conversely, biface technology traits included a high proportion of pronounced multidirectional dorsal flake scars, diffuse bulbs, shallow platform angles (averaging under 58°), a high degree of platform edge modification (primarily grinding), the presence of ventral face platform lipping, and shallow platform depth.

Within Feature 65, 11 primary core groups and numerous isolated flakes were noted. Two core groups, resulting from different reduction technologies, were identified: one possibly indicating early-stage reduction flakes related to initial shaping of the biface and the other indicating intermediate- to late-stage biface flake removals. Post-removal modification was indicated visually by the presence of blunted edges and retouched flake margins. Several of these were large, robust flakes that generally could be classified as large scrapers. The flakes were found in a tightly packed cluster with no evidence of a container or structure for containing the collection. The feature's relatively isolated location several meters away from the nearest structural feature, in addition to the above characteristics of the flakes within that feature, led to the conclusion that Feature 65 should be considered a genuine cache.

The appearance of the two reduction strategies in the collection was interesting for consideration of the individual knapper. Assuming that a cache like Feature 65 represented the work of a single flintknapper, then the characteristics of the flakes were indicative of the individual's ability. First, he was capable of reducing a piece of raw material through blocky core or biface trajectories. He had particular strategies for flake removal unique to each approach. He was experienced, as his proficiency with platform stabilization would suggest. His skill was reflected in his ability to strike flakes off in such a manner as to allow distinction between his biface and core flakes on the basis of platform depth and angle.

Feature 2701 was identified as representing solely a biface technology. Recognized were two core groups and a small number of individual flakes struck from an undetermined number of other cores. Post-removal modification was limited to four examples, including one formal flake tool that could be classified as a scraper. In addition, a broken alternately beveled knife was recovered with the collection of flakes. These lithic specimens were found in a loosely associated group below one of several caliche boulders, lying at or near the floor of a trash-filled storage pit. The characteristics of the lithic artifacts and the feature context were then quite contrary to those of Feature 65. While it is possible that Feature 2701 represented an actual lithic cache, it was not considered a cache on the basis of this analysis and cross-comparison of the two features.

Comparisons between the biface flakes from Feature 65 and the lithic artifacts in Feature 2701 revealed some striking similarities among several variables. Attributes related to the flake platforms—specifically their depths, angles, and modifications—were nearly identical between the two groups. Other variables that were not as comparable might be related to the stage of reduction, purposeful post-removal modification, or bias due to biface flake selection for caching versus simple representation of biface reduction flakes. These similarities pointed to one individual being responsible for the production of each lithic feature, whether it was

related to caching behavior or debitage disposal. Additional research into the lithic debitage assemblage of the Booth site revealed that intermediate to late stage biface reduction flakes accounted for 94 percent of the debitage. Only 6 percent of the flakes were identified as early stage biface or blocky core reduction flakes (Bevitt 1999:46). Comparisons with lithic materials from other sites, not necessarily related to caches, will be important for determining the validity of the proposals discussed here.

Caching behavior can provide insight useful for understanding prehistoric culture on a number of levels, ranging from large questions of exchange and mobility to the very specific level of the identification of patterned behavior recognized at an individual level. The lithic artifacts present in the features discussed here were recognized as remains that potentially could contribute important information, if not of the idiosyncratic behavior of a specific flintknapper, then at least of some of the patterned choices and reduction strategies that were used by the inhabitants of the site.

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Hilltop Camps

Peter W. Bowman (deceased)

The Kansas Anthropologist *22:33-40*

A six-year archeological reconnaissance of the High Plains and Piedmont physiographic regions of eastern Colorado was undertaken to identify the relationships between site locations and certain topographic features. The ultimate goal was to gain a better understanding of the setting of the Herl site, a hilltop campsite in Greeley County, Kansas. A total of 505 possible locations were checked, and 191 sites were recorded. These were classified according to their topographic settings as Hilltop, Valley, Blowout, Butte, or Pond, and the resulting data were compared with the findings of E. B. Renaud's Colorado High Plains survey. The small and uneven sample revealed marked and consistent trends that reflected the cultural factors in site location selection.

Introduction

by Janice McLean, November 2001

In 1971 Peter W. Bowman included the brief report published here as part of a much longer manuscript entitled "The Herl Site (14GL401): A Hilltop Camp in Western Kansas" (Bowman 1971). Bowman conducted excavations at the Herl site from 1961 to1965 and wrote the site report over a period extending from 1966 to 1971. This excerpt pertains to a survey of archeological sites that he conducted in eastern Colorado from 1964 to 1970. Since few sites analogous to Herl had been reported from the High Plains, Bowman undertook the survey in order to place the site in a broader interpretive context. In this report Bowman compares his findings to Renaud's 1930-1933 High Plains survey work in eastern Colorado. Bowman's study area consisted of the area east of the Rocky Mountains between the South Platte and Arkansas rivers and corresponds to E. B. Renaud's High Plains, Highland, and South Platte districts (Renaud 1931:57).

Renaud's work (1931, 1932a, 1933, 1935) has been criticized as "superficial and inexact" by today's standards (Cassells 1983:243), and, if it is considered in isolation, the same criticisms might apply to the report printed here. However, Bowman conducted his survey with much higher standards of precision than Renaud, and, as in all of his research projects, he did so with the purest of scientific intentions: to better understand ***why***. Not many archeologists, professional or avocational, would singlehandedly undertake a monumental endeavor like a six-year survey, covering over 9,200 square miles, simply to get a better grasp of why one particular site was located where it was. With the Herl report and this section in particular, Bowman has once again proven himself to be a key figure (or anomaly) in the history of High Plains archeology (McLean 1996).

Furthermore, the supporting documentation for this report has a great deal of potential for future study. For instance, Bowman recorded all of his site locations on 1:250,000 scale Colorado quadrangle maps. These maps are supplemented with a partial set of Bowman's original field notes, which include legal descriptions for about 60 sites, comments on site settings, and brief descriptions of the artifact types recovered (McLean 1996:31). These materials are now curated at the University of Kansas Museum of Anthropology (KUMA) in Lawrence, Kansas, along with the original Herl site manuscript and artifact collection.

The Herl site manuscript and maps were donated to KUMA in September 2001 by Jerome S. ("Pete") Bussen at the request of Bowman's family, who had recovered these items from his home after his death in Pueblo, Colorado. Mr. Bussen had previously donated the Herl site artifact collection to KUMA in 1995, along with the Coal-Oil Canyon (14LO1/14LO401) collection (McLean 1996:31).

Unfortunately, the location of Bowman's surface collection from eastern Colorado is not known at this time, and his death in 1998 makes it unlikely that the collection will ever be found. A comparable surface collection for the High Plains of western Kansas is present in Wallace, Kansas, at the home of Mr. Bussen. It consists of thousands of lithic and ceramic artifacts collected in 1954-1959 from approximately 100 sites, located mainly in Wallace and Logan counties in Kansas.

Bowman's dedication to systematic research proves that he deserves a key place in the history of High Plains archeology (Bowman 1960, 1996; McLean 1996). However, Bowman himself did not actively pursue this recognition and abandoned virtually all of his archeological research materials, including the Herl site collection, when he left Wallace, Kansas, to move to Pueblo, Colorado. Mr. Bussen, acting as long-term and long-distance curator of many of Bowman's archeology-related documents, papers, maps, and collections, deserves equal credit and recognition for preserving Bowman's rich archeological legacy.

Hilltop Camps

Possibly the most important single diagnostic trait of the Herl site is its topographic location, a fact that may not be widely appreciated. Among amateur prehistorians, arrowhead collectors, and anyone else even mildly interested in the matter, it has always been axiomatic that the place to look for Indian sites in northwest Kansas is on hilltops. Being accustomed to this, I was unaware of anything anomalous in the situation until I noticed a mild but invariable incredulity on the part of professional archeologists to whom it was mentioned. Upon completion of the Herl fieldwork, it became obvious that some sort of investigation of this phenomenon was necessary.

Since the hilltop site setting apparently was associated with semiarid climate, it seemed probable that its purest manifestation would be to the west, so I undertook an archeological reconnaissance of east-central Colorado to determine the extent of hilltop sites and whatever else might be learned about them. The area reconnoitered, roughly that east of the mountains between the Arkansas and South Platte rivers, is divisible into two physiographic sections: the Colorado Piedmont and the High Plains (Fenneman 1931) (Figure 1). The dividing line between these sections in east-central Colorado is the usually prominent surface water divide between the Kansas River drainage system (Smoky Hill and Republican rivers) and those of the Arkansas and Platte rivers.

The Colorado High Plains encompass a roughly V-shaped area of about 9,289 square miles, terminating on the west at Cedar Point, some 10 miles northwest of Limon. Except for extensive dune sand localities in its northeastern part, the region is relatively uniform physiographically. For the most part it is a gently to moderately rolling treeless upland with occasional nearly flat localities, dissected at frequent intervals by systems of swales and shallow draws that coalesce and gradually widen and deepen into the creeks that make up the branches of the two major drainages. Over more than 95 percent of this area, the drainageways are well above the permanent watertable and, hence, are dry except for runoff after heavy rains. There are occasional "raises" where the water courses intersect the watertable for a short distance, but in general the only permanent live water occurs in the lower part of the three main forks of the Republican River in eastern Yuma County (Weist 1964:28, Plate 4). The rate of flow in this locality, however, is—or at least formerly was—considerable, as indicated by the fact that between 1881 and 1936 the Office of the State Engineer of Colorado issued 5 reservoir and 69 ditch decrees for irrigation rights on the North, South, and Arickaree forks of the Republican and their tributary creeks (Woodward-Clyde-Sherard and Associates 1966:Table VI). No locations are listed for 13 of these decrees, but the others are all within 26 miles of the state line.

In these permanently watered valleys the flood plain, averaging about a half mile wide, is subirrigated and usually supports discontinuous stands of cottonwood and willow trees, plus meadows of tall grass and numerous species of annual and perennial forbs. On the upland short and mid-grasses predominate, with buffalo and blue grama making up to 95 percent of the basal cover. And, as with most other hardland (virgin sod) areas of the west-central Plains, the Colorado High Plains has in many localities the undrained depressions of various sizes that collect runoff water and form upland ponds for lengths of time, ranging from a few days to many months (Frye 1950; Wedel 1963:7-8).

The Colorado Piedmont has a greater physiographic diversity. To the south of Cedar Point, in the bend formed by Big Sandy Creek, there is a locality that is identical to the High Plains and is, in fact, an outlying portion of it. Southwest of this is a locality that has a semi-desert aspect. To the east between the Arkansas River and the High Plains, the terrain is mostly flat to gently rolling hardlands, but with many areas of dune sand. Westward from Cedar Point to the mountains, the terrain is increasingly rough with coniferous trees on the hills and brush in the valleys, blending into typical foothills environment in the Black Forest-Castle

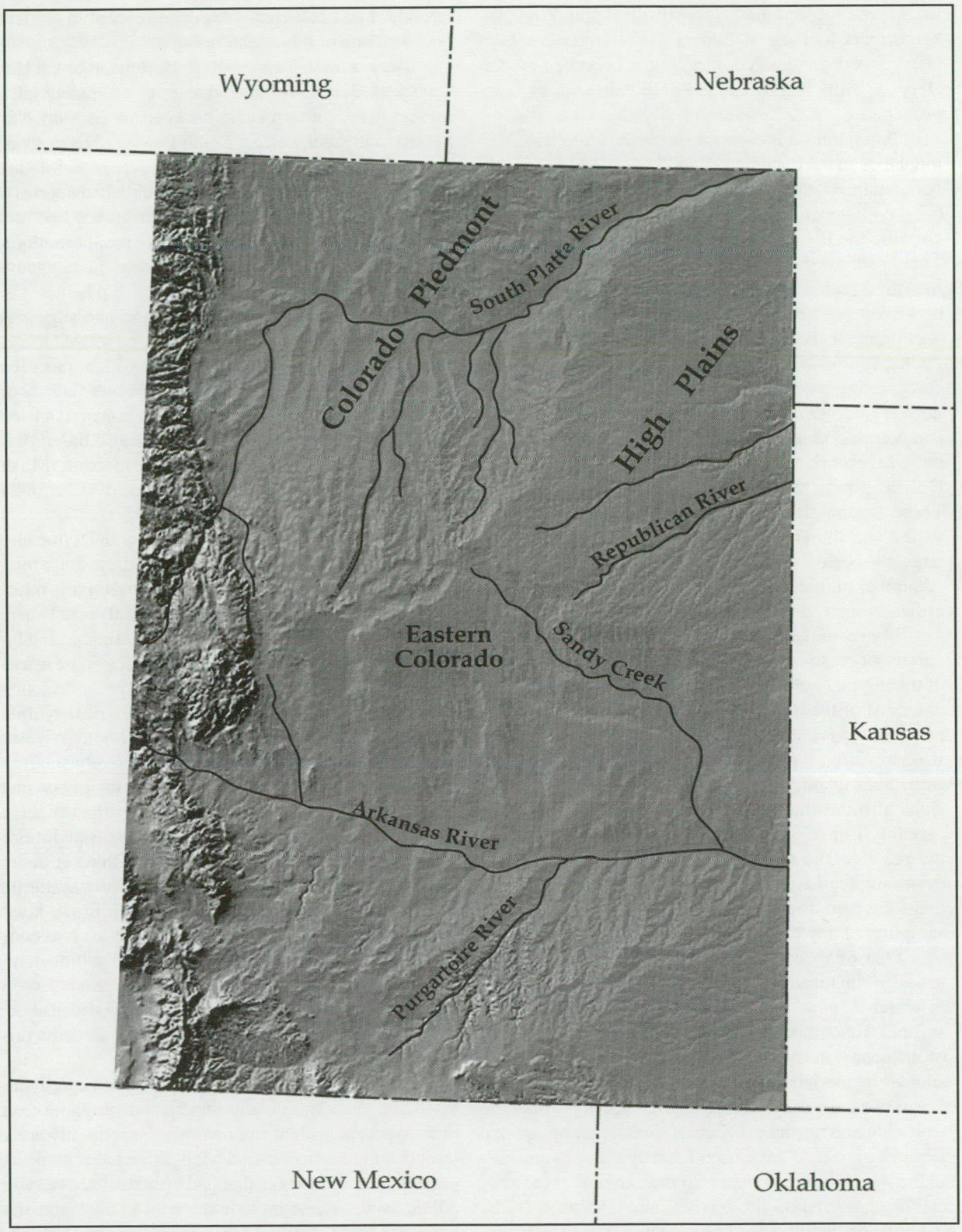


Figure 1. The area involved in this study falls roughly east of the Rocky Mountains and between the Arkansas and South Platt rivers. Its two physiographic regions, the Colorado Piedmont and the High Plains, are also shown here.

Rock area. Immediately north of Cedar Point the headwaters locality of Beaver and Badger creeks is also rugged, treeless country, but it becomes moderately to gently rolling as the South Platte valley is approached.

Precipitation is even sparser in the Colorado Piedmont than in the Colorado High Plains—12 to 15 inches per annum, as compared with 15 to 18 inches. Excepting the Platte and Arkansas rivers, there are no streams crossing the Piedmont that originate in the mountains. Therefore, most of its watercourses are dry except for runoff. Much of it has a good permanent watertable, however. Where the drainageways intersect the watertable, there are, as in the eastern edge of the High Plains, valleys with permanent stream flow and the accompanying vegetation of deciduous trees, meadow grasses, etc. On the uplands the grass is for the most part correspondingly thinner than in the High Plains with more sagebrush and cactus, especially on sandier soils. Upland ponds also occur on the more level terrain. Those on the flat lands between the Arkansas River valley and the High Plains tend to be conspicuously large, the basins of some covering several square miles. A number of these with minor modifications have been utilized for irrigation water storage.

My reconnaissance of eastern Colorado has for a variety of reasons been sporadic and uneven. In parts of the region, including the western and northern edges and most of the dune sand localities, I have done little more than drive through. Where and when it was possible to search for and examine sites, coverage ranged from light to intensive. Probably I have been within sight of more than 25 percent of the total land area; certainly I have not examined more than 1 percent of the possible site locations. But in this small and uneven sample, there are trends so marked and consistent that I have no doubt that they would persist through a sampling of any magnitude.

One of these trends is the obvious relationship between site locations and certain topographic features, of which I found the hilltop examples are but one of several. Topography, no doubt, has had a certain amount of influence on the selection of almost any living site, ancient or modern, in some cases being the most important or even the deciding factor. But in east-central Colorado and northwest Kansas specific topographical features appear to have been literally the *sine qua non* in the location of campsites, to the extent that the sites can be classified on this basis alone, regardless of the quantity or quality of cultural material, with remarkably few intergrades or exceptions. It became apparent early that in my study area sites could be readily classified as Hilltop, Valley, Blowout, Butte, or Pond; only rarely did archeological sites occur except in association with one of these features.

Between 1930 and 1936 E. B. Renaud of the University of Denver conducted a series of archeological surveys in the western Plains between northeastern New Mexico and southwestern South Dakota. His work included the only systematic surveys ever made of eastern Colorado, as far as I know. He published a series of reports on his findings. After my own survey had been underway for some two years, I had an opportunity to read most of Renaud's reports and was encouraged to find that he also had noted the relationship between topography and the location of sites and had suggested that topography "might in some way be related to culture" (Renaud 1934:11). His site classifications seem to vary somewhat between reports, and there are subdivisions apparently based on cultural objects and features found, but his main topographically based divisions include Lookout, Valley, Blowout, Mesa, Rockshelter, and Sandhill sites (Renaud 1931:21-24, 1934:11).

Since my main concern has been with Hilltop sites and their possible relationships to Valley sites, these categories have received the most attention; the others need more study and can be mentioned only briefly here. Pond sites are among the most easily definable and understandable of the categories, being located near temporary ponds on the uplands, the only possible source of water often for many miles. They are usually difficult and very time consuming to check out. Whereas the other categories are confined to relatively small areas, there are scores or hundreds of acres of possible site locations around the ponds with perhaps several more or less separate sites. Also their levels and shorelines seem to have fluctuated greatly, with wave action and the trampling of animals in the shallows scattering or destroying all evidence of occupation in the lower levels of the basins. These sites seem to be less common than I had expected, occurring mainly, though not entirely, in the southern part of the study area. Except in those instances where camps were located well above all shorelines, this category is probably the least productive archeologically.

My Blowout category is presently not clearly defined and even less clearly understood. Judging from other work, as well as my own, there apparently are at least two kinds. In one kind wind action has re-exposed old occupation surfaces that had been drifted over with eolian sand. These include the well known sites that have produced Early Man material (e.g., Dick and Mountain 1960). In other cases it is abundantly clear that deflation basins were used as campsites after their formation and that these basins have changed relatively

little since that time. Why they should have been thus occupied, I have no idea. Some with impervious layers immediately below may have held water in more humid times; with others this is questionable at best.

Butte or Mesa sites are self-explanatory, being located on the tops of prominent isolated erosional remnants, usually of considerable height. They are, of course, restricted to certain areas. Not all possible buttes were occupied, and there may be a pattern to this. There is a degree of similarity to Hilltop sites, and there may be some intergrading, but in general the distinction is clear enough. In Butte sites the main concern apparently was with protective isolation.

The differences between Hilltop and Valley sites are clear and fundamental, and there are few intergrades between them. In the former, visibility is obviously the primary consideration with proximity to water secondary. Valley sites are usually located as close to the stream channel as safety from flooding will permit with little, if any, regard for visibility. Occasionally the accidents of topography will provide excellent visibility from a bluff top immediately overlooking a stream channel. These locations invariably have sites that I classify as Hilltop, since they have all the requirements. But where valleys are wide with sloping sides, sites occur only on the high ground along the rims or in the valleys along the channels and rarely, if ever, on the slopes, regardless of other possibly favorable factors.

The other topographically induced site classes that probably also occur in my study area are Rockshelters and Springs. I have not checked any possible locations of the former and have found no sites at three of the latter.

Of 505 possible site locations checked, I have recorded a total of 191 sites, classified as follows. In the Colorado Piedmont: 65 Hilltop sites from 194 examined locations; 19 Valley sites from 84 locations; 2 sites on 2 Buttes (both local report); 2 sites of 7 Blowouts; 1 site of 7 Ponds. In the Colorado High Plains: 100 Hilltop sites from 162 checked locations; 1 Valley site from 42 possible locations; 1 site from 4 Ponds; no Butte, Blowout, or Spring possibilities checked.

Three trends are evident here. The most tenuous, which might not hold up in a larger sampling, is that sites of all kinds are less numerous in the Colorado Piedmont. Another, more certain, is that away from sandhill and foothill environments, where Blowouts and Buttes (and, no doubt, Rockshelters and Springs) are of necessity more plentiful, Hilltop sites are the dominant kind in both sections. The other trend, overwhelmingly obvious, is that Hilltop sites are dominant in the High Plains hardlands, while Valley sites are relatively more numerous in the Colorado Piedmont.

There is a suggestion here of a central area in the Colorado High Plains dominated by Hilltop sites and surrounded by areas in which they are less prevalent. Distinctions between cultural and natural causation must be kept in mind because, of course, there can be no Hilltop sites where there are no proper hilltops. But in northwest Kansas, where hilltops are at least as plentiful as in the Colorado High Plains, Valley sites are appreciably more numerous. I have no precise figures, but it would be a safe estimate that 10 percent of the sites in northwest Kansas are Valley, with nearly all the others being Hilltop. Suggestions along this same line are evident in Renaud's reports. In his first and most extensive survey of eastern Colorado, his Lookout sites were regarded as campsites, described thus:

> In some cases the finds were grouped on a relatively small area so located that from that place one had a splendid view of the surrounding country, plain or valleys, such as on a spur between two creeks, the slope of a high hill, a shoulder between two vales, the edge of a cliff or mesa over a canyon or the lower lands. Such sites were naturally called "Lookouts" and 18 were identified, although there are certainly many more not reported. They have been principally found in the Highland region, Douglas, Elbert and El Paso counties, and along the Apishapa River in Otero county (Renaud 1931:21-22).

The second survey of eastern Colorado, mostly in the Platte and Arkansas valleys, found fewer Lookout sites, and these seem not to have been considered campsites: "There are only a dozen look-outs, 5 in the Northern Area, 6 in the Southern Area and one near Morrison" (Renaud 1932a:33).

In his report on the survey of eastern Wyoming, made in the same year, there is an evident change in attitude toward Lookout sites:

> In 31 instances the campsites were so placed and often so small as to deserve rather the name of LOOKOUTS. Such small groups of tipi rings, so located as to have a very extensive view of the surrounding country were nowhere found in large number but a few only were seen in propitious places in practically all the districts, none having more than four. Many may have been overlooked, as we often traveled along the valleys in search of larger camp sites whereas look-outs are more frequently perched on a high spur on the edge of a cliff, and it

> would have taken too much time and labor to hunt for them. Besides they are of little cultural value, as very few artifacts are usually found at such small sites, although they are sometimes in the vicinity of a camp or guard its approach. Only 18 had been identified in Colorado in 1930, although Wyoming, being more mountainous in the regions we explored, was naturally more propitious for these (Renaud 1932b:27).

The report on the western Nebraska survey, made in 1933 mostly in the vicinity of Signal and Barn buttes, does not mention Lookout sites (Renaud 1934). Finally, in 1937 after having surveyed adjacent parts of Wyoming, Nebraska, and New Mexico, as well as eastern Colorado, he had this to say:

> Lookouts are self-defined sites, of secondary importance in the study of archeology as few artifacts are usually collected at such places, often of small extension and depending upon the nature of the terrain for their existence. They generally are located on a butte, a natural mount, a cliff of a projecting rock. Their obvious purpose is to sight from a distance the presence of game or the coming of an enemy. To be efficient in their double function, they must be fairly close to a dwelling site or in view of it, for exchange of signals. In some instances the very position of a cave or rock shelter high up in the cliffs—answered perfectly the functions of look-outs. However, this number (12 recorded) may be inferior to reality as, for reasons already given, look-outs are of little interest in the study of a culture and, therefore, not much time is devoted to finding them (Renaud 1937:11).

It is reasonably clear that Renaud's look-out category included both campsites (located in positions commanding wide visibility) and small observation posts (associated with Valley or other sites) and that the former were more common in east-central Colorado. Without excavation it might be difficult in some instances to distinguish between small Hilltop campsites and Lookout posts, but there is a clear and fundamental difference between them. A man on lookout might pass the time chipping stone tools, and he might or might not have a small fire or even shelter of some sort. On the other hand, he would be unlikely to encumber himself with pottery or grinding implements, both of which are found on a small percentage of Hilltop sites in the Colorado High Plains. Furthermore, observation posts could not account for cultural material, including hundreds of thousands of chips and burned rocks and dozens of fireplaces, strung out for hundreds of yards along the narrow crest of a ridge or the edge of a bluff. The near total lack of any other kind of site in the Colorado High Plains hardlands proves beyond question that the Hilltop sites were not mere observation posts.

In a few places I have been able to make a fairly intensive survey of valleys in the vicinity of Hilltop sites, but I found in none of these any sign of occupation. In the case of the one Valley site found in the Colorado High Plains, there was indeed a Hilltop site about a mile away on the valley edge in full view, but the Hilltop site was much larger with much more evidence of occupation than the Valley site. By no stretch of the imagination could the Herl site be considered a lookout post. There can be no doubt, therefore, that these Hilltop sites were campsites in the fullest sense of the term or that the locations were selected because of the visibility factor.

Of all the site categories, Hilltops are probably the least definable in concrete terms. They are, in fact, one more example of those scientifically exasperating features of human behavior that are better recognized than defined. After having visited many hundreds of locations where they do and do not occur, I have no trouble recognizing a possible or actual Hilltop location. Except in a few borderline cases, it can be done with hardly more than a look around, and even in most borderline cases, there is little doubt. I am confident that anyone else with normal powers of observation and conceptualization and with sufficient experience can do the same. But describing and delimiting their attributes in not this easy. Even the name I have applied to them is imprecise, although it is probably as good as any other descriptive term; not all hilltops have the necessary characteristics for a Hilltop site, nor do all Hilltop sites occur on a landform that would satisfy everyone's definition of a hill. Although a certain minimum of visibility is an obvious requirement, simple measurements of distance and direction are wholly inadequate for describing the essential aspects of the phenomenon. Probably no Hilltop site has a view of less than 2 miles or so in at least one direction, but I have found a number of hilltops with near panoramic views of much greater distance than this that were not used as sites. How far you could see was important, but what you could see was more important. These sites were obviously selected on intuitive recognition of certain minimum requirements, and with experience they can be recognized on the same basis.

The most apparent reason for this visibility factor is long-range observation of game animals. The two

major game animals of the High Plains, buffalo and antelope, are both among the most easily visible of the world's big game. The antelope's rump patch is visible to humans for up to 2 miles against either the green or the grayish background of grass. The individual buffalo probably could have been spotted from twice this distance under optimum conditions, and a large herd seen from even farther. This is reflected in the views from the Hilltop sites. They appear to have been selected not for panoramic, far-horizon views, although some have this, but rather for visibility over a maximum expanse of adjacent terrain suitable for herbivorous feeding.

High vantage points overlooking miles of rugged canyon lands never have Hilltop sites. In contrast relatively inconspicuous knolls or bluffs that by topographic chance are the high ground in an expanse of several square miles of open rolling land almost always do, if they are reasonably near a possible source of water. If a system could be devised to measure the acreage of grazable land continuously visible from Hilltop sites, I am confident a minimum would be found below which these sites do not occur. This minimum probably would vary somewhat between localities. There would be a more or less flexible relationship between it and the proximity of water, and the size of the visible expanse would be reflected in the size and richness of the site in most cases. I am certain that such a system, applied uniformly to all types of sites in the west-central Plains, would clearly distinguish Hilltop sites from all other except Buttes.

During the course of my investigations in eastern Colorado, however, I developed a suspicion that has since grown into a conviction: the observation of game animals, valuable though it may have been, was not the primary reason for the location of Hilltop sites. In August 1967, while I was walking out a small Hilltop site near the western point of the High Plains, three antelope approached to the foot of the hill and watched me intently. They milled around occasionally but were still in the vicinity when I left some 30 minutes later. From my experiments with luring antelope, I have no doubt that the sight of two or three tipis and camp activities prominently visible on a hilltop would be an irresistible attraction to the antelope for miles around. With precautions taken so as not to startle them, they would certainly approach to the immediate vicinity, if not right up to the door flap. Thus, the Hilltop sites were probably not only combination camps and observation posts but also continuously operating antelope lures. Efficiency no doubt varied from time to time and place to place; however, at best, this could have been among the easiest methods of big game hunting ever devised.

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The Final Context: Kansas Archaeological Field School Investigation of the DB Site, 1997

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The Kansas Anthropologist 22:41-63

DB (14LV1071) was a multi-component site on a loess-mantled ridge that overlooks the Missouri River valley on the Fort Leavenworth military reservation. Extensive excavations were done here from 1995 to 1996 to mitigate the effects of construction of a United States Disciplinary Barracks. The last investigation of the site, subsequently destroyed by prison construction, was undertaken by the Kansas Archaeological Field School in 1997. The results of that work, which consisted of intensive surface survey, salvage mechanical stripping, and excavation of a 36-m² block, are presented in this article and another by Daniel Pugh (herein). The data provide additional support for the intermittent occupation of this upland site during the Archaic, Woodland, and Late Prehistoric periods. The data reflect the less frequent occurrence of camp activities on the northwestern periphery of the site.

The DB site was named for the United States Disciplinary Barracks (USDB), construction of which had destroyed it by 1998. Located on the Fort Leavenworth military reservation, DB was centered on the summit of a loess-mantled ridge that provides an excellent overlook of the Missouri River valley to the north and of Salt Creek valley to the west (Figures 1 and 2). The site was found during a survey in the autumn of 1994, undertaken to locate other prehistoric sites in the vicinity of the Quarry Creek site (14LV401 and 14LV357; Figure 1; Logan 1995a). Excavations at Quarry Creek in 1991 by the Kansas Archaeological Field School (KAFS), a joint research-educational program of the University of Kansas (KU) and Kansas State University (KSU), had yielded abundant evidence of prolonged occupation by the Kansas City Hopewell culture (Logan 1993, 2000a, 2000b). One purpose of the survey was to locate other evidence of Hopewell activities that might have been related to the occupation of Quarry Creek.

Among the kinds of sites anticipated were bluff-top burial mounds, a characteristic feature of Kansas City Hopewell. One putative example of such sites is 14LV335 (Figure 1), situated a short distance northwest of Quarry Creek. Thus, the ridge top on which DB was found was included in the survey area in the belief that it might contain another such mortuary feature. Ironically, all subsequent investigations at DB have not revealed any evidence of a mound or of burial activities. Indeed, evidence of Kansas City Hopewell occupation is relatively scarce. Rather, more extensive evidence of Paleoindian, Middle-Late Archaic, and Late Prehistoric (Steed-Kisker phase) occupations was found.

This paper describes the KAFS investigation of the DB site that occurred over a five-week period in the summer of 1997. The goal of the field school was to take advantage of the last window of opportunity prior to prison construction to explore the remaining portion of the site that had not been mechanically stripped during the mitigation effort the previous summer. Thus, the plan was to excavate a block of units in that remnant in the hopes of recovering cultural material in good context. This effort was done by eight undergraduate students from the sponsoring universities under the direction of the author, who was assisted by William E.

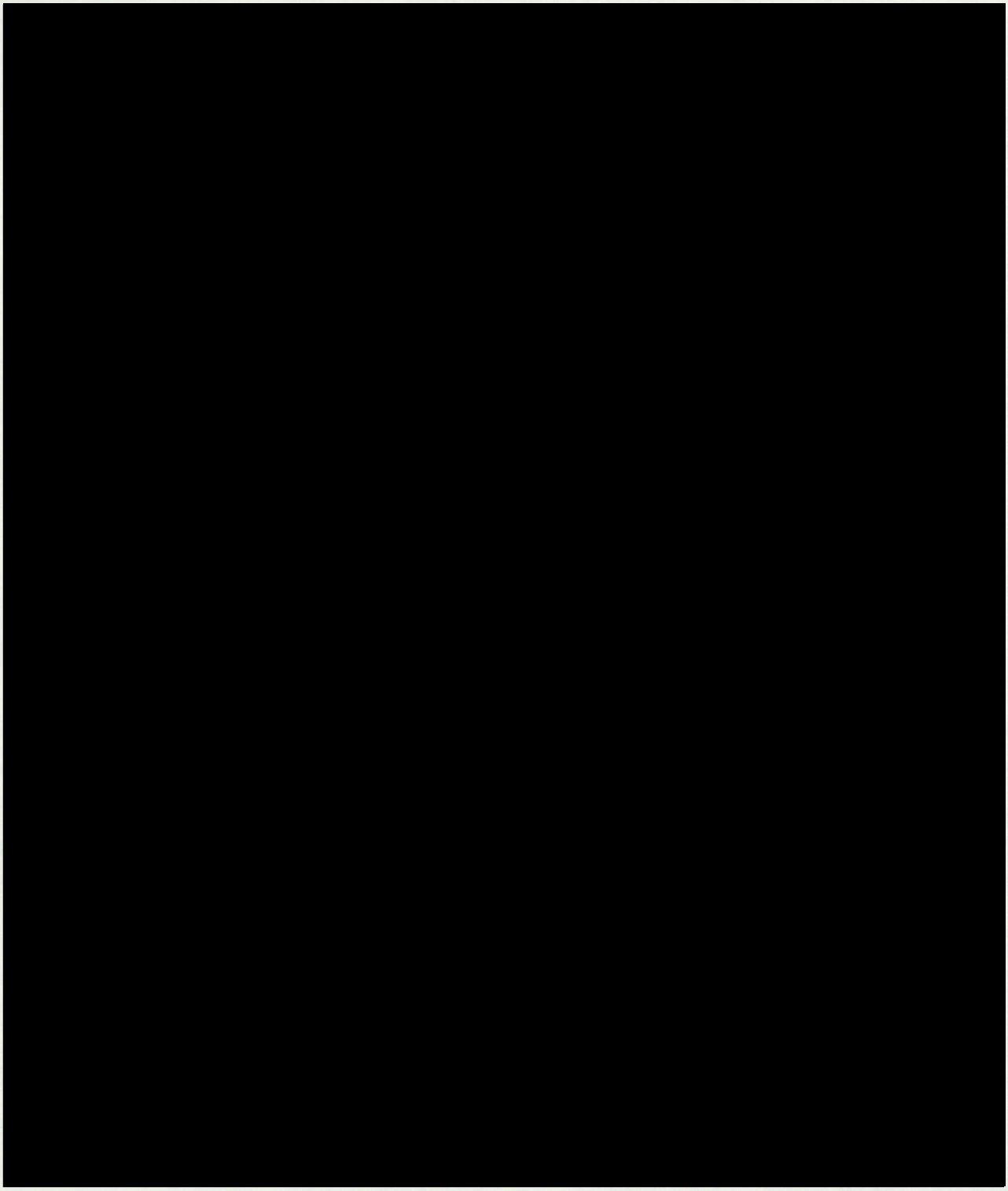


Figure 1. Map showing the location of the DB site (14LV1071) and other sites mentioned.



Figure 2. Aerial photograph of the DB site showing the Phase IV excavation block on July 19, 1996, and view southwest across Salt Creek Valley. Note the site's proximity to the primary growth hardwood trees on the bluff slope in the foreground. Hancock Hill, a source of Plattsmouth chert and glacial cobbles, is in the near background, upper left of the photo.

Banks and Matthew E. Hill, Jr., then KU graduate students.

Subsequent to the field school, the author directed 23 students in the laboratory analysis of recovered data through a KU course, Laboratory Techniques in Archaeology, during the spring 1998 semester. The primary goal of the lab course was two-fold: 1) to complete the sorting, identification, and curation of artifacts, and 2) to direct teams of the participating students in a spatial analysis of the 1997 block excavation data. Daniel Pugh, a participant in both the field school and lab course, then synthesized the spatial data and compared it to the model of the 1996 block (Hill 1998). His work, which was done as part of an independent research course at KU under the direction of the author, appears as a separate paper in this volume of *The Kansas Anthropologist*. The discussion presented here puts Pugh's analysis in a broader context and provides more detail about the KAFS project.

Following a summary of previous work at the site, the field methods and laboratory procedures are described. Then the small assemblages of stone tools and ceramics recovered during the project and subsequent surface inspections are described and compared to those found during previous investigations. Finally, the information gained as a result of the field school project is discussed in the broader context of the total site assemblage and its significance to regional prehistory.

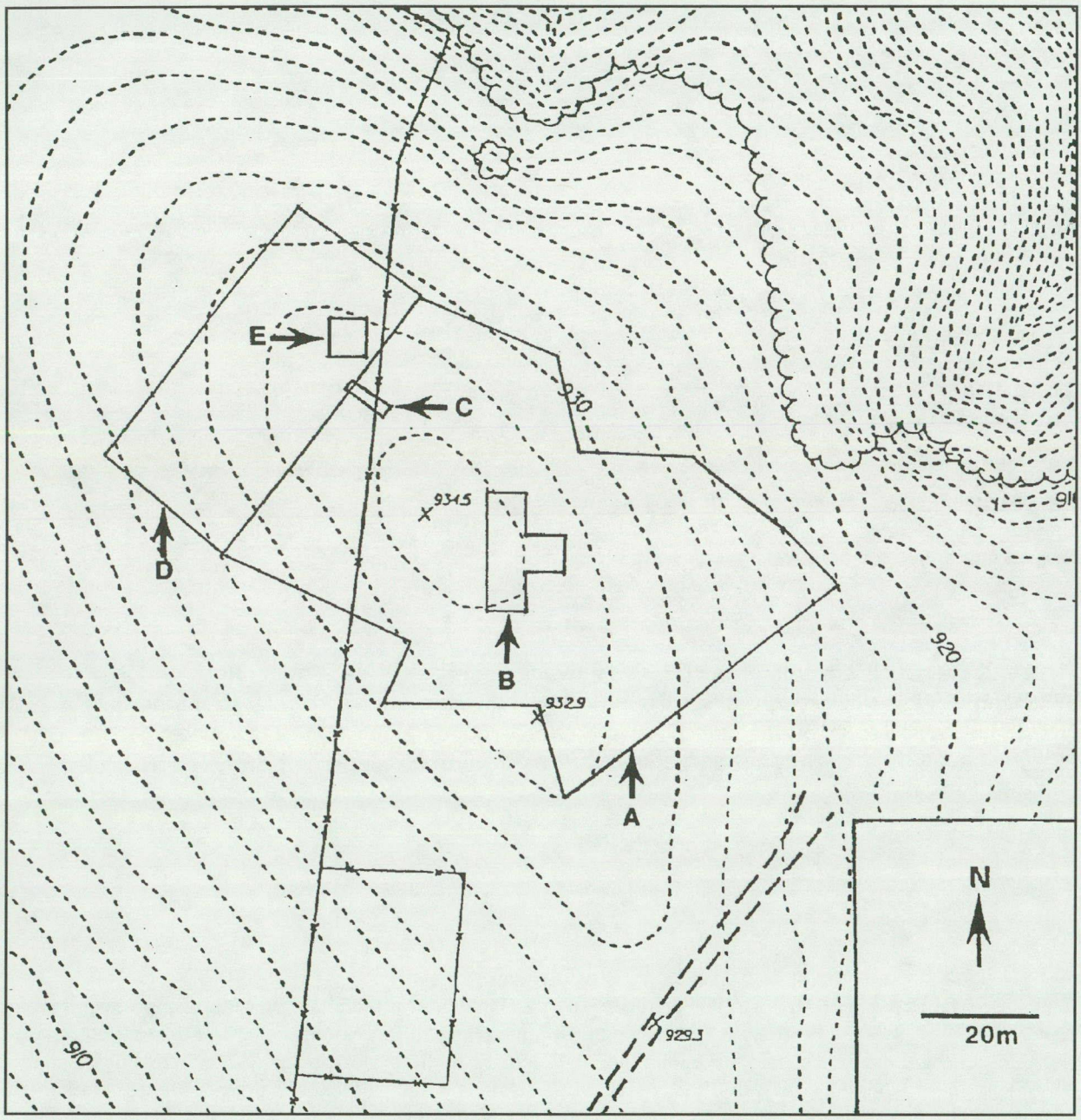


Figure 3. Plan map of the DB site showing the location of investigations undertaken in 1996 and 1997: A) area mechanically stripped in 1996, B) 1996 block excavation, C) 1996 backhoe trench that revealed the Brady A horizon, D) area mechanically stripped in 1997, E) KAFS block excavation. Contour intervals = 2 feet.

Previous Investigations

Survey of the DB ridge, then covered in grass and devoted to the grazing of cattle belonging to the reservation's USDB Vocational Farm, entailed shovel testing by a three-person team on November 14, 1994. The one-day reconnaissance was sufficient to yield a small sample of artifacts (10 pieces of debitage, 3 pieces of burned earth, and 1 piece of ferrous oxide). Most of the material was recovered from a northwest-southeast-oriented ridge. A few specimens were found on a smaller ridge southeast of the principal part of the site, designated Area A, and in a saddle between them. Because the site area had been designated as the location for the proposed USDB, testing to determine eligibility for the National Register of Historic Places (Phase III evaluation) was recommended (Logan and Sather 1995:21-23; Logan 1995a:47)

Phase III investigations occurred July 21-26 and October 9-29, 1995. Those in the summer entailed more systematic shovel testing, extraction of cores with an Oakfield tool, and manual excavation of test units totaling 6 m^2. The fact that cultural deposits occurred to a depth of at least 60 cm in Area A, well below the plow zone (ca. 20 cm thick), led to the finding of National Register of Historic Places eligibility (Logan 1995b). The October investigations were done in order to recover information necessary for a Data Recovery Plan that could be implemented during the required mitigation (Phase IV) effort (Logan 1996). (Mitigation entails extensive, controlled excavations to prevent the loss of significant information.) The Phase III work included remote sensing (magnetometry and ground penetrating radar) surveys (McKinley 1996), backhoe excavation of trenches to recover geomorphological data (Johnson 1996), and manual excavation of units totaling 33.4 m^2 (Logan and Beck 1996).

Phase IV fieldwork was completed from May 28 to August 5, 1996 (Logan 1998a). This began with the plowing of Area A to facilitate subsequent intensive, systematic surface collection within 10 x 10-m units, covering a total of 17,700 m^2. The surface collection delineated areas of artifact density, one of the greatest of which was targeted for the manual excavation of a 163-m^2 block (Figure 3). In addition, two 1-m^2 test units were dug and several backhoe trenches were excavated to recover more detailed geoarchaeological information (for the latter, see Johnson 1998).

Phase IV laboratory work resulted in analyses of recovered assemblages, including ceramics (Logan 1998b), chipped stone (Hatfield 1998), ground stone (Beck 1998; Beck and Begeman 1998), and floral remains (Adair 1998; Bozarth 1998), as well as research into raw material procurement (McLean 1998) and site formation processes (Hill 1998). The final report of the mitigation project addressed the various cultural-temporal components with respect to a variety of research problems, including taxonomy, geography, chronology, settlement-subsistence patterns, technology, and regional cultural relations (Logan 1998c).

Field Methods

Mechanical Stripping

Review of aerial photographs and other historical documents at Fort Leavenworth's Frontier Army Museum, undertaken as part of the background research for the Phase III evaluation of the site, had shown that the DB pasture had been tilled from about the 1920s through the 1940s (Logan and Hesse 1995). All previous excavations had revealed a plow zone that was ca. 20 cm thick. As noted above, the KAFS block area also had been plowed just prior to the 1996 fieldwork in order to facilitate surface survey. Thus, prior to the 1997 excavation the plow zone in the block area was stripped by a road grader. The same approach had been applied before the Phase IV excavation in the area of the block excavation subsequently dug at that time. In both cases this procedure was done to maximize the time devoted to the exploration of deposits that had not been severely disturbed by recent agricultural practices.

Figure 3 shows the area that was graded in shallow (ca. 2-cm) strips. As the map indicates, it was immediately adjacent to the westernmost extent of mechanical stripping that had been achieved in 1996. As was the case during the mitigation project, a team of two to three persons followed the grader and recovered all visible artifacts. Those that were temporally or functionally diagnostic and were exposed but not displaced were mapped in place with an EDM (electronic distance measuring) transit within the same grid controls used during all previous fieldwork. Stripping in the block area ceased at the base of the plow zone, clearly marked by the vegetative mat that had been overturned the previous spring. Comparison of the graded surface, where the block was later dug, with control elevation points obtained with the EDM transit prior to stripping confirmed the removal of 20 cm of overburden. Stripping beyond the immediate vicinity of the block area continued to a depth of ca. 60 cm, generally the maximum extent of cultural material.

Block Excavation

There were two reasons for selecting the particular location of the block excavation: 1) proximity to the

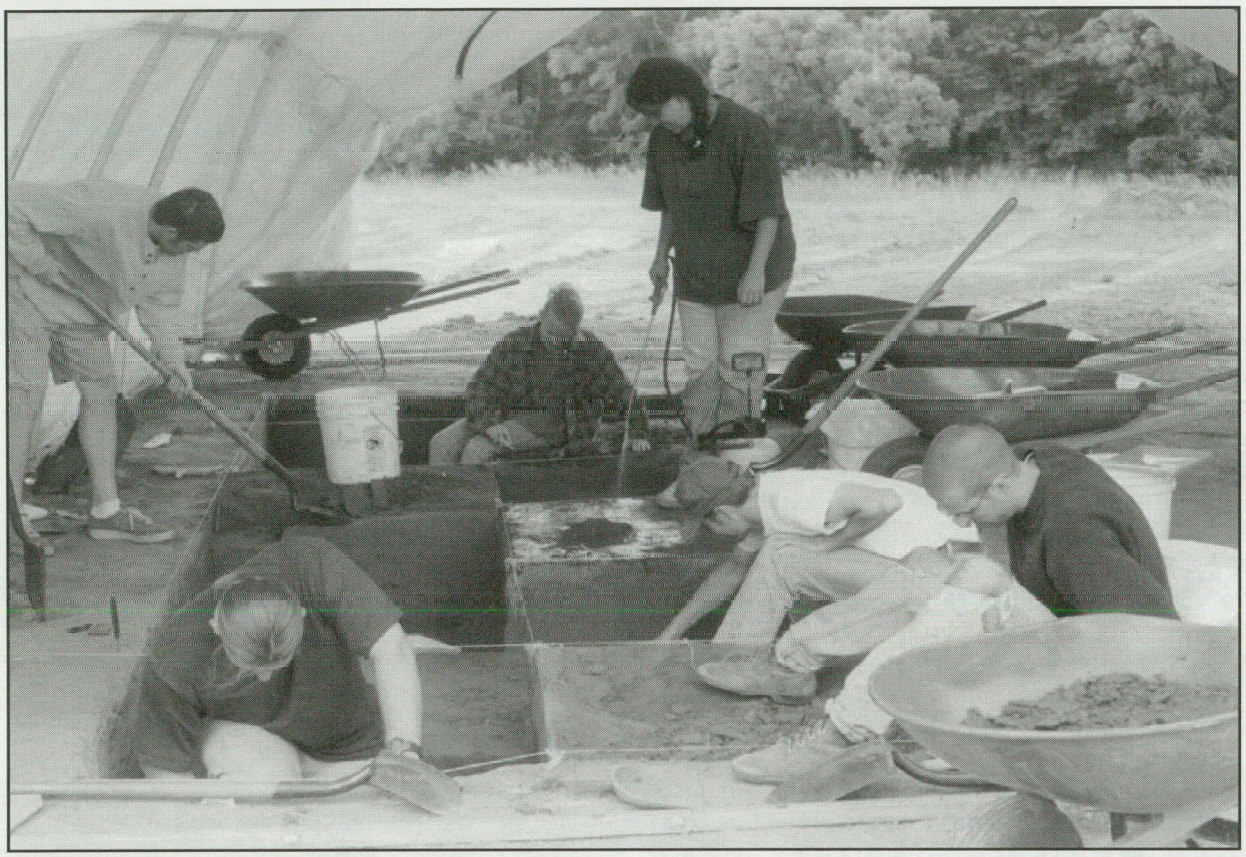


Figure 4. Excavation of the western portion of the block by the Kansas Archaeological Field School.

ridge summit, where the Phase IV surface survey had indicated that cultural material was concentrated, and 2) proximity to a backhoe trench excavated in October 1995 that was one of only two such trenches that had exposed the A horizon of the buried Brady soil, believed to have formed during the Pleistocene-Holocene transition (Johnson 1996, 1998; Figure 3). Previous excavations had yielded some chipped stone tools diagnostic of Paleoindian activity at DB (Logan and Johnson 1997; Logan et al. 1998) at depths of ca. 50-70 cm, the approximate depth of the A horizon in that trench. Across most of the ridge, however, erosion had removed most of this horizon, resulting in a welding of the Brady B horizon with that of the modern soil (Johnson 1998). Thus, it was thought that excavations in the vicinity of the trench would have a greater chance of revealing more intact evidence of any Paleoindian component. Unfortunately, no trace of the Brady A horizon was encountered in the KAFS block.

The KAFS block was a 6 x 6-m square composed of 1 x 1-m units, each of which was dug in 10-cm intervals to a depth of 65-70 cm below the original surface (i.e., 45-50 cm below the mechanically stripped surface; Figures 3 and 4). The use of 1-m^2 units provided finer control than the 2 x 2-m units used because of time constraints during the Phase IV investigation. As in 1996 all fill was water screened at a nearby pond with pump-driven pressure hoses through two nested screens, the upper of 1/4-inch mesh and the lower of 1/8-inch mesh. Fill samples, each 5 gl in volume, were shovel-scraped from the southwestern quadrant of each unit-level for flotation in a Dausman Flote-Tech machine. All samples have been floated, although not all have been sorted at this time.

Artifacts $\geq$ 2.5 cm along any dimension were piece-plotted. This entailed three-dimensional (x,y, and z coordinates) mapping with the EDM transit, as well as recording the object's orientation (in the direction of dip), dip, and strike. These data are analyzed with regard to site formation processes by Pugh (herein).

Surface Survey

Throughout the time of KAFS fieldwork, the graded surface of the DB site was inspected non-systematically by the students and supervisors. On one occasion, following a particularly heavy rain, the graded surface was subjected to a more systematic, intensive survey. In none of these instances was any attempt made to record the precise location of artifacts since all had been dislodged from their original contexts. Rather, these inspections were an attempt to retrieve all diagnostic artifacts prior to the complete destruction of the site by construction activities. On several occasions following the conclusion of the KAFS dig, the author visited the site for that purpose. On February 28, 1998, as part of the spring laboratory class to familiarize the participants with the site that was the subject of their work, the author supervised the students on a similar artifact "salvage" foray. Some of the artifacts illustrated here were found during these examinations.

Laboratory Methods

As noted previously, the laboratory analysis of the KAFS data was accomplished by students enrolled in a course at KU during the spring semester following the field school project. Continuity in personnel was provided by seven of the eight KAFS students; the eighth, a KSU student, was unable to attend. These students, who comprised about one-third of the total course enrollment, were already familiar with the general artifact types recognized during the sorting process, as well as knowledgeable about the spatial context of the specimens.

During the sorting process, the following categories of cultural material were recognized: debitage, edge modified debitage, bifaces/points, unifaces, cores, ground stone/hammerstone, ceramics, daub, historic, heat-altered rock, unburned bone, burned bone, wood charcoal, charred plant remains (i.e., seeds and nutshells), shell, ferrous oxide, sandstone, limestone, quartz, quartzite, pebbles, fossils, coal, scoria, and unknown. The mass of each category was determined to the nearest .1 g on an Ohaus C305S scale and a larger triple beam scale. Counts were recorded for piece-plotted data, which were identified according to the following categories: lithic, ceramic, ground stone, daub, burned earth, faunal, floral, historic, unmodified, other/unknown. At a lower hierarchical level, data entries included the following types: lithic— flake, non-flake, core, tested piece, biface, uniface; ceramic—rim sherd, body sherd, handle, appendage; ground stone—mano, metate, nutting stone, abrader, hammerstone, axe, celt; faunal—bone, teeth, shell; floral—wood charcoal, other plant remains; historic—glass, ceramic, coal, bone, concrete, metal, brick, or other general/specific functional identification. These data were then entered on an Excel computer spreadsheet for manipulation.

For the class research project the students were divided into six roughly equal teams each of which included at least one of the KAFS participants. Each team then was assigned six north-south units from the block (i.e., 30E/193-198N; 31E/193-198N, etc.) and asked to interpret the horizontal and vertical distribution of the various artifact categories therein. As noted previously, one of the students (Pugh herein) combined all the data sets and carried out a more detailed spatial analysis in comparison with Phase IV data (i.e., Hill 1998). The following section of this paper, therefore, is limited to a description of those artifacts recovered from the KAFS block and collected from the graded surface of the site after 1997 that are diagnostic of site function and cultural affiliation.

Artifact Assemblage

In the following description of artifacts, all depths are given with respect to the original ground surface. Thus, artifacts recovered from the first level of the block excavation (0-10 cm below the graded surface) are described as having come from 20-30 cm below surface (bs).

Ceramics

Despite intensive surface collection and test and block excavations of more than 200 m^2 during previous investigations, the DB site yielded a modest ceramic assemblage. The Phase IV effort yielded only 165 sherds (22 rims and 143 body sherds with a total mass of 1,663 g) large enough for analysis ($\geq$ 2.5 cm along the greatest dimension) (Logan 1998b). Given that the KAFS block excavation was on the periphery of that portion of the site that had yielded most of the material during intensive surface collection the previous year (Figure 3), it is not surprising that the ceramic assemblage recovered in 1997 was very small. Only 112 sherds were recovered (total mass = 119.6 g), and of those only 8 (total mass = 76.6 g) were piece-plotted in the block excavation. Six of the latter were found within a 4-m^2 area in the southwestern part of it (Pugh herein). The latter includes the only rim sherd recovered from the block, a specimen that deserves description not only for its singularity but for the information provided by its cultural affiliation and context.

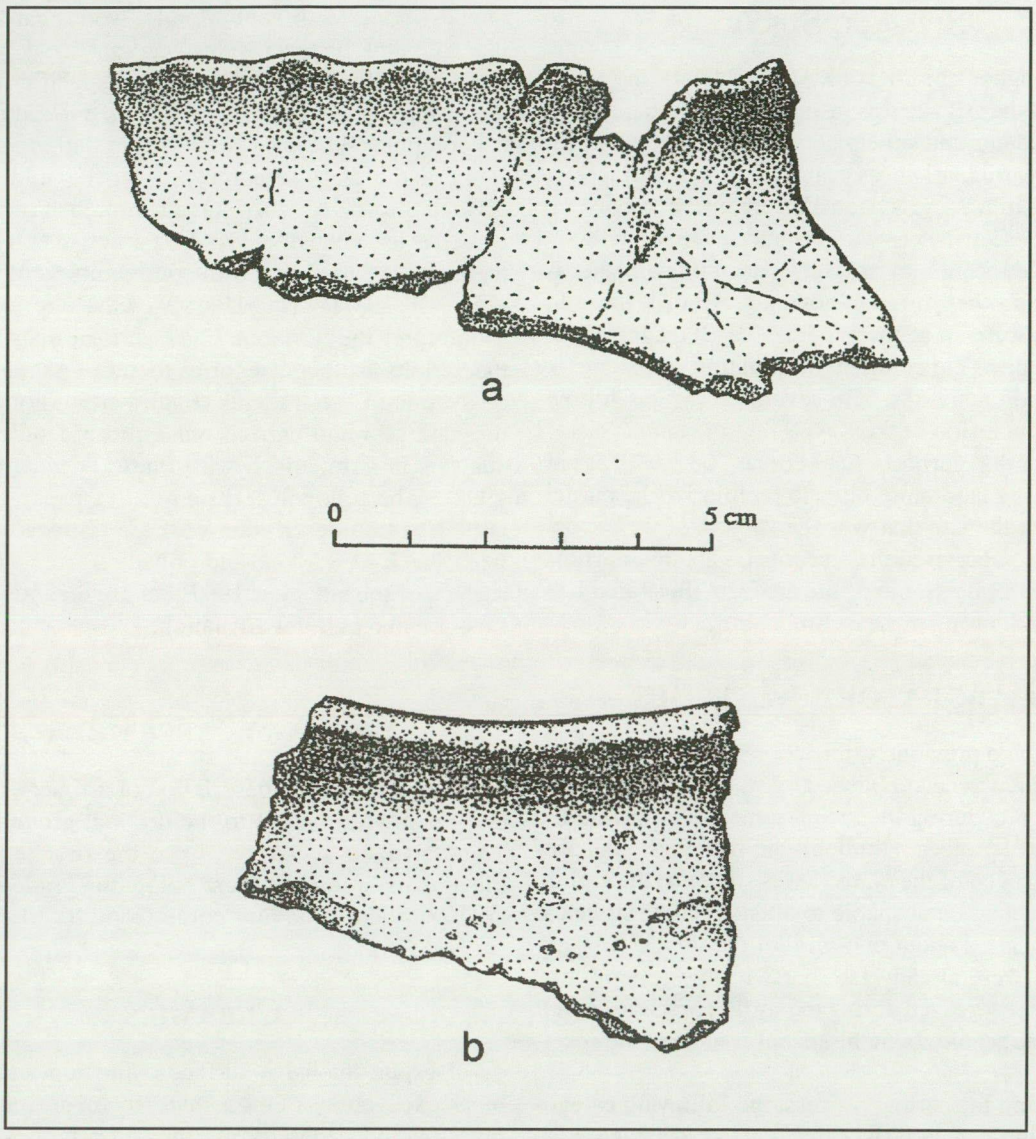


Figure 5. Rim sherds: a) Edwardsville phase ware and b) Platte Valley Plain ware.

The rim sherd (Figure 5a) is plain, sand tempered, and has a crenelated lip (4.6 mm thick), everted rim, and low shoulder profile (shoulder thickness = 4.7 mm; mouth diameter = 14 cm). Though remarkably thin for Woodland pottery, it is identifiable as Edwardsville phase ware, diagnostic of that phase of the late Kansas City Hopewell culture. Johnson (2001; compare Johnson and Johnson 1975) suggested that this pottery, comparable to Weaver ware in the Illinois River valley region, succeeded the more decorated pottery (cross-hatched incisions, punctates, rocker stamping) of the Kansas City phase around A.D. 500. Subsequent investigation of the ceramic assemblage from the Quarry Creek site—where the rim sherds evenly represented the Kansas City and Edwardsville phases (Cook 1993)—indicated that the latter dated slightly earlier, ca. A.D. 400 (Logan 1993:187, 2000a).

Woodland ware sherds were scarce in the 1996 assemblage, numbering only two rim sherds, which may have derived from a single vessel. Of the 29 sand-tempered sherds of analyzable size recovered at that time, a few are clearly Platte Valley ware, though the thicker walls of most suggest that they are Woodland pottery (Logan 1998b). The two rims in that assemblage, like those recovered in the KAFS block, are Edwardsville phase ware, with such diagnostic attributes as non-flaring shoulder, s-curved rim form, plain exterior surface, and crenelated lip. Thus, the rim sherd from the KAFS



Figure 6. Krotovina in KAFS block with rim sherd, flake, and chert chunk at depth of 65cm bs (compare Figure 7).



Figure 7. Krotovina in Phase IV block with rim sherd of Steed-Kisker Incised ware, body sherd with handle of Platte Valley ware, composite flake tool, and debitage at 62 cm bs (menu board shows depth below graded surface). From Logan 1998d:124.

block provides additional support for the identification of a late Kansas City Hopewell occupation of DB.

The context of the KAFS block rim sherd provides evidence of post-occupational disturbance of the deposits in this part of the site. The left half of the rim shown in Figure 5a was found in a krotovina (rodent burrow) at a depth of 65 cm, generally below the ceramic-age horizon identified during previous investigations (Figure 6; Logan 1998c). It obviously had been dislocated downward from its proper context in the A horizon of the modern soil, which formed the fill of the krotovina. This context is comparable to that of two sherds of Platte Valley ware, diagnostic of the Steed-Kisker phase, that were found in the Phase IV block at a depth of 62 cm in a krotovina (Figure 7). Remarkably, the right half of the KAFS rim sherd was recovered 7.35 m west of the left half and exposed in the side of a grader cut that had been made during

mechanical stripping. This cut separated the more shallow, stripped surface in the block area (ca. 20 cm bs) from the more deeply graded surface to its west (ca. 60 cm bs). This portion of the sherd was found in fragmented condition, having been broken by the grader, and its vertical provenience is imprecise. A reasonable estimate of its original depth is ca. 20-40 cm bs. It is likely then that the right portion of this rim sherd remained closer to its original context than the left portion, which had been dislocated by rodent burrowing. What force accounts for the lateral separation of the two halves cannot be identified.

All of the other plotted sherds from the block are plain, relatively thick (6.8-8.4 mm), sand-tempered body sherds of Woodland ware. The mean thickness (7.5 mm) of this small sample is comparable to that of the 29 sand-tempered sherds from the Phase IV investigation mentioned above (7.7 mm). This mean was found to be significantly greater than that (6.2 mm) of 103 shell-tempered sherds in the same assemblage (Logan 1998b), suggesting that stone temper required thicker vessel walls and/or that this attribute helps to distinguish Woodland and Late Prehistoric wares from the site.

Two other sherds of plotable size were found in the block. One, pieced together from fragments in the heavy fraction of the flotation sample from level 2 (30-40 cm bs) of unit 193N/33E, is plain, thick (7.9 mm), and grog tempered. The other, mended from three small sherds from level 1 (20-30 cm bs) of unit 194N/35E, is thin (4.57 mm), exhibits a dark gray slip, and lacks apparent temper. It is suggested that this latter sherd is an example of Platte Valley ware.

Surface inspection prior to and after the field school yielded nine sherds of sufficient surface area for analysis. Of these the only rim sherd is a good example of Platte Valley Plain (Figure 5b). It is shell tempered, has a flaring shoulder without decorative treatment (shoulder thickness tapers from 9.0 to 4.8 mm) and a relatively low (rim height = 17.5 mm), straight rim (mouth diameter = 16 cm). This specimen, the last artifact recovered from DB before it was completely destroyed by prison construction, was recovered from the westernmost spoil line created by the mechanical stripping of the KAFS. Its original vertical provenience is unknown, although its horizontal context must have been within the area stripped in 1997 just west of the KAFS block. The other surface sherds have more general surface provenience and consist of six body sherds (thickness range = 4.5-7.4 mm; mean = 6.4 mm) and one handle of Platte Valley ware and one body sherd of Woodland ware (thickness = 9.1 mm). Nine other handles were recovered during the Phase IV investigation (Logan 1998b:137). Assuming a certain degree of symmetry of paired handles on vessels, these findings bring the total number of vessels with such appendages to 10, as none of the handles are similar in several respects (e.g., length, width, thickness, ratio of width to thickness, and degree of arc).

Chipped Stone Tools

Lithic material in the KAFS block was also sparse compared to the density of debitage and chipped stone tools in the Phase IV block. Only 216 pieces of debitage were piece-plotted in the 36-m^2 block dug in 1997, an average of only 6 pieces per unit, reflecting a relatively small amount of tool maintenance activity in this area.

Complete chipped stone tools were very rare in the KAFS block, and few were collected from the graded surface of the site during and after that project. Indeed, nearly all of those recovered are among the artifacts shown in Figures 7 and 10. Of these only six were found within the block, including three bifaces with hafting elements, two drills, and one complete knife. Among the artifacts recovered from the graded surface of the site are six hafted bifaces, a preform, a knife, a drill midsection, an arrow point, and a complete mano. These are described below according to artifact category. Measurements are in millimeters.

Projectile Points/Knives

This category includes all bifaces with hafting elements. The specimens may have served as piercing weapons and/or as cutting implements. Some show reworking of the tips, which suggests that they were recycled for use as hafted scraping tools. Most of these artifacts were recovered from the graded surface of the site, only one of them from that portion stripped in 1997. The latter specimen (Figure 8e) was dislodged by the grader; its precise provenience is unknown. All of these artifacts are either broken or reworked, reflecting the function of the DB site as a camp locale. This interpretation follows the explanation proposed by Hatfield (1998), who found only 41 complete specimens among the 232 projectile point/knives she examined from the previous investigations at the site. The balance consisted of tips (distal fragments), midsections, and bases (proximal fragments), reflecting a high frequency of tool refitting and discard behavior typical at camp sites.

All of the projectile points/knives from the KAFS assemblage fit into one of the 11 varieties defined by Hatfield (1998) for the previous DB assemblage. They are described here with respect to the particular variety and following the attributes specified by Hatfield (1998:142-143).

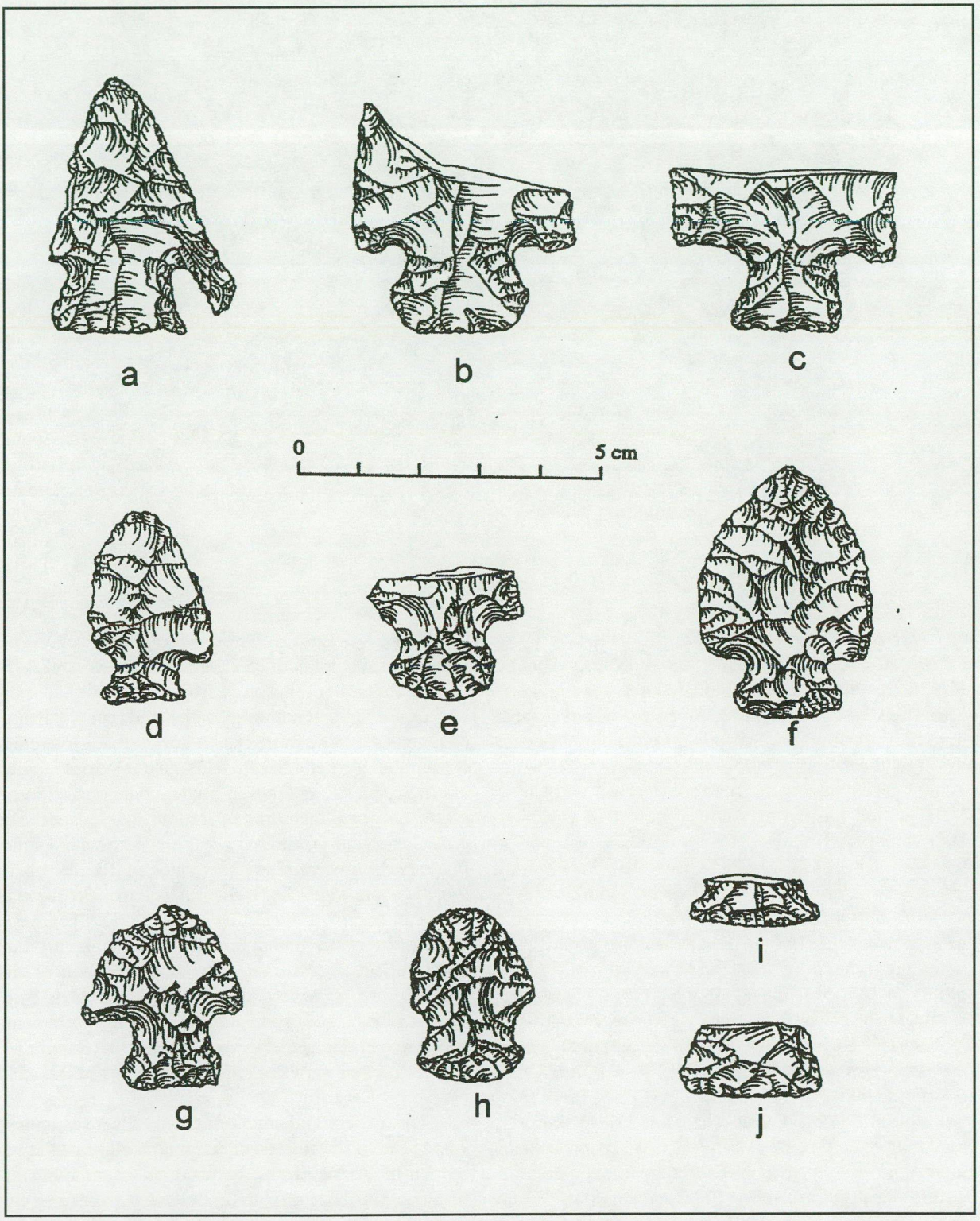


Figure 8. Projectile points/knives from the DB site: a) basal notched biface of the Calf Creek or Afton type from the Phase IIIa investigation, b-j) others from the KAFS investigation.



Figure 9. Hearth remnant or debris exposed by mechanical stripping ca. 4 m west of the KAFS block.

Varieties I and II, Paleoindian and Archaic lanceolates respectively, are not represented in the KAFS assemblage. Neither are there examples of Variety IV, a contracting stemmed form that appears regionally in the Early Woodland period and persists through the Middle Woodland; Variety VII, which exhibits an expanding stem and convex base; and Variety VIII, which has an expanding stem and flat base. Hatfield's (1998) Variety X is a miscellaneous category that includes projectile points/knives that share a single characteristic or a number of attributes with one of the varieties but differ sufficiently to preclude assignment to that category. Two of the artifacts from the KAFS assemblage have been assigned to Variety X. Nine others conform well enough to the attributes defined by Hatfield to be placed in the other varieties she established.

Variety III is characterized by an expanding stem and long barbs. It was compared to the Calf Creek (Hatfield 1998:146-147) and Afton (Logan 1998c:311) types of the Middle-Late Archaic and is also similar to the Castroville type (Bell 1960:14). A complete specimen of this variety was recovered in situ at a depth of 42 cm during the October 1995 investigation (Figure 8a; Logan and Beck 1996:36-38). It was made of Winterset chert, lacks one barb, and has an extensively reworked blade. Two fragments of this variety were recovered from the graded surface of the site during the Phase IV investigation. One of Mississippian chert was recovered at a depth of ca. 20 cm. Hatfield (1998:146) described it as "a very long barb with a very small portion of the blade remaining" and stated that "its length ... suggests it came from a Calf Creek point." The other is the medial fragment of a barb, also of Mississippian chert, that was found during final grading operations in 1996. During the grading operations that preceded the KAFS excavation, another complete barb with a small blade portion was found. It is made of Toronto chert, which occurs within Leavenworth County. The fact that the most complete specimen of this variety lacks one barb and that the other three Variety III artifacts are barbs reflects the vulnerability of that portion of this tool. It also suggests that the implements could have been reworked and used without any barbs. Thus, some of the expanding stemmed projectile points/knives assigned to other varieties may be examples of this kind of maintenance.

The Variety III barb from the KAFS investigation was found in the fill associated with a cluster of small burned limestone pieces that were either the remnants of an in-situ hearth or debris cleaned from a hearth (Figure 9). This material was found 4.3 m west of the KAFS block excavation; its coordinates were 197.7N/25.7E. Its depth (ca. 22-23 cm bs) was only slightly greater than that of the first barb fragment described

above, indicating that chipped stone tools of Archaic age occurred at relatively shallow depths. In her analysis of projectile points/knives of known elevation from the Phase IV investigation, Hatfield noted that 17 of 30 Archaic specimens were found in the first 10-cm level below the plow zone (i.e., at depths of 20-30 cm), the same level at which nearly all Late Prehistoric arrow points (see Variety XI below) were found. This likely reflects the cumulative affects of two processes: 1) the relatively slow aggradation of the surface soil through loess accumulation and organic build up and 2) the upward dislocation of some artifacts from lower depths through natural disturbance (rodent burrowing, tree fall, root growth, etc.).

Two broken specimens recovered in 1998 from the surface that had been graded during the close of the Phase IV investigation were assigned to Variety III (Figure 8b and c). Both lack the distal portion of the blade, and the barbs on both have been partially or completely broken. One (Figure 8b) is made of Toronto chert. It retains one complete, rather short barb and another broken one. The base is flat with rounded tangs (length = 39.9; width = 36.3; thickness = 9.4; stem width = 17.5; base width = 22.4). The other example is made of Plattsmouth chert, which occurs in outcrops on Hancock Hill just south of the site (McLean 1998). It has a flat base and appears more broadly notched on one side because the barb has been completely removed. The other barb has been slightly shortened through breakage (length = 28.1; width = 37.8; thickness = 8.4; stem width = 14.5; base width = 18.5).

Variety V is a side-notched form. Hatfield (1998:147-151) compared examples from the Phase IV investigation to the Logan Creek and Godar types. These are generally considered diagnostic of the Middle Archaic period, roughly coeval in the Great Plains and Midwest with the Hypsithermal climatic episode (ca. 9000-5000 B.P.). A single example of this variety (Figure 8d) was recovered during the KAFS investigation. It is a nearly complete specimen of Winterset chert with asymmetrical notching and a flat base (length = 32.9; width = 20.5; thickness = 6.9; stem width = 10.5; base width = 14.2). The blade edges have been reworked, one to the point of beveling. The tip has been blunted, perhaps reflecting reuse of this tool as a scraper. It was a surface find from the area that had been graded at the conclusion of the Phase IV investigation.

Variety VI has a pronounced convex base and barbs. Three such artifacts were found during the Phase IV investigation, one complete and two with blades that had been extensively reworked into scrapers (Hatfield 1998:151-152). The single specimen of this variety (Figure 8e) recovered in 1997 was found west of the block area during the machine scraping that preceded excavation. It was dislodged by the grader, and its exact provenience is unknown. Its blade and barbs have been broken, and it is made of Toronto chert (length = 23.6; width = 25.5; thickness = 6.4; stem width = 13.8; base width = 16.9).

Variety IX is an expanding stemmed form with a straight to slightly convex base. It resembles the Steuben type, assigned to the Middle to Late Woodland periods throughout the Midwest. It also is comparable to expanding stemmed forms from Late Archaic period components at the Koster site (Cook 1976) and from sites in the American Bottom area that have been assigned to the Falling Springs, Labras Lake, and Prairie Lake phases (McElrath et al. 1984). This was the most prevalent type recovered during previous investigations at DB, accounting for 19 of the specimens identified (Hatfield 1998:152-155). Projectile points/knives of this general form were dominant at the Quarry Creek site, suggesting that those at DB might belong to a Kansas City Hopewell occupation. Considering the paucity of pottery of that time and the fact that the few recovered sherds date to the Edwardsville phase, such an interpretation seems untenable unless a hitherto unknown type of site for that culture is recognized—that is, an upland hunting camp. While such an interpretation is plausible, there is no other supporting evidence for it. Given the fact that expanding stemmed points appear at Late Archaic sites in the region (e.g., at Nebo Hill [Reid 1984]) and that a pair of radiocarbon dates from a hearth feature in the Phase IV block indicate a terminal Archaic occupation at DB (ca. 2800-2600 B.P.), it is suggested that Variety IX artifacts reflect activities during that time (Logan 1998c).

Variety IX artifacts from the KAFS investigation include two specimens (Figure 8f and g). One of these (Figure 8f) was recovered from the surface of the area graded in 1996. Made of an unidentified, possibly heat-treated chert (Janice McLean, personal communication 2001), it is nicely symmetrical with an ovate blade that may have been reworked and a convex base (length = 43.5; width = 29.1; thickness = 6.3; stem width = 13.8; base width = 18.4). The other specimen (Figure 8g) was recovered in situ in the block excavation at a depth of 57 cm (Figure 10). Made of a thoroughly heat-treated chert, perhaps of the Toronto variety (Janice McLean, personal communication 2001), it has a flat base with one broken tang and an extensively reworked and slightly damaged tip, reflecting use as a scraping tool (length = 32.0; width = 27.1; thickness = 7.4; stem width = 12.8; base width = 16.4).

Variety X projectile points/knives are miscellaneous forms, either too fragmentary or reworked to be



Figure 10. Variety IX biface (see Figure 8g) in situ at depth of 57 cm bs (dip = 44°; strike = 8°).

assigned to any of the more specific varieties (Hatfield 1998:156-159). Six specimens are assigned to this variety, one complete and five basal fragments. The complete artifact (Figure 8h) is made of an unidentified chert (Janice McLean, personal communication 2001). It has an extensively reworked blade with a rounded tip suitable for scraping or cutting, a convex base, and broad side notches (length = 30.2; width = 21.1; thickness = 6.9; stem width = 14.7; base width = 17.7). It was found in April 1997 during inspection of the surface that had been mechanically stripped in 1996.

Four of the basal pieces assigned to Variety X have in common a convex base and breakage at what appears to have been the narrowest part of the stem. Three were recovered from the block excavation, and the fourth was found in the area graded during the 1996 investigation. Of the former, one (Figure 8i) is made of gray, possibly Winterset chert, and it was found at a depth of 20-30 cm (base width = 21.2; stem width = 16.5; thickness = 5.1). A second of light gray, possibly Plattsmouth chert was found at a depth of 28 cm bs (base width = 21.7; stem width is indeterminate; thickness = 5.4). The third, of Permian chert, was plotted at a depth of 36 cm (base width = 19.0; stem width = 15.7; thickness = 6.2). The base fragment of Winterset chert, recovered from the graded area, has a base width of 25.1, a stem width of 19.2, and a thickness of 6.5. Another basal fragment assigned to Variety X (Figure 8j) is made of Toronto chert and has a flat base (width = 23.2). It has a stem width of 18.6 and a thickness of 6.5. It was recovered from a depth of 66 cm.

Variety XI consists of arrow points (Hatfield 1998:159-161), only two examples of which were recovered during the KAFS investigation. A complete specimen (Figure 11a) made of heat-treated Toronto chert is triangular and unnotched with a rounded base. It exhibits invasive retouch on one face, marginal retouch on the obverse face, and an impact-fractured tip (length = 20.7; width = 15.0; thickness = 3.8). It was found in unit 181N/24E on the surface graded prior to the field school at an estimated depth of ca. 20 cm bs. Like 12 other points of this variety described by Hatfield (1998), most of which are notched, it is typical of Late Prehistoric arrow points and is assigned to the Steed-Kisker phase component.

The other specimen is a blade fragment that was recovered from the block excavation at a depth of 20-30 cm bs. Made of Plattsmouth chert, it has a maximum width of 15.0 and a thickness of 3.2. Its most distinctive attribute is the serrated edges, which suggest that it was part of a Scallorn point. Such points are diagnostic of the Late (Plains) Woodland period. Only one other example, a complete point, has been recorded at the DB site. That artifact was recovered from the Phase IV block also at a depth of 20-30 cm.

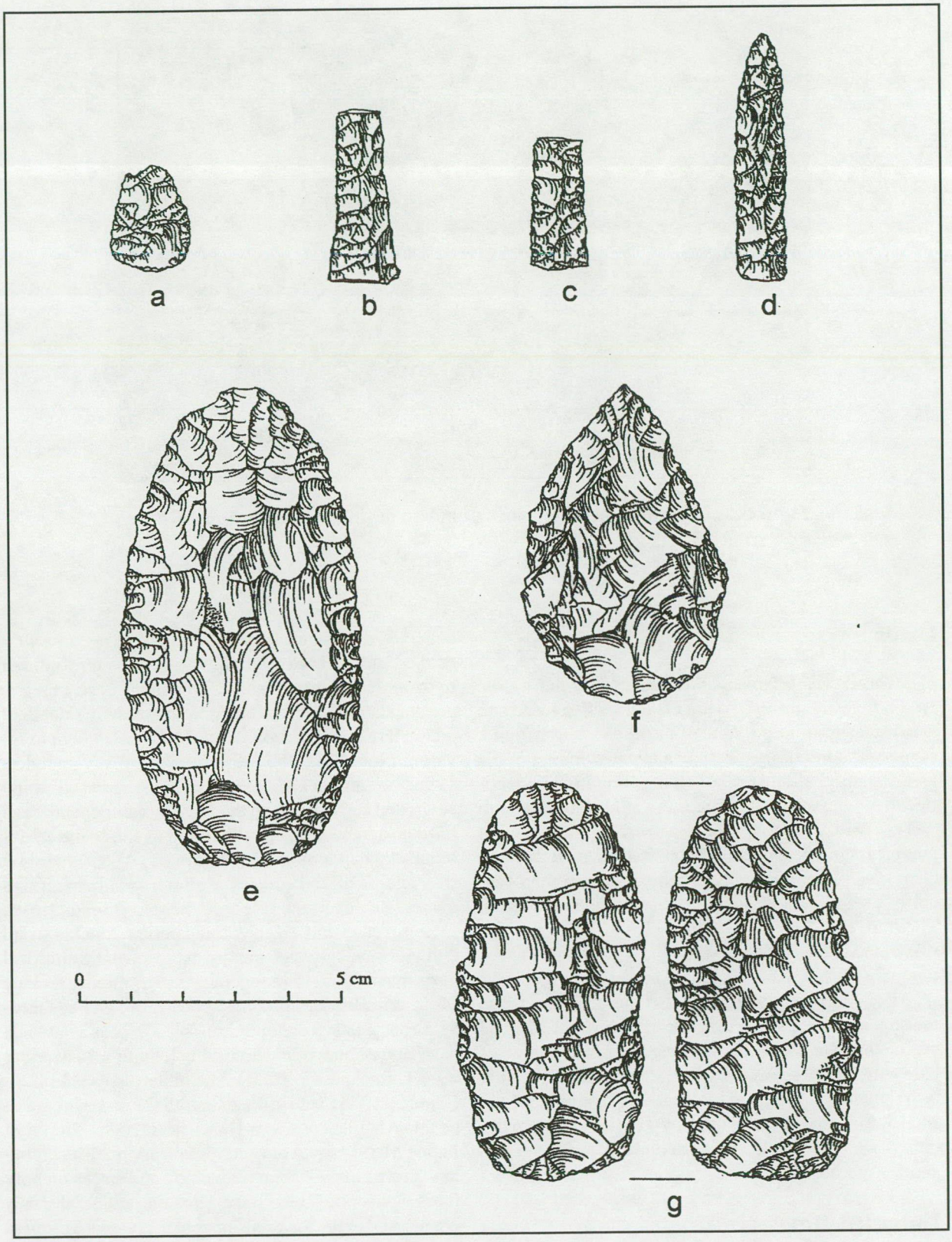


Figure 11. Chipped stone tools from the KAFS investigation of the DB site.



Figure 12. Drill tip (see Figure 11d) in situ at depth of 34 cm bs (dip = 14°; strike = 14°).

Drills

Three drill fragments were recovered during the KAFS investigation. Two are medial sections, and one is a distal (tip) portion. One of the midsections (Figure 11b) was found during the mechanical stripping of the area west of the field school block. Tentatively identified as Winterset chert, it flares toward the base (length = 34.0; width = 14.3; thickness = 6.2). The second medial fragment (Figure 11c) of heat-treated Toronto chert was plotted in the KAFS block at a depth of 55 cm bs (length = 26.0; width = 11.0; thickness = 5.7). The third drill fragment (Figure 11d) of Permian chert was found in the block excavation at a depth of 34 cm bs (length = 49.2; width = 10.2; thickness = 6.5; Figure 12).

The fragmentary condition of these tools reflects the stress of the tasks to which they were applied. The torque that was entailed in drilling or piercing wood or hide with these narrow stone tools undoubtedly resulted in frequent breakage and discard. For example, of the 21 drills from DB described by Hatfield (1998:165) only 4 were complete; 10 were distal, 2 were medial, and 5 were proximal (basal) pieces.

Unhafted Bifaces

The KAFS chipped stone tool assemblage includes three complete unstemmed bifaces. Two of these were collected during mechanical stripping of the area west of the field school block. While both were displaced by the grader, their vertical provenience was clearly greater than 30 cm and at approximately the depth at which large cobbles appeared. Throughout both excavation blocks and the area mechanically stripped in 1996, the "big rock" zone was encountered at ca. 30-60 cm bs and correlates with the Archaic components. The third unstemmed biface was found in situ in the KAFS block at a depth of 51 cm (Figure 13).

The displaced bifaces are both symmetrical and ovate. However, the larger of the two (Figure 11e) is more finished and exhibits fine lateral retouching, and although no edge wear analysis has been done, this suggests that it could have functioned as a knife. It is made of an unidentified, probably local gray chert (Janice McLean, personal communication 2001), has a flattened base, and is more rounded distally (length = 94.3; width = 46.1; thickness = 10.7). The other displaced biface (Figure 11f) is made of Plattsmouth C chert, which can be found in till deposits on Hancock Hill (McLean 1998; Janice McLean, personal communication 2001). It exhibits incomplete lateral retouching and stacks on both faces adjacent to steep flake scars that reflect the failure to remove the material and thin the blank. The presence of these stacks and the consequent thickness of the piece, together with its length, width, and relatively sharp tip, suggest that it is a failed preform that was



Figure 13. Unstemmed biface (see Figure 11g) in situ at depth of 51 cm bs (dip = 5°; strike = 57°).

intended for completion as a dart point or other hafted bifacial tool.

The unstemmed biface with precise provenience (Figure 11g) is made of heat-treated gray chert, possibly from a Permian-age formation (Janice McLean, personal communication 2001). It is ovate, somewhat more flattened proximally than distally, and well thinned bifacially (thickness = 6.26). The knapping method resulted in several oblique flakes that passed the midline of the blank and a few others that passed entirely to the opposite margin. This latter attribute (outre passe) appears on some Paleoindian bifaces (Frison 1991:330), and its presence on the DB tool, the specimen's depth, and the documentation of other Paleoindian stone tools at the site (Logan and Johnson 1997; Logan et al. 1998) tempt one to assign this biface to the general Paleoindian time period. However, knowledge about the temporal range of this kind of bifacial thinning technique in the Central Plains is currently inadequate to infer the age of this artifact. Its form, thinness, and long sharp edges indicate that it served as a knife.

Biface Fragments

Eleven biface fragments were recovered from the block excavation, including four distal, six medial, and one possible barb pieces. Of these, one was found in the uppermost level of the block (i.e., 20-30 cm bs), two in the second (30-40 cm bs), four in the third (40-50 cm bs), two in the fourth (50-60 cm bs), and two in the fifth (60-70 cm bs). The presence of most of these in the lower levels, generally attributed to the Archaic occupations at DB, suggests they reflect refitting of cutting and piercing tools in this area during Archaic times. However, evidence of bioturbation in the block, as elsewhere at the site, precludes a more certain temporal affiliation for these small items.

Ground Stone Tools

The ground stone assemblage consists of 10 artifacts of which 8 were plotted in the KAFS block excavation and 2 were recovered from that portion of the site that had been mechanically stripped in 1996. One of the artifacts is a piece of faceted dense hematite (Figure 14a), plotted at a depth of 26 cm bs. Faceted pieces of hematite occur at Steed-Kisker sites (Calabrese 1969; O'Brien 1993), and a complete celt with incised lines from DB was tentatively assigned to the Steed-Kisker occupation (Beck 1998:237, 239; Logan 1998c:327-328). However, modified pieces of this material occur at Archaic sites throughout the Midwest (e.g., Cook 1976). Thus, this artifact cannot be assigned with any confidence to any particular component.

A small cube (9.1 g) of fine-grained sandstone from the upper level (20-30 cm bs) of the block exhibits a

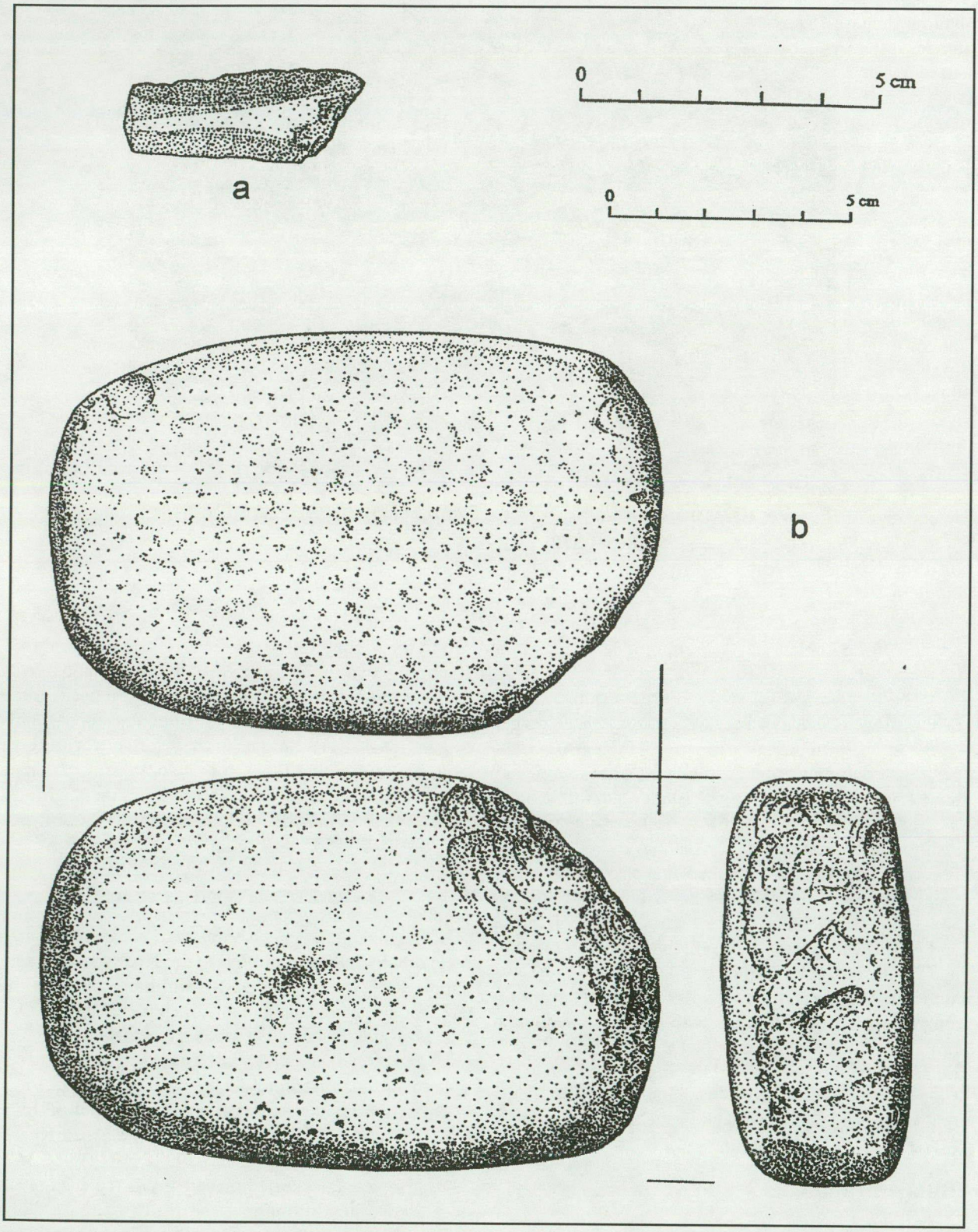


Figure 14. Faceted hematite from the KAFS block and pitted, multi-use cobble from the 1996 graded area.

shallow U-shaped groove suggestive of its use as a shaft abrader. The width of the groove (5.1 mm) is consistent with the diameter of an arrow shaft. On the basis of this characteristic and its shallow provenience, it is suggested that the artifact is part of the Steed-Kisker phase occupation (compare Beck and Begeman 1998:238).

The remaining eight ground stone artifacts are quartzite cobbles and fragments. Of these, seven were plotted in the block excavation, and one was recovered from the area to the east that had been graded in 1996. Beck (1998) described outcrops of glacially deposited cobbles on Hancock Hill that would have been handy sources of this material. As was the case in the 1996 block excavation (Logan 1998a:120-122; Hill 1998:281), these cobbles were encountered in the lower levels of the KAFS block (Pugh herein). Of the six piece-plotted cobbles from the block, four were found in level 4 (50-60 cm bs) and two in level 5, one of which rested in the unexcavated level a few centimeters below the level 5 floor.

Two cobbles were found adjacent to each other in unit 198N/32E at depths of 58 and 61 cm bs. One is a complete circular (diameter = 89 mm) and relatively thin (thickness = 31 mm) piece (mass = 342 g) with no evident modification. (Note: None of the ground stone artifacts from the block has been washed in order to preserve any plant remains, such as phytoliths, that might be present. See Beck [1998:226] and Bozarth [1998:85] for a discussion of the presence of wild grass phytoliths in ground stone washes from DB cobbles.) The other specimen is broken and appears to have been part of a metate (mass = 345 g). Even though it has not been washed, one surface clearly is dished and polished like that of more complete metates recovered at the site in 1996 (Beck 1998:220-223). Given the proximity of these two artifacts and the difference in modification, they are prime candidates for ground stone wash analysis to test the correlation between modification and the presence of food plant phytoliths.

A complete rounded cobble (mass = 550 g) that was plotted at a depth of 39 cm bs in unit 193N/35E bears no evident modification. Neither does a smaller complete piece (mass = 142.9 g), plotted at a depth of 74 cm bs in the unit 2 m north of the latter. A small (mass = 21.8 g) quartzite spall, plotted in unit 194N/31E at a depth of 71cm bs, exhibits one convex surface that appears to have been smoothed by grinding. Unfortunately, that surface is less than 15 cm^2 in area—too small for confident determination of natural versus cultural modification.

The largest, most massive (2,341 g) cobble recovered from the KAFS block was plotted in unit 194N/31E at a depth of 53 cm bs. Rectangular in form (17.6 x 10.9 x 7.8 cm), it presents one broad, flat surface that would have been suitable for grinding. However, in its currently unwashed state no cultural modification of that surface is evident.

Two cobble artifacts were recovered from the graded surface east of the KAFS block during surveys after the field school. Both were collected because they show cultural modification. One of these, as yet unwashed, is 9.4 x 8.5 x 4.5 cm with a mass of 589.5 g and has no formal shaping. However, the broadest surface of the piece is irregularly dished, hinting at some possible use for grinding or nutting. The other artifact (Figure 14b) is a formally shaped, rectangular grinding stone with one convex, polished surface, reflecting use as a mano. A stone wash sample has been prepared from this surface and curated for future analysis at the University of Kansas Museum of Anthropology. The obverse face has a central depression and pitting that may indicate its use for bipolar flint knapping or some other use. Five such pitted stones or multi-use pitted stones are described by Beck (1998:223-225) from the 1996 ground stone assemblage.

Beck's (1998) inspection of the 85-piece cobble assemblage from the 1996 block, along with experimental tests with unmodified cobbles she collected from sources on Hancock Hill, led her to infer that most of the use of these items was expedient and that this use left no discernible trace that differed from the naturally modified surfaces of the cobbles in her control sample. Relatively few of the cobbles exhibited formal shaping or clear evidence of any specific use. However, some cobbles showed evidence of use as hammerstones and grinding implements. Any of the others might have served for a brief time to perform various tasks that entailed rubbing (e.g., hide work), grinding (e.g., as manos or metates), hammering, or heating (e.g., as boiling stones), but the lack of any macroscopically or microscopically evident wear precludes such interpretations. Beck's conclusions are consistent with the smaller cobble assemblage from the KAFS block. Finally, with regard to the ground stone assemblages from the block excavations, the ratio of cobbles per unit (.16) in the KAFS block is noticeably smaller than that of the Phase IV block (1.9), again reflecting the lower frequency of camp activities in the former area.

Summary and Conclusions

The relatively low amount of cultural material recovered from the KAFS block excavation is consistent with its location in an area that had yielded a small number of artifacts (<20 per 100 m^2) during an intensive surface grid collection in 1996. Interestingly, at that time more artifacts were found in the two 10 x 10-m

grid units immediately south of the block (146 and 72 artifacts, respectively). Unfortunately, the area covered by those units, which appeared as dense anomalies near the northwestern edge of the site, had been stripped by the grader at the end of the Phase IV investigation. The data from the KAFS block, then, reflect many activities that had occurred nearer the summit of the DB ridge and were documented in the Phase IV block excavation, except for the Late Prehistoric occupation. Where the Phase IV block revealed remains of two wattle-and-daub structures and associated activity areas (i.e., lithic production and maintenance, cooking/heating, and trash discard) of a Steed-Kisker phase occupation (Logan and Hill 2000), very little evidence of that component was found in the KAFS block or its vicinity.

Just as sparse ceramic evidence of an Edwardsville phase (late Kansas City Hopewell) component had been recovered in the Phase IV block and its vicinity, only a few pottery sherds of that complex were documented in and near the KAFS block. While the stratigraphic context of the latter in the block reflects disturbance by rodent burrowing, it appears that those sherds, like pottery from the Steed-Kisker component, originally occurred within the upper 30 cm of the cultural deposits. The two arrow points in the KAFS assemblage, one complete and the other a Scallorn midsection, were also found in the upper 30 cm of the deposits.

The lower half of the soils (i.e., the welded B horizons of the modern soil and the Brady soil from ca. 30-60 cm bs) that yielded artifacts throughout the DB site more frequently contained artifacts diagnostic of the Archaic and Paleoindian periods. Despite the fact that one of the few remnants of the A horizon of the Brady soil, a Pleistocene-Holocene transitional soil, had been exposed in a backhoe trench a short distance south of the KAFS block in 1996 and that a half dozen projectile points indicative of Paleoindian presence had been found at that time elsewhere at the site, no trace of the Brady A horizon or any artifacts of certain Paleoindian affiliation were noted within the KAFS excavation. However, additional evidence of Archaic occupation was recorded. This includes a small number of stemmed bifaces that are comparable to some of the varieties identified in the 1995 and 1996 assemblages. It is suggested that to these be added the few drill fragments, unstemmed bifaces, and ground stone artifacts found in 1997.

Although the KAFS excavation yielded only a few ground stone artifacts, it is notable that all of these were encountered at depths greater than 30 cm. This pattern, detected also in the Phase IV block excavation and during mechanical stripping of the site (Hill 1998; Pugh herein), cannot be attributed to the downward dislocation of these larger manuports from nearby glacial deposits through natural or cultural processes. Frost-heaving and the size effect (Baker 1978) both move larger artifacts upward (compare Logan 1998d:120-122), and it is unlikely that tree growth and rodent burrowing would have been so selective as to move nearly all such items downward through the soil horizons at DB (Hill 1998). These larger stone artifacts, then, provide a good index of the relative stratigraphic integrity of the site despite its bioturbation.

No features were found in the KAFS block, though this was not surprising. Only one hearth feature was encountered in the much larger Phase IV block on the ridge summit. Concentrations of small burned limestone pieces were also found in the graded areas of the site, one east of the Phase IV block (Logan 1998d:126-127) and the other west of the KAFS block. The latter are suggested to be the remnants of intact hearths that suffered disturbance through treadage, dismantling, recycling of manuported hearthstones, or they reflect the dumping of hearth debris. The paucity of features and intact hearths at DB likely reflects the short-term nature of all occupations and the effects of the traffic and other disturbances related to periodic visits.

The evidence described here, and that presented in the Phase IV project report (Logan 1998a), testifies to three significant aspects of the DB site that can be applied to future investigations of the loess uplands along the lower Missouri River: 1) such settings were favored for short-term, conceivably summer-fall encampments by many different groups of the preceramic and ceramic periods, 2) Holocene loess deposition and soil formation resulted in the burial of all prehistoric components, and 3) careful excavation and documentation of artifact provenience and disturbance processes may distinguish the various components represented.

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Notes

Spatial Analyses and Tests of Disturbance at the DB Site, 14LV1071

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The Kansas Anthropologist 22:65-82

The spatial distribution of artifacts from the DB site, a stratified, multicomponent prehistoric site on the grounds of Fort Leavenworth, is analyzed with particular attention to artifacts collected during the 1997 KAFS field school. From this analysis, it appears that the KAFS block was peripheral to the site's major Late Prehistoric activity areas but that the overall stratigraphy previously noted remains throughout the site. A set of tests also is performed to determine the extent and nature of disturbance processes acting on this site.

The DB site (14LV1071) was a stratified prehistoric occupation on an upland setting in the lower Missouri River valley. Located on a loess-covered ridge north of Hancock Hill in the northwest corner of the Fort Leavenworth military reservation, the site was estimated to have an area of about 23,000 m^2. Previous analyses recognized evidence of Paleoindian, Middle Archaic, Late Archaic, Middle Woodland, and Late Prehistoric occupations. Among the previous studies of DB site data is that of Hill (1998). His spatial analysis of the 1996 block excavation demonstrated that, although some natural disturbance processes acted on the DB site, a significant stratigraphic relationship was retained between the pre-ceramic and ceramic horizons and that some activity areas of the latter were discernible.

Investigation of the DB ridge was prompted by plans to build a new military prison on the site. Because of the presence of known Woodland sites in the area and the proximity of the DB ridge to the Missouri River, it was thought to be a probable location for camps reflecting food-gathering forays from nearby settlements, such as the Quarry Creek site (Logan 1993, 1995). Ironically, Woodland material was extremely sparse at the DB site (Logan 1998a, 1998b).

Although much cultural material was found, construction of the prison was scheduled to begin after the 1996 excavations. In fact, the threat of imminent destruction of the site prompted mechanical stripping of a large area following the block excavation. However, construction was delayed for another year, and Dr. Brad Logan, who had headed the original investigations, took the opportunity to devote another field season there. In 1997 the Kansas Archaeological Field School (KAFS) uncovered 36 m^2 in a square block with the southwest corner at 193N/30E, just northwest of that portion of the site that had been mechanically stripped.

Phase IV investigation of the DB site in the summer of 1996 included the manual excavation of 163 m^2 as well as the mechanical stripping of 3,200 m^2 around the block. Hill's (1998) spatial analysis focused on artifacts found in the block excavation and excluded those found during mechanical stripping of the site. The two data sets were not combined because the collection techniques differed to such a degree that the validity of comparison would be questionable. The grader stripped the soil from this area in thin (ca. 2-cm) intervals, while a team of archeologists followed to collect certain artifacts. Anything deemed to be diagnostic temporally, functionally, or culturally was given x, y, z coordinates with an electronic distance measuring (EDM) transit. However, measurements of orientation, dip (angle that an artifact makes with a horizontal plane), and strike (direction of a line formed by the intersection of an artifact with a horizontal plane) were not taken because of the probability that these aspects of the artifacts had

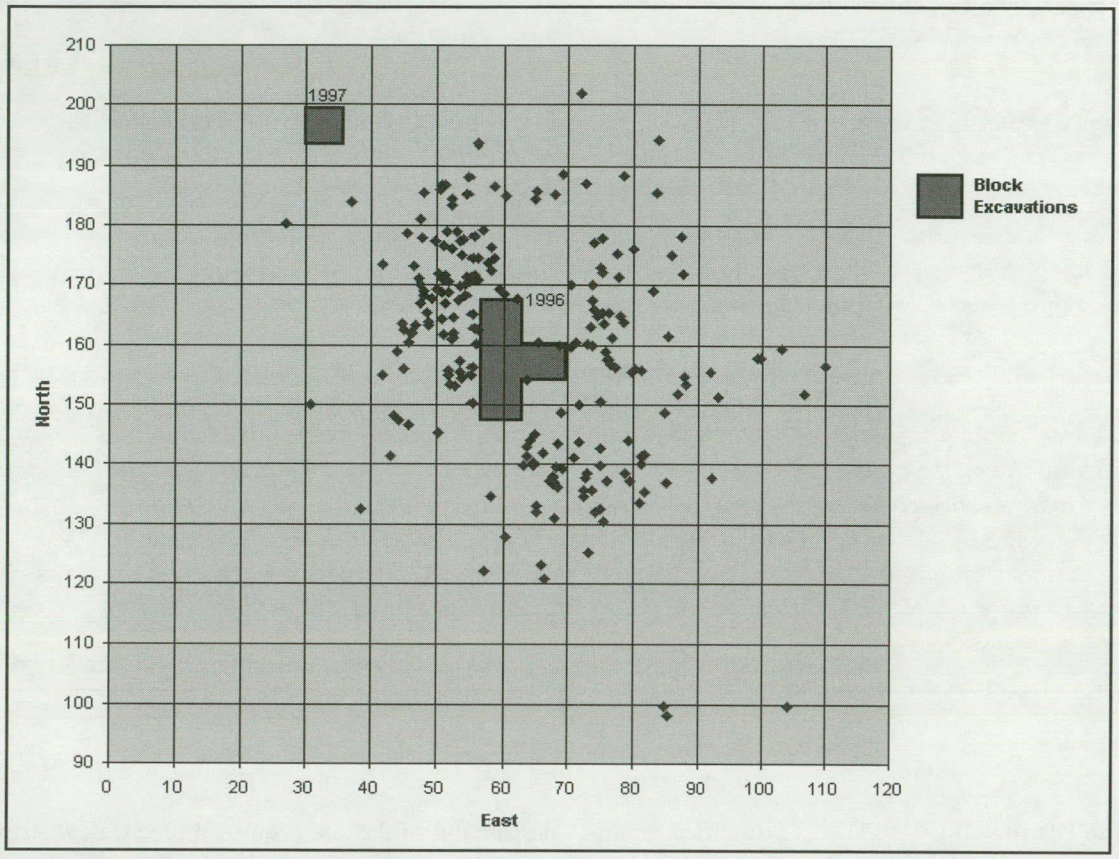


Figure 1. Horizontal distribution of artifacts plotted outside the excavation block in 1996.

been altered by the grader. Therefore, the data collected during this process gave little information that could be used to perform disturbance tests like those employed by Hill. Furthermore, these data arguably were not representative of the same set of artifacts as those from the block because they excluded very small and very fragile artifacts; thus, significant amounts of material, such as small debitage or daub, may have been missed.

This paper is an analysis of the spatial distribution of and post-depositional processes acting upon the piece-plotted artifacts collected during 1997 and includes some data collected from water screen samples. An analysis of the artifacts collected during the 1996 mechanical stripping is also performed, and the three major areas of the site—the graded portion and the 1996 and 1997 excavation blocks—are related to one another. It should be noted that collection techniques and sample sizes differed among these areas, especially the graded area and the excavation blocks. Therefore, the data are not expected to concur entirely, but given these differences, common tendencies seem all the more significant.

Horizontal Distributions

General

Figure 1 shows the horizontal distribution of all piece-plotted artifacts found during mechanical stripping in 1996. The data points appear to be clustered in two areas, with a clean swath running between them on a southwest-northeast axis and perhaps a third cluster in the northeast. To test the statistical significance of these apparent clusters, a k-means analysis was employed.

Cluster analyses are performed by assigning scattered points to groups, based on their similarity or difference from other points. The most basic type of cluster analysis for spatial data is known as nearest-neighbor analysis, and this simply groups points based on Euclidian proximity; that is, each point is grouped with its nearest neighbor. In simplified terms, the k-means process searches for a specified number of clusters with the lowest amount of scatter possible by calculating a center point for each group of existing

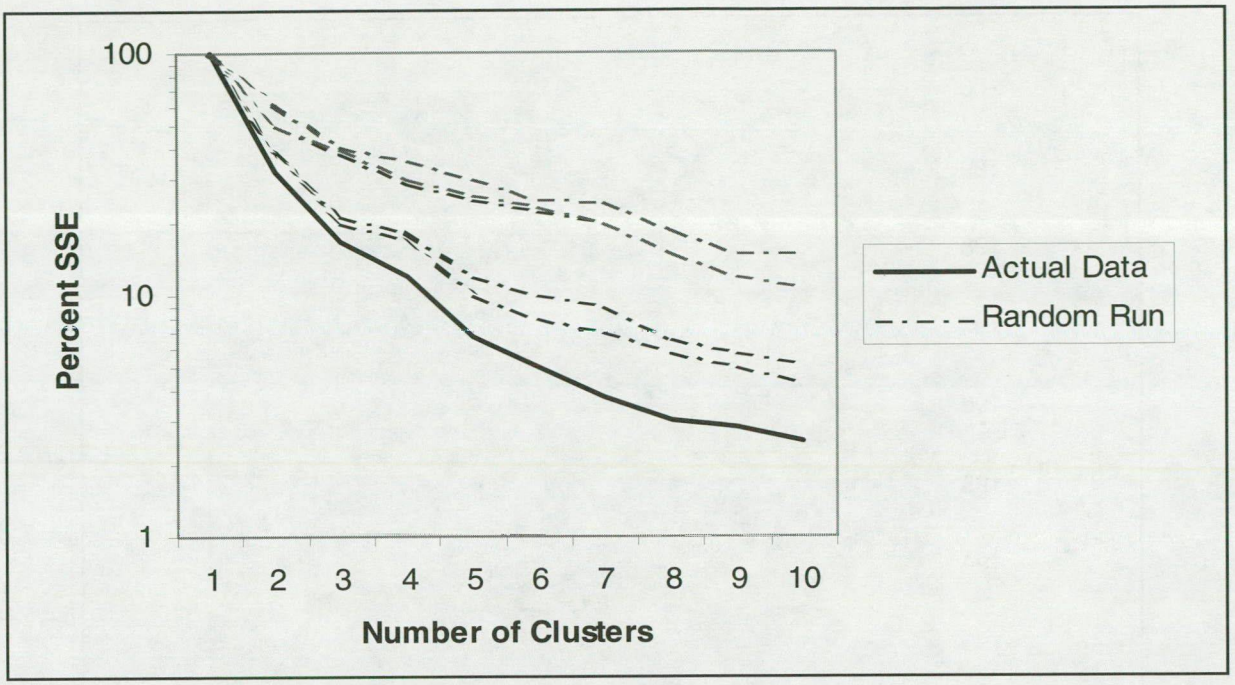


Figure 2. Results of the k-means analysis for data from the surface of the DB hill graded in 1996 (solid line at bottom) and five randomly generated test runs.

points and regrouping based on proximity to those center points. After regrouping, those center points are recalculated and the points are grouped yet again. This process continues until the groups are stable. The result of this process is a predetermined set of clusters with the least spread possible. For more detailed information on this process, see Shennan (1997:216-258), Kintigh (1998:20-32), or any statistical text dealing with spatial analysis.

The other major advantage of the k-means technique is that it allows an evaluation of the degree of spread, which is a measure of the quality of clusters, and thus the ability to compare this degree of spread to clusters generated from a random sample of points. The statistic used to evaluate the degree of spread is called the error sum of squares (SSE). SSE is first calculated for all the points in the sample as one single cluster to evaluate the spread of the group as a whole. Then it is calculated for each number of clusters up to the number of clusters that were calculated in the original k-means process. These values are turned into percentages of the SSE value for a single cluster, which creates a statistic essentially measuring the amount of spread that is overcome by creating each new cluster. Finally these values are plotted against the number of clusters on a k-means plot.

The k-means plot is evaluated by examining the line created by connecting these values and searching for significant points of inflection. That is to say, as long as significant advantage in terms of reducing overall degree of spread is gained by creating new clusters, each point will be significantly lower on the SSE scale than the previous point. When little advantage is gained by creating new clusters, the line flattens out noticeably. Using this procedure, it can be determined how many of the clusters calculated by the k-means procedure are significant and how many are simply statistical artifacts.

Finally, the k-means technique allows the data to be tested for randomness. Because it is a mathematical technique, the k-means process will find any number of clusters desired by the user, even in a totally random sample. The simplest way to check for randomness in a sample of k-means clusters is to create some samples of random points the same size as the sample under analysis and to subject these random samples to k-means analysis and compare the k-means plots. As long as the line for the test sample falls noticeably outside the range of the other samples on the plot, it can be considered to be significantly non-random.

A k-means analysis of the 14LV1071 data compared to five random runs shows significant divergence in the actual data from the expected with a sigificant point of inflection at the point of three clusters (Figure 2). At the grossest scale the data points form a continuous distribution along a northwest-southeast axis

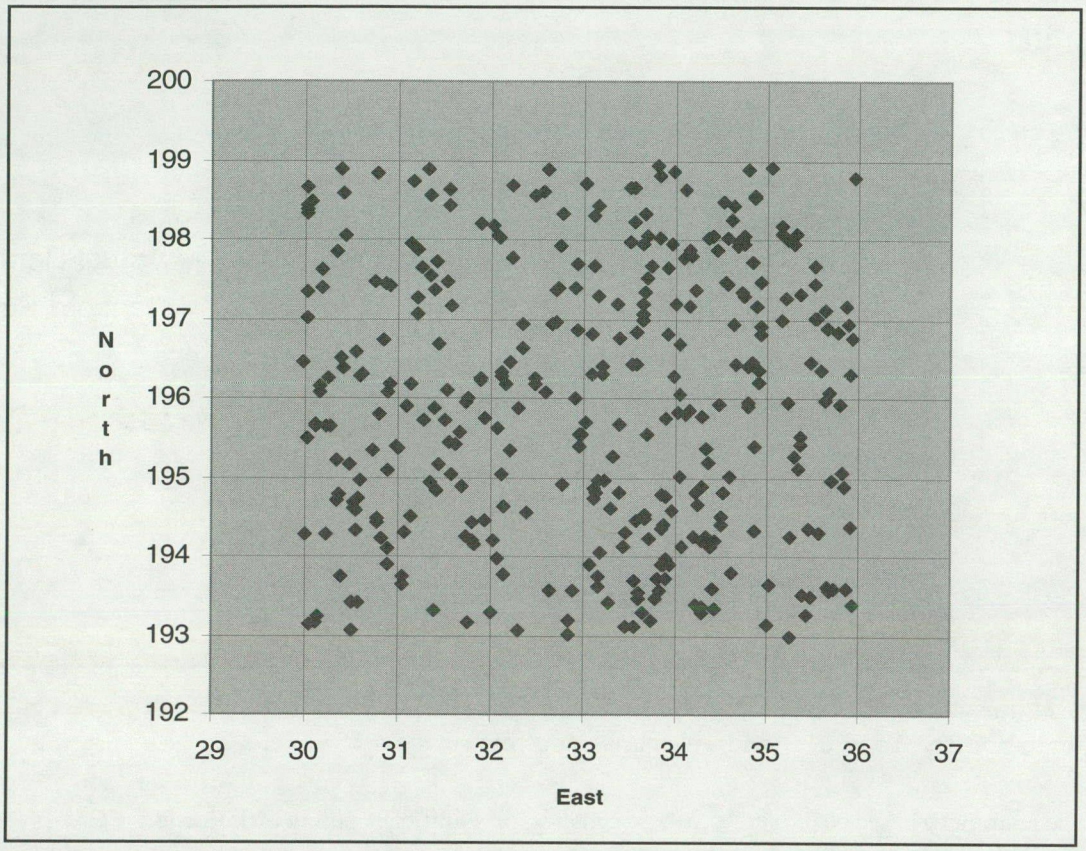


Figure 3. Horizontal distribution of all piece-plotted artifacts from the 1997 KAFS excavation block.

from about 130N/90E to 190N/40E. This seems to indicate an area of concentrated activity, and indeed it follows the same axis as the DB ridge where elevation and a relatively flat surface would have created an attractive place to build camps.

The KAFS block was just northwest of the graded area, and its southeast corner (193N/36E) was in line with the swath mentioned above. At higher resolution the horizontal distribution of piece-plotted artifacts in that block shows no significant pattern (Figure 3). In fact, the general distribution seems very even overall.

Daub and Burned Earth

Looking only at masses of daub and burned earth recovered during water screening in 1997, a pattern is evident. The heaviest concentrations tended to be in the southern and eastern units. On Figure 4 all units with total daub/burned earth concentrations greater than 5.0 g are shaded; those with concentrations higher than 10.0 g are shaded more darkly. The greatest mass was in the most southeastern unit (193N/35E), with surrounding units showing a gradual decline. The concentration pattern within the KAFS block takes a V-shape, pointing toward the 1996 block where heavy concentrations were found. Therefore, it is likely that more features of this material, possibly structures, lay between the excavation blocks.

Unfortunately, the total densities of charcoal were very low, but some clustering is apparent within the KAFS block. In Figure 5 all units with charcoal counts higher than 1.0 g are shaded more darkly than the others, and the units in between them generally had very low relative densities. Unfortunately, this pattern does not match any of the other artifact distributions, such as ceramic or faunal materials, that might indicate a specific type of use area.

Three pieces of charcoal large enough to be piece-plotted were found in 1997. While they formed a line that followed the swath of general artifact concentration, they were by no means clustered. In addition, a small burned limestone cluster was found about 4 m

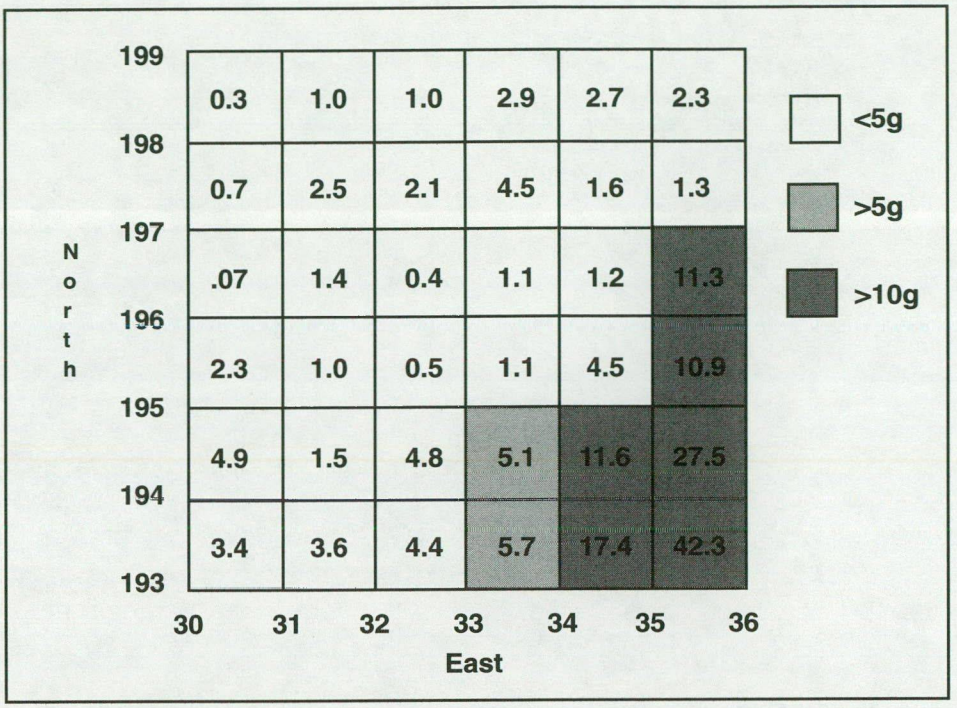


Figure 4. Mass in grams of daub and burned earth by unit for the KAFS excavation block.

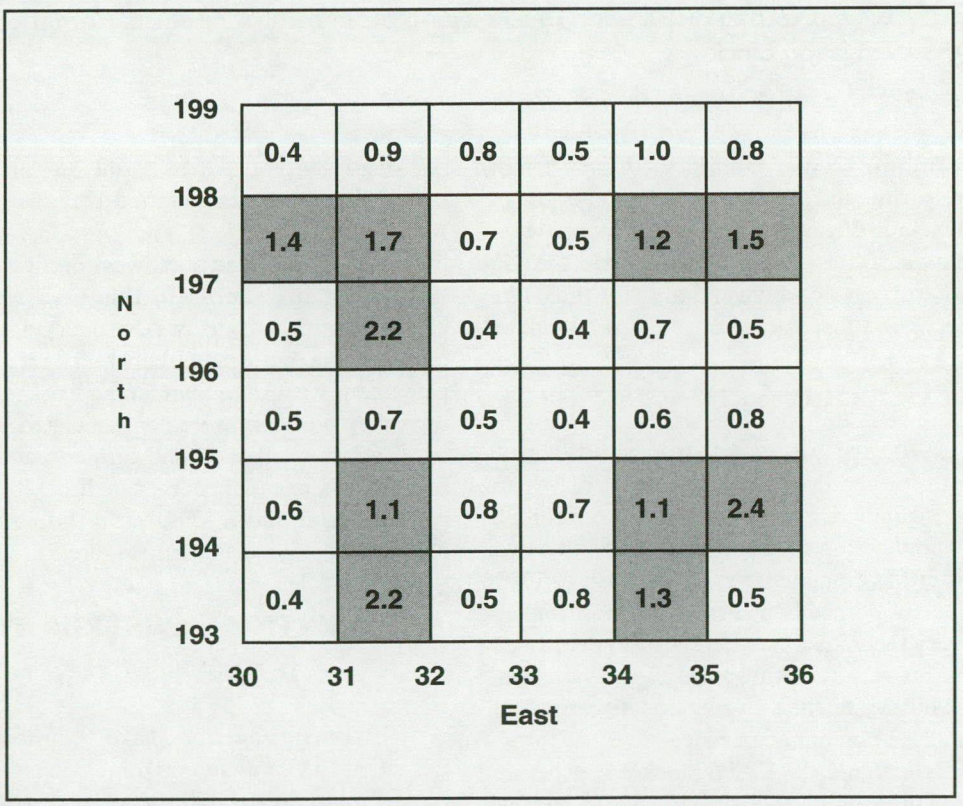


Figure 5. Mass in grams of charcoal by unit for the KAFS excavation block.

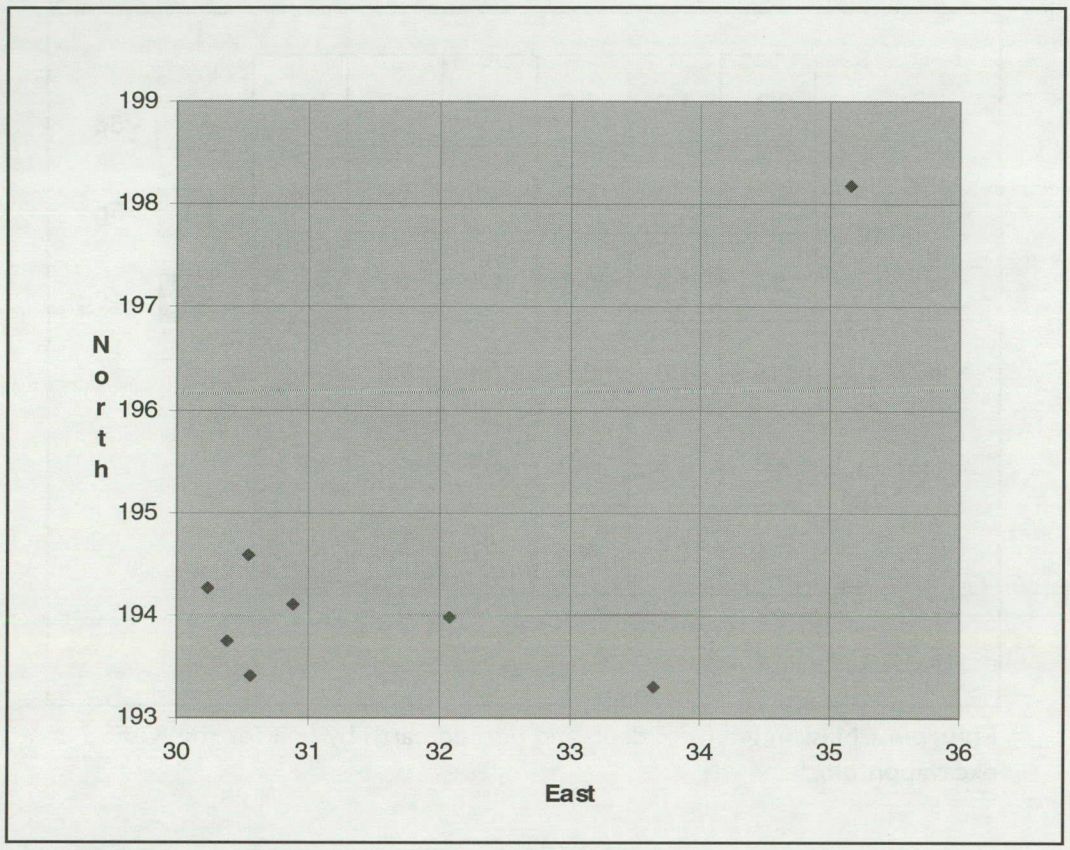


Figure 6. Horizontal distribution of all piece-plotted ceramic artifacts from the KAFS excavation block.

west of the northwest corner of the block (Logan herein). Unfortunately, time did not allow expansion of the excavation to include this area. However, the burned limestone cluster was a considerable distance from the daub and burned earth concentration and from the three large charcoal pieces and, therefore, probably was not related.

Ceramic Artifacts

Hill (1998) used clusters of ceramic artifacts associated with burned bone to delineate food preparation and/or storage areas. While the mechanically stripped area did not reveal any burned bone, there was a small cluster of ceramic material just north of 170N/55E. The lack of burned bone here may be attributable to the recovery technique, but there was no evidence to suggest that this was a cooking area. Equally plausible are the possibilities that the cluster was discarded material or simply a random occurrence.

On the other hand, the KAFS block was excavated manually, and no concentrations of burned bone or charcoal were associated with ceramic remains. Although one sherd was plotted in its northeasternmost unit, seven out of the eight piece-plotted ceramic artifacts were found south of 195N (Figure 6). Most were clustered in a 4-m^2 area of the southwest portion of the block. Several of the sherds in this area were found in krotovinas (rodent burrows), so their original depth was questionable, but it is unlikely that their horizontal displacement was more than a couple of meters. Therefore, they probably were not associated with either the concentration of daub and burned earth or with the burned limestone cluster. Much debitage was piece plotted during the KAFS, but it did not appear to be clustered in any way either (Figure 7).

Vertical Distributions

Projectile Points

Two major horizons have been identified at the DB site. The ceramic horizon extended from the surface to approximately 40 cm below unit datum (bd) and was characterized by Middle Woodland and Late Pre-

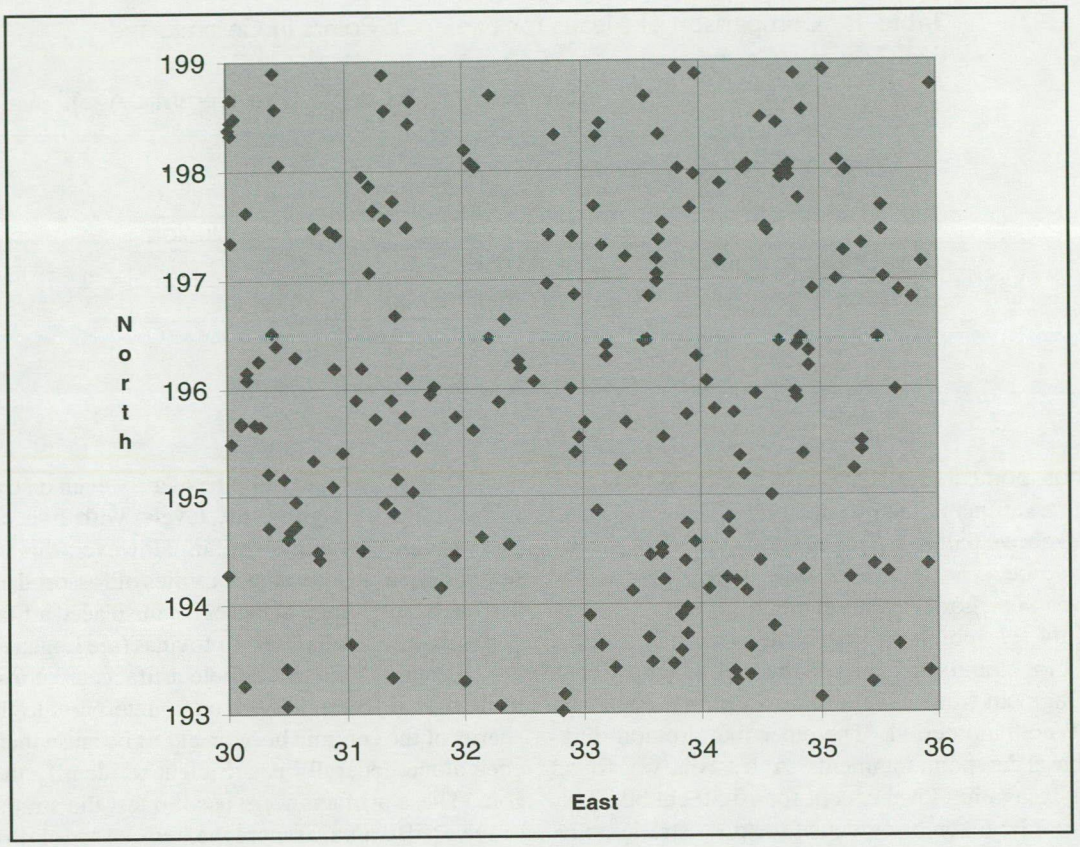


Figure 7. Horizontal distribution of all piece-plotted debitage from the KAFS excavation block.

historic artifacts. These included arrow points, ceramic sherds, and daub. The presence of projectile points/knives and ground stone artifacts in the pre-ceramic horizon, which extended ca. 40-60 cm bd, is evidence of Paleoindian, Middle Archaic, and Late Archaic occupations. In the report of the 1996 excavations, all expanding stem points were classified as Archaic/Woodland due to difficulties in dating these common points (Hatfield 1998). Because of the paucity of Woodland ceramic wares at the site, Logan (1998a:305) tentatively attributed the points to the terminal Archaic occupation, an interpretation that is followed here. Hatfield (1998) and Hill (1998) have shown that the site retained some stratigraphy with respect to Paleoindian and Archaic materials but that some disturbance affected the Archaic components.

To test this stratigraphy in the graded area, means (sample averages) were taken for the real elevations (elevations above site datum) of projectile points from both horizons. This sample includes 22 pre-ceramic artifacts but only 3 from the Late Prehistoric component. This ratio is similar to that of projectile points/knives and arrow points in the 1996 block excavation. Also, given that the latter points are much smaller, the probability of seeing them during grading was much lower than the chance of spotting the larger dart points. Therefore, although it is recognized that there is a discrepancy between the actual number of artifacts from the two classes in the graded area, it should not necessarily be assumed that the disparity is as high as is indicated here. Since no information about excavation level was available for artifacts recovered during grading, a mean elevation was calculated for each group of points. Indeed, the mean for points in the Late Prehistoric class was over 38 cm higher than the mean for pre-ceramic points. To test the significance of this difference, these numbers were subjected to a one-tail t-test, a statistical analysis of two sample averages and the variation within those samples to determine within a certain degree of confidence whether they could have been drawn from the same population. The difference in mean elevations for these groups was found to be significant to 95 percent (Table 1). Furthermore, the two projectile points used in this analysis that are thought to be Paleoindian

Table 1. Comparison of Means for Projectile Points in Ceramic and Pre-Ceramic Categories.

$H_{\varnothing}$: m_1 (Ceramic Age) is statistically equal to m_2 (Pre-Ceramic Age).
One-tail t-test.
Reject at 5% significance.

	Number	Mean	Significance	Conclusion
Pre-Ceramic Age	3	9.0133		
Ceramic Age	22	9.3955	<0.05	reject

(a Dalton point and a Plainview point) had the two lowest elevations in the pre-ceramic group (7.917 and 8.457 m above datum). This suggests that stratigraphy may have been preserved to some degree beyond the very broad categories examined here.

Only five points or fragments were found in the KAFS block, and only one of these is diagnostic—a blade fragment from a Scallorn arrow point, diagnostic of the Woodland period. The other four are non-diagnostic basal dart point fragments. At least one was found in each excavation level except for 40-50 cm bd. This should not be taken as evidence for poor stratigraphy, however, given such a small sample size. When considering the sample size, it is important to remember that the KAFS block was only 36 m^2, while the graded area covered 3,200 m^2 and the 1996 block exposed 163 m^2. Therefore, from the relative density of these artifacts alone, it should not be concluded that there was any differential concentration of activity between the KAFS block and the other areas.

Ceramic Artifacts and Ground Stone

Pottery, the hallmark of the later occupations at DB, also has been used to test stratigraphy. Hill (1998) noted that, with a small number of exceptions, all ceramic artifacts recovered in the 1996 excavation were found in the upper 20 cm of the block. Logan (1998b) assigned most of these to the Late Prehistoric component. On the other hand, nearly all sherds from the KAFS block are Woodland ware (Logan herein). The Woodland ceramic assemblage was unexpectedly sparse, especially considering that the DB site was originally surveyed for evidence of Hopewell activity related to the nearby Quarry Creek site (Logan 1995). Despite the different cultural affiliations of ceramics, they still occurred, by definition, in the ceramic horizon. Although the KAFS data set is far too small to rely on statistically, there seems to be a fairly even distribution of ceramics throughout the levels, with five of eight pieces found below 50 cm bd. However, this unusual ratio likely was due to the activities of fossorial animals because at least three of these five misplaced artifacts are known to have come from krotovinas (see Logan herein).

Ground stone and cobble artifacts are considered to be the pre-ceramic horizon counterparts to the potsherds of the ceramic horizon at DB because their presence alone generally is sufficient to identify the horizon. These artifacts were used to test the stratigraphy of the graded area, as were the two classes of projectile points. In an attempt to offset the slope of the DB ridge, the graded area was divided into two sections, east and west. The division was defined along 60E because this grid line was near the center of the graded area and it seemed to coincide with a natural break between artifact clusters. Mean elevations were taken for ceramic and ground stone/cobble artifacts for four basic areas: the 1996 excavation block, the 1996 graded area, the eastern portion of the 1996 graded area, and the western portion of the 1996 graded area. The mean elevation of the ceramic assemblage was higher than that of the ground stone/cobble assemblage in all areas. To test the significance of these differences, they were subjected to a t-test like that previously applied (Table 2). The difference in means was found to be significant in every area except the graded area as a whole. The lack of a significant difference in elevations for this broad area was probably due in large part to the slope of the western portion of the original surface.

Assuming that the topography of the ridge had not changed significantly since its prehistoric occupation, the real elevations of artifacts would be expected to parallel the general contour of the surface. Lacking sufficient control for the elevation of the original ground surface, the real elevations of artifacts from smaller areas relative to one another seem to be the most reliable indicators of vertical distribution.

Table 2. Comparisons of Ceramic and Ground Stone Artifacts by Area.

For all tests: $H_{\varnothing}$: m_1 (ground stone) is statistically equal to m_2 (ceramic).
One-tail t-test.
Reject at 5% significance.

Block				
	Number	Mean	Significance	Conclusion
Ceramic	35	9.5171		
Ground Stone	82	9.4067	<0.0005	reject
Graded Area				
	Number	Mean	Significance	Conclusion
Ceramic	15	9.3738		
Ground Stone	72	9.2388	0.05	do not reject
East Graded Area				
	Number	Mean	Significance	Conclusion
Ceramic	6	9.2632		
Ground Stone	21	9.0053	<0.005	reject
West Graded Area				
	Number	Mean	Significance	Conclusion
Ceramic	9	9.4476		
Ground Stone	51	9.335	<0.025	reject

The KAFS assemblages are fairly small, but the total area from which they came was also small, relative to that of the 1996 investigations. Since the excavation levels of KAFS piece-plotted artifacts are known, their vertical distribution can be examined. As noted earlier, most sherds were recovered below their expected depths. However, all ground stone artifacts retrieved in the block were found below 50 cm bd. Likewise, all cobble artifacts were found below 40 cm bd, so their stratigraphic position was maintained. In fact, it was noted during the course of the field school that cobbles and ground stone began to appear near 50 cm bd in a layer that the crew referred to as the "big rock zone."

Daub and Burned Earth

Logan (1998a) cited evidence of one or two lodges in the Late Prehistoric component as evidence that occupation may have been brief, perhaps one season long. As discussed earlier, a concentration of daub and burned earth was apparent in the southeast corner of the KAFS block. Though this type of artifact is fragile and often small, it does not appear that its vertical distribution had been disturbed greatly. In fact, 83 percent of all daub/burned earth recovered through water screening came from the first level (0-10 cm bd). Furthermore, daub/burned earth was found exclusively in

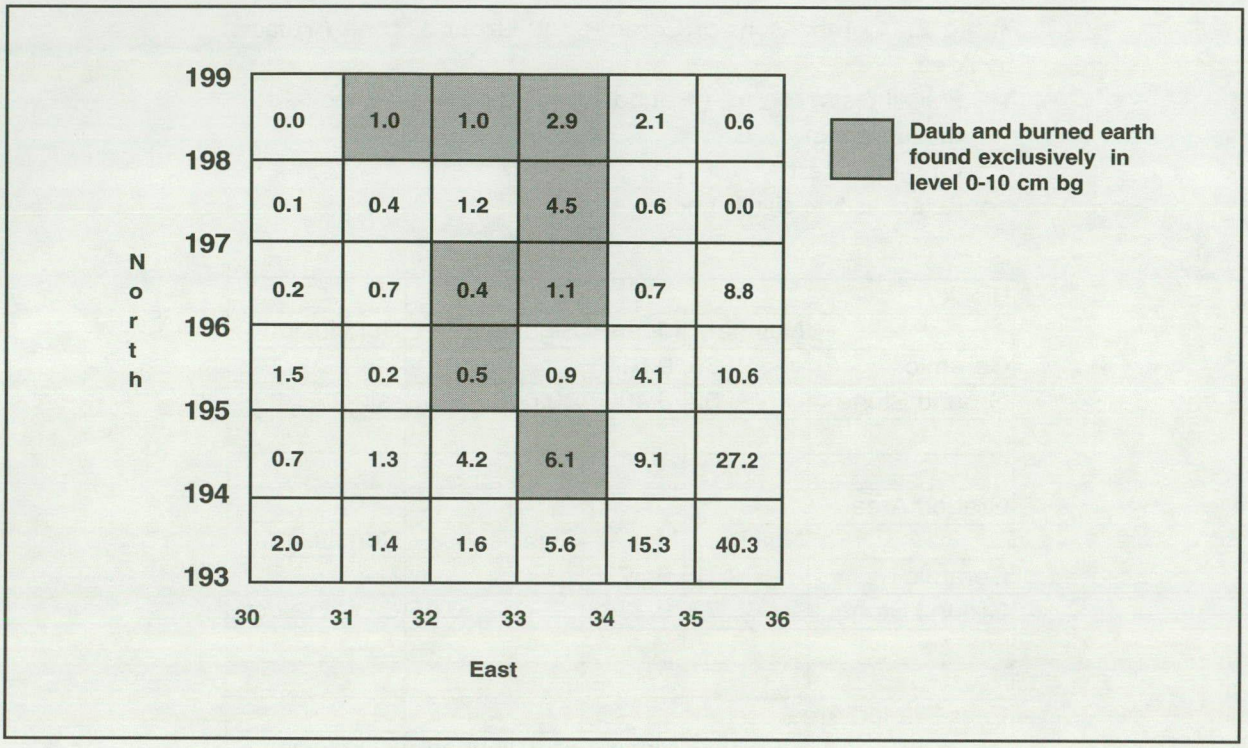


Figure 8. Mass in grams of daub and burned earth from level 0-10 cm bd from the KAFS excavation block.

this level in 8 of the 36 units excavated. These units are shaded more darkly than the others in Figure 8.

Disturbance Processes

Size Sorting

It could be argued that the apparent "big rock zone" was the result of a post-depositional disturbance process that resulted in an overall size-sorting effect. To investigate this possibility, Hill (1998) analyzed the vertical distribution of artifacts from seven mass classes: 0-5 g, 5-10 g, 10-25 g, 25-50 g, 50-100 g, 100-200 g and 200+ g. His results seem to indicate that size sorting had not occurred to a significant degree within the 1996 excavation block. He stated, however, that "this is not ... to imply that a small degree of size-sorting has not taken place" (Hill 1998: 265).

The same size classes were used to test the degree of size sorting within the 1997 excavation block. Figure 9 shows the means for these classes with their 95 percent confidence intervals. The intervals overlap for most mass classes, which indicates that their mean elevations were not significantly different. The heaviest class (200+ g), however, does appear to be statistically lower than the two lightest classes (0-5 g and 5-10 g). Though sample size is fairly small for the largest group (n = 11), the other two have statistically reliable samples (n = 169 and n = 64). Thus, this apparent size sorting may be the result of poor statistical resolution. It should be remembered, however, that these "big rocks" are often the identifying markers of the earlier horizon.

Other Post-Depositional Processes

Theoretically, given a relatively flat surface, artifacts that are deposited randomly should tend to lie more or less flat. If disturbance is not significant, they should remain in that position. If they are disturbed, they may take on more drastic declinations. During both the 1996 and 1997 excavations, dip measurements were recorded for all piece-plotted artifacts, so that any disturbance could be documented. As Hill (1998) reported, items so measured in 1996 tended to have low dip measurements overall, and this pattern also was observed in each excavation level. He showed that a small number of artifacts with high dip measurements should be expected

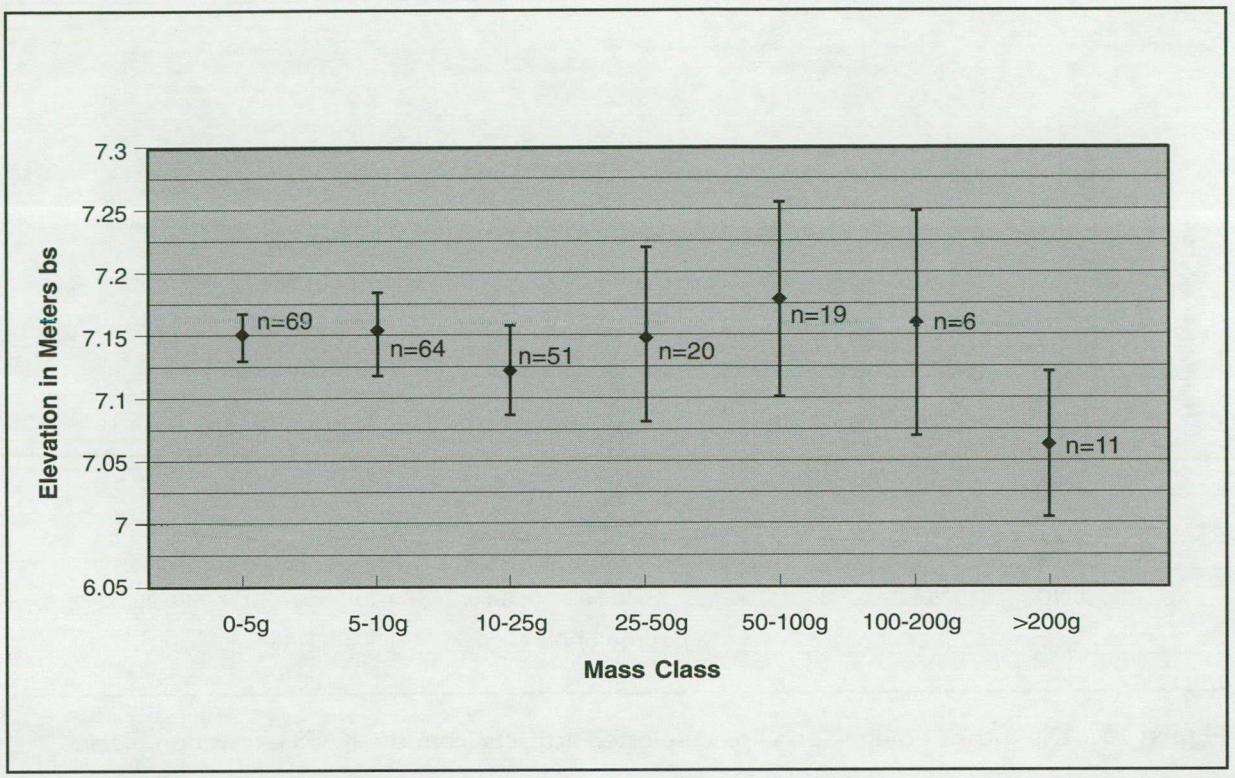


Figure 9. Mean elevations with 95 percent confidence intervals of two-tail t-test for piece-plotted artifacts from seven mass classes.

in random deposition, tending to be concentrated in small areas, especially those affected by faunalturbation (animal disturbance).

Piece-plotted artifacts from the KAFS block show a similar trend of low declination overall, although this pattern is not as pronounced (Figure 10). In fact, the 26° mean dip for all items is within Hill's parameters for low dip, 0-30°. When individual levels are examined, it is apparent that the lower levels retain the expected pattern for a low disturbance situation but that the first two levels, 0-10 cm and 10-20 cm bd, actually show an irregular pattern with unusually high numbers of artifacts having dips of 20-40° (Figures 11-15). In fact, these levels have relatively higher mean dips, 27° and 28° respectively. The horizontal distribution of artifacts with dips between 30° and 90° shows little clustering, but dips of 60-90° are somewhat patterned. As expected, many of these drastically angled artifacts came from the southwest portion of the block where rodent runs were noted and where ceramic artifacts were found in unusually low levels (Figure 16).

Along with dip, measurements of orientation were also taken for piece-plotted artifacts from both blocks. On a relatively flat surface artifacts should be deposited with random orientations. Over time, however, low-energy disturbance processes, such as slope wash, will realign them perpendicular to the direction of water flow and, thus, to the slope of the hill. This has been compared to the effect of current on the pebbles in a stream. Hill (1998) demonstrated that the distribution of orientation measurements was not random within the 1996 excavation block. Rather, artifacts tended to be oriented perpendicular to the DB hill slope in that area.

The charts showing the orientation measurements for items recovered in 1997 show a similar trend for artifacts to point northeast or southwest, which was approximately perpendicular to the direction of slope in this area (Figures 17-19). As in Hill's analysis, the most irregular distribution of orientation measurements for 1997 came from the first two levels (0-20 cm bd). The irregularity was not as extreme here, however. Whereas Hill pointed to the 10-20 cm bd level as the most random of the 1996 excavation block, in the KAFS block that level shows a fairly patterned distribution (Figure 20). While this is likely due to sample size, it is also possible that processes, such as treadage, which can counteract the effects of slope wash were not as common in this area.

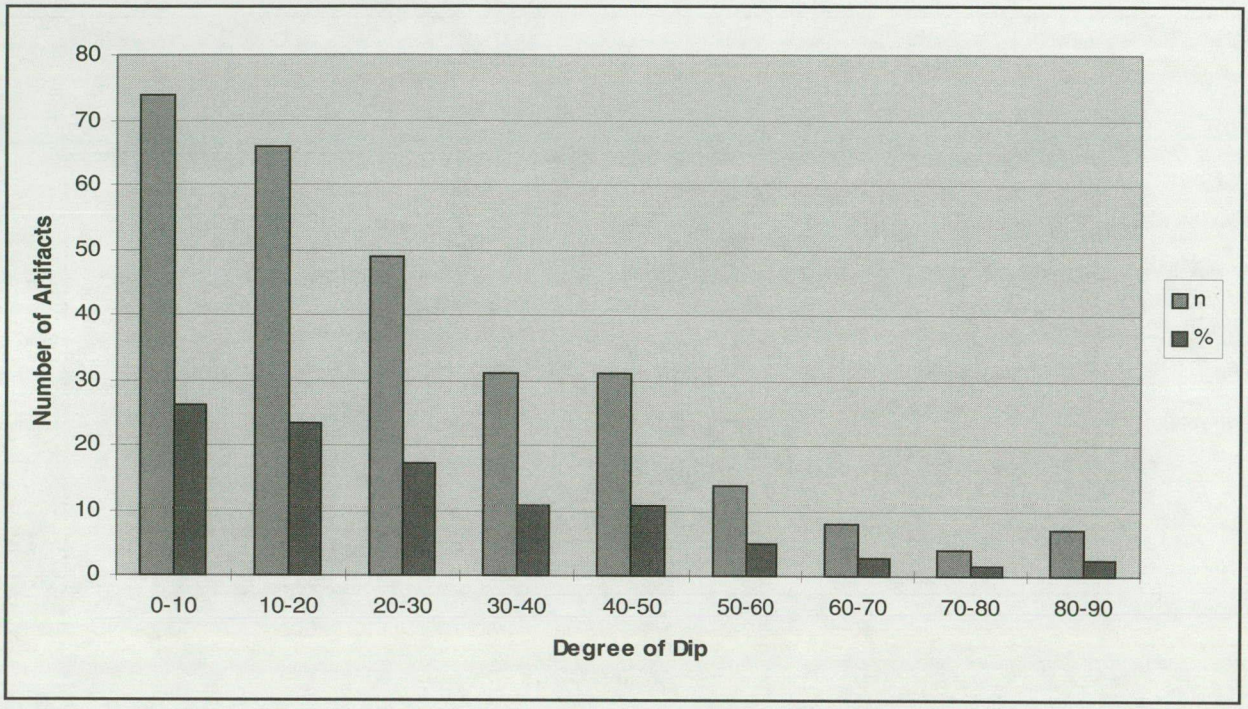


Figure 10. Dip measurements for all piece-plotted artifacts from the KAFS excavation block.

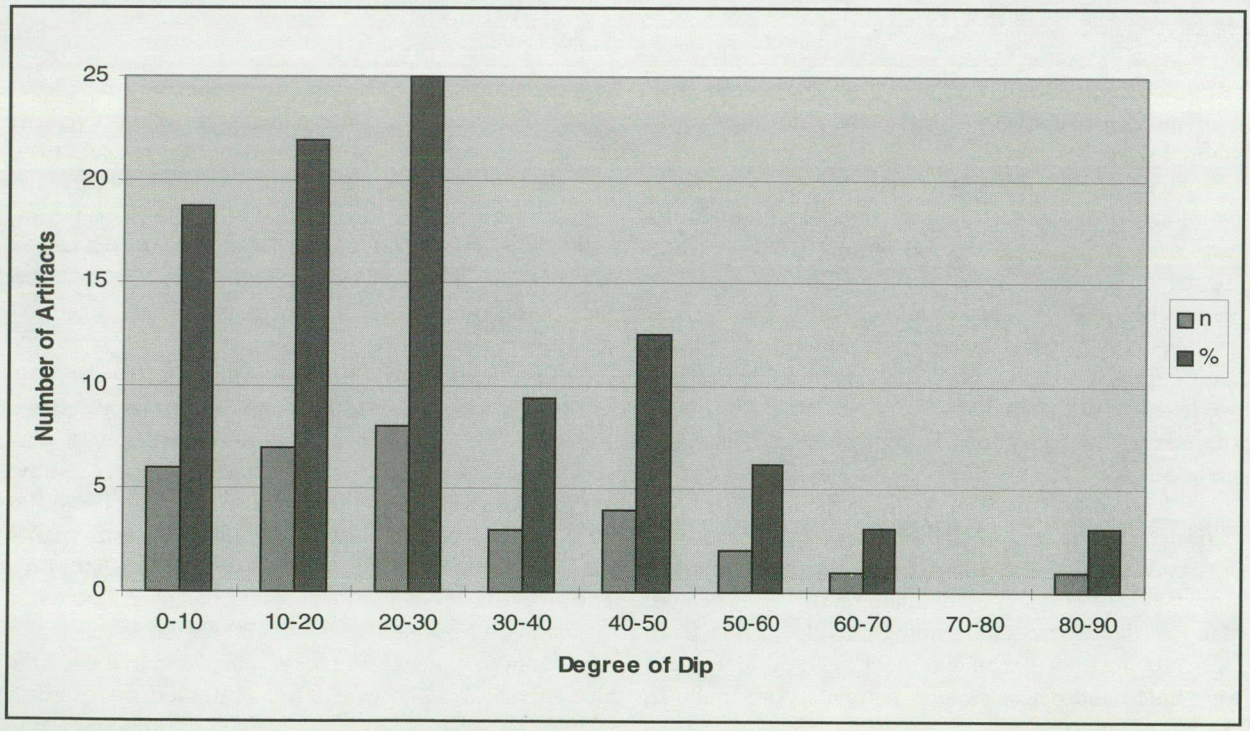


Figure 11. Dip measurements for piece-plotted artifacts from level 0-10 cm bd of the KAFS excavation block.

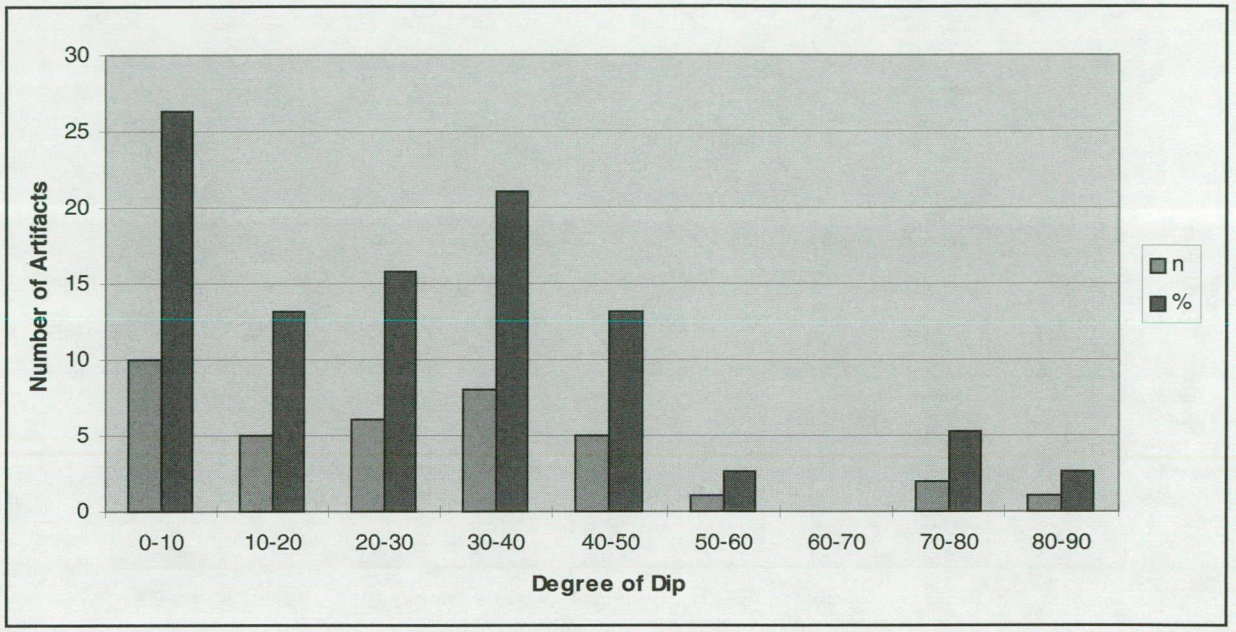


Figure 12. Dip measurements for piece-plotted artifacts from level 10-20 cm bd of the KAFS excavation block.

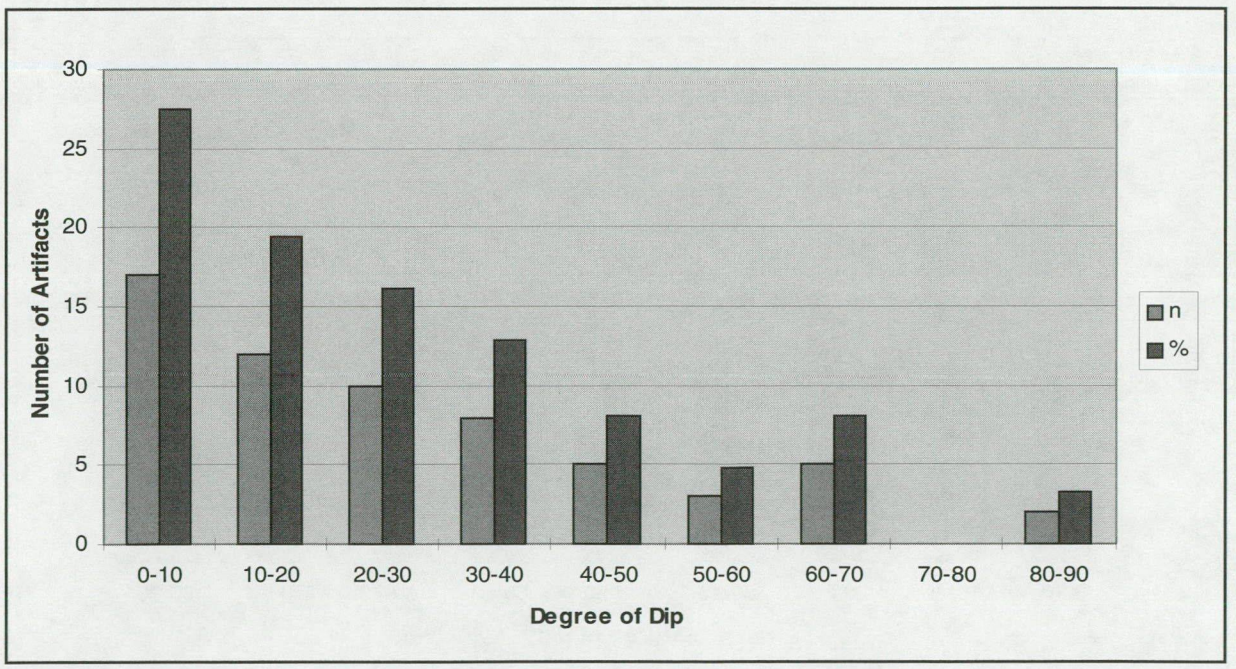


Figure 13. Dip measurements for piece-plotted artifacts from level 20-30 cm bd of the KAFS excavation block.

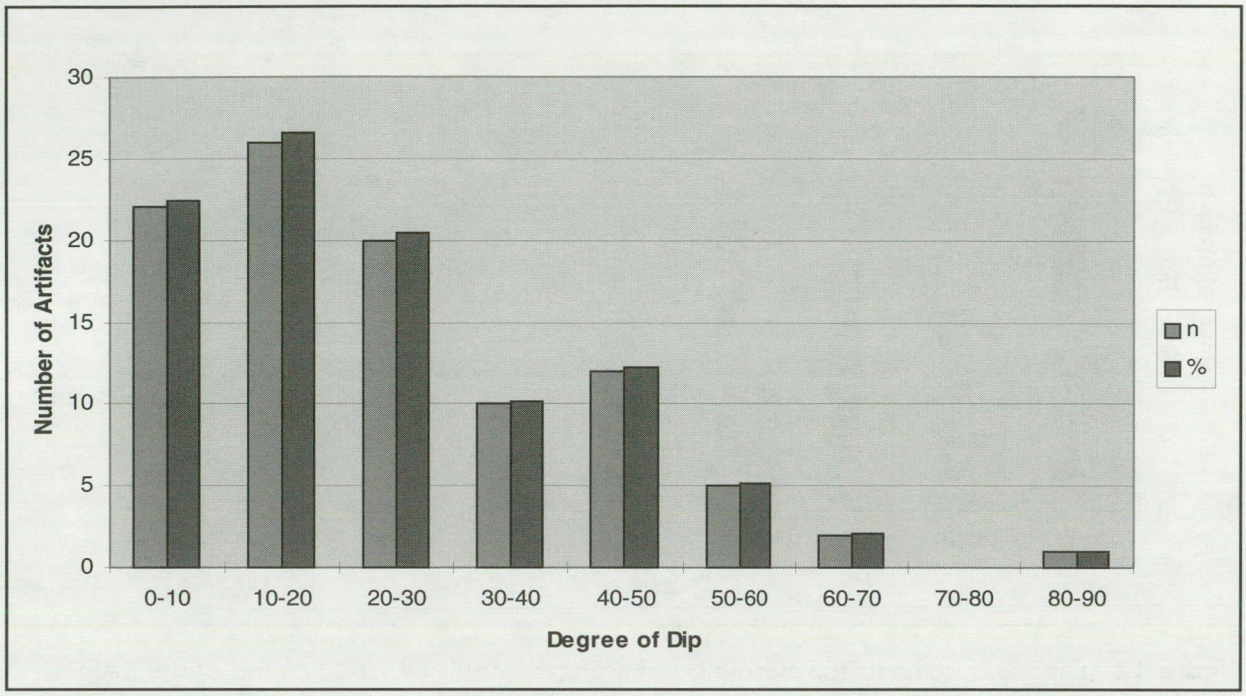


Figure 14. Dip measurements for piece-plotted artifacts from level 30-40 cm bd of the KAFS excavation block.

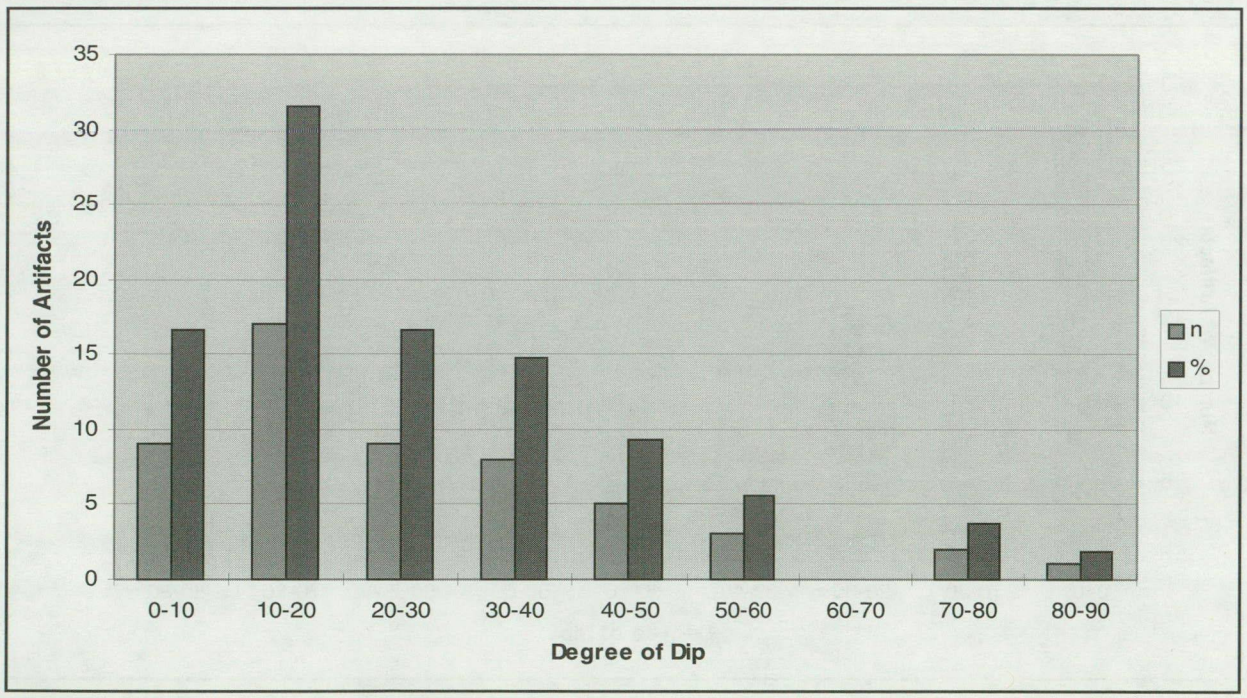


Figure 15. Dip measurements for piece-plotted artifacts from level 40-50 cm bd of the KAFS excavation block.

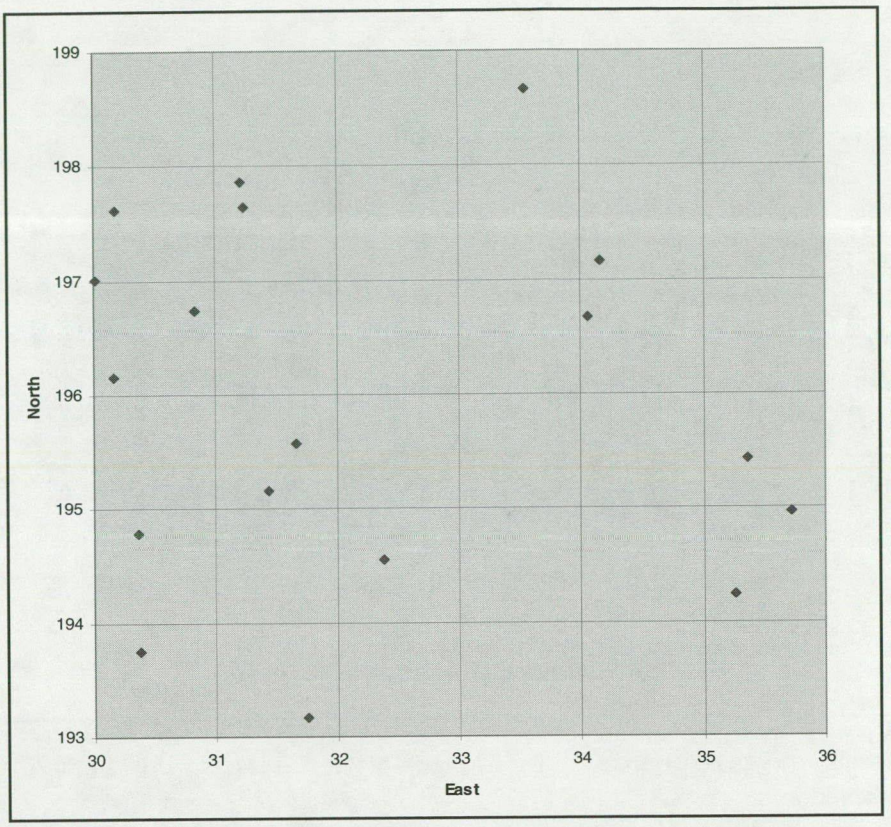


Figure 16. Horizontal distribution of artifacts from the KAFS excavation block with dip measurements of 60-90°.

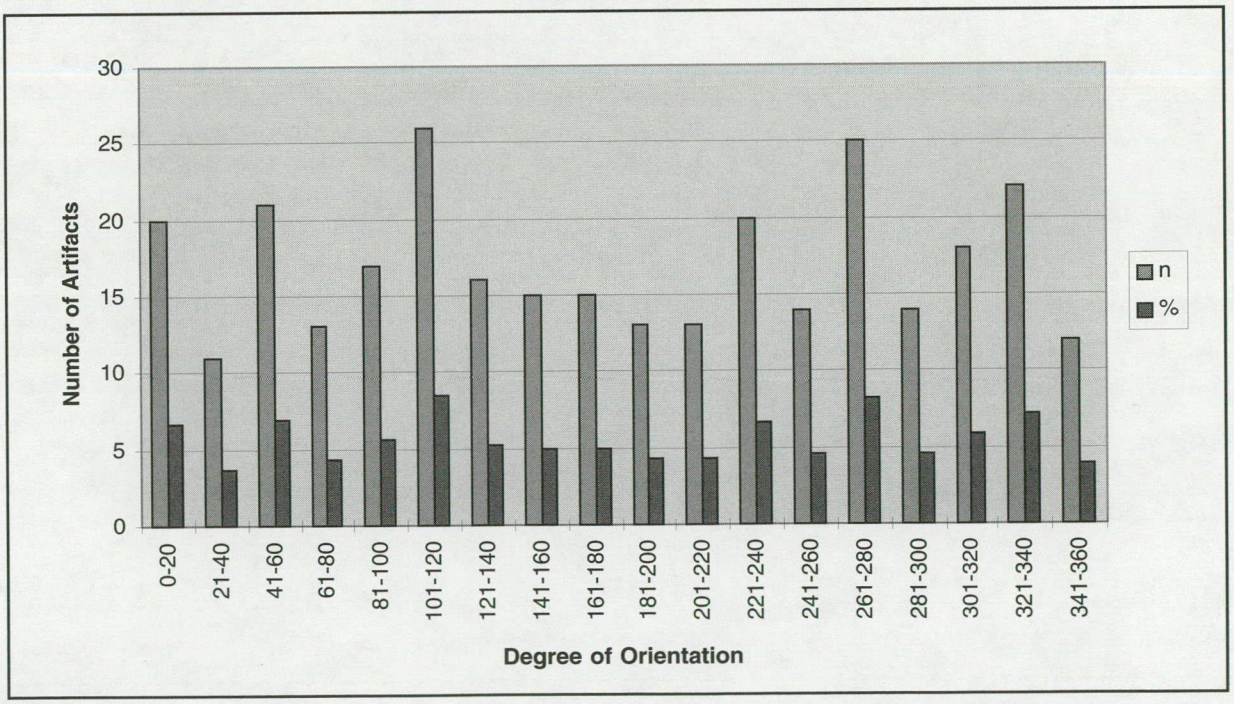


Figure 17. Measurements of orientation for all piece-plotted artifacts from the KAFS excavation block.

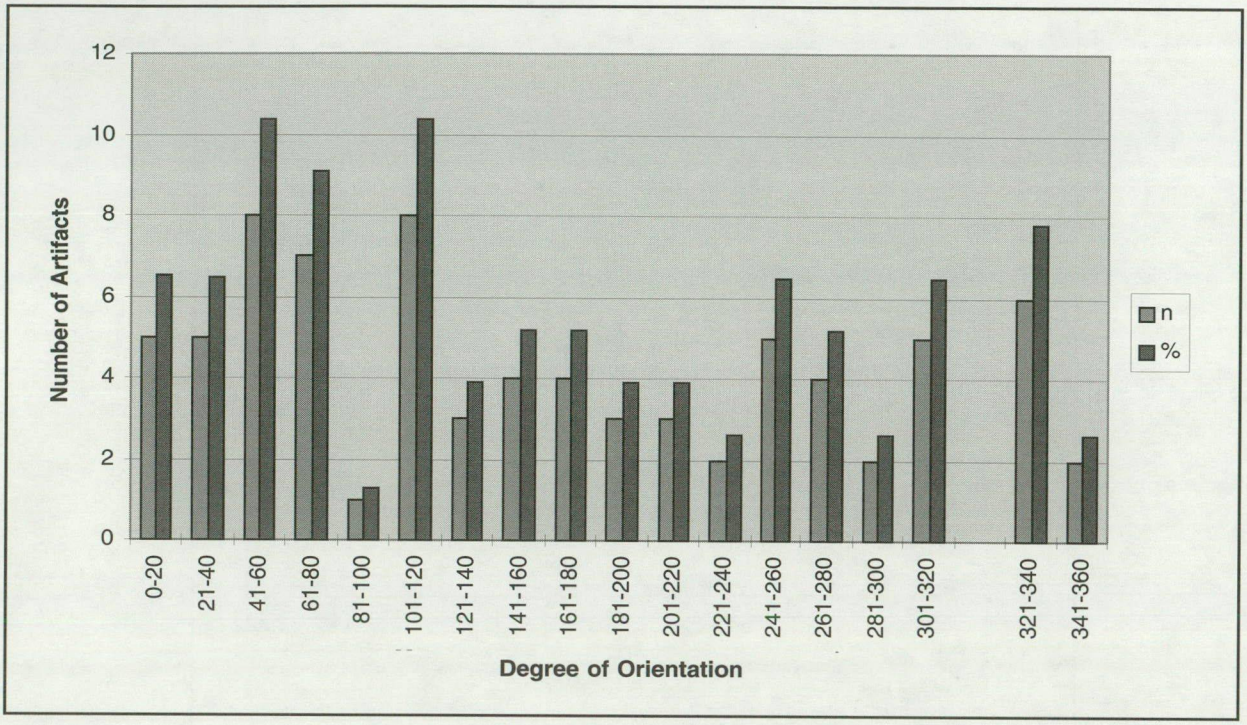


Figure 18. Measurements of orientation for all piece-plotted artifacts from the 0-20 cm bd level of the KAFS excavation block.

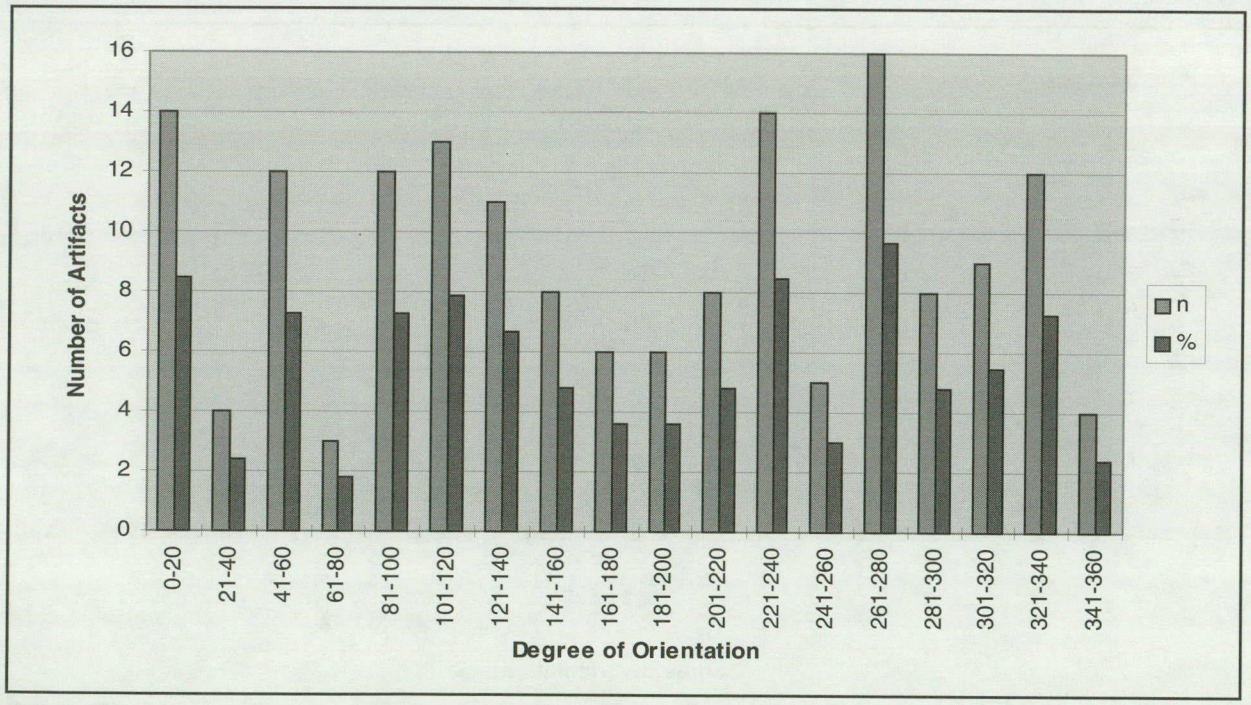


Figure 19. Measurements of orientation for all piece-plotted artifacts from 20+ cm bd of the KAFS excavation block.

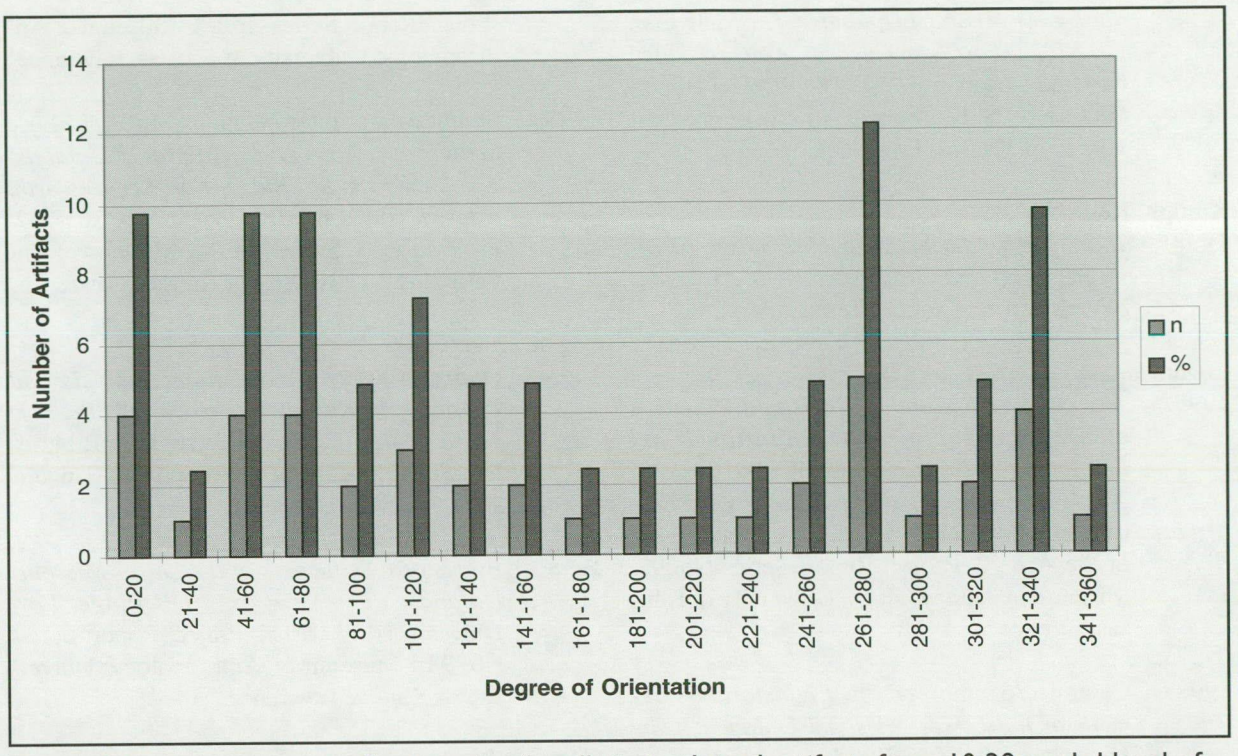


Figure 20. Measurements of orientation for all piece-plotted artifacts from 10-20 cm bd level of the KAFS excavation block.

Conclusion

This examination of the three areas of the DB site seems to support many of the interpretations made by Hill (1998). Although the lower components have experienced some degree of post-depositional disturbance, two basic horizons seem to be discernible throughout. Even in the lower component, some stratigraphy was maintained.

High dip measurements and several artifacts out of place suggest that the area opened by the 1997 KAFS was affected more than the area excavated in 1996. Specifically, the clustering of ceramic artifacts in the lower levels of units in the southwest portion of the block, where krotovinas were noted, indicates that faunalturbation may have been one of the major factors at work here. Well-patterned orientation curves also suggest that low-energy processes, such as slope wash, had some effect. The consistency of this patterning and paucity of cultural debris relative to the 1996 excavation block may suggest that the KAFS block was on the fringe of the activity area. This broad activity area is suggested by the general distribution of artifacts in the graded area. Although no specific activity areas are obvious within the KAFS block, a concentration of daub and burned earth in its southeastern corner points to the peripheral position of the block with respect to remains of Late Prehistoric shelters delineated on the ridge's summit. It is not surprising that the KAFS ceramic assemblage is not spatially associated with this concentration since it is mostly Woodland ware.

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Five Smoky Hill Phase Houses in Saline and Ottawa Counties: The Whiteford Excavations, 1934-1945

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The Whiteford family of Salina is well known in Kansas for the excavation and operation of the Indian Burial Pit, a Smoky Hill phase cemetery. The Whitefords, however, excavated several other Smoky Hill phase sites in the years 1934 to 1945, including five houses and one isolated burial. In 1971 they donated all collections and records from those sites to the Kansas State Historical Society. The five houses and isolated burial are here described. No architectural data are available for one house, and its collection cannot be separated from a mixed aggregate of material. An excellent floor plan and feature data are available for another house, but the collection is not intact and was very small to begin with. Excellent floor plans and feature data are available for the other three houses, and their collections are intact or nearly so. Much valuable information can be extracted from these houses and their collections. Some inter-house comparisons are drawn, and a discussion is presented of issues pertaining to Smoky Hill phase and Central Plains culture history.

Introduction

Smoky Hill phase sites are distributed from the Blue River drainage of western Pottawatomie County (Johnson 1973) to the middle Saline River drainage of eastern Russell County (Witty 1962) with some of the largest and most prominent sites in the lower valleys of the Solomon, Saline, and Smoky Hill rivers in Saline and Ottawa counties. Floyd Schultz excavated one house at the Burns site (14OT2) and another at the Sarah Smith site (14OT1) in 1932; A. T. Hill and Waldo Wedel excavated three houses at the Minneapolis site (14OT5) in 1934; the Kansas Anthropological Association (KAA) excavated one house at 14SA403 in 1968; and the KAA excavated three more houses at the Minneapolis site in 1970. Wedel's report of the Minneapolis site excavation (1934a) is the only published comprehensive description of Saline/Ottawa counties Smoky Hill phase sites, although several other studies have considered materials from either Schultz's work (Fastiggi 1960; Hedden 1992, 1994; Hughes 1954) or the Minneapolis site excavations (Beck 1998; Fosha 1994), and there are some brief notes on the 14SA403 excavation (Witty 1968). This is a rather limited published record, though, for what must have been a comparatively intensely settled part of the Smoky Hill phase area.

There is another corpus of excavated Smoky Hill phase houses, the reporting of which will nearly double the number of described Saline/Ottawa counties houses. This is the set of five houses—two in Saline County and three in Ottawa County—excavated by the Whiteford family of Salina in the years 1934 to 1945. From the beginning the Whitefords had the attention of both Hill and Wedel; indeed, they might not have been excavating Smoky Hill phase sites were it not for this connection. Except for two general descriptions of one house (Wedel 1959:513-517; Whiteford 1937:3-10;



Figure 1. Jay Dee and Mabel Whiteford wielding shovels at the Paint Creek site. The photograph has no date, but it must have been taken between November 1934 and March 1936. Photo is catalogue number 74.46.60, Whiteford Collection, Kansas State Historical Society, Topeka.

1941:11-18), though, these excavations are so little known that only one or maybe two of the other four houses have been mentioned in print, and then only with the barest of notices (Wedel 1959:513; Whiteford 1941:18, 19). The Whiteford excavations, however, met the same standards as the Nebraska State Historical Society (NSHS) excavations. The records are overall quite good for their time. The collections, while selective as were most collections made during that era, were catalogued and are largely intact. Description of the houses and the collections is feasible and will contribute valuable information about the Smoky Hill phase.

Not the least reason for these sites' importance is the fact that two of the five houses were circular, not square or rectangular as are the majority of known Smoky Hill phase houses. Mentioning round houses in Central Plains tradition context may bring Gilder's early-twentieth-century excavations of Nebraska phase houses to the minds of archeologists conscious of the history of research in the Central Plains. Gilder's field techniques led him to believe that Nebraska phase houses were round until Sterns' later excavations showed them to be square (Blakeslee and Caldwell 1979:4–5).

The Whitefords likely were not this naïve. In fact, they directed A. T. Hill and the 1934 NSHS field party to the Minneapolis site, so they must have seen the house excavations there, and those houses definitely were square (Wedel 1934a). The Whitefords emulated the practices of the NSHS party by exposing and mapping entire house floors, and their photographs corroborate the floor plan maps. The conclusion seems undeniable: two of the houses that the Whitefords excavated were circular. Since circular houses are generally considered to be later than rectangular houses—and since there are some serious unsolved culture-history questions in central Kansas—the presence of these two structures in Ottawa County makes analysis of the Whiteford collections of more than passing interest.

The Whitefords and Their Explorations of Smoky Hill Phase House Sites

The Whiteford family—Guy and Mabel and their son Jay Dee—is best known and remembered in Kansas for the excavation and commercial operation of the site variously known as the Indian Burial Pit, the Salina Burial Pit, or the Whiteford site (14SA1), the large Smoky Hill phase cemetery east of Salina. I will detail both the overall course of the Whitefords' archeological work in Kansas and the story of the burial pit elsewhere (Roper 2002a, c). For here it will suffice to say that the Whitefords' archeological investigations extended well beyond the burial pit and included, but even

Table 1. The Whitefords' House Sites.

State Site Number	Site Name	Whiteford Site Number	House Number	Year	Drainage
14OT305	Aerhart	S6	1	1934	Solomon River
14OT304	Lamar	S5	1	1935	Pipe Creek
14SA414	Kohr	S1	1	1936	Smoky Hill River
14SA414	Kohr	S1	2	1937?	Smoky Hill River
14OT308	Markley	S12	1	1945	Solomon River

then were not limited to, the five house excavations. I also will note that most discussions and such published information as is available credit Guy Whiteford with this work and talk about "his" excavations, "his" notes, and so forth. I wish to correct that error, as the excavations were conducted by the entire Whiteford family (Figure 1). I, therefore, will speak of the Whitefords and their work, except in those instances where a map, letter, or other document is specifically attributable to one or another of the Whitefords.

Guy and Mabel Whiteford's artifact collecting passion grew out of their search for fossils for a rock garden. It was a surface collecting hobby only until one day in the summer of 1934 when they went to the Paint Creek site (14MP1). Upon arrival at the site, they found A. T. Hill, Waldo Wedel, and the summer field party from the NSHS excavating cache pits (Wedel 1934b). By their own account the Whitefords at first were "disgusted" to find someone else in their favorite place. However, they all introduced themselves, the Whitefords showed the NSHS party their collection, they learned of its "real scientific value," and some long-lasting and productive friendships and working relationships were formed (*Kansas City Star*, 10 February 1938). The Whitefords' hobby activity was transformed in a way that would have a significant impact on Kansas archeology (Roper 2002c).

The Whitefords' first contribution to Kansas archeology must have been made during that 1934 encounter, for Wedel's report of the 1934 excavation at the Minneapolis site credited "Mr. G. L. Whiteford [sic] of Salina" with showing the NSHS party the site (Wedel 1934a:218). Wedel later used the Minneapolis site, along with the burial pit, as type sites for his definition of the Smoky Hill phase (1959:563). Similarly, a 1936 letter from Wedel to Guy Whiteford referred to the two of them, also in 1934, walking over what we now call the Kohr site (14SA414) where, as we shall see, the Whitefords eventually excavated two houses. Wedel was also familiar with these excavations and had described the collections in his notes before he defined the Smoky Hill phase (Roper 2002d).

The Whitefords conducted their own first house site excavation in fall 1934 within a month or two of the NSHS excavations at the Minneapolis site. This was at an Ottawa County site that they referred to as the Aerhart site (14OT305). They excavated one more house each year in 1935 and 1936 (Table 1): the 1935 excavation also in Ottawa County at a site they referred to as the Lamar site and the 1936 excavation at the Kohr site in Saline County. This latter house, designated Kohr House No. 1, was only about 1,700 feet from the burial pit site. Local publicity of this excavation (*Salina Journal*, 1 August 1936) stimulated Howard Kohr, the grandson of the landowner Mary Kohr, to look for the place where the original homesteader encountered human bones while erecting his first home (a dugout). When Howard Kohr found the burial pit on October 1, 1936, he notified the Whitefords and they immediately became heavily involved in that site's excavation and operation. Their work on houses, therefore, was considerably slowed, and they would excavate only two more houses: a second one on the Kohr site (Kohr House No. 2) sometime between early 1937 and mid-1940 and a house on the Markley site (14OT308) in Ottawa County in 1945. However, they did surface collect at other Smoky Hill phase sites in both Saline and Ottawa counties, and they excavated a single burial at one of these sites.

The Whitefords left Kansas in 1946 after the Kohrs' successors as owners of the land containing and surrounding the burial pit took over the operation of the site. Their collections from the excavated Smoky Hill phase houses and other sites remained largely intact, and in 1971 the Whitefords donated them to the Kansas State Historical Society (KSHS). The donation included catalogues, other notebooks that the Whitefords maintained, drawings, and photographs.

Records

Following their meeting with A. T. Hill and the NSHS field party in the summer of 1934, the Whitefords began not only excavating but also keeping a ledger cataloguing their collection. The state site numbering system in use today, and into which all the sites they investigated are now entered, as yet had not been developed. Like many investigators of that era, the Whitefords devised their own system. Eschewing any county designation, they simply numbered sites in order, prefixing the number with an S, which stood for "site." In all, their ledger contained catalogue entries for 12 sites, S1 through S12, in Saline, Ottawa, McPherson, and Rice counties. The Indian Burial Pit was not one of these 12, but 4 houses were; Kohr House No. 2 was the exception. All but 1 of the 12 catalogued sites, including all 4 house sites, can be identified by the current state site number (Table 1). Within each site the Whitefords numbered the house (e.g., H1), each cache pit (e.g., C1, C2, etc.), and each post mold (1, 2, etc. with no letter prefix). Objects from each provenience unit, which would be either a cache pit or simply the house (taken to mean the floor) were then given a catalogue number. Objects sometimes were given individual numbers and sometimes were lotted, with the lot given a single number and the number of objects usually recorded. A complete catalogue entry, therefore, consisted of the site number, the house number, the cache pit number (if applicable), and the object number or object class lot number. For example, a shell hoe from Cache 2 in the Aerhart site house was numbered S6.HI.CII.81, and the 13 lotted sherds from Cache 2 at the Markley house were numbered S12.H1.C2.6. These numbers usually were written on the object. The collection now is catalogued in the KSHS system. The Whiteford numbers remain on the objects, however, and, as we shall see, that is a good thing.

Excavation, record keeping, and curation standards of the 1930s and 1940s differed significantly from those of today. Judged by the standards of their time, though, the Whitefords' efforts were exemplary. They had learned something about excavation technique from A. T. Hill and Waldo Wedel, and their excavations met the standards that those two men had set. Floor plans are available for four houses, and we have listings of feature dimensions, including posthole dimensions, for most of them. We do not have feature profiles, although we can approximate some of them from the metric data that the Whitefords recorded. The photographic record was somewhat variable but was generally good. The house sites collections, with one notable exception, have suffered little attrition. Overall, we should remember that these were 1930s/1940s excavations and that the recovery techniques of that era did not include even coarse-mesh screening, let alone fine-mesh screening or flotation; did not emphasize comprehensive recovery of debitage or even necessarily broken artifacts; and often did not include any but the largest and most intact subsistence remains. Taking these factors into consideration, we can place the information from the Whitefords' Smoky Hill house excavations alongside the Minneapolis site excavations of Hill and his 1934 field party. We still cite those excavations. We should also refer to the Whitefords' excavations.

This paper describes the five Smoky Hill phase houses the Whitefords excavated and the collections from these houses. The reader will find some unevenness among the descriptions of the various houses and the material recovered. This is solely due to considerable variability in the amount and types of available information. For Kohr House No.1 we have the Whitefords' floor plans and catalogue, a detailed set of notes that Wedel made when he visited the Whitefords in June 1940, and the published summary descriptions by the Whitefords and by Wedel. A similar wealth of information is available for no other house. For Kohr House No. 2 we have some notes by Wedel but no floor plan and no catalogue, and we cannot reliably separate the collected artifacts from a larger aggregate. Most of the Lamar House collection never made it to the KSHS. The other two houses, while they have good records and intact collections, do not have the level of detail and published commentary available for Kohr House No. 1. Still, a valuable data set can be derived and is presented here. I have also included a description of the single burial and collection from the Lindeman site, probably 14SA412, that the Whitefords excavated perhaps in the late 1930s. Inclusion of this site will mean that, when the now-in-preparation study (Roper 2002d) of the Salina Burial Pit is complete, we will have a full account of the Whitefords' excavations into Smoky Hill phase sites.

Biophysical Setting

The four sites containing the five Smoky Hill phase houses that the Whitefords excavated lie in the valleys of the Smoky Hill River, the Solomon River, and Pipe Creek in Saline and Ottawa counties (Figure 2). They collectively lie along an ecological gradient of some interest. The two Kohr site houses lie near the confluence of two major rivers, the Smoky Hill and Saline; the Aerhart and Markley houses lie in a major river valley, that of the Solomon River, but not near a confluence of major rivers; and the Lamar House lies



Figure 2. Smoky Hill Phase sites excavated by the Whitefords and other sites mentioned in the text.

in an upstream portion of the valley of a tributary stream, Pipe Creek. Interesting comparisons are possible in this situation, at least in principle. Is subsistence or functional variation evident? Are notable differences in length of the occupation indicated? Are temporal differences possible? We know very little about the ecology of the Smoky Hill phase—indeed, of all Central Plains tradition occupation; faunal and floral lists are not interpretations of ecological relations. Therefore, I will give some attention in a later section to the relation between the individual houses and their environmental setting. An overview of the biophysical setting of Saline and Ottawa counties and their surrounding area will set the stage for that evaluation.

General Physiography and Hydrology

The Smoky Hill, Saline, and Solomon rivers rise on the western High Plains. They flow in parallel channels for several hundred miles across the High Plains and High Plains Border sections of the Great Plains physiographic province but begin to deviate from a quite strict west-to-east course as they approach the Saline and Ottawa counties area. Beginning in about northwest Ellsworth County, the Smoky Hill River turns a long gentle curve to the southeast and flows diagonally across the county, then takes a nearly right-angle turn in northwest McPherson County to flow north for about 25 miles to a point on the northeast side of Salina. Here it turns another near right angle to again flow to the east. The Saline River departs from its west-to-east course somewhat less radically, bending very gradually to the southeast through extreme southwest Ottawa County and northeast Saline County to empty into the Smoky Hill River about 3½ miles east of Salina. The Solomon River, like the Saline, turns to the south, in this case at a somewhat sharper and larger angle, to flow south-southeast across Ottawa County and empty into the Smoky Hill River near the town of Solomon in extreme western Dickinson County. Numerous small tributaries that parallel one another and drain the ridges between the rivers feed these rivers. The lowest and one of the larger of these tributary streams in the Solomon River drainage is Pipe Creek. This stream drains the eastern end of the upland ridge between the

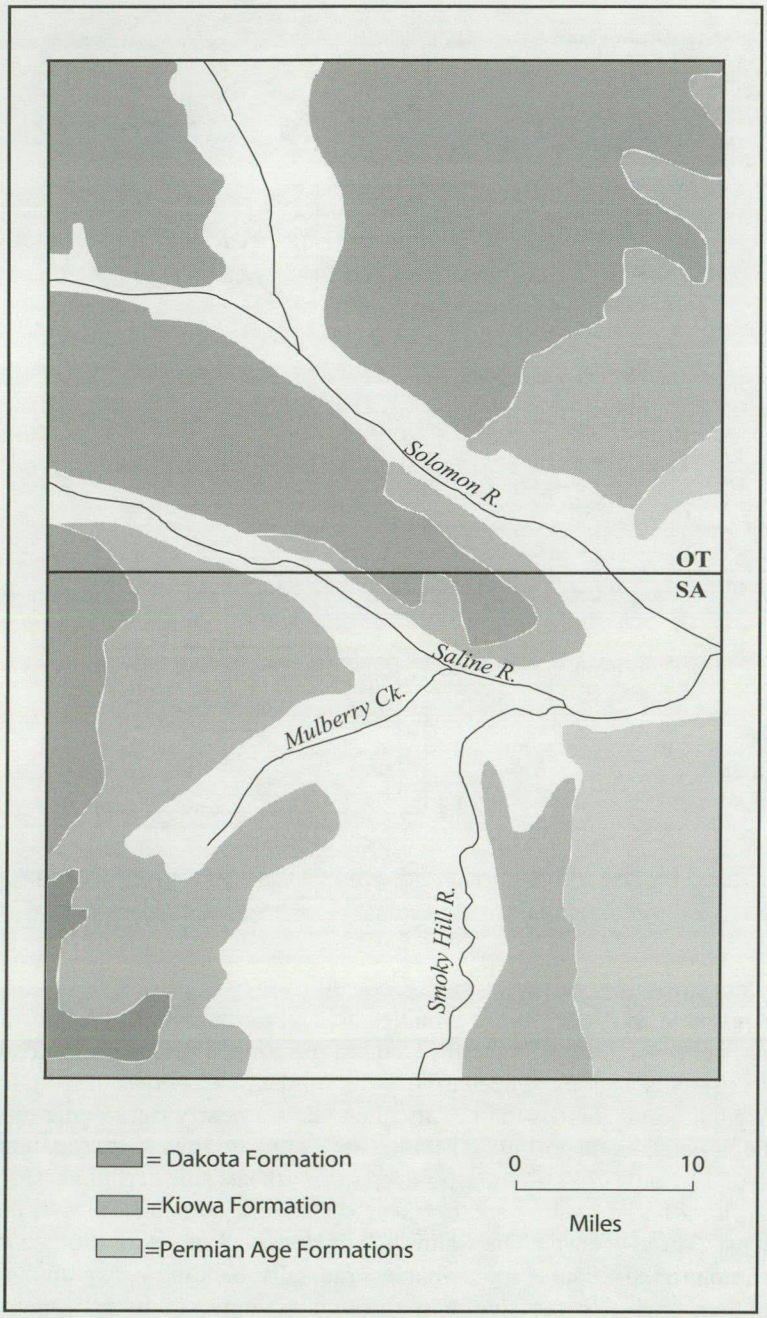


Figure 3. Generalized geologic formations in Saline and Ottawa counties (after Ross 1991).

Solomon and Republican rivers, emptying into the Solomon about 25 miles above the point at which that river empties into the Smoky Hill River. Beyond the Solomon River confluence, the Smoky Hill River continues to the east for another 35 or so miles to near Junction City in Geary County where it joins the Republican River and forms the Kansas River.

The lower Smoky Hill River, the lower Saline River, and the lower Solomon River are underfit streams, flowing in highly sinuous courses in meander belts that are about a mile wide at their widest. Old meander scars and cutoffs are shown on USGS quadrangle maps and are visible on aerial photographs (e.g., sheets in Atkinson and Grimwood 1980 and in Palmer et al 1992). Other abandoned meanders no longer have topographic expression. Exact stream channel locations thus are subject to rapid change.

Geology and Geomorphology

The boundary between the Dakota Hills to the west and the Flint Hills on the east, which is to say between the Cretaceous and Permian surface bedrock formations, strikes northeast-southwest across the southeast corner of Ottawa County and more or less diagonally across Saline County (Fent 1998; Mack 1962; Ross 1991; Schoewe 1949) (Figure 3). The Permian system formations immediately to the east are part of the Wellington formation, a soft shale unit that has eroded to form somewhat inconspicuous bluffs rising in long gentle slopes to about 100 feet above the valley floor (Latta 1949:20 and measurements from USGS 7.5' topographic maps). About 30 miles to the east near Abilene, the lower Smoky Hill River valley walls narrow markedly as they encounter the harder limestones of the older formations within the Chase group of the Permian system (Ross 1991; see also Latta 1949:20). The Three-Mile and Schroyer members of the Wreford formation and the Florence limestone member of the Barnston formation of the Chase group contain abundant chert; indeed, at this point the rivers have entered the western edge of the Flint Hills Upland. Exposures of Chase group formations are the chert sources closest to the five Smoky Hill phase sites that the Whitefords excavated. Not surprisingly, Chase group cherts are represented at these sites.

A few remnants of the Wellington formation may be exposed in the lower valley walls in southeast Ottawa County and in Saline County west of Salina (Fent

1998; Mack 1962:21 and Plate 1), but most exposed bedrock in eastern Ottawa County is part of the Kiowa formation of the Cretaceous system. The Kiowa is a shale and sandstone unit that does not contain chert. It is exposed along a fairly narrow band, striking north-south across both counties.

In the western part of both Ottawa (Mack 1962) and Saline counties (Fent 1998) and extending west for some distance through adjacent Ellsworth and Lincoln counties (Ross 1991) is the Dakota formation, a younger and stratigraphically higher formation of the Cretaceous system. The Dakota formation is a brown to red sandstone. It is cemented by dark brown iron oxide and is very resistant to erosion (Tolsted and Swineford 1984:53). The sandstone does not contain chert but was itself an important lithic resource, exploited for manufacturing abraders and metates or grinding stones, and was used for this purpose in the sites described in this study.

Farther to the west are exposures of the Niobrara formation, an upper Cretaceous-age formation. The closest exposures to the Whiteford site are in Ellis and Osborne counties (Ross 1991). The upper member of the Niobrara formation is the Smoky Hill chalk, which is silicified where it is in contact with the overlying Tertiary-age Ogallala formation. The silicified chalk, which qualifies as chert, is perhaps most accurately known as Smoky Hill silicified chalk, but it also is known in the archeological literature as Smoky Hill jasper, Niobrara jasper or Niobrarite (particularly in Kansas, following Wright's [1985] suggestion), Republican River jasper (particularly in Nebraska, following Carlson and Peacock [1975]), and Graham or Alma jasper (Banks 1990:96). It was widely used throughout prehistory and is represented in the Smoky Hill phase sites that the Whitefords excavated.

The rivers episodically deepened their channels throughout the Pleistocene, cutting channels as much as 90 feet deep, then filling them with alluvial sediments. Although we do not have a good alluvial chronology for Ottawa and Saline counties, we can be confident that both Pleistocene and Holocene deposits are represented (Cline 1974; Latta 1949; Mack 1962; Mandel 1992).

Climate

The cordillera (mountain range system) of the Western Hemisphere plays a significant role in determining the climate of the Plains. The nearly continuous chain of north-south-trending mountain ranges impedes the flow of the westerlies across the continents, deflecting winds to the north through the Arctic and to the south through a low-elevation segment of mountains in Central America. The two air masses reconverge in front of the mountains, which in North America means that they reconverge on the Plains. Plains weather, then, can be dominated by the cold dry polar air masses, as is typical in winter, or by the warm moist Gulf air masses, as is typical in summer (Borchert 1950; Rosenberg 1987). On average, therefore, winters are cold and dry, while summers are hot and wetter. A climate summary for Minneapolis (Bark 1980:1-2 and accompanying tables) and an analysis of the weather monthly temperature and precipitation data records for the 100 years from 1900 through 1999, obtained from the Weather Data Library at Kansas State University, at the Minneapolis weather station will illustrate these points. (Note that the data were incomplete for several years of the twentieth century, so these years had to be eliminated from the calculations. The analysis presented here is based on data for 94 of the 100 years of the twentieth century.)

The January average low temperature was 18° F, and the average high for the month was 40° F. The average July low was 68° F, and the average high was 94° F. Variability, both within the year and from year to year, was evident. Historic temperature extremes for the two-county area are –31° F at Salina and 119° F at Minneapolis.

In principle the length of the frost-free period is a climatic factor critical to maize horticulture. In actuality it is not a matter for particular concern in Kansas. Corn requires at least 120 days to mature, but the 120-day average frost-free period contour line passes through North Dakota, while central Kansas lies on the 180-day frost-free line (U.S. Department of Commerce 1983:31). At Minneapolis the frost-free period is at least 181 days for 5 years in 10 and at least 160 days for 9 years in 10 (Bark 1980:61). This frost-free (temperature >32° F) period extends from around mid-April to mid-October, rarely beginning later than early May or ending earlier than late September.

Precipitation also is important to a horticultural economy. Central Kansas—indeed, all of Kansas—is within the rain shadow cast by the Rocky Mountains. Normal, or mean, annual precipitation, therefore, shows an orderly and substantial decline from 40–45 inches in the southeastern part of the state to 15–20 inches per year in the westernmost counties (Goodin et al. 1995:4). Saline and Ottawa counties are in the middle of this cline. Mean annual precipitation at Minneapolis through the twentieth century was 27.72 inches, although the median annual precipitation was a somewhat lower 26.01 inches. Average, expressed either as mean or median, annual precipitation is a rather gross measure.

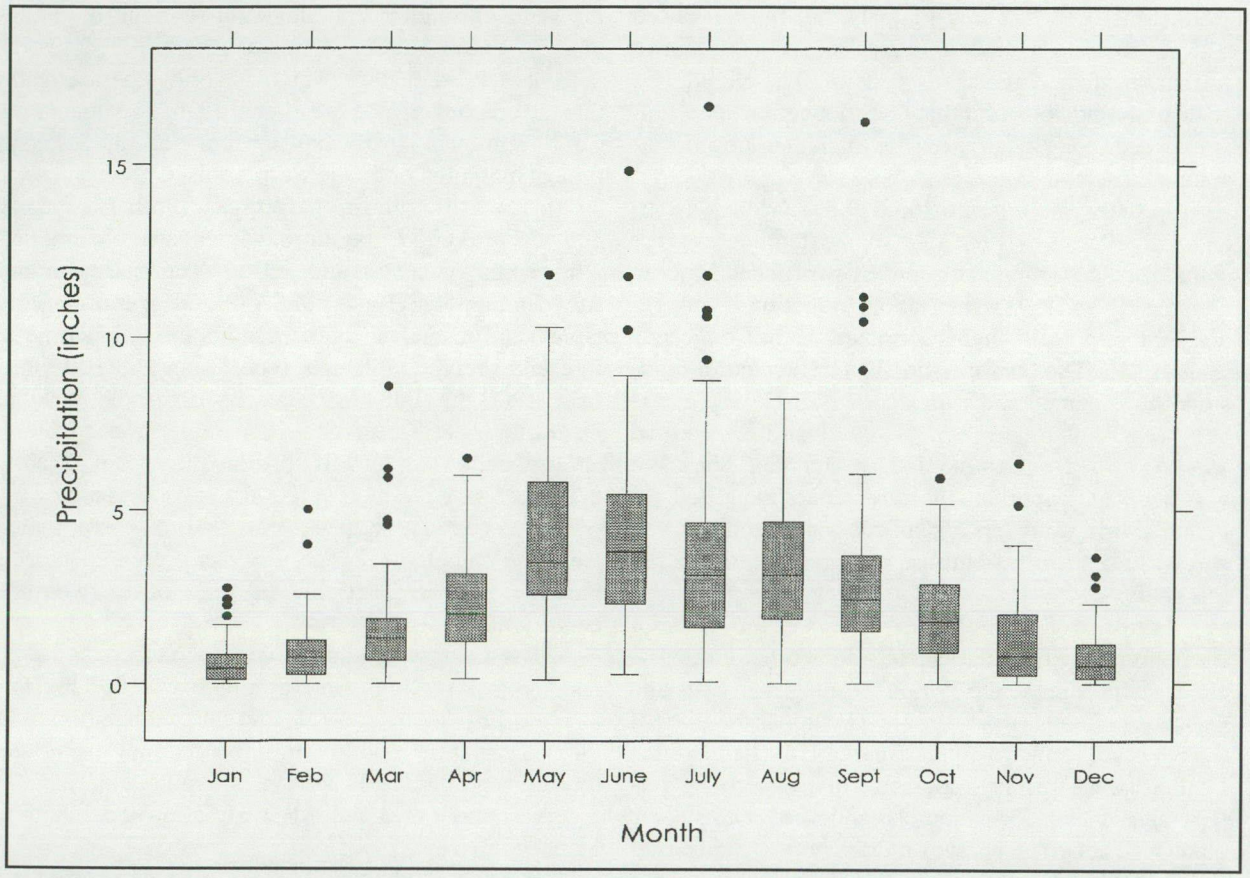


Figure 4. Monthly precipitation at Minneapolis and its variability in the twentieth century. Box plots were constructed according to principles described by Cleveland (1985:129-134).

More important are the growing season precipitation and interannual precipitation patterns, particularly cycles of drought and overabundance of moisture.

Winter precipitation is overall low (Figure 4). During the twentieth century mean precipitation in January, the driest month, was a mere 0.59 inches; median January precipitation was 0.44 inches. Average annual snowfall during the twentieth century was 17.0 inches, with most falling during the months of December through March. Total precipitation is highest during the warmer months when Gulf air dominates, with total growing season (May through September) precipitation accounting for an average of about 67 percent of annual precipitation. Mean precipitation in June, which is overall the wettest month, was 4.08 inches (median = 3.80), but, as Figure 4 amply demonstrates, summer precipitation can be quite variable from one year to another. Both drought years and years of excessive precipitation occurred throughout the twentieth century. In fact, only about one-third of the years of the twentieth century had "normal" (taken as the mean) or "above normal" precipitation.

Vegetation and Floral Resources

Viewed on small-scale maps, Saline and Ottawa counties appear to fall near the boundary between the tall-grass and mixed-grass zones, most readily observed on Küchler's (1964) map. Indeed, a larger-scale view also indicates that these counties are in a transition zone between the tall-grass and mixed-grass prairies (Küchler 1974). Weaver and Bruner, who did not define the mixed-grass prairie but did determine where tall-grass prairie gives way to mixed prairie, placed the line just west of the Saline and Ottawa counties study area (1954:119). On the other hand Küchler (1974:588) suggested that there is an approximately 50-mile-wide ecotone (1954:125), composed of a mosaic of tall-grass prairie and mixed prairie on a substrate of Dakota sandstone. Along the ecotone passes a line—Küchler (1970:298) named it the Tatschl line after the biologist who first described the phenomenon it delimits—that forms a distinct biogeographical boundary. The



Figure 5. The extent of stream-lining timber at the time of the GLO surveys in the Kohr site area (after GLO plat map).

distribution of numerous floral and faunal species in both eastern and western Kansas ends rather abruptly at this line (Küchler 1970).

Generalizing from various studies of prairie composition (Küchler 1974; Sims and Risser 2000; Weaver and Bruner 1948), the prairie of the broad river bottoms in the general study area would have supported a tall-grass prairie dominated by big bluestem (*Andropogon gerardi*), along with little bluestem (*Andropogon scoparius*), switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*), and with a diversity of other grasses and forbs appearing in minor quantities. Hillslopes, particularly the upper parts of hillslopes, and level uplands probably would have supported a grassland association similar to that in the bottoms, but with big bluestem less dominant and side oats grama (*Bouteloua curtipendula*) and blue grama (*Bouteloua gracilis*) becoming more prominent. Lesser grasses and forbs would again appear in some diversity but in minor quantities.

Woodlands bordering the larger stream courses were and are a floodplain association. Küchler (1974:600-601) listed dominant species as hackberry (*Celtis occidentalis*), cottonwood (*Populus deltoides*), peachleaved willow (*Salix amygdaloides*), black willow (*Salix nigra*), and American elm (*Ulmus Americana*) with a lesser mixture of other trees and shrubs. Records from the Government Land Office (GLO) surveys of 1858 also record oak (*Quercus* sp., species not recorded) and walnut (*Juglans* sp., not specified but presumably black walnut, *Juglans nigra*) in the Smoky Hill River-Saline River confluence area.

An interesting question concerns the extent of woodlands in the study area in Middle Ceramic period times. The GLO records are a frequently used source of information on forest-prairie distribution in the period prior to opening the land to Euroamerican agriculture. These surveys were run in the Salina area in 1858. A portion of the plat map for the area encompassing and surrounding the Kohr site and the burial pit (Figure 5) clearly shows narrow and sometimes discontinuous woods lining the rivers.

To quantify this I have examined the GLO records for a 6-township (216-section) study area almost exactly centered on the Kohr site. In essence, the section corners and half-section corners form a ½-mile grid. The verbal descriptions in the GLO records skip the center of the section, though, so to make this a true ½-mile grid I consulted the plat maps on the assumption that they accurately map the major details of the section interiors. Using this method, the study area has 901 sample points. Of these, seven or a mere 0.78

percent fell in woods. If this is a valid sample—and point sampling on a grid is a valid sampling technique—then the mid-nineteenth-century woods were quite limited, even in the riverine area. I will present a fuller account of this study in an upcoming publication (Roper 2002d).

The data also allowed some quantification of the differences between major streams and tributary streams. First, I simply counted the number of stream crossings that were timbered versus those that were not. Of 71 crossings of major rivers (i.e., the Smoky Hill and Saline), the surveyors were moving though timber in 45 (63.4 percent) cases. Of 27 crossings of large, named tributaries, 10 (37.0 percent) were timbered, and only 28 (3.6 percent) of minor, unnamed stream crossings were timbered. Second, I calculated distances the surveyors traveled through the stream-skirting woods. Distances could not be determined in all instances, but for 44 recorded cases along major rivers, the mean distance was 565.2 feet, often including the river itself. For eight instances of traversing woods along smaller tributaries, the median was 171.6 feet, again usually including the stream channel. Unfortunately, with very few section or half-section corners falling in the woods, and, therefore, very few instances of land surveyors marking distances to witness trees for these corners, it is impossible to calculate the density of trees in these woods (see Bourdo 1956, Curtis 1959, or references cited therein on the use of the GLO records for evaluating forest characteristics).

Yet the Smoky Hill phase occupation was fairly intense in this area, and there is little question that wood was an important resource to people of the Smoky Hill phase. House construction required a lot of wood, and, as we shall see, the houses the Whitefords excavated were constructed of heavy timbers that seemingly must have been culled from primary growth forest. Wood also was used as fuel, and, although direct evidence is lacking, undoubtedly it also was used for many other purposes. Except for the timbers needed to construct housing, the demand for wood would have been continuous, although secondary growth often could have sufficed except for house timbers. The need for wood for housing was more episodic, but with house life perhaps in the 7- to 10-year range and probably a number of simultaneously occupied houses in the general area, that need, too, would have been sustained for many decades.

Fauna

The fauna of the area would have included a wide variety of mammals. Of outstanding importance would have been the bison, white-tailed deer, and perhaps wapiti. Bear, coyote, fox, raccoon, opossum, rabbits, and squirrels also were, and sometimes are, present. The wooded stream bottoms, albeit limited in extent as they were in previous times, would have been important for a diversity of medium to small mammals such as skunk, raccoon, muskrat, beaver, fox, squirrels, and others. Streams, of course, were sources of fish and freshwater mussels, the latter prominently represented in the sites described in this study. Among birds, turkey was important, as were prairie chicken, grouse, quail, and certain raptors.

Kohr Site Houses

Site Description

The Whiteford site or Indian Burial Pit (14SA1) lies amidst an aggregate of houses near the confluence of the Smoky Hill and Saline rivers. Originally considered a part of 14SA1, the house aggregate site was redesignated 14SA414 in 1970. The Whitefords excavated the first of two houses there in 1936, when the Kohrs still owned the land. They always referred to this as Kohr House No. 1, and, when they excavated a second house a year or so later, they referred to it as Kohr House No. 2. For this reason I refer to 14SA414 as the Kohr site.

The 14SA414 site form, completed in 1970 by Tom Witty, suggested that the Kohr site extends for about 20 acres across a terrace adjacent to the Smoky Hill River and stated that "cultural detritus extends across most of the terrace top." However, no obvious house locations were noted on the 1970 progress report record sheets attached to the site form. Coring with an Oakfield tool and even a test pit excavated over a possible house location in that year failed to reveal a house. Whiteford (1941:18), on the other hand, said that "no less than twelve lodge sites are known to be located in the immediate vicinity of the first lodge [Kohr House No. 1] and burial pit." Wedel (1959:512-513), working from observations made in the late 1930s, also described the site as consisting

> of low inconspicuous elevations, or house mounds, scattered loosely over the terrace. These have been nearly obliterated by many years of agricultural activities; and it is quite likely that the 12 or 15 mounds visible in 1936 represent only a fraction of the habitations that once stood on the area. Most of the mounds, actually house sites, remain unexcavated, their location being apparent only when crops have

> been removed and plowing brings to the surface bits of wattling clay, broken musselshells [sic], flint chips, bones, and occasional potsherds.

Three decades of plowing between Wedel's and Witty's observations would have exacerbated this site condition; yet another three decades of plowing since Witty's examination likely has obliterated even further the traces of houses at this location.

The two houses that the Whitefords excavated are not specifically plotted on any map that I have found. From Wedel's verbal descriptions, however, it appears that they were some distance apart—perhaps as much as 2,200 feet or so—but apparently they were both a part of the same "loose scatter" of houses composing this site. Because they are so far apart, I will describe their specific settings individually, preceding the feature descriptions and collections analysis for each house.

Before describing the two houses, a word about the collections is necessary. Quite simply, it appears that the Whitefords mixed the materials from the two Kohr houses in the collection. The material that the KSHS catalogued as being from the Kohr house actually is the intermingled material from both houses and possibly surface material as well. In fact, notes that the Whitefords made when they donated the collection to the KSHS in 1971 are a bag inventory/collections inventory on a sheet of paper headed "Kohr House 1 & 2."

Not all is lost, however; while the Whitefords catalogued and labeled the material from Kohr House No. 1, they never did so for the material from Kohr House No. 2. There are no ledger entries for the Kohr House No. 2 objects, and the collection is too large to match the ledger entries for House No. 1, but a substantial number of objects within the house collection have no catalogue information written on them. Suspecting that this was the key to separating the House No. 1 and House No. 2 materials, I did so. I found that the object totals for what I supposed to be the House No. 1 material (i.e., the labeled material) were similar to the totals recorded in the ledger. Fortunately, too, in his notes Wedel separately described the materials from House Nos. 1 and 2, indicating that the intermingling happened after June 1940. Much, although not all, of the House No. 1 material is illustrated in the Whitefords' publications (Whiteford 1937:6; 1941:15), so Wedel's totals and descriptions and the Whitefords' photographs also can be used to help separate the two house assemblages. Comparisons of Wedel's data with mine and a comparison of the sorted material with the Whiteford photographs suggests that I have correctly separated at least the House No. 1 material from the aggregate. As we will see, though, while it is possible to pretty reliably sort out much of the House No. 1 material, the implication that all the unlabeled residuum is from House No. 2 may not be warranted.

Kohr House No. 1

Setting

A published photograph of Kohr House No. 1 showed the burial pit location in the background with an arrow indicating the distance to the burial pit as 1,750 feet (Whiteford 1937:1; 1941:11). (It is fortuitous that a photograph was made from this angle since the burial pit was not found until about a month and a half after the house excavation was backfilled.) Neither the published figure captions nor information in the Whiteford site descriptions tell us the direction to the burial pit, but we glean at least approximate information from Wedel (1959:573), who said the house was "about 200 yards from the bank of the Smoky Hill River and some 1,750 feet southeast of the burial ground." The notes from his 1940 site visit, however, originally recorded the distances and directions as "1750' SE of bur. pit, 200' NW of river" with the abbreviation "yds?" written in above the second foot sign (untitled notebook, Wedel Papers, Box 110, National Anthropological Archives, Smithsonian Institution, Washington, D.C.). It is impossible to plot a point that is both 1,750 feet southeast of the burial pit and 200 yards northwest of the river, but it is possible to plot a point that can be fairly described as 1,750 feet southeast of the burial pit and 200 feet northwest of the river, which is the point that I have plotted in Figure 6. This specific stretch of the river does not appear to have changed its course between the time of the fieldwork for the 1955 quadrangle map and the 1978 photorevision. Presumably the river was not in a radically different position in the late 1930s or 1940 than it was in 1954.

If the house location is correctly plotted, then in addition to being the stated distance and direction from the Smoky Hill River, it is about 3,500 feet southwest of the closest approach of the Saline River and about 4,600 feet west of the current point of confluence of the two rivers. Its elevation is 1,200 feet above mean sea level (amsl) on a very broad terrace between the rivers. The closest approach of the stream valley walls is about 3,500 feet to the south and on the south side of the Smoky Hill River. These valley walls rise gently to generally less than 100 feet above the site except at Iron Mound about 3½ miles to the south-southeast, where the elevation is almost 300 feet above the site. In any direction but south, there is less than 10 feet of relief



Figure 6. Generalized topographic setting of the Kohr site houses.

above or below the site elevation for a distance of several miles surrounding the site. The soil series mapped for the exact site location is the Roxbury silt loam, a terrace soil formed under grasses and with no limitations for agriculture (Palmer et al. 1992:sheet 13). Further information concerning soils of the land surrounding the site and comparisons with other Smoky Hill phase sites are discussed later in this paper.

Architecture

Kohr House No. 1 was a rectangular or rectanguloid structure, oriented north-south by east-west, with an entryway probably facing generally east (Figure 7[1]). Published descriptions (Wedel 1959:513; Whiteford 1937:5, 1941:16) listed the house dimensions as 30 x 32 feet. The Whitefords' house floor plan, however, was drawn to scale and showed the dimensions (Figure 7), indicating that 30 x 32 feet were the maximum outside dimensions, squared off and tangential to the outermost point of the outermost posts. Maximum interior dimensions, measured from the same drawing, were about 25 x 29 feet.

The house walls were represented by 23 post molds in a configuration with subrectangular corners on the front and right rear of the structure but a nearly right-angle left rear corner. This corner was the farthest point of the house from the camera in the often-published photograph (Figure 8), but it appears that the edge of the excavation was just outside the row of posts marking the house wall, so the possibility should not be dismissed that a right rear corner post was missed. Wall posts, measured from the house plan to the nearest half foot, were spaced 2½ to 7 feet apart with a mean and median of 4 feet. This aggregate number is a little misleading,

[1]This and all other floor plans in this report are redrawings of the Whiteford originals in the KSHS files. Stylistic inconsistencies in the drawing of the various floor plans for this report will become apparent and result from the inconsistencies of the originals. Similarly, the Whitefords changed their cache pit numbering style over the years. Their original designations are retained here.

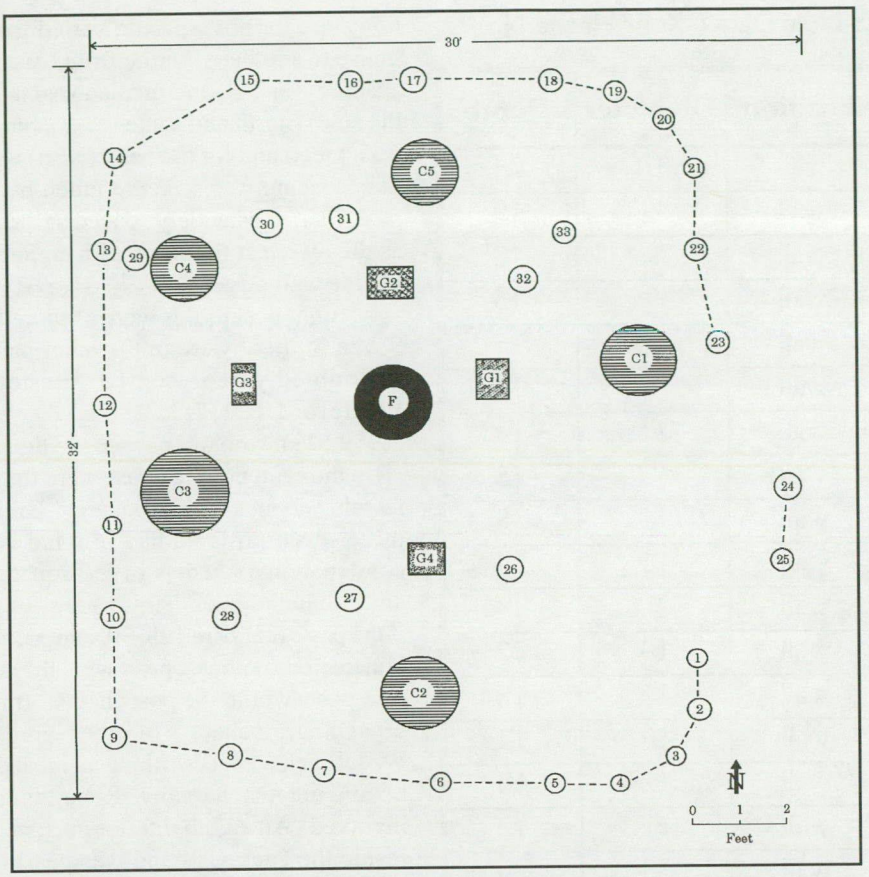


Figure 7. Floor plan of Kohr House No. 1 (redrawn from Whiteford original at Kansas State Historical Society, Topeka).



Figure 8. Photograph of Kohr House No. 1 (from slide collection at Kansas State Historical Society, Topeka).

Table 2. Post Mold Data—Kohr House No. 1.

Post Number	Position	Diameter	Depth
1	wall	10	24
2	wall	11	19
3	wall	9	18
4	wall	9	15
5	wall	10	15
6	wall	9	14
7	wall	11	14
8	wall	12	15
9	wall	11	18
10	wall	11	14
11	wall	9	13
12	wall	10	22
13	wall	11	15
14	wall	10	14
15	wall	12	18
16	wall	11	12
17	wall	13	20
18	wall	11	15
19	wall	10	13
20	wall	10	14
21	wall	10	19
22	wall	11	22
23	wall	11	24
24	entryway	13	23
25	entryway	11	16
26	interior	12	23
27	interior	14	18
28	interior	13	16
29	wall	12	13
30	interior	15	22
31	interior	13	14
32	interior	14	22
33	interior	11	28

however, for post spacing varied from one part of the house to another. For the front (east) wall posts, mean spacing was 3.3, and median spacing was 2.5 feet; for the sides (north and south walls), the mean and median was 4 feet; and for the back (west) wall, mean and median spacing was 5 feet. Quite obviously, posts were nearly twice as widely spaced at the back of the house as they were at the front with an intermediate spacing of side wall posts.

Eight post molds were observed inside the house. Seven of these were in the inner part of the floor and undoubtedly represented interior support posts. Whiteford (1937:5, 1941:16) said—and Wedel (1959:513), who did not see the house, paraphrased—"[I]n the center of the house were found four post holes forming about a 14 foot square." Exactly which four of these seven posts he had in mind is uncertain, as no combination of them is 14 feet square, although almost any combination of them is about 14 feet square. Only if the posts numbered 28, 30, and 33, along with a fourth undetected southeast post, were the actual interior support posts would the posts have formed something approaching a square. In other words, Whiteford and Wedel each were describing an ideal that approximated but did not match reality. Rebuilding might have been involved. An eighth interior post, number 29, was just inside the back wall and was nearly paired with post number 13. One of these may have been a replacement for the other, indicating that part of the back wall was repaired at some time during the house's use life.

The entryway to this house was ill defined. A 13-foot-long gap between wall post numbers 1 and 23 on the east side of the structure was the obvious candidate to be, or at least to contain, the entryway. It was slightly offset from the middle of the wall. Posts numbers 24 and 25 were out of line with and 3 feet east of the line of wall posts and may have represented remnants of the entryway. However, these posts were only 2 feet apart, and this would be a very narrow entryway. If the entryway has been interpreted correctly, it faced generally east, or, if orientation is measured from the center of the central fireplace to a line midway between the two entryway posts, the orientation was east-southeast with a bearing of about 110°. Also if the entryway was correctly identified, the house was wider (29 feet) than it was long (25 feet) with a length:width ratio of 0.86.

Table 2 shows the dimensions of all posts in the house. Diameters and depths were taken from a legend on the house floor plan, and positions were as described above. Post diameters ranged from 9 to 15 inches with a mean of 11.2 and median of 11 inches. Again, this is an aggregate and should be broken down. Traditional size specifications for historic period earthlodge posts

Table 3. Cache Pit Data from Kohr House No. 1.

Cache Number	Diameter		Depth	Volume	
	Top	Bottom		Cubic inches	Bushels
C1	39	52	52	86,276	40.1
C2	36	37	36	37,676	12.5
C3	45	46	60	97,570	45.4
C4	34	37	43	42,637	19.8
C5	33	39	59	60,472	28.1

specify that the interior supports should be larger than the wall posts (Will 1930:40, 42; Wilson 1934:358, 363), and, even though the late prehistoric period houses were smaller overall, it was appropriate to separately evaluate the interior and wall posts of a house. In the Kohr House No. 1 case, the interior support posts ranged from 11 to 15 inches in diameter with a mean of 13.1 and median of 13 inches, while the wall posts ranged from 9 to 13 inches in diameter with a mean of 10.6 and median of 11 inches. Post number 29 was considered a wall post, and the two entryway posts were omitted from the post position calculations. Post mold diameters probably somewhat overestimated the actual diameter of the posts, and in this case the recorded diameters obviously were measured to the nearest inch rather than to some fraction of an inch. Still, even allowing for the actual posts to have been a little smaller than their post molds, these posts were as large or larger than the posts in two much bigger historic period Hidatsa earthlodges, as measured by Gilbert Wilson (1934:Figures 11, 14, 20, and 21).

Wall post mold depths ranged from 12 to 24 inches with a mean of 16.8 and median of 15 inches. Interior post depths ranged from 14 to 28 inches with a mean of 20.4 and median of 22 inches. Even the interior posts, which bore considerable weight, were much shallower than modern standards for building pole embedment would require (Merrilees and Loveday 1980:48-52), but this is characteristic of Plains lodges. Traditional specifications, which clearly encode sound structural engineering practice, do not seem to have included specifications for post depths.

The strength and durability of the house was only partially a product of post size, though. Post strength under compression stress parallel to the wood grain and resistance to decay both varied among the assorted woods available for use in the lower Smoky Hill River valley. If the moderately strong but decay-resistant oak or walnut were used, the building would have been stronger than if the weaker and non-decay-resistant elm or cottonwood were used. The Whiteford map legend indicated that decayed wood or charcoal was found in several postholes, but it apparently was not saved; at least it is not listed in the Whitefords' catalogue, and it is not in the collection as it currently exists. Still, given the large post size relative to the dimensions of the building, this was a solidly constructed house regardless of wood species used.

Features

Features other than the post molds and the house floor itself included a central hearth, five cache pits, and four grinding stones or metates. These last are not really features in the textbook sense, but they were part of the site furniture. They were not listed in the collection catalogue, are not present in the collection, and apparently were not removed when the house excavation was backfilled. The only information we have or can obtain, therefore, is that recorded with the feature data.

The Whiteford (1937:4-5, 1941:14) booklet described the central hearth as "a hollowed out place in the ground 39 inches in diameter, 9 inches deep in the center, sloping to floor level at the outside, and filled with wood ashes. The earth on the bottom of the fireplace was burned to a deep red, ..." Neither the map legend, nor Wedel's notes, nor Wedel's (1959:513) published description added to this.

Basic dimensions of the cache pits were given on the Whitefords' map legend and in their published verbal description and are compiled in Table 3. Approximate volumes, expressed in cubic inches and in bushels, were calculated using the formula $V = h/2(a_1 + a_2)$,

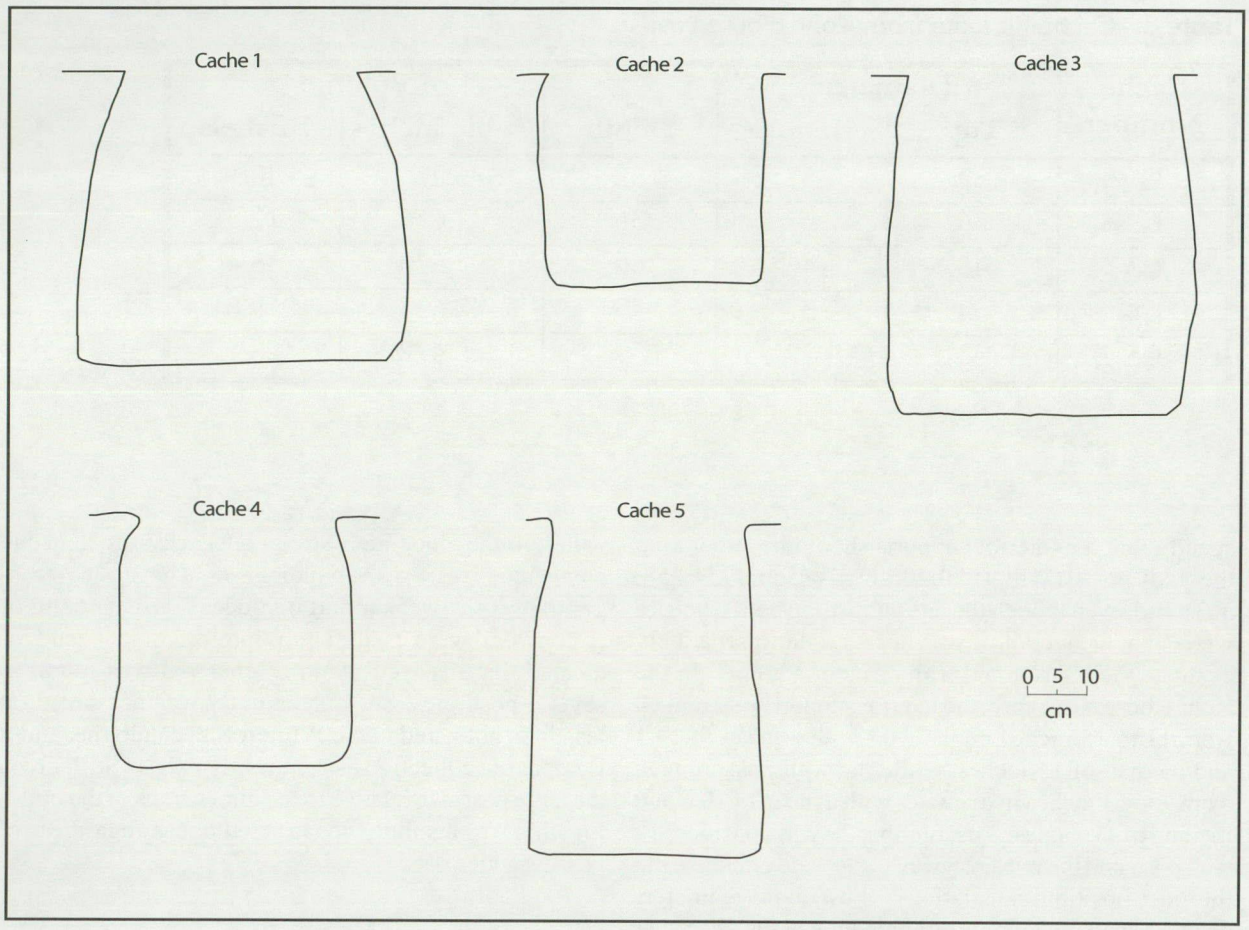


Figure 9. Approximate profiles of Kohr House No. 1 cache pits.

where a_1 = area of base (πr^2), a_2 = area of top (πr^2), and h = height (Fortier 1984:23). This formula is for pits with diverging or converging sides. Idealized or approximated profiles of Kohr House No. 1 pits, drawn from the only available dimensions, are shown in Figure 9.

Cache 1 (C1) was the most obviously bell-shaped of the five cache pits and was the second-largest of them in terms of volume. The Whiteford booklets reported that Jay Dee Whiteford, then eight years old, excavated this pit, recovering mussel shell, mussel shell hoes, a mussel shell probably used for shelling corn, a mano and metate, and portions of two pipes, one of which was an effigy pipe (1937:7, 1941:16). Some but not all of these artifacts remain in the collection and are described below.

Caches 2 through 5 diverged but little from a cylindrical form, with Cache 5 perhaps belling slightly. These four cache pits were described as clay-lined or, as Whiteford (1937:7, 1941:17) related, they

> were very interesting in construction as the side walls showed very plainly how these people had used their hands as trowels, leaving their finger marks in the clay, plastering it on the walls. Then by building a fire in the bottom of the cache the clay was baked very hard giving a protection against moisture.

Cache 2, the smallest of the five, contained no artifacts but did yield "a quantity of charred corn from the bottom of the pit" (Whiteford1937:7, 1941:17). The remaining caches

> were entirely empty at the time the home was destroyed by fire, as we found roofing material in the bottom of the caches along with several small limbs of charcoal, measuring up to two and one half inches in diameter (Whiteford1937:7, 1941:17).

The Whitefords also found a portion of a pot at the bottom of Cache 5, but no other artifacts in Caches 2 through 5 (Whiteford 1937:7; 1941:18).

The four grinding stones were placed around the central hearth. They were shown at the cardinal directions, although that likely was an accident of house orientation, for they were between the pairs of interior support posts (Wedel 1959:513). The four metates were listed as measuring 18 x 20 inches (G1), 18 x 21 inches (G2), 11 x 22 inches (G3), and 18 x 20 inches (G4). Specific thicknesses were not recorded, but summary descriptions indicated that they were "about four to five inches thick" and "hollowed out from long use" (Whiteford 1937:5, 1941:15). The map legend said that they were made of Dakota sandstone and were badly broken.

Collection

The Whiteford catalogue for Kohr House No. 1 contained 36 catalogue entries, 17 of which referred to object lots. In all, the catalogue described 105 discrete objects, plus the indefinite quantity items such as "corn" and "adobe." Body sherds, which were collected but not catalogued, were not included. Table 4 summarizes the contents of this inventory. The provenience of cache pit objects was listed simply as "cache" without numbers in the Whitefords' catalogue. Since their description makes it clear that all objects except some corn were in Cache 1, the corn was in Cache 2, and Caches 3 through 5 were (except for the pot section at the bottom of Cache 5) devoid of artifacts, it would seem that the distribution shown in the table must be correct.

Also listed in Table 4 are the contents of the collection as Wedel described it in June 1940 and as it exists today. In addition to the Whiteford catalogue and Wedel's notes, the Whiteford (1937:6-10; 1941:15-18) booklets presented both a brief descriptive account and a photographic mosaic of much, but not all, of the assemblage. Wedel (1959:514-417, Plates 88-92) presented some verbal descriptive information and a photographs of selected objects. For the following collection descriptions, I have drawn on all available sources of information: the Whiteford catalogue, the Whiteford verbal description, the Whiteford photograph, Wedel's notes (untitled notebook, Wedel Papers, Box 110, National Anthropological Archives, Smithsonian Institution, Washington, D.C.), Wedel's published verbal descriptions, the available Wedel photographs, and, of course, the collection as it currently exists. I state explicitly when I have used the Whitefords' or Wedel's descriptions, so, if none of these sources is cited, the data presented are from my analysis. Unfortunately, there are some discrepancies among the various sources. Most are easily accounted for by collection attrition, but that does not explain all of the problems.

Pottery

A full account of the Kohr House No. 1 pottery cannot be written. Body sherds were not catalogued and labeled, meaning that they cannot be separated from body sherds collected from other parts of 14SA414. No attempt is made to describe them here. It also is obvious that the collection has suffered some attrition, but the problem may be a little more complicated than that. The Whiteford photographic mosaic of the house assemblage depicted three restored pots. The picture also showed probably nine rim sherds, but it was taken at such a distance as to preclude either fully reliable counting or detailed description of the specimens. The catalogue listed 11 "pottery rims," 1 "large pot" from the floor, and 1 object from a cache identified simply as "pottery." Presumably this is the "one half a piece of pottery" said to have been found in Cache 5. The third pot illustrated cannot be accounted for in the catalogue. Wedel's notes reported three pots, listing the Whiteford catalogue numbers for only two of them: the "large pot" from the floor and the piece from Cache 5. Wedel also described 12 rim sherds, 1 more than was listed in the Whiteford catalogue. He might, however, have identified a rim sherd that the Whitefords had missed, for he described at least one rim sherd as "small rim fragment unidentifiable as to type." Wedel (1949:Plates 87b and 88) also illustrated the three restored pots but none of the rim sherds.

I conclude, therefore, that at one time there were 3 restored pots and 12 rim sherds in the Kohr House No. 1 collection. As the collection exists at the KSHS, there are no restored pots and only 7 rim sherds. This pottery, and that from all other sites described in this paper, was evaluated using a series of attributes similar to those Beck (1998) used in her study of the Minneapolis site pottery. Types are those defined by Hedden (1992, 1994) in his analysis of the Schultz collection pottery from sites in Clay, Ottawa, Pottawatomie, and Republic counties. Using Wedel's notes and photographs and the Whiteford photograph, I can identify the missing restored pots to type, or at least to one of two types. I cannot match even the rim sherds still in the collection to the descriptions in Wedel's notes and, therefore, cannot extract the right information from those notes to offer an identification for the missing rim sherds.

Each of the seven rims remaining in the collection represents a separate vessel. Because they vary considerably in form and decoration, they are individually described, as are the illustrated but missing restored vessels.

Table 4. Catalogued Objects from Kohr House No. 2.

Object class	Whiteford Catalogue: Floor	Cache 1	Cache 2	Cache 5	Wedel Description	In Collection
Pottery						
rim sherds	11				12	7
unspecified		1				
"piece"	1					
pot	1			1	7	
body sherds	-- not catalogued --				148	
effigy	1				1	1
"Adobe"	1 lot				?	?
"Clay"	1 lot				?	?
Projectile points						
notched	2	3			5	5
triangular	5				5	5
Knife	6	1			9?	2
End scraper	13				10	11
Ground stone						
Celt	4				4	4
"cutting stone"	2*				4	4
hammerstone	9				"plentiful"	8
mano	1				1	1
pipe	1				1	1
Bone						
Hoe		1			1	1
flaker	1				1	1
Awl	3				3**	3**
"celt"	1				1	1
"scraper"	2				1	1***
"piece"	1				?	?
Shell						
hoes	2	10			7	8
bead	1				1	1
pendant		1			1	1
unmodified	1	14			unspec.	7
Corn			present			1 vial
Mud dauber nest	4					4?****

* Two listings, quantity is unspecified in one of them.

** All pieces catalogued by Whitefords accounted for but by different names.

*** In two pieces.

**** Four in collection, but two not labeled; provenience assumed but not certain.

One vessel section in the collection, identified as Riley Flaring Plain, is from a small pot with a generally globular body and only slightly flattened shoulder (Figure 10a). The exterior surface originally was cord roughened and then incompletely smoothed. The rim is only 6.2 mm high, but it clearly flared or rolled outward. The lip is squared. A strap handle is attached to the lip and shoulder. The vessel is entirely undecorated.

A second vessel section in the collection is similar in form to the first but is slightly larger and has a somewhat more pronounced shoulder (Figure 10c). Any cord roughening on the exterior surface is now completely obliterated by surface smoothing. The shoulder and part of the body below it are heavily sooted and have small bits of charred residue adhering, suggesting that this small pot was a cooking vessel. The rim is 10.0 mm high and flared at a sharp angle. The lip is squared

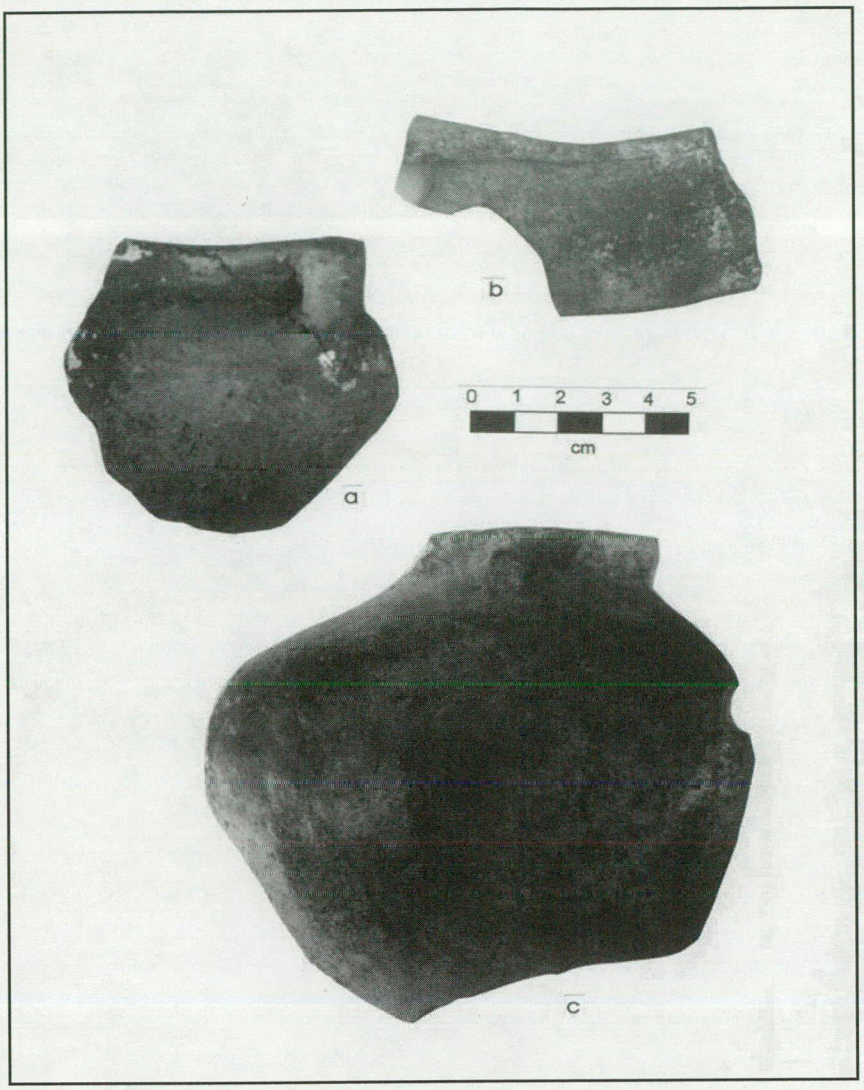


Figure 10. Pottery rims—Kohr House No. 1.

and decorated with right-left tool impressions, which are the only decorations on the pot. A small loop handle is attached to the neck and upper part of the shoulder. The vessel is identified as Riley Flaring Tool-Decorated.

Two of the missing reconstructed pots appear from published illustrations to have been Riley Flaring types, too. The first of these vessels (Whiteford 1937:6, #5 left; 1941:15, #5 left; Wedel 1959:87b) is the one not accounted for in the Whiteford catalogue. Wedel commented that it came from the house floor. It was a large, sub-conoidal vessel that Wedel's notes specified was 31 cm high, 37 cm in maximum diameter, and 29.7 cm in diameter at the orifice. The exterior is cord roughened to the lip. The rim is 30 mm high and flaring. Lip form is not recorded and cannot be evaluated from the photographs. Lip decoration also cannot be determined from the photographs, but, since Wedel did not mentioned it in his notes, it presumably was absent. If so, this was a Riley Flaring Plain vessel.

The other Riley Flaring reconstructed pot was the one from Cache 5, also illustrated in photographs by both the Whitefords (1937:6, #5 right; 1941:15, #5 right) and Wedel (1959:Plate 88a). This sub-conical vessel with a flattened shoulder was 26 cm tall, with a maximum diameter of 29 cm and orifice diameter of 19 cm, according to Wedel's notes. It, too, is cord roughened to the lip. Rim height was not recorded but proportionally was not very high. The flaring of the rim was marked. Lip form appeared from the photograph to be rounded with some clay pushed over onto the exterior

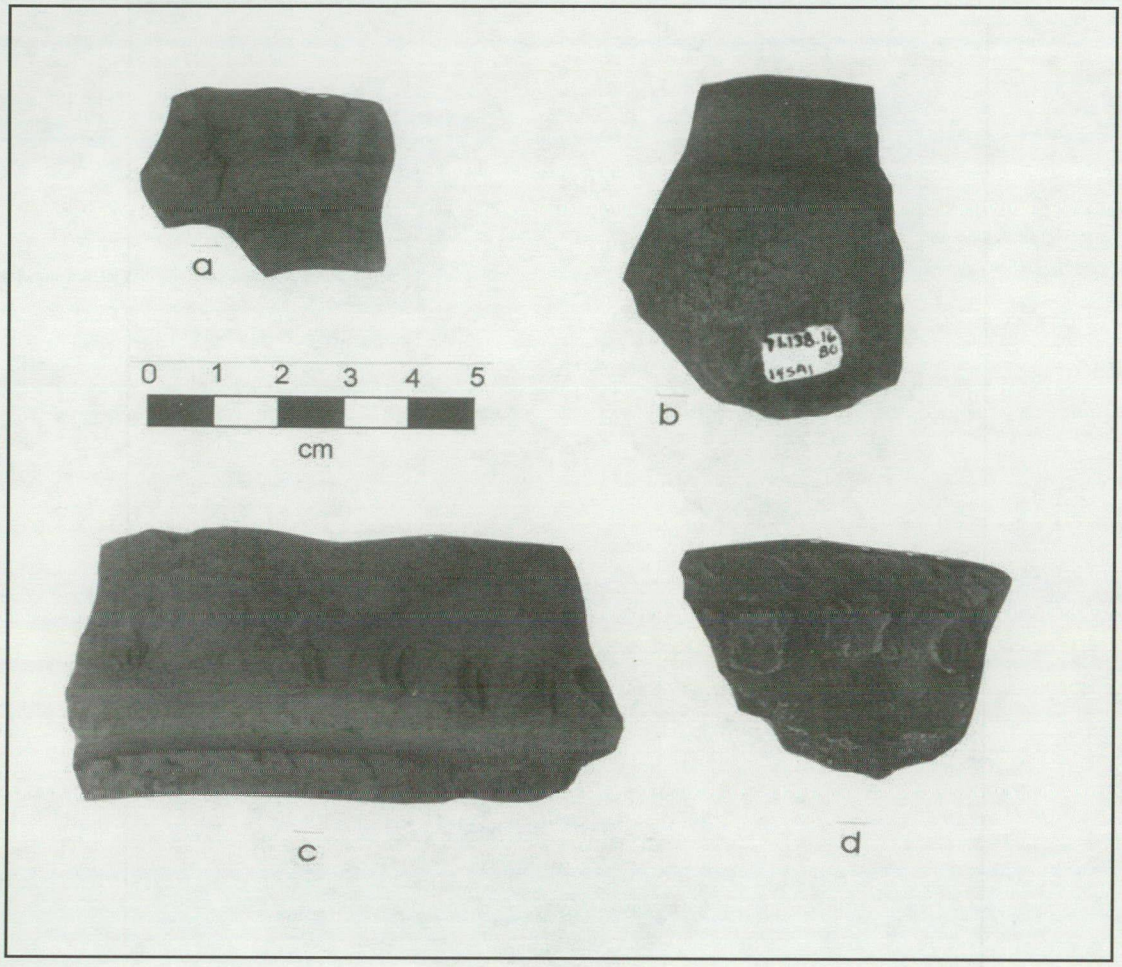


Figure 11. Pottery rims—Kohr House No. 1.

surface. Lip decoration again was not mentioned and probably was absent. If so, this was another Riley Flaring Plain vessel.

A final Riley Flaring vessel is represented by a small sherd still in the collection (Figure 11a). This sherd consists of only the rim, neck, and uppermost part of the shoulder. The surface is smooth. The low rim is only 11.0 mm high but noticeably flaring. The lip is more or less squared but is somewhat difficult to evaluate because of the decoration on the uppermost part of the rim. This decoration is pronounced pinched appliqués whose top variably is flush with or extends above the lip. The type is Riley Flaring Pinched.

One rim sherd in the collection is an example of Riley Collared Plain (Figure 10b). Only the neck and rim of this sherd remain. The surface of the 37.5-mm-high rim is smoothed and undecorated. The lip is neatly squared and also undecorated. A hint of a 15.8-mm-high undecorated collar is observable.

The final missing restored pot also was a Riley Collared Plain vessel, this one from the hearth of the house, according to Wedel's notes. It was illustrated by both the Whitefords (1937:6, #5 middle; 1941:15, #5 middle) and Wedel (1959:Plate 88b). It had a somewhat elongated body and well-rounded shoulder. Wedel listed its dimensions as 33 cm tall with a 33- cm-maximum diameter and 20-cm-diameter orifice. The exterior was cord roughened to the lip. According to Wedel, the rim height was 27 mm, but no collar height was recorded. The lip was rounded. No decoration was noted.

Two other rim sherds in the collection are both Riley Collared Pinched sherds, each represented by the neck and rim only (Figure 11c and d). In one case, cord roughening extends through the neck and to the lip. The rim is 23.4 mm high with an 18.5-mm-high collar and is pinched at the bottom of the collar. The lip is squared and undecorated. The other rim is 31.4 mm high with a

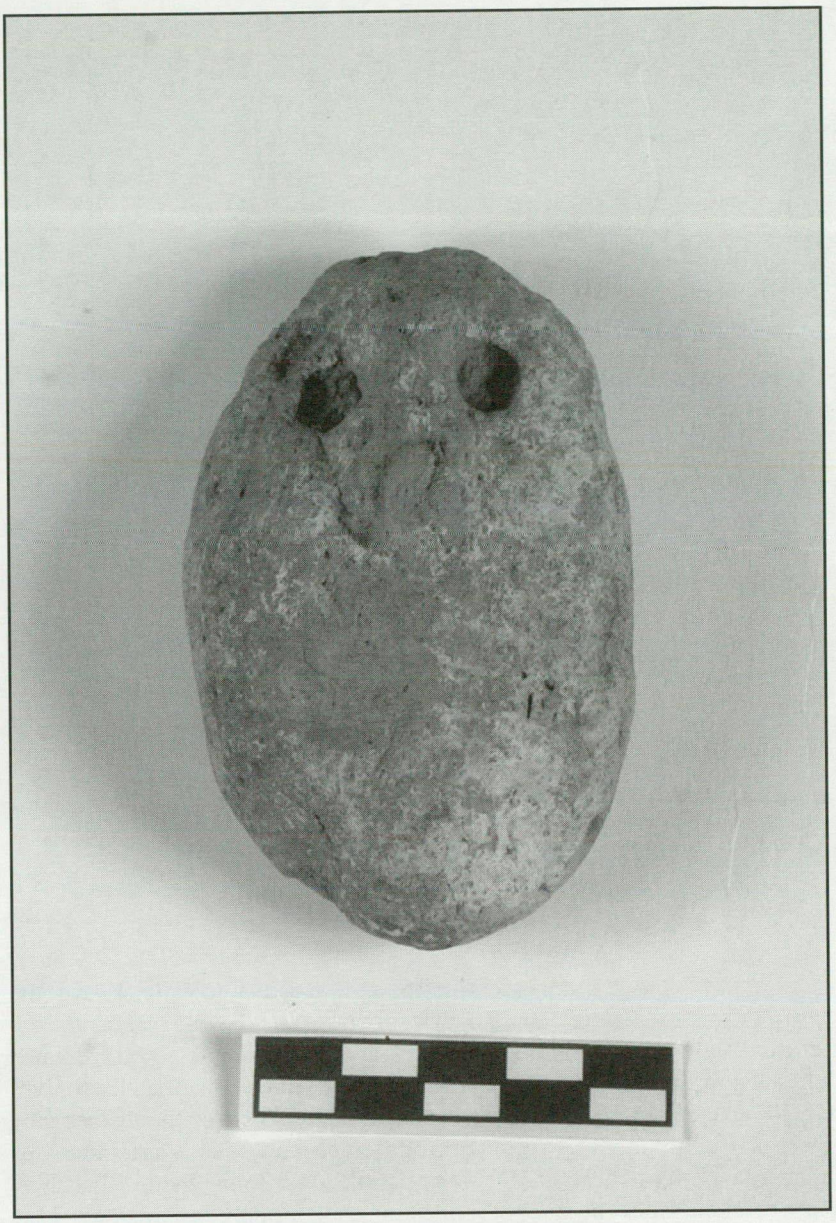


Figure 12. Ceramic effigy—Kohr House No. 1.

26.8-mm-high collar also with pinching at the collar base. The surface cord roughening extends through the neck where it is partially obliterated. The collar above the row of pinches is smooth. The lip is squared and undecorated.

A final vessel, the smallest of them all, is represented by a sherd still in the collection (Figure 11b). It has a smoothed exterior surface, a sharply defined shoulder, an only narrowly constricted neck, and a rim that rises 12.1 mm straight from the neck. The rim is undecorated. The lip is rounded with clay pushed inward to thicken or bevel it. The lip is not decorated. This type is not accommodated within Hedden's typology. However, it does appear as much larger vessels in the Salina Burial pit (Whiteford 1937:9, #1 top row second from left; 1941:9, #7 right; Wedel 1959:Plate 90b). Interestingly, the form, again as larger vessels, also is present at the Great Bend aspect Paint Creek site (Wedel 1934b:Plate 14, #2).

Other Ceramic Objects

Effigy. A unique object from Kohr House No.1 was catalogued as an effigy, representing an owl face (Figure 12). The Whiteford photographs showed it (1937:6, #3, left; 1941:15, #3, left), and the text of the booklet suggested that it was "a very good image of a screech owl" (Whiteford 1937:10; 1941:18). Wedel accepted this identification, and apparently was somewhat intrigued by the object, since he mentioned it twice in his notes and also illustrated it (Wedel 1959:Plate 92i). The object is still in the collection. It is a cobble-like lump of fired clay, measuring 86.6 x 53.4 x 30.3 mm. Two punctates were formed with a circular but blunt-ended instrument. A ridge of clay between and extending beyond these two impressions was probably produced by pinching. It definitely seems to be an effigy. Perhaps it does resemble a screech owl, but it may also represent some other animal or even a human face.

A second clay object was shown in the Whiteford photograph (1937:6, #3, right; 1941:15, #3, right). It, however, was not catalogued or described in Wedel's notes and is not in the collection. Judging from the Whiteford photograph, it was about the same size and shape as the effigy. The Whiteford (1937:10; 1941:18) description said that it had "three small holes, one on one side and two just opposite." They identified it as a war club. Clay, however, would seem an unlikely material for manufacturing a usable club.

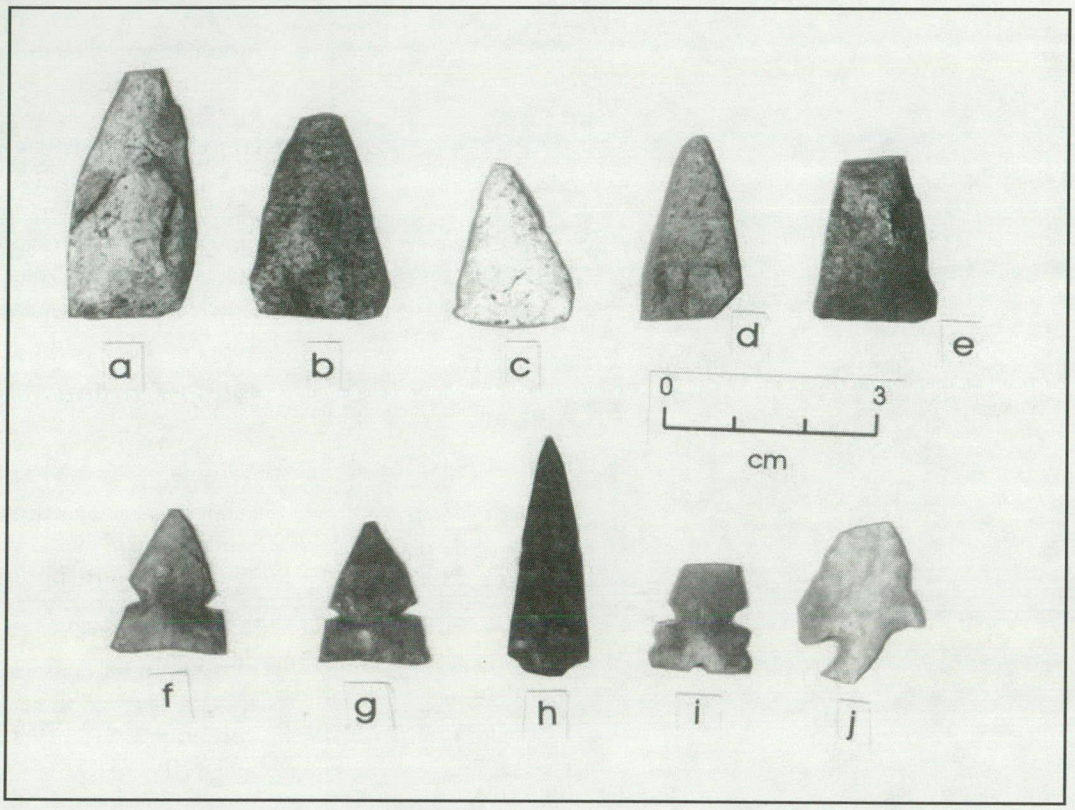


Figure 13. Projectile points—Kohr House No. 1.

Chipped Stone Artifacts

Projectile Points. The Whiteford catalogue, Wedel's descriptions, and the collection as it now exists all agree that ten projectile points were collected from Kohr House No.1. Five are unnotched triangular specimens, all from floor context (Figure 13a-e). Two other specimens from floor context are each side notched with nearly straight, unnotched bases (Figure 13f and g). The remaining three were from Cache 1. One is double side notched and basal notched and is broken at mid-blade (Figure 13i). Another is the blade of a point broken across the neck (Figure 13h). This blade is more reminiscent of a Scallorn point than of a point we would expect in Smoky Hill phase context, but without the haft it is difficult to confirm this. The final specimen is a small corner-notched point, missing part of the blade and one haft corner (Figure 13j). Seven of the ten points were made from Florence chert, the other three are unidentified stone.

Bifaces/Knives. The Whiteford catalogue listed seven knives, six of them diamond shaped and one simply identified as a piece of a large knife. Five of the six diamond-shaped knives and the one fragment were from floor context; the other diamond-shaped specimen was from Cache 1. Wedel's notes described five knives and fragments of four more. Part of the discrepancy may result from differences in what a specimen was called. It is not possible to reconcile the two lists now because the collection contains only two fragments: the first probably one of the five knives from floor context and the other the piece of a large knife mentioned in the catalogue. This latter specimen is a partial end segment ca. 49.2 mm long, 57.4 mm wide, and 8.9 mm thick, representing much less than half the original (Figure 14a). It was made of Niobrara jasper. The other fragment in the collection is a smaller, 52.1 x 24.7 x 5.8 mm, made from a fine-grained sugary quartzite that may be Spanish Diggings Quartzite (Figure 14b). Neither of these fragments were shown in the Whiteford booklet as the photograph there showed only four complete knives. These probably were two of the four fragments Wedel mentioned, but he gave no dimensions, and they cannot be matched to his list.

From the Whiteford photograph and the Wedel

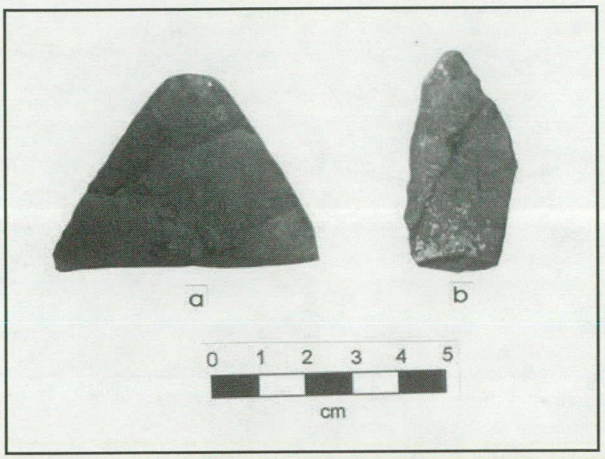


Figure 14. Knives—Kohr House No. 1.

notes, we can describe the five complete knives (apparently four from the floor and the one from the cache) as fairly large diamond-shaped Harahey knives. Wedel gave the dimensions as 103 x 30 x 8 mm, 92 x 32 x 7 mm, 80 x 27 x 7 mm, 71 x 27 x 6 mm, and 74 x 48 x 6 mm. It is difficult to decide what the raw materials were—three specimens of "grey chert" may be Florence chert, while "reddish brown" for two others could refer to Niobrara jasper. There are no raw material notations for the other two fragments that Wedel mentioned.

End Scrapers. The Whiteford catalogue listed 13 end scrapers, all from the house floor. Five of these were shown in the Whiteford booklet photograph. Wedel described five "snub-nosed" scrapers, four more with dorsal ridges, and one "sub-quadrilateral 'scraper-knife.'" Once again, the discrepancy may be partly terminology and partly attrition. The collection as it exists contains 11 end scrapers, or 10 end scrapers and the "sub-quadrangular scraper-knife" that can be identified from the catalogue number as one of the Whiteford end scrapers (Figure 15).

The difference between the Wedel description and the collection as it currently exists is one specimen. The KSHS catalogued this specimen as a biface, but it clearly is worked only on one face and has a rounded, steeply retouched working edge. Thus, it qualifies as an end



Figure 15. Scrapers—Kohr House No. 1.

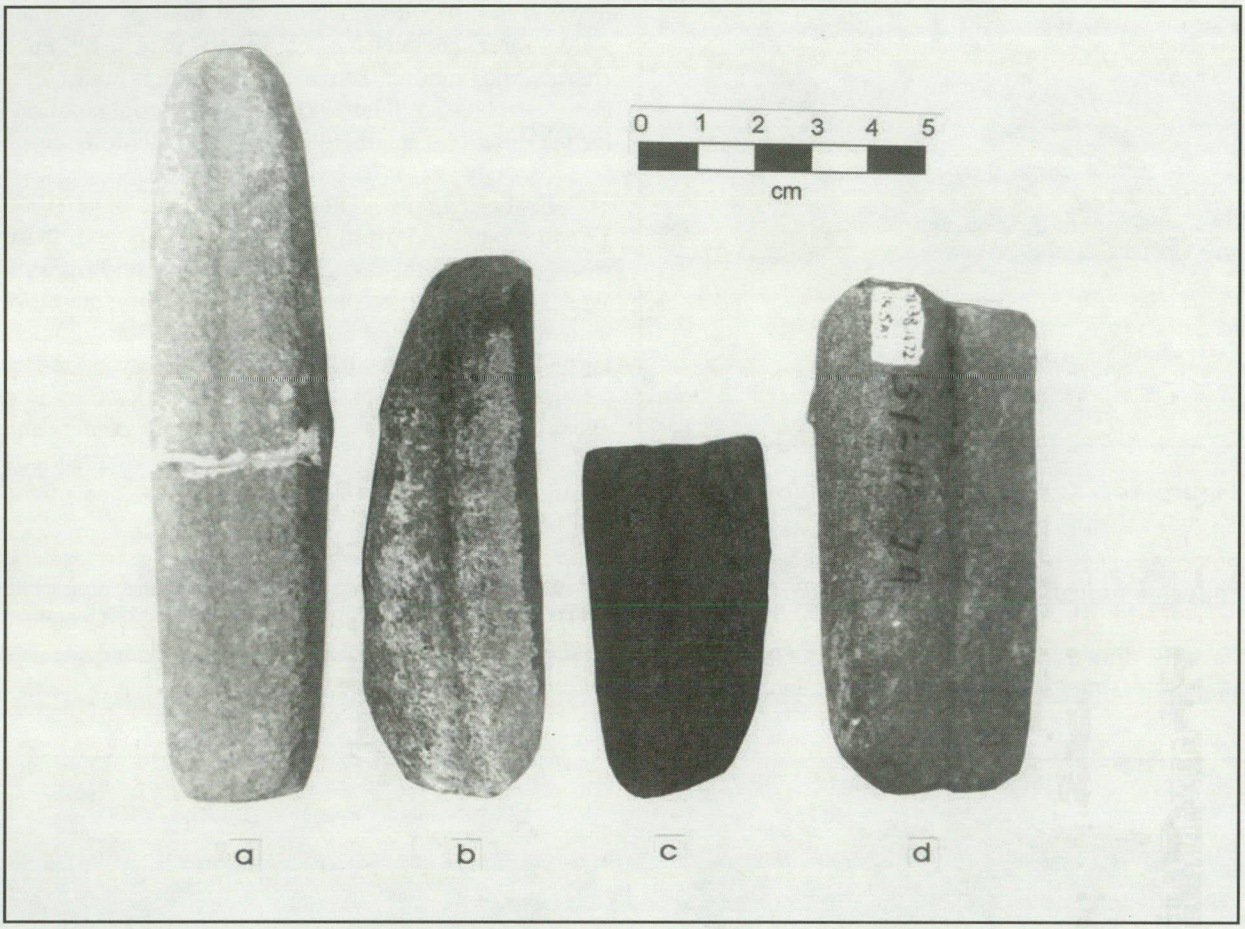


Figure 16. Abraders—Kohr House No. 1.

scraper, albeit rather thin. I cannot find this specimen specifically mentioned in Wedel's notes, but the Whiteford number written on it clearly shows that they considered it an endscraper. The other two of the Whiteford end scrapers either have disappeared or the numbers written on them were completely worn off, making it impossible to reliably identify them in the collection.

Scraper lengths range from 35.9 to 83.6 mm, widths from 20.3 to 36.8 mm (if the particularly wide sub-quadrilateral specimen that measures 36.8 mm is eliminated, the width range is from 20.3 to 25.8 mm), and thicknesses from 5.7 to 13.3 mm. The specimens vary considerably in their proportions. Wedel speculated in his notes that two specimens might be of chert from the Maple City quarries, more commonly referred to as Cowley County, Kay County, or Florence A chert. This, in fact, is a correct identification for those two specimens. All but one of the other nine specimens are Florence B, C, or D chert; the stone type of this last specimen is unidentified.

Ground Stone Artifacts

Abraders and "Cutting-Stones." Wedel's notes described four abraders or fragments thereof and two unfinished abraders, which matches the contents of the existing collection. Abraders were not listed in the Whiteford catalogue but "cutting-stones" were. Entries were "cutting-stone" with a quantity of one and "cutting-stones" with no quantity, although the plural was used. The numbers on the specimens are very difficult to read but do appear to be the catalogue numbers listed for the "cutting-stones," so I presume this term referred to abraders. All of these objects were from the house floor.

As Wedel described, there are four standard abraders: one complete, one complete as two conjoined sections, and two fragments (Figure 16). All four are Dakota sandstone. All have U-shaped or V-shaped straight grooves running longitudinally along one face and may have shallow secondary grooves elsewhere on the pieces.

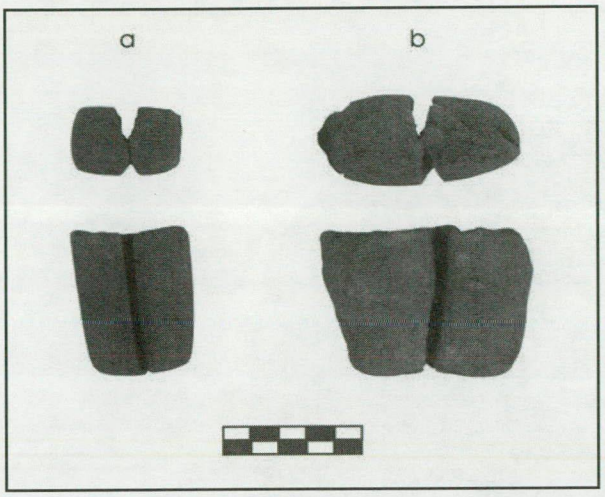


Figure 17. Cross sections and plan views of abraders in the process of manufacture—Kohr House No. 1.

The other two specimens are blocks of Dakota sandstone in the process of being fashioned into abraders (Figure 17). They provide some wonderful insight into how paired abraders were made. Each block is deeply grooved on each face. The grooves are straight and parallel the long axis of the specimen. These grooves are very deep—up to nearly 12 mm—and narrow, suggesting that the intent was to cut the blocks in half. One block had little surface preparation; the other was formed, as illustrated by Wedel (1959:Plate 92g). The pieces were symmetrical, and the two abraders would have been exactly paired once separated. The just-separated halves would have been smoothed and the grooves formed to make useful abraders. Flenniken and Ozbun (1988:39-41) have described the preparation of paired abraders using exactly the technique that the two Kohr House No.1 specimens reflect. Of course, abraders are quite common on archeological sites, but this is the only instance I know of still-connected, paired abraders in the process of manufacture.

Celts. The Whiteford catalogue listed four celts from Kohr House No.1, all of them from the house floor. One was shown with house objects in the Whiteford photograph (1937:6,#1, center; 1941:15, #1, center). Wedel described four, and all remain in the collection. Three were made of limestone or shale (Figure 18a, b, and d); the other is hematite (Figure 18c). Three of the four, including the hematite specimen, are well polished on parts of each face and have sharply defined bits. One bit is beveled. The fourth specimen is less finished; the

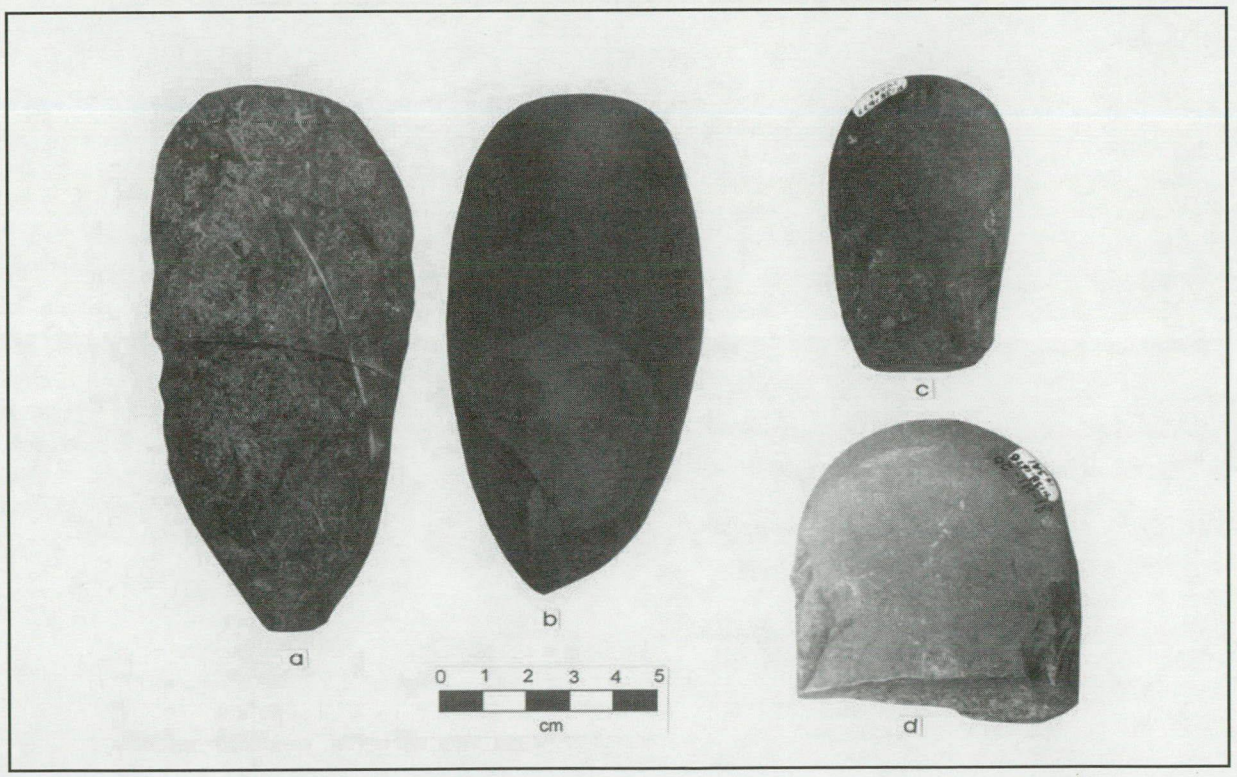


Figure 18. Celts—Kohr House No. 1.

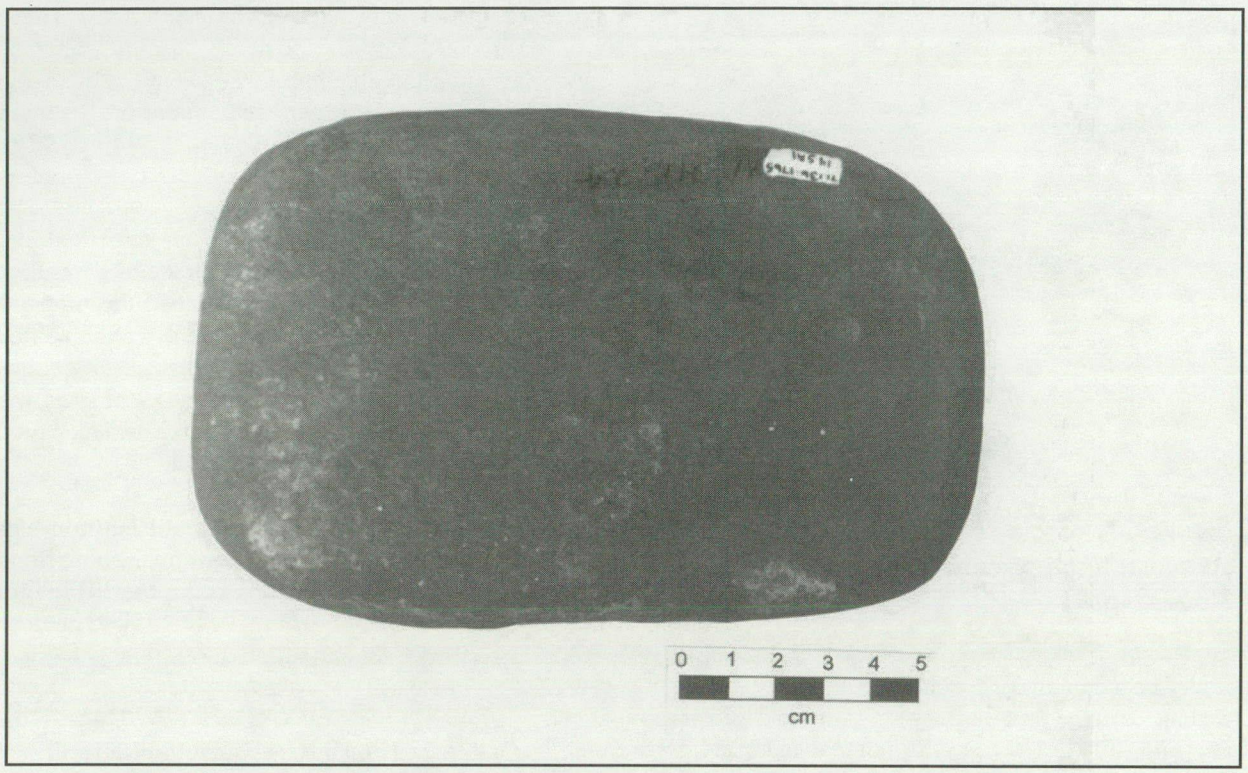


Figure 19. Mano—Kohr House No. 1.



Figure 20. Pipe—Kohr House No. 1.

bit is less defined, and polishing on the faces is neither as smooth nor as extensive as on the other specimens. The possibility comes to mind that it is unfinished. Basic dimensions of the celts are 127.0 x 59.1 x 35.6 mm for the complete specimen illustrated in the Whiteford photograph, 119.1 x 55.8 x 19.4 mm for the possibly unfinished specimen, 64.6 x 38.1 x 18.2 mm for the hematite specimen, and 66.3 x 61.0 x 21.7 mm for the fourth fragmentary specimen.



Figure 21. Scapula hoe—Kohr House No. 1.

Mano. The Whiteford catalogue, Wedel's notes, and the collection as it exists today all agree that one mano was recovered from the house floor. It was made of dense Dakota sandstone and is rectangular in both plan view and cross section (Figure 19). One surface is unmodified; the other is flat and exhibits evidence of use for grinding. Dimensions are 153 x 108.4 x 40.0 mm.

Hammerstones. The Whiteford catalogue listed nine hammerstones, all from the floor. Eight of these were shown in the photograph of objects from the house (Whiteford 1937:6, #1 part of middle row; 1941:15, #1 part of middle row). Wedel merely listed hammerstones as "plentiful." Six of these remain in the collection. All are rounded, somewhat-less-than-fist-sized cobbles that would be good for tasks such as early stage biface manufacture (cf. Whittaker 1994:87). Some of these stones definitely were used as hammerstones, but the status of others is a little more doubtful as the specimens do not appear extensively used for this purpose. If there were really nine in this house, one has to wonder how much debitage was discarded when the house was excavated.

Pipes. The Whiteford catalogue listed one pipe from Kohr House No. 1 (Figure 20). This specimen was illustrated in the booklet photograph (Whiteford 1937:6, #2, left; 15, #2, left) and Wedel's monograph (1959:Plate 92f). Although the catalogue listing seemed to suggest that the pipe was from the house floor, the published description indicated that it was recovered from Cache 1 (Whiteford 1937:7; 1941:16). It was manufactured of light grey limestone. I could not get a very satisfactory match on the Rock Color Chart (Rock-Color Chart Committee 1984), but it is closest to N6 or N7 with a bit of brown. The pipe was not finished, or perhaps it would be more accurate to say that it was virtually finished except for the important matter of boring the stem and the bowl. The stem is 62.4 mm long, 29.3 mm wide at the wider end, and 13.2 mm wide at the narrow end. Thickness cannot be measured since the backside (as illustrated) is cleaved away. For that matter the specimen as it exists today is completely split in two, and the two cleavage planes are glued together. Whether this is why the pipe was never finished cannot be known. Scratch marks across all surfaces remain from rough finishing, and one wonders if the maker would have polished the surface had he/she finished the pipe. The fat bowl tapers somewhat from 47.4 mm wide at the top to 37.6 mm where it joins the stem, angling away from what presumably would be the end where a wooden stem would have been inserted. The top of the unbored bowl is rounded. A groove about 3 mm wide parallels the bowl lip about 7 mm below its crest.

A second pipe, not listed in the catalogue, was illustrated (Whiteford 1937:6, #2, right; 15, #2, right) and described in the booklet. Its provenience was listed as Cache 1. It was said to be "a small broken part of an effigy pipe showing hand, arm and part of knees" (Whiteford 1937:7, 1941:16). Wedel did not describe this specimen in his notes, but he did illustrate it (1959:Pl. 91b). It is not now in the collection.

Bone Artifacts

Hoe Fragment. A single bison scapula hoe fragment from Cache 1 was listed in the Whiteford

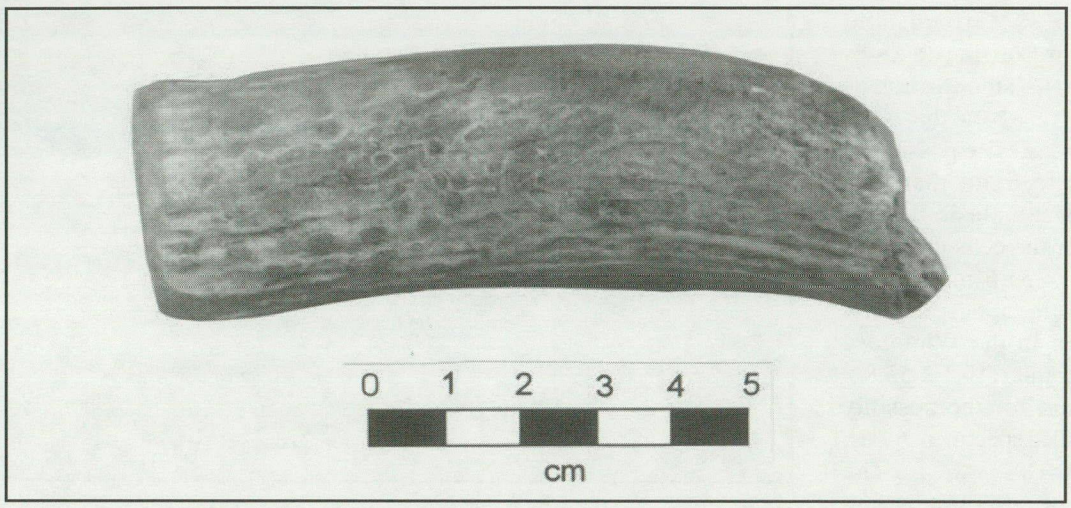


Figure 22. Bone flaker/handle—Kohr House No. 1.

catalogue and was described in Wedel's notes. It is in the collection as it exists today (Figure 21). The glenoid portion and the spine of the scapula were removed to form this tool. The piece as we have it is 165 mm long. The blade is very short but the end was cut to a regular edge, beveled, and heavily polished from use, suggesting that this short piece nevertheless was used as it is. A large, ovoid hole, 19.6 mm in maximum diameter, was drilled in the blade. The rim of this perforation, which undoubtedly served for lashing to a handle, is beveled and may well be polished. The specimen now is split across this hole.

Flaker. A piece made from an unidentified mammal bone was described by the Whitefords as a flaker and by Wedel as an antler handle. This specimen, which came from the house floor, is in the collection (Figure 22). It measures 80.3 mm long and 20.9 mm in maximum diameter, and it weighs 25.77 g. The artifact does indeed resemble a flaker or billet for flaking, but it seems small for this purpose. One end is hollow, and Wedel's suggestion that it was a handle is more likely correct, even though it is bone, not antler.

Ulna Awl. The Whiteford catalogue listed three awls, all from the floor. Wedel described one of these as an "ulna punch awl," and that is a good description of the piece, which is still in the collection. At 84.1 mm long, short for an ulna, it is nevertheless a complete awl. The proximal end has some damage, but the awl point is formed on the distal end, which tapers to a blunt and fairly sharp point about 26.7 mm long.

Rods. The other two objects catalogued as awls also remain in the collection but probably are not awls. Each is a bone rod, measuring 58.3 and 63.3 mm long. In each case the blunt end is smooth. One has a blunt pointed tip that would not seem particularly suitable for piercing tasks. The other specimen has a tapered flat end.

"Celt." The Whiteford catalogue listed a bone celt from the floor. Wedel's notes called this a "gouge made from the shaft of lrg mammal leg bone." The object is still in the collection. It now is in two conjoining pieces that form a complete tool, measuring 168 mm long. One end was cut and beveled to form the working end, and it is highly polished from use. The specimen exhibits some charring.

"Scrapers." The Whiteford catalogue listed two objects under the heading of bone scraper. Wedel's notes described these as "2 fragments of metapodial beamer ... fresh breaks but no fit, possibly single specimen." Although broken, these are still in the collection. They are small metapodial sections, measuring 103.2 and 94.6 mm long. Together they are too long to be a single tool, and they may represent the same end anyway. Each had a longitudinal portion of the shaft removed to manufacture the tool, and the working edges bear remnants of polish from use. Both were collected from the floor.

"Piece." A final bone object, also from the floor, was listed in the Whiteford catalogue simply as a bone "piece." This probably is what Wedel listed as "worked bone fragment" with no additional information. It cannot now be certainly identified in the collection, although there is a slightly worked fragment without a number that might be this piece.

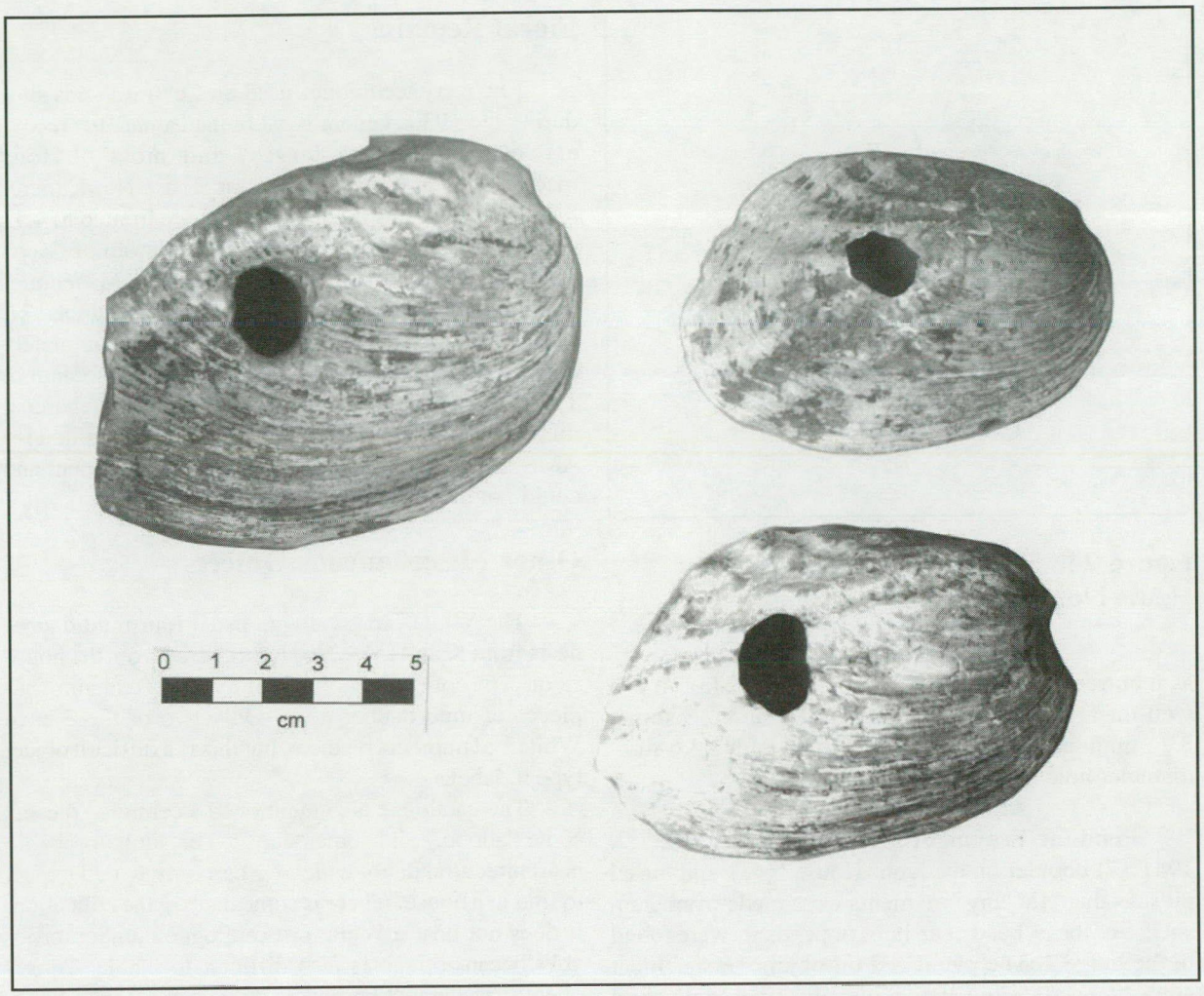


Figure 23. Shell hoes—Kohr House No. 1.

Shell Artifacts

Hoes. The Whiteford catalogue listed 12 shell hoes from Kohr House No. 1: 10 from Cache 1 and 2 from the house floor. Eight of these 12 remain in the collection: 7 of the Cache 1 specimens and 1 of the house floor specimens (Figure 23). Lengths range from about 86.7 to 118.9 mm; widths from 65.6 to 102.1 mm; and masses from 32.99 to 166.18 g, although only one specimen is less than 70.28 g. Six of these eight are identified as *Megalonaias giganta* or Washboard mussel; one as a *Tritigonia verrucosa*, a Buckhorn or Pistol-Grip mussel; and one as a species of floater (*Anodonta* sp.). Save for one specimen, the Washboard mussels are the largest and heaviest of the shells. All specimens have holes in roughly the middles of the shells, similar to the hole in the scapula hoe. The posterior margins were cut and/or worn to a more or less straight edges; the extent of wear varies among these tools.

It probably is notable that the Washboard seems to have been favored for hoe making. It is a thick and heavy shell, and one of its distinctive characteristics is a series of heavy ridges that are more or less perpendicular to the posterior margin. The Buckhorn has lighter ridges. A hoe blade is subject to torsion around the point of hafting, so the ridges may have served to reinforce the blade and retard breakage, much as the thickness and keel of many endscrapers probably helped reinforce them against breakage from a similar motion.

Bead. The Whiteford catalogue listed a single shell bead from the floor. Wedel's notes on the house collection mentioned this bead, and it is in the collection

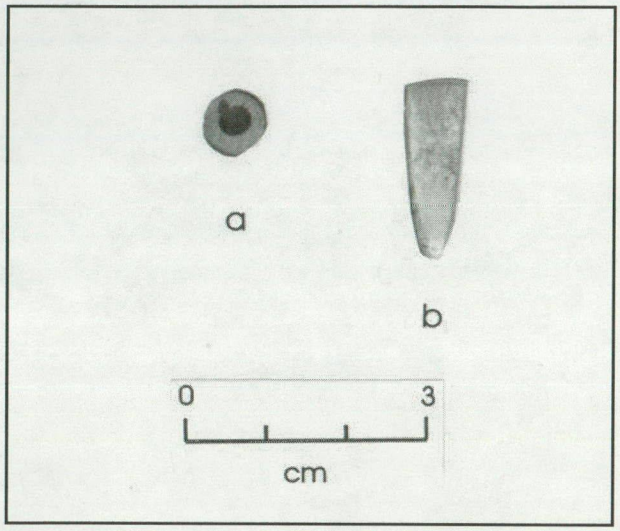


Figure 24. Shell pendant and bead—Kohr House No. 1.

as it currently exists at the KSHS (Figure 24a). It is a well-made specimen, weighing 0.24 g and measuring 8.2 mm in diameter and 2.7 mm thick with a 3.6-mm-diameter hole in the middle.

Pendant Fragment. The Whiteford (1937:7, 1941:17) booklet on the Kohr House No. 1 and burial pit says that "[M]any ornaments were made from clam shells: of these, beads, ear-bobs or pendants were found in the lodge." The plural is a bit of an overstatement since the catalogue listed just the one shell bead described above and one "ear bob," which is the term that the Whitefords usually used for shell pendants when they described these objects in the burial pit. Wedel also listed a "tip fragment of tapered pendant" in his notes. This specimen is still in the collection (Figure 24b). It is the distal end of a pendant, and as Wedel notes, it tapers to a blunt tip. The fragment is 23.3 mm long, 7.1 mm wide, and 2.9 mm thick with a mass of 0.77 g. It is stylistically consistent with shell pendants in the burial pit.

Unmodified Mussel Shells. The Whiteford catalogue listed 15 mussel shells, 14 from Cache 1 and 1 from the house floor. Wedel mentioned these as simply "unworked fresh water messel shells ... several species present." The collection as it currently exists has seven unworked shells, all from Cache 1. They are too small to have been used for hoes and may also have been too small for bead-making. They could, of course, represent food remains. As Wedel noted, several species are represented.

Floral Remains

Recovery techniques used on Central Plains sites during the 1930s generally were inadequate for recovery of any but the largest and most obvious macrobotanical remains. In Kohr House No. 1, therefore, floral remains in the collection are limited to 4.53 g of the charred corn observed at the bottom of Cache 2. Mary Adair of the University of Kansas Museum of Anthropology examined this material on October 27, 2000. The size and form of the kernels are completely consistent with their Smoky Hill phase association. They are broken up, and there is some wood charcoal mixed with the material. One kernel was submitted for AMS dating, but it dissolved during pre-treatment and could not be assayed.

Other Miscellaneous Objects

The Whiteford catalogue listed four mud dauber nests from Kohr House No. 1, recovered from the house floor. The collection as it currently exists contains four pieces of mud dauber nest. Only two of these have Whiteford numbers on them, but this is a difficult object type to label.

The catalogue also mentioned a ceramic "piece," some "adobe," and some "clay." The adobe probably is architectural daub, which we certainly would expect to find in a house. There is some daub in the collection. It does not bear a Whiteford catalogue number, probably because daub is also difficult to label. Consequently, we cannot be certain if it is from House No. 1. The identity of the "piece" and the "clay" is uncertain. Wedel's notes mentioned "3 frags of worked clay," one of which is the "owl effigy" described above. The identity of the other two is uncertain. The collection does contain some miscellaneous ceramic fragments. They are unlabeled, and there is no way to know if these are the referenced objects from Kohr House No. 1.

Discussion

The Kohr House No. 1 collection is remarkable in a couple of ways. First, it is implicit in the catalogue entries and slightly more explicit in the published description (Whiteford 1937:7, 1941:18) that many of the recovered objects came from the house floor, not from cache pits. This includes two restorable pots, abraders (two of which were in the process of manufacture), hammerstones, and many chipped stone tools. We expect that some of these large utilitarian objects would have been within ready grasp of the house's residents, so their floor context is reasonable. However, they also

are useful objects that we would envision the residents taking with them if they planned to abandon their house and move to a new place. The evidence suggests, therefore, that the abandonment of this house was not anticipated—that the residents had to leave in haste or they had planned to return but never did.

There are also indications that the house burned (Whiteford 1937:5, 1941:14). This, of course, is a possible reason for a hasty, unplanned abandonment of the house, but it is not an automatic conclusion. When aggregates of Central Plains tradition houses are viewed as wholes, house burning is revealed to be very common. In southwest Nebraska's Medicine Creek valley, for example, of 54 excavated Upper Republican houses for which reliable data could be assembled, 43 (79.6 percent) were burned. House burning occurred in all stages of abandonment, strongly implying that accidental and catastrophic ignition of still-occupied houses was not the cause of many or even most of these fires. Setting an earthlodge or wattle-and-daub structure ablaze is not particularly easy, as experimental fires have shown (Bankoff and Winter 1979; Taylor 1982). It seems more likely that many houses were intentionally burned—a conclusion that is not unique to the Plains (Stevanovic´ 1997:335; Wilshusen 1986:247)—and that this was a sensible action. An abandoned structure is not necessarily a desirable thing to have in the neighborhood. As it deteriorates, the danger of collapse becomes imminent. Meanwhile, it may attract vermin. Getting rid of it is a good idea. Having directed the dismantling of a replica earthlodge (Roper 2002b), I can attest to how labor-intensive the process is. Setting a structure on fire may be somewhat difficult, but it probably is far less time consuming than tearing it down. Furthermore, it would destroy the no-longer-usable materials that probably would be no more desirable to have around as piles of debris than as a standing house.

A second remarkable characteristic of the Kohr House No. 1 assemblage is how many objects obviously were in the process of manufacture but as yet were unfinished. The two sets of paired abraders and the pipe are particularly notable. The large number of hammerstones (assuming they were hammerstones) on the floor also would seem to attest to a considerable amount of manufacturing taking place at the time of house abandonment. It is tempting to speculate that abandonment might have occurred at a slow time of the year—perhaps winter—when other activities did not have a priority over refurbishment of tool kits, but that is difficult to demonstrate. Still, this would have been a very interesting house to have excavated using modern comprehensive recovery techniques and more precise provenience control.

Kohr House No. 2

Setting

As Wedel (1959:514) described it, Kohr House No. 2 was about 150 yards west of the burial pit. His 1940 notes, though, suggested it was 150 to 200 yards to the west. Since he gave only a general bearing and this one distance as a range, it is somewhat more difficult to plot the location of House No. 2 than it was to plot the location of House No. 1. My plot in Figure 6 (see page 5), therefore, must be regarded as an approximation only—the house could have been somewhat farther north or south, depending on its actual bearing "west" of the burial pit. If reasonably correct, this house could have been 700 feet or even a little more north of the Smoky Hill River and 4,800 feet or so southwest of the Saline River. Like House No. 1, it lies at an elevation of 1,200 feet amsl near the edge of the broad terrace between the Smoky Hill and Saline rivers. The soil series mapped for the location are the Hord silt loam and Roxbury silt loam, each of which are terrace soils (Palmer et al. 1992:Sheet 13).

Architecture and Features

We have no map and very little in the way of description of Kohr House No. 2. The second edition of the Whiteford (1941:18) booklet simply stated, "[A] second house yielding many interesting artifacts was also excavated at a later date. Due to its condition, however, it was not considered of enough interest to open to the public." The Whitefords nowhere indicate what that "condition" was. Wedel was a little more helpful, telling us that this house "was approximately half excavated," that it had a clay-lined, ash-filled central hearth, four central support posts, and three cache pits between the walls and the ring of central support posts. He (Wedel 1959:14) also said, "[It] is believed to have had about the same dimensions as the first house opened." His notes provided no additional data concerning the house or its features except for the fact that a grinding stone fragment came from Cache 1.

Collection

The Whitefords never catalogued the Kohr House No. 2 collection and, even worse, eventually intermingled the objects with the material from Kohr House No. 1. As I have already noted, it is easy to separate the Kohr House No. 1 material from the aggregate because the Whitefords' catalogue numbers are still on

Table 5. Waldo Wedel's List of Objects from Kohr House No. 2.

Object Class		Floor	Cache 1	Cache 2	Cache 3	Post
Pottery						
	rim sherds	28	1	1		1
	body sherds	235	21	38	8	3
Projectile points						
	side-notched	2				
	stemmed	1				
	triangular	2				
Knife			1			
End scraper		4				
Retouched flake					1	
Debitage		present				
Ground stone						
	abrader				1	1
	hammerstone	1				
	mano			1		
	sandstone "disc"	1				
Bone						
	hoe	1				
	awl	2		1	1	
	needle			2	2	
	bead	3 + frags		1		
	cylindrical object	1				
Shell						
	hoe	6		1		
	bead	2				
	pendant	1				
	unmodified	60		2	8	1
	"spoon"	2				

those objects. Wedel's notes from his 1940 examination of the collection, however, rescued us from drawing the erroneous conclusion that all material not bearing House No.1 catalogue numbers was from House No. 2. The types, quantities, and intrahouse distributions of House No. 2 objects, as given in Wedel's notes, are shown in Table 5. The collection does not match this list. It contains, for example, more than twice as many projectile points and end scrapers and fewer rim sherds than Wedel said there should be. I can only conclude that this collection also includes other material from the Kohr site in general. It perhaps is pertinent that the Whitefords lived in the farmhouse adjacent to the burial pit for a number of years and, thus, were essentially living on the Kohr site. It would be no surprise to learn that they surface collected from the site periodically over the years, accounting for the extra material in the collection. In any event, since neither the surface collection material—if that is what it is—nor the Kohr House No. 2 material was catalogued, it is impossible to separate the latter.

It is rather frustrating to have a collection in front of me and know that part of it is from the site I am reporting on, yet be unable to describe it because I do not know what part of the whole collection it is, but that is the situation here. It is even more frustrating to have at hand a set of notes describing the part of the collection I am trying to isolate but be unable to match the specimens to the description, but that also is the situation. One must remember that those descriptions are notes made decades ago over a period of a couple of hours at most.

The best I can do, therefore, is extract some of the information from the Wedel notes and use it to add some substance to the raw numbers of Table 5. I will organize these comments by provenience, since that is the way Wedel recorded the information. I also will concentrate on extracting information about the pottery.

Pottery, which he could use in culture-history studies, probably was Wedel's biggest interest; his notes on this material, while brief and general, usually allowed type identifications, although not a detailed description.

Pottery

The sparse amount of material from Cache 1 included one large pottery rim sherd. Wedel described it as part of a large vessel with a constricted neck and flaring rim. Decoration was not mentioned. This probably was a Riley Flaring Plain vessel.

The single rim sherd from Cache 2 also was from a vessel with a constricted neck and what Wedel called a "converging rim." It was cord roughened to the lip. This may have been another Riley Flaring Plain vessel.

No pottery rims were found in Cache 3. The listing of body sherds told us very little.

The final feature provenience unit was a posthole south of the hearth. Wedel said that one rim sherd from it had a slightly flaring, cord-roughened rim with a flattened lip. Since no decoration on either rim or lip was mentioned, this appears to have been another Riley Flaring Plain vessel.

The 28 rim sherds on the house floor, for present purposes and in the absence of any indications to the contrary, are presumed to represent a minimum of 28 vessels. Of these, 14 have direct flaring rims, 10 have collared rims, and 3 have no rims, although they do have lips and, therefore, are called rim sherds. The rim form of the last pot cannot be determined.

Of the 14 flaring-rim vessels, it appears that 13 can be more specifically identified as Riley Flaring Plain. Wedel's notes grouped 10 of them, indicating that their exteriors were cord roughened, lips were usually rounded and rarely flat, and rims were 15-35 mm high. The absence of any mention of lip or rim decoration is the basis for the tentative type identification. Three more rims were grouped and described as having vertical to slightly flaring rims, 25-30 mm high. One had a flat lip. Again, decoration was not mentioned and is presumed absent.

The final flaring rim pot was described as having a vertical rim with flaring lip, cord-roughened exterior, and three incised lines paralleling the lip and superimposed on the cord roughening. Hedden (1994:31) did not describe this particular decorative motif for direct flaring-rim vessels, and it does not seem to be a part of his definition of the Riley Flaring Tool-Decorated type. Beck (1998:291) did recognize it in the Minneapolis site collection, however, and appears to have extended the type definition to include vessels decorated with this rather uncommon motif. That is to say, the motif is uncommon on flared rim vessels from Smoky Hill phase sites. It is more abundant to very common on collared rim vessels from Smoky Hill and especially Upper Republican phase sites on the Central Plains.

The 10 collared-rim vessels are identifiable to several types from Wedel's notes. Five probably were Riley Collared Plain. Collars were 15–30 mm high and were obvious but not pronounced. Their surfaces were cord roughened. Two other collared vessels probably were Riley Collared Pinched. In each case the pinching was applied to the base of the collar, and no other decoration was listed. An eighth collared vessel was described as having diagonal incisions on the lip and three parallel incised lines on the collar. This rim is probably still in the collection—at least one that matches this description can be identified. Lip decoration on that sherd consists of left-right incisions at very acute angles to the edges of the lip. The grooves now are filled with burned-on food residue. The collar panel is 22.5 mm high. This is a Riley Collared Tool-Decorated vessel part. A ninth collared rim also was decorated. Wedel's description suggested that two parallel sets of zig-zag incised lines were on the collar panel, which was pinched along its lower edge. This clearly distinctive rim is no longer in the collection and cannot be further described or illustrated. It probably is best identified as a Riley Collared Tool-Decorated vessel, since in Hedden's (1994:32) type definitions the incised decoration seems to supercede the pinching at the base of the collar. Wedel gave no information about the tenth collared rim.

Wedel likewise gave very little information about the three vessels without rims. The collection as it exists today contains several such rims sherds, but there is insufficient information available to determine if they are the rims from Kohr House No. 2. Wedel called these "coconut" pots, and these neckless, rimless pots do somewhat resemble a coconut. Two were described as cord roughened, one with cord roughening extending onto the lip. No descriptive information was provided for the third "coconut" pot. These vessels are not accommodated within Hedden's typology, and Beck apparently did not see them in the Minneapolis site collection either. They appear in Upper Republican assemblages at Medicine Creek (Kivett and Metcalf 1997:101; Roper 1996:97-98), however, and probably also in Central Plains tradition sites elsewhere.

Chipped Stone Artifacts

Beyond the pottery, the other house floor objects appear unexceptional from Wedel's descriptions. A single, minor exception might be the stemmed point, which he traced and so is readily identifiable in the collection. It has a triangular blade with slightly concave lateral margins, nearly straight shoulders, and a stem



Figure 25. Generalized topographic setting of the Markley (308) and Minneapolis (5) sites.

that expands only slightly to a concave base much narrower than the shoulders, making it an SCa1 form in Strong's (1935:88) form classification. It is made of a translucent light brownish grey (5YR6/1 on the Rock Color Chart [Rock-Color Chart Committee 1984]) chalcedony. This form is not particularly characteristic of Smoky Hill phase assemblages. Otherwise, looking at the chipped stone material as a whole—which includes, but is not limited to, the house material—Florence chert is predominant, if not exclusive.

Markley House

Site Description and Setting

What the Whitefords called the Markley House was part of site 14OT308 in the Solomon River valley, about [redacted] city of Minneapolis and not quite [redacted] of the Minneapolis site (14OT5) (Figure 2, see page 5). It is one of at least five Smoky Hill phase sites that the Whitefords knew in the central Ottawa County portion of the Solomon River valley. The Minneapolis site, of course, was another. We do not know too much about the extent of 14OT308, but there are indications that the single house excavated by the Whitefords was not the only house present. A sketch map by John Reynolds, attached to a state site form completed in 1971, showed two "possible mounds" west of the plotted location of 14OT308, but it is unclear whether these were suggested to be house mounds. In a 1990 letter to the KSHS, a Sterling, Kansas, man who photographed and helped with the excavation stated that, when the Whitefords began work, they "detected several slight mounds" (Max Moxley to Thomas Witty, undated, but reply dated July 1990, 14OT308 site file, Kansas State Historical Society, Topeka). Given that many Smoky Hill phase house sites do contain multiple houses, it is reasonable to believe that 14OT308 also contained (or contains) multiple houses. The spatial relations among the houses on the site and their relationship to the excavated house are unknown.

The Markley site lies on [redacted] (Figure 25). Salt Creek, which flows to the Solomon about [redacted] straight line miles [redacted] from the site, [redacted] in

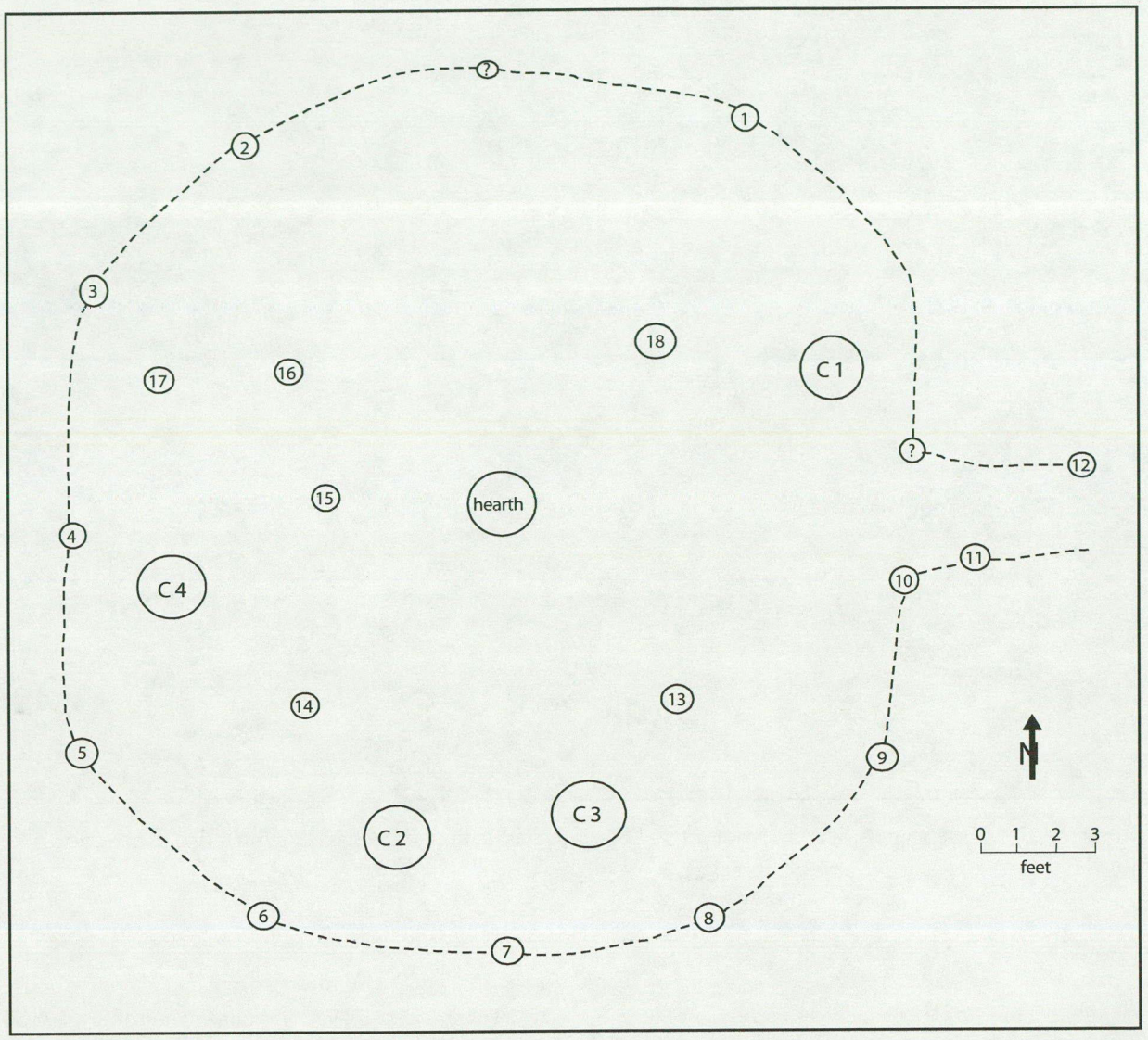


Figure 26. Floor plan of Markley House (redrawn from Whiteford original at Kansas State Historical Society, Topeka).

this area. The two streams are less than a mile apart. They share a valley, and all land between them is alluvial terraces and floodplain. The Markley site is about [redacted] of the river as it appears on the 7.5' Minneapolis South USGS quadrangle, published in 1965, and no channel changes are shown in this location on the 1980 photorevision. Abandoned channel meander scars are visible on the quadrangle and aerial photos for this area, however, so it is possible that the relationship between the site and the river was different in the past. Salt Creek currently is about [redacted] feet southwest of the site. The elevation is very close to 1,250 feet amsl. The toe slope of the gently rising north valley wall of the Solomon River is no closer than about 3,200 feet northeast of 14OT308 and on the other side of the river. As with the Kohr site, relief does not exceed 10 feet for about 2 miles or more in all other directions surrounding the site. The mapped soil series is Hord silt loam (Atkinson and Grimwood 1980:sheet 31).

Architecture

The Markley House floor plan was portrayed on two Whiteford maps housed in the KSHS files. One of these, surely the original, was drawn in pencil on a dark brown paper bag and is very difficult to read. The second, clearly in Mabel Whiteford's hand, probably represents a redrawing and transcription of the paper bag



Figure 27. Photograph of Markley House (Negative Number 74.46.151, Whiteford Collection, Kansas State Historical Society, Topeka).

original. This version was used to produce Figure 26. The scale on this figure should be regarded as approximate since neither version of the map had a scale, making it difficult to reconstruct the scale from the scanty information available regarding dimensions. On the other hand, all post positions and other data on the two maps match exactly. Post dimensions discussed below were transcribed from that information and are accurate.

The house floor plan and a photograph of the finished house excavation (Figure 27) showed a house defined by 12 wall posts in a configuration that was more circular than rectangular, although not classically either. The maximum length of this house was about 25 feet, and maximum width was about 28 feet. Wall posts were spaced at intervals, ranging from about 6 to 8 feet with a median of about 7½ feet. Spacing did not noticeably vary along different parts of the house perimeter.

Another six posts were recognized inside the house. Four of these—numbers 13, 14, 16, and 18—were in a configuration suggesting that they functioned as the interior support posts. They were almost uniformly spaced in a square that measured about 11 feet on a side. Judging from their positions, the other interior posts, numbers 15 and 17, may have been additional supports, perhaps erected later to support sagging beams.

The entryway was moderately well defined, represented by only two posts other than those at the point where the entryway met the house wall. A notation on the Whiteford map read, "Doorway excavated 8' east of PH#12, Bank showed mixture of burnt clay," suggesting that the entryway was somewhat longer than the 5-6 feet it appeared on the map. The map showed it as not quite 3 feet wide and facing due east at a bearing of 90° from north.

Post dimensions are listed in Table 6. Diameters of 11 wall posts (data for the twelfth post are missing) ranged from 7 to 12 inches with a mean of 10.1 and median of 10 inches. Depths of some of these posts varied from 20 to 34 inches with a mean of 26.6 and median of 26 inches. Diameters ranged from 12 to 17

Table 6. Post Mold Data from Markley House.

Post Number	Position	Diameter	Depth	Comments
no number	wall	--	--	showing mixture, no wood
1	wall	12	22	
no number	wall	7	22	showing mixture, no charcoal, decayed wood
2	wall	10	24	mixed dirt
3	wall	11	34	decayed wood bottom, charred wood top
4	wall	9	25	charred post
5	wall	10	27	charcoal on floor, mixed dirt
6	wall	11	31	decayed wood
7	wall	9	--	
8	wall	10	30	charred post on floor
9	wall	11	31	charred post
10	wall	11	20	mixed dirt, decayed wood
11	entryway	10	18	mixed dirt
12	entryway	8	20	mixed dirt
13	interior	16	17	heavy chunks of decayed wood
14	interior	13	25	heavy chunks of decayed wood
15	interior	12	16	decayed wood
16	interior	13	25	decayed wood
17	interior	12	15	mixed dirt
18	interior	17	28	heavy chunks of decayed wood

inches for the six interior posts and from 13 to 17 inches for the four posts in proper positions for interior supports. The diameter of both extra posts (numbers 15 and 17) was 12 inches. Depths varied from 15 to 28 inches for the six interior posts and measured 17, 25, 25, and 28 inches for the four support posts and 15 and 16 inches for the two extra posts. The shallow depths for the extra posts seems consistent with the conjecture that they were late additions to the house. Diameters of the two entryway posts overlapped the lower half of the range of the wall posts, and were shallower than the wall posts but slightly deeper than the extra interior posts.

Notations on the original map suggested that decayed or charred wood appeared in most of the wall perimeter and interior postholes. According to the artifact catalogue, a small amount of this wood from Post Hole 18, one of the interior support posts, was saved.

Features

Features other than the post molds and the house floor itself included a central hearth and four cache pits. The hearth was 36 inches in diameter. The map label read, "8" ash—6" burnt clay," so presumably the hearth was 14 inches deep and stratified. No additional information for this feature exists.

Cache pit dimensions and calculated volumes were listed on the map and are transcribed in Table 7. Idealized or approximated profiles, drawn from top and bottom diameters and depths, are shown in Figure 28. In these views all pits are slightly bell shaped. In the mid-1930s the Whitefords excavated seven large cache pits on the Great Bend aspect Paint Creek site. The catalogue for some of these pits included a list of recovered objects, a brief description of fill characteristics, and

Table 7. Cache Pit Data from Markley House.

Cache Number	Diameter		Depth	Volume	
	Top	Bottom		Cubic inches	Bushels
1	34	38	43	43,904	20.4
2	32	38	52	50,397	23.4
3	36	44	52	65,999	30.7
4	36	45	53	69,120	32.1

sometimes a small profile sketch with dimensions. Interestingly, this usually was not the case for the Smoky Hill sites, even though most house excavations were done later than the Paint Creek cache pit excavations. The Markley House catalogue was the exception and then was only partial. Profiles were not sketched—although, as with most other houses, the dimensions were listed on the floor plan—but some fill and content characteristics were recorded and provide useful information.

Cache 1, the smallest of the four cache pits, was described as "filled with mix of dirt and charcoal" and as "empty of artifacts." The catalogue entries that followed this description showed that this last statement was not completely accurate, but artifact yield was lower here than in any other pit in this house (Table 8).

Cache 2 was described as "filled with heavy charcoal, one limb (chard [sic]) measured 6" dia. Limb had fallen from roof. Cache was empty at the time the house fell. Silt dirt." We can only wish that charcoal and especially the "limb" had been saved. Otherwise, though, this pit held more artifacts than Cache 1 (Table 8).

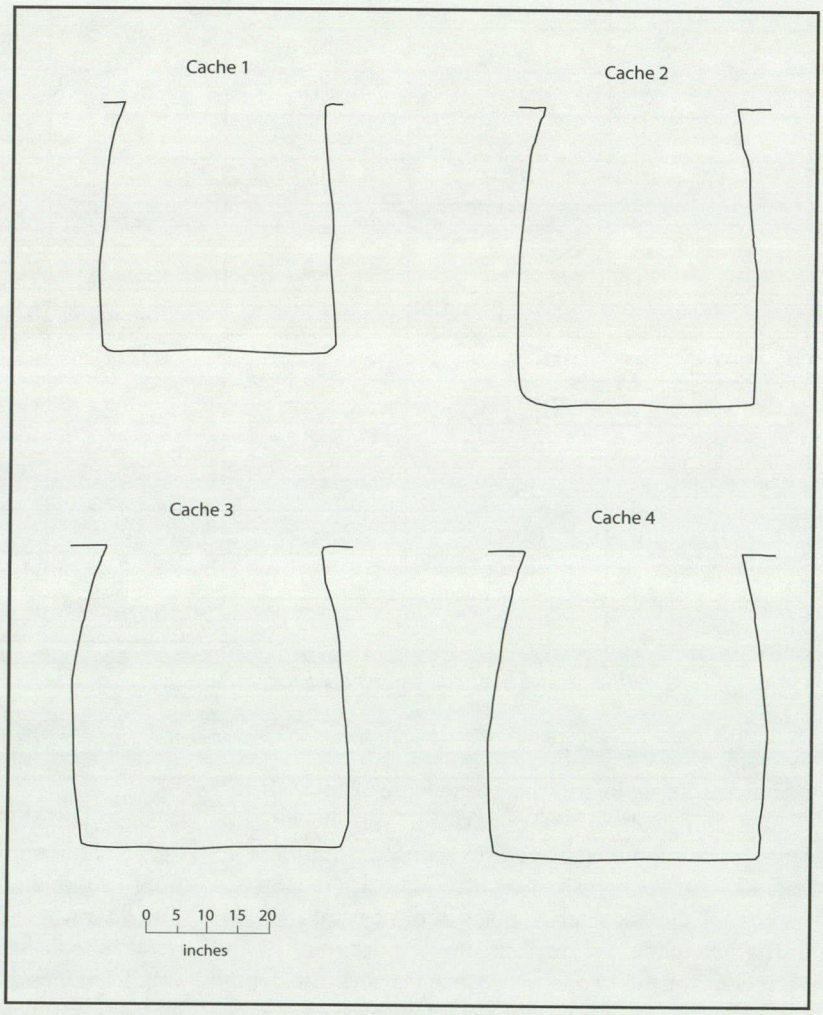


Figure 28. Approximate profiles of Markley House cache pits.

Cache 3 had numerous artifacts (Table 8). The catalogue description said it had a "very heavy mixture of burnt roofing material," but none of this material was catalogued or saved.

Cache 4, the largest pit, also was said to have "mixed black dirt—chard [sic] limbs; several animal bones." A considerable number of artifacts and more than "several" animal bones from this pit were saved (Table 8). The wood was not collected.

Table 8. Catalogued Objects from Markley House.

Object Class	Whiteford Catalogue						In Collection
	Floor	Cache 1	Cache 2	Cache 3	Cache 4	| |	
Pottery						| |	
rims	57	1	3			| |	63
body sherds	335	9	13	5	43	| |	85
worked	6				2	| |	8
pipe	1					| |	1
Projectile points						| |	
triangular	11				9	| |	11
large triangular						| |	5
notched	1					| |	6
blade fragments						| |	2
Knives	2					| |	4
Drill						| |	1
Other biface frags						| |	2
End scrapers	34		1	1	3	| |	32
Retouched flakes						| |	18
Debitage					11	| |	1
Ground stone						| |	
celt	1					| |	1
abrader	39		2	3	5	| |	49
hammerstone	6				1	| |	6
unmod cobbles						| |	2
mano	3					| |	3
"soap stone"	1					| |	1
pigment					1	| |	1
pipe	2					| |	1
Bone						| |	
hoe	7				4	| |	11
knife	3					| |	3
shaft straightener						| |	1
needle	4		1	1		| |	6
bead	2					| |	2
unmodified	1 qt. jar		3	6	2+	| |	present
Shell						| |	
hoe	8					| |	4
bead						| |	2
pendant						| |	1
unmodified	25	8	1	1	33	| |	81
Wood	1 (post 18)					| |	1

Collection

The Markley House was the last of the Whitefords' house excavations. The collection was by far the largest of their Smoky Hill phase house collections, mainly because the house floor and cache pits held a lot of debris. However, a closer examination of the catalogue and Table 8 also shows that collection and cataloguing procedures used at Markley represented a growth in the Whitefords' techniques. For example, they collected and catalogued body sherds, not just rim sherds and complete pots (of which there were none at Markley anyway). They had collected some body sherds from the Kohr houses but did not catalogue them. They had not even systematically collected them at the Aerhart and Lamar sites, the first two of their house excavations, described below. Markley was the only site where the Whitefords collected a small amount of debitage, and they saved animal bone far more systematically. As we have seen, they also recorded a little more information about the cache pits than they had for any other site. And, perhaps not of great consequence but a contrast with previous procedure nonetheless, they classified objects and recorded them as artifact lots to a greater extent than for any other house.

The catalogue was systematically laid out, with objects grouped by provenience—house floor and each of the four cache pits—and with object classes often arranged in the same overall order within each provenience group. Many of the 60 catalogue entries denoted artifact lots, and together they enumerated 678 objects (Table 8) plus a few entries whose quantities were not precisely specified. Most of these objects remain in the collection (Table 8, last column). As always, though, some discrepancies in numbers occur due to my calling something by a different name, finding several rim sherds with the body sherds, and perhaps differently counting rim sections composed of several conjoining pieces.

Pottery

The Markley House pottery collection is by far the largest from any house described in this study, and it represents a wide range of variation in Smoky Hill phase pottery. It also holds a few surprises. The total number of rims listed in the Whiteford catalogue is 65, and the collection as it now exists contains this same number of rim sherds, representing a minimum of 63 vessels. Since the Markley House collection is large, only selected examples of at least the common pottery types are illustrated.

The most common type in the collection is Riley Flaring Plain, represented by 22 vessels (Figures 29-30). In general vessel exteriors were cord roughened. In 10 cases cord roughening extends to the lip; in 11 cases it extends to the neck with a smooth, undecorated rim. The final case is indeterminate. Lips are variably flat (n = 8), rounded (n = 8), beveled (n = 4), or pointed (n = 1), with one indeterminate fragment. Heights of 16 rims range from 9.1 to 32.5 mm with a median of 17.35, but these numbers are somewhat misleading. The distribution of rim heights in this sample actually is 9.1 mm (n = 1), 13.1–18.4 mm (n = 9), 21 mm (n = 1), 26.7–27.3 mm (n = 3), and 32.0–32.5 mm (n = 2). In other words two classes of direct flared rims are apparent: one 18.4 mm or less in height and another 26.7 mm or greater in height with only one intermediate specimen. Only one of the Riley Flaring Plain vessels has a handle, which in this case is a broad strap handle (Figure 30c).

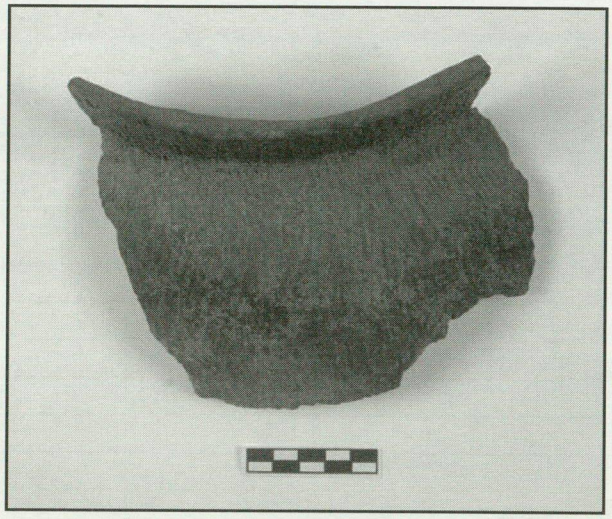


Figure 29. Riley Flaring Plain vessel section—Markley House.

Riley Flaring Tool-Decorated is the second most common type, represented in this collection by 13 vessels (Figure 31). Exterior cord roughening extends to the lip on 11 of these vessels; rims are smoothed on the other 2. Rim panels are undecorated. Lips are flat on 12 rims and rounded on the other with, by type definition, tool-impressed decoration. In seven cases tool decoration is left-right incision; in six cases the incisions are right-left. Rim heights of eight vessels range from 12.3 to 32.6 mm with a median of 22.6 mm. One of these vessels has a strap handle attached to the lip and the shoulder. Incised decoration, in the manner of that applied to the lip, extends around the edges of the handle (Figure 31c).

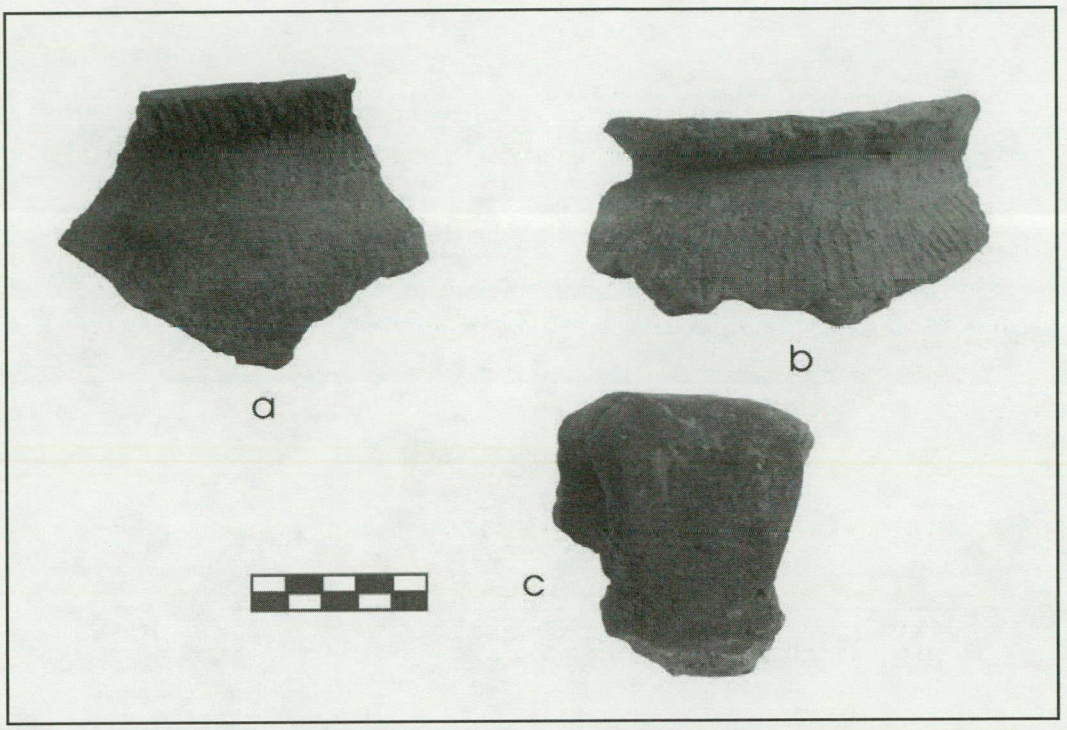


Figure 30. Riley Flaring Plain pottery: a-b) rim sections, c) handle—Markley House.

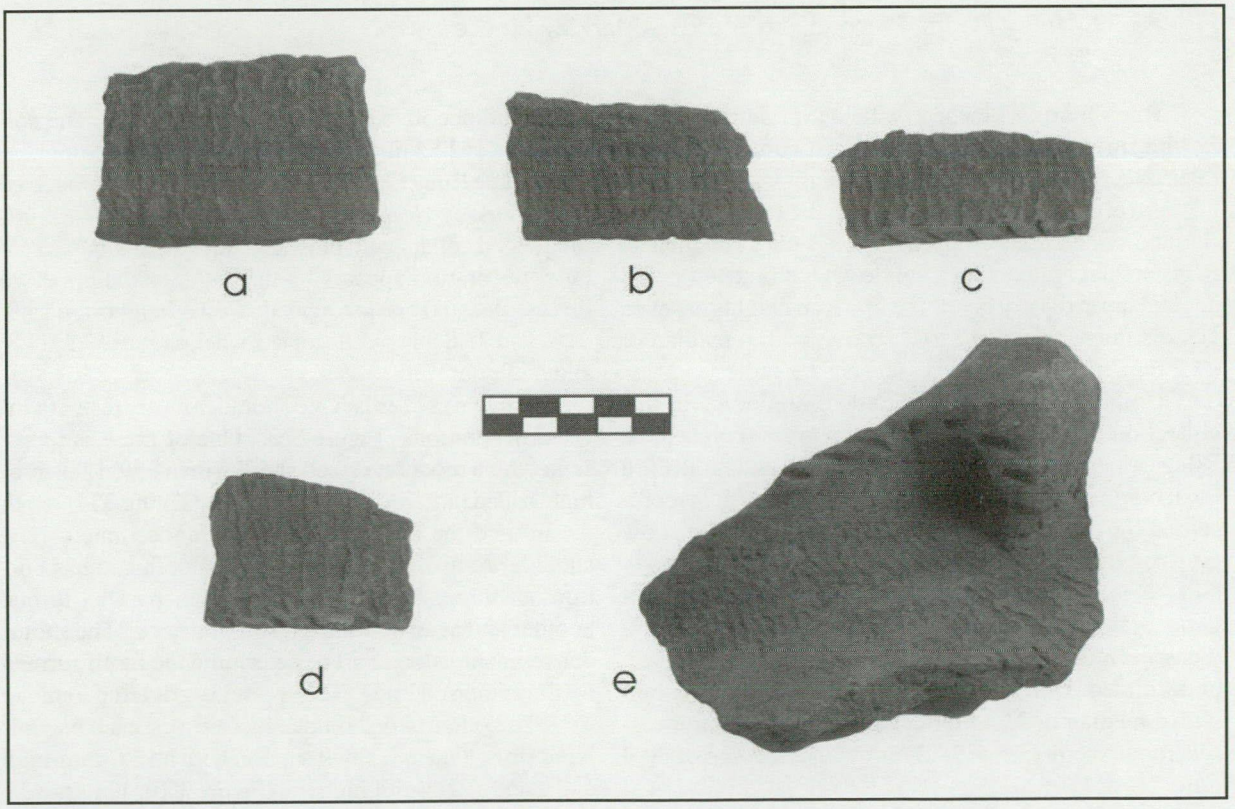


Figure 31. Riley Flaring Tool-Decorated rim sherds—Markley House.

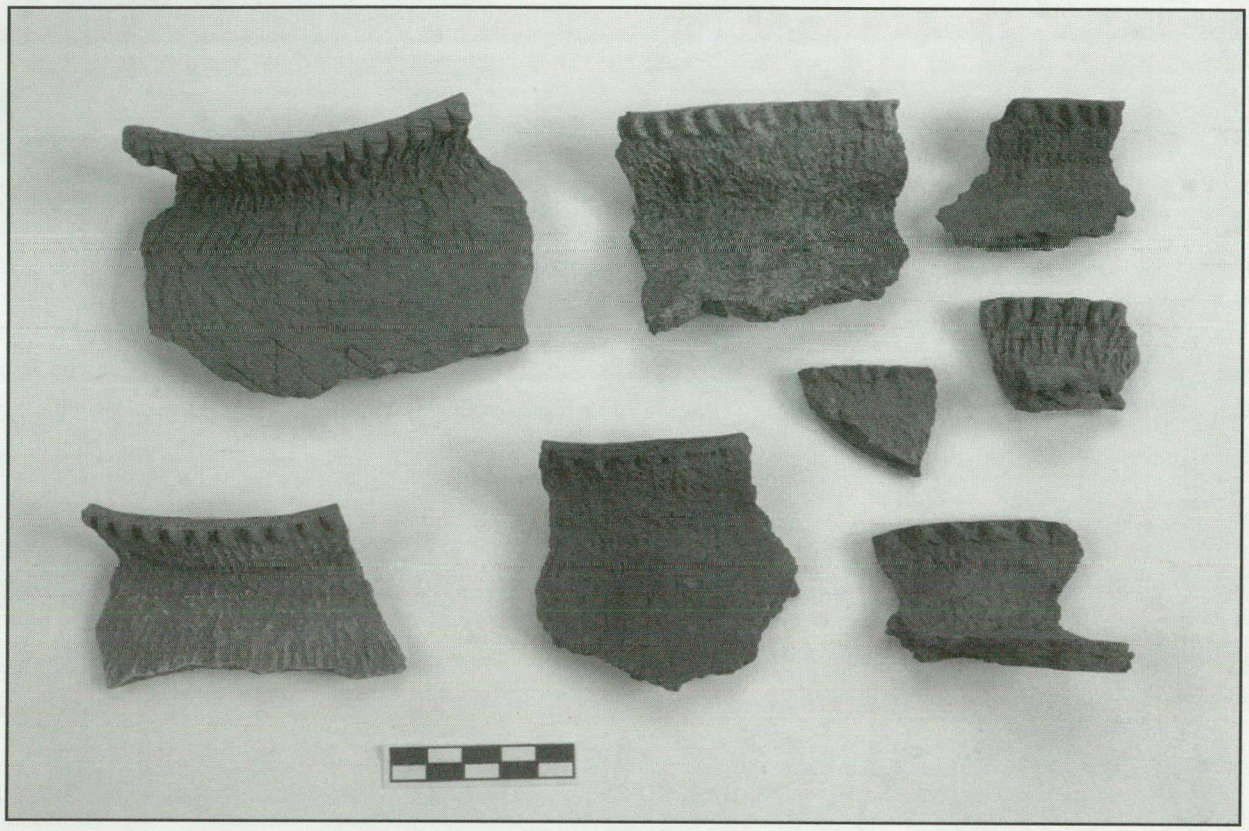


Figure 32. Riley Flaring Pinched rim sherds—Markley House.

Riley Flaring Pinched is the least common of the flaring rim types and the fourth most common type in this collection. It is represented by eight vessels (Figure 32). All eight are cord roughened to the lip. All lips are flat and undecorated, although one is cord roughened. Rims are decorated with a single row of pinched nodes applied immediately below the lip. Rim heights of seven vessels range from 20.2 to 35.5 mm with a median of 22.3 mm. None of these vessels has a handle.

Collared vessels are much less numerous in this collection. Of the three collared rim types represented, Riley Collared Plain is the most common and is the third most common pottery type in the collection. It is represented by 10 vessels (Figure 33). Eight of these show cord roughening on the exterior of both the vessel body and the collar panel. The other two have smoothed but undecorated collar panels. Lips are flat on six specimens and rounded on the other four, and all are, of course, undecorated. Collar heights range from 15.5 to 25.1 mm with a median of 21.15 mm. Rim heights for nine vessels range from 23.5 to 38.2 mm with a median of 30.9 mm.

A single Riley Collared Tool-Decorated rim sherd has a cord-roughened exterior and collar panel. The lip is flat and decorated with left-right incisions. The collar height is 22.5 mm, and the rim height is 31.1 mm.

Three Riley Collared Pinched sherds were collected from Markley House (Figure 34). All three have cord-roughened collars with pinched nodes at their bases. No other decoration appears on the collar or the lip. Two lips are flat, and one is rounded. Collar heights are 15.9, 21.7, and 25.8 mm, while total rim heights are 19.2, 24.8, and 35.9 mm.

Three rim sherds have shoulder remnants with incised decorations (Figure 35). One of these is represented by a moderate sized sherd with a low, 12.3-mm-high, rolled or flared rim and a flat lip (Figure 35d). Both the lip and the rim are smooth but undecorated. The shoulder remnant on this sherd is smooth and has portions of three shallowly incised lines, parallel to one another and at an oblique angle to the neck. The shoulder remnant is too short to determine the motif formed by these incised lines. This vessel is grit tempered.

The other two shoulder-incised vessels have collared rims. One is a small section with a 13.6-mm-high collar and a 24.2-mm-high rim (Figure 35b). It is sparsely tempered with grit and shell, which is now leached (dissolved by percolating water). The lip is rounded and



Figure 33. Riley Collared Plain rim sherds—Markley House.



Figure 34. Riley Collared Pinched rim sherds—Markley House.

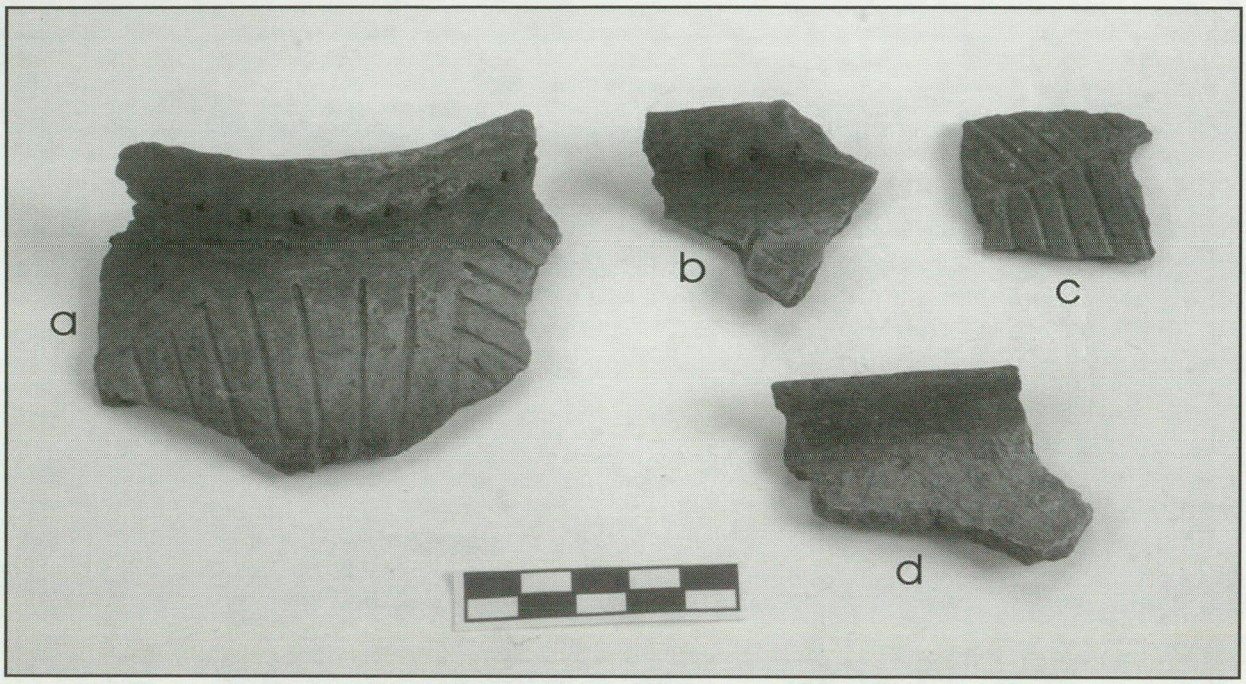


Figure 35. Shoulder-incised sherds—Markley House.

undecorated; the collar panel is smooth and undecorated. The base of the collar has nodes, formed either by pinching or gouging out small pieces of clay to produce a pinched effect. The neck and shoulder also are smooth. The small shoulder remnant has three incised lines; two of them are parallel to one another and at an angle to the neck but nearly parallel to the third line. So little of this shoulder remains that it is impossible to determine the motif, but it probably is opposed diagonal.

There is no such uncertainty about the third rim (Figure 35a). Temper is sparse but appears to have included grit and possibly some now-leached shell. The lip of this vessel is rounded and undecorated. The collar is 11.3 mm high with a 23.7-mm-high rim. The collar panel is smooth and undecorated except for the pinched or gouged nodes at its base. The neck and shoulder are smoothed. The shoulder decoration is fairly deeply incised opposed diagonals. This rim section is obviously similar to the one described above, but the neck angles are different. The incision on this second vessel is deeper, suggesting that these non-conjoining rim sections are from separate vessels.

It is difficult to know what to call these vessels. The characteristics of the flared or rolled rim vessel are nearly identical to those comprising the definition of Majors Opposed Diagonal (Scott 1995:51) except that type is tempered with shell "often coarse and abundant" (Scott 1995:51), which the 14OT308 specimen is not. The two collared rims are even less like the Majors Opposed Diagonal type. They would be identified as Riley Collared Pinched were it not for the shoulder decoration. Shoulder incision is not accommodated within the definitions of Riley Collared Pinched or Riley Collared Tool-Decorated (Hedden 1992:50-52). It does not appear in the collections from the Minneapolis (Beck 1998), Budenbender (Johnson 1973), Miller, or Rush Creek (Sperry 1965) sites, all of which had Majors Opposed Diagonal vessels and usually collared rim vessels but never shoulder-decorated, collared-rim vessels. This pottery is currently unique to the Markley site.

One rim sherd represents a large portion of a miniature vessel. The vessel was probably only about 70 mm high. In profile it is slightly elongated with no constriction at the neck and with a direct rim that slants inward from the shoulder. The lip is rounded, smooth surfaced, and undecorated. The exterior is cord roughened to the lip and is undecorated.

Two rim sherds are from different vessels without rims. Wedel referred to these as "coconut" pots (Figure 36). Each is undecorated and cord roughened to the lip.

A last rim sherd in the Markley House collection has an eroded exterior surface and is unidentifiable. It had a flat, undecorated lip and may or may not have been collared. It almost certainly had a handle attached at the top of the rim. It is broken above the neck, however, and cannot be further described.



Figure 36. "Coconut" pot—Markley House.



Figure 37. Riveted pot handles—Markley House.

Two final pot sections are vessel handles (Figure 37). One is an undecorated strap handle, broken across the middle, with the upper part missing. The intact lower part of the handle, the part that would attach somewhere on the vessel body, is a rivet. The second pot handle also is a undecorated strap handle, broken in a manner similar to the first. Its lower end clearly is riveted and is recurved outward from the vessel surface below the rivet, coming to a blunt point.

Riveted vessel handles, particularly with the recurvate and pointed lower end, are not characteristic of Smoky Hill phase pottery but are virtually diagnostic of Great Bend aspect pottery. Their presence in this collection, therefore, is something of an enigma. They are not itemized in the Whiteford collection catalogue, nor do they have Whiteford catalogue numbers written on them. However, few sherds from this house were labeled, and, as has already been pointed out, the Whitefords tended to lump this collection's material into lots to a greater extent than usual. The Whitefords did excavate a number of cache pits on the Paint Creek site, the last of them nearly a decade before the Markley House excavation. It is possible that a few sherds were mingled with the house material, but it seems suspicious that mixing was confined to two pot handles. Although some slight skepticism must remain, at the moment we have no strong reason to suspect that these two pot handles came from someplace other than the Markley House.

The Whitefords collected a substantial number of body sherds from this house—405 according to the catalogue. This part of the collection apparently has suffered some attrition, for only 84 (20.7 percent) remain. The vast majority of these, 75 (89.3 percent), are cord roughened; another six are smoothed; one has incised-line decoration (Figure 35c); one is a large, thick, pot base; and one is indeterminate. Thicknesses of 80 measurable specimens (excluding the 3.3-mm-thick decorated sherd, the 13.1-mm-thick base sherd, and two sherds with eroded surfaces) range from 3.4 to 13.2 mm, with the middle half of cases ranging from 5.4 to 7.85 mm and a median of 6.15 mm.

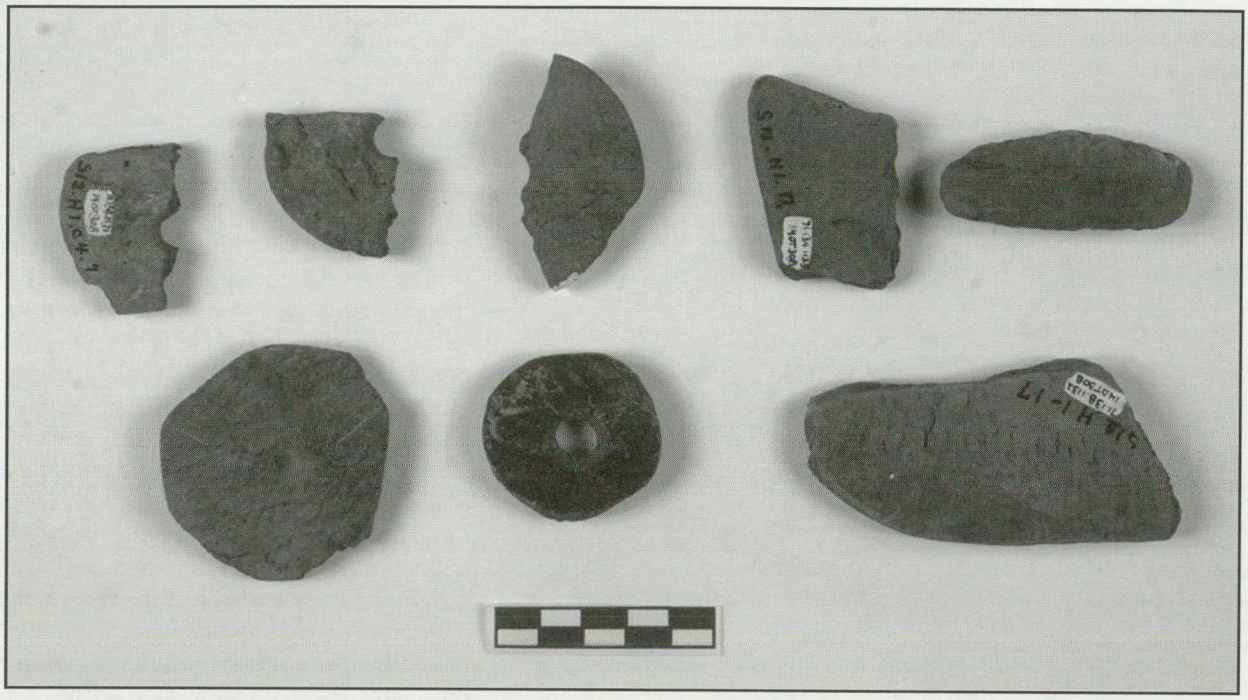


Figure 38. Worked sherds—Markley House.

Other Ceramic Objects

Worked Sherds. The Whiteford catalogue lists eight "worked sherds." All specimens remain in the collection (Figure 38). One is a complete perforated disk, and three others are fragments of the same. In each case the outer edge was ground fairly smooth, and a hole at the center also has smoothed edges. Another piece also is complete and is similar to the first four described except that the center perforation does not completely penetrate. The final three specimens are elongated, trapezoidal-shaped pieces with ground edges all around.

I find no reported instances of similar objects in Smoky Hill phase context. The closest things I can find are similar disks made of sandstone in Great Bend aspect sites in Rice County (Wedel 1959:289-290). In reporting these disks, Wedel (1959:289) referred to them merely as "curious objects" and declined to comment on possible function. Three possibilities that come to mind are spindle whorls (circular balance disks for the round, tapering stick used to twist fiber), which still would accommodate only the perforated disks; loom weights; and fishing net weights.

Pipe Fragment. A final ceramic object is a fragment of a rather large pipe (Figure 39b). Listed in the catalogue, it also remains in the collection. The piece is longitudinally split, leaving about half of the bowl. The lip is missing, as is the connection to the stem. The exterior surface is smooth, almost burnished, and is undecorated. The interior does not show any sign that it was ever smoked.

Chipped Stone Artifacts

As Table 8 shows, the Whiteford catalogue enumerated 73 chipped stone objects. The collection in fact contains 85 pieces attributed to the Markley site. Not all of them have Whiteford catalogue numbers written on them, but the number of objects without these numbers is greater than 12. Furthermore, in several instances the count of objects with Whiteford catalogue lot numbers is greater than the count listed in the catalogue. It is impossible to reconcile the discrepancies. Obviously the collection is intact or nearly so. It may be augmented by some surface material, but unfortunately there is no way to know for sure. Inevitably, I have assigned some objects to different classes than did the Whitefords, and the totals in the last column of Table 8 reflect those classification decisions.

Projectile Points. The Whiteford catalogue lists 21 projectile points for this house, including 11 triangular and 1 notched specimen from the floor and 9 triangular points from Cache 4 (Figure 40). The collection, though, does not contain the eight "perfect arrows (1 notched)" from the floor, as stated in the catalogue. Going by numbered objects, there are seven

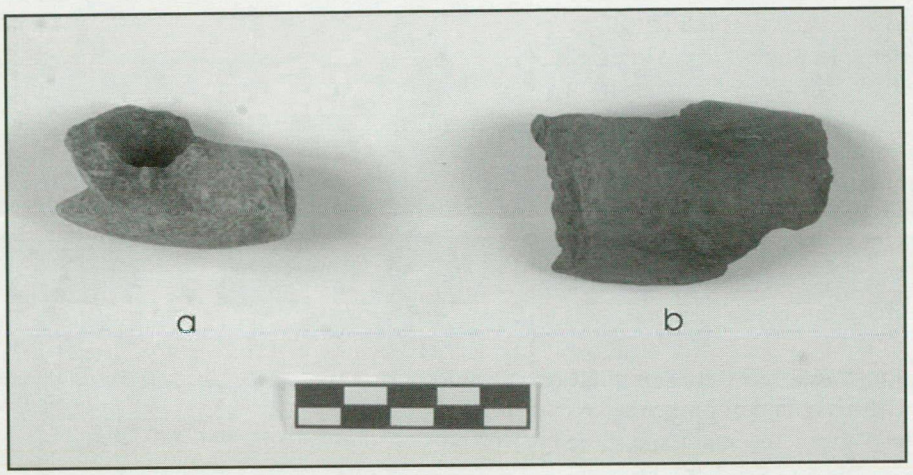


Figure 39. Pipes—Markley House.

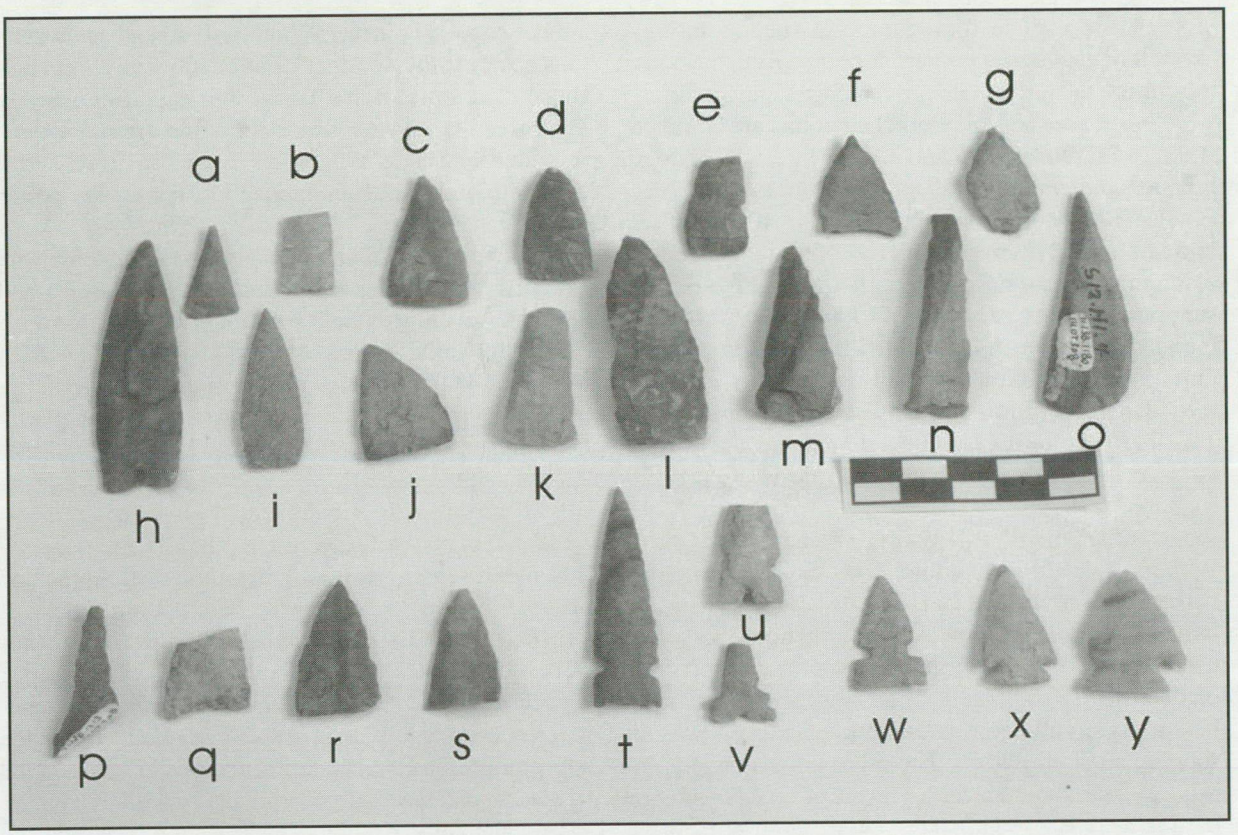


Figure 40. Point and other chipped stone objects—Markley House.

unbroken points, two of which are notched. The small number overall perhaps can be accounted for in some fashion, but the larger number of specimens is not so easily reconciled. Of larger consequence is the fact that several unusual points in the Markley House collection have no Whiteford catalogue numbers written on them. These specimens are clearly indicated in the following descriptions.

After reshuffling the point classes to reflect contemporary practice, the collection contains 11 unnotched triangular arrow points (Figure 40 a-e, i, k, q-s); 5 unnotched, pointed, bifacially worked specimens that are large for arrow points and probably are best regarded as knives (Figure 40 h, j, l); four side-notched arrow points (Figure 40 t-w); two corner-notched points (Figure 40 x-y); and two blade fragments that may be from

almost any of these classes (Figure 40 f-g). Six of the 11 triangular points have Whiteford catalogue numbers, indicating they came from the house.

All 11 triangular arrow points are of Florence chert that was heated in at least one instance. Five are complete. Another five are broken at mid-blade and are missing their distal ends. The last retains the tip and a portion of the base but is missing both haft corners.

Four of the five knives are complete specimens; the fifth is obliquely broken across the blade. This broken specimen and three complete ones are of Florence chert. The final specimen may be heat-treated Florence chert, or it might be some other material. It was not well thinned. The four complete specimens have Whiteford catalogue numbers and come from the house; the fifth does not, and its provenience is uncertain.

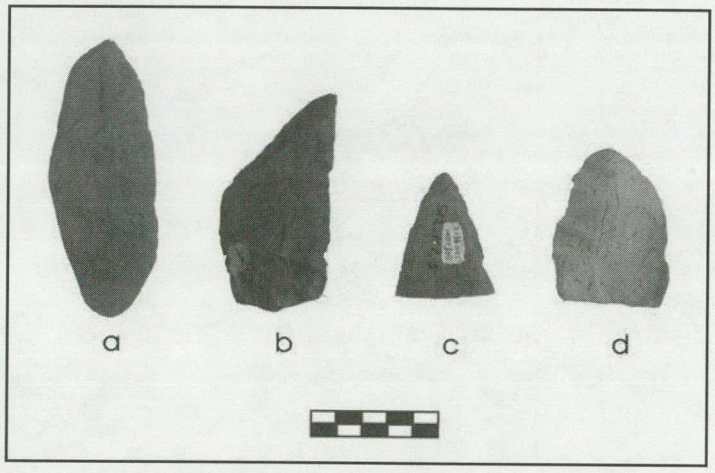


Figure 41. Bifaces/knives—Markley House.

Two of the four side-notched points are complete, made of Florence chert, and have Whiteford catalogue numbers indicating that they were from the floor. The first is a long, narrow specimen (Figure 40t). The second has a similar size haft element but a much shorter blade than does the first (Figure 40w). The other two side-notched specimens are of Florence chert, but neither is complete or has a Whiteford catalogue number. One, a side- and basal-notched specimen, is broken at mid-blade and is missing its distal end (Figure 40u). The fourth point has double side-notches and a basal notch (Figure 40v). Its narrow blade is transversely fractured.

Neither of the two corner-notched points has a Whiteford catalogue number. This indeterminate provenience is unfortunate because the association or lack of association of these points with the house would be useful to know. Both points are well made and complete or nearly so. One is of an unidentified tan chert. Its base is slightly convex and not quite as wide as the shoulders (Figure 40x). The other point is wider and missing one shoulder barb (Figure 40y). Its straight base is heavily ground. The raw material probably is Alibates agatized dolomite.

Two fragments are distal ends of points, broken across the blades and, therefore, of indeterminate original form. Both are of Florence chert that in one instance was heated. Both have Whiteford catalogue numbers.

Bifaces/Knives. The Whiteford catalogue listed two diamond-shaped knives from the house floor, one complete and the other broken. Both are in the collection and retain their Whiteford catalogue numbers, thus ensuring their correct identification. In addition to these two knives are two other specimens with Whiteford catalogue numbers: one fragment was included among the scrapers from the floor and a complete object was enumerated as one of the points from Cache 4.

The complete diamond-shaped knife is somewhat irregular but exhibits the angular lateral margins and alternate beveling of the classic Plains diamond-shaped "Harahey" knife (Figure 41a). This specimen is 92.4 mm long, 33.9 mm wide, and 8.0 mm thick. The entire perimeter is heavily ground. The specimen is of quartzite, which has the sugary appearance of Cloverly (Spanish Diggings) quartzite.

The broken specimen actually is missing only a small part of one end (Figure 41b). It is 74.9 mm long—this measurement only slightly underestimating the original length, 36.7 mm wide, and 8.3 mm thick. It exhibits the characteristic alternate beveling of diamond-shaped knives. It is made of good quality Niobrara jasper.

The fragment that the Whitefords called a scraper was understandably assigned to that class. It has the appearance of a Harahey knife, and I have so classified it, but the piece actually is unifacially worked (Figure 41c). The steep beveling is all on one face, and the other side has basically no retouch. In this case the knife-like flat surface apparently results from having been fashioned from a tabular piece of Niobrara jasper. The fragment is 41.8 mm long, 31.4 mm wide, and 6.7 mm thick. Since it appears to represent less than half the complete specimen, obviously it is from a large original.

A piece that the Whitefords classified as a point is a complete thin biface of Florence chert (Figure 41d). Its lateral margins are convex and converge to a blunt



Figure 42. End scrapers—Markley House.

tip, and the third edge or base is straight. It is 53.0 mm long, 37.9 mm wide, and 5.5 mm thick.

Drill. One small drill is made on a flake of Florence chert. Its short bit is 8.5 mm long and was formed by steep beveled retouch on each edge of each face. The haft is broken but appears to be simply the retouched remainder of the flake.

Other Biface Fragments. The collection contains two other biface fragments. Neither is listed in the Whiteford catalogue, and neither has a Whiteford catalogue number. One specimen is an edge segment from a thin biface of unidentified, although possibly Florence, chert. The remaining part of the original edge is heavily ground. The other piece is a drill fragment or the narrow portion of some other tool (Figure 40p). It is of Florence chert.

End Scrapers. The Whiteford catalogue listed 39 end scrapers from Markley House, most of them from the floor. Most of the objects that the Whitefords catalogued as scrapers remain in the collection. I have classified some of them differently than did the Whitefords; by the time I finished my sorting, I had placed 32 specimens in the class of end scrapers (Figure 42). Five of these do not have Whiteford catalogue numbers, however, indicating that they may or may not be from this house, although presumably they are from this site. Of the 32 end scrapers, 23 are complete and 9 are missing one end or the other, usually the proximal end. Complete lengths range from 37.7 to 76.8 mm, widths from 19.4 to 29.0 mm, and thicknesses from 5.3 to 13.1 mm. Specimens vary considerably in proportion, however. Twenty-nine are of Florence chert, one is of Niobrara jasper, one is of Flattop chalcedony or at least a purple chalcedony that probably derives from the



Figure 43. Celt—Markley House.

White River Group on the High Plains, and one is of an unidentified chert.

Retouched Flakes. Retouched flakes are not chipped stone artifacts that the Whitefords recognized, but they now are known to be present in almost any house site collection. The Markley House collection contains 18 retouched flakes. The Whitefords called some of these end scrapers, and it is possible that a couple of them were end scraper fragments. The Whitefords also identified some of these specimens as projectile points (Figure 40m-o), but they are not that, nor are they triangular knives. Some of these artifacts are unlabeled and may represent either surface collection pieces or what the Whitefords thought were unmodified debitage. This latter class of material appears in the catalogue, but the assigned lot number does not appear on a single specimen in this largely intact collection.

The 18 retouched flakes include 16 of Florence chert, 1 of a dark purple opaque chalcedony, and 1 of a tan banded chert from an unidentified source. Retouch in most cases is continuous along one or both lateral margins of the tools.

Debitage. As just stated, none of the catalogued pieces of debitage are identifiable in the collection, and I may have reclassified some of the material as retouched flakes. In fact the collection now contains only one piece of debitage. It is a burned flake of Florence chert.

Ground Stone Artifacts

Celt. The one celt that the Whitefords catalogued remains in the collection with its catalogue number written on it (Figure 43). It was collected from the house floor. It is made of dense limestone and measures 6.28 mm long, 40.7 mm wide, and 23.2 mm thick. It probably is broken, in which case the length measurement would underestimate the original size of the object. Both faces have extensive polishing. They converge to an even and well defined bit.

Abraders. One of the truly remarkable aspects of the Markley House collection is the number of abraders it contains. The Whiteford catalogue listed no fewer than 49 abraders from the floor and cache pits (Table 8, see page 39). All of them remain in the collection. Of the total, 35 are formed, grooved shaft abraders (Figure 44; one other is on display at the Kansas Museum of History). All exhibit at least one groove running the length of the specimen; several have one or more additional grooves. Many of these objects are partial. No concerted effort was expended in looking for joins among the fragments, but some casual attempts at refitting produced no matches.

Two other specimens are shaft abraders-in-the-making. They are not still joined, as were the two sets of abraders-in-the-making in Kohr House No. 1. Each is shaped, but neither specimen is yet grooved. On the face where the groove is expected instead are the remnants of the material joining the object to its mate in the manufacturing process. These faces, therefore, were awaiting removal of the last bit of joining sandstone and the subsequent formation of the grooves.

The other 12 abraders are not classic formed, grooved abraders but rather are tabular pieces of sandstone (Figure 45). Overall they were not shaped and were somewhat haphazardly grooved, when grooved at all. They likely were not shaft abraders but rather were used for other abrading tasks.

Hammerstones. The Whitefords identified and catalogued seven hammerstones, six from the house floor and one from Cache 4. All objects remain in the collection. I have only slightly modified the identifications, removing from this class two specimens—one from the floor and the one from Cache 4—that show no battering and adding to it one hammerstone without a Whiteford catalogue number. Thus, the collection contains six hammerstones and two cobbles without battering.

The hammerstones range in size from 52 to 84 mm in maximum dimension. Each shows battering,

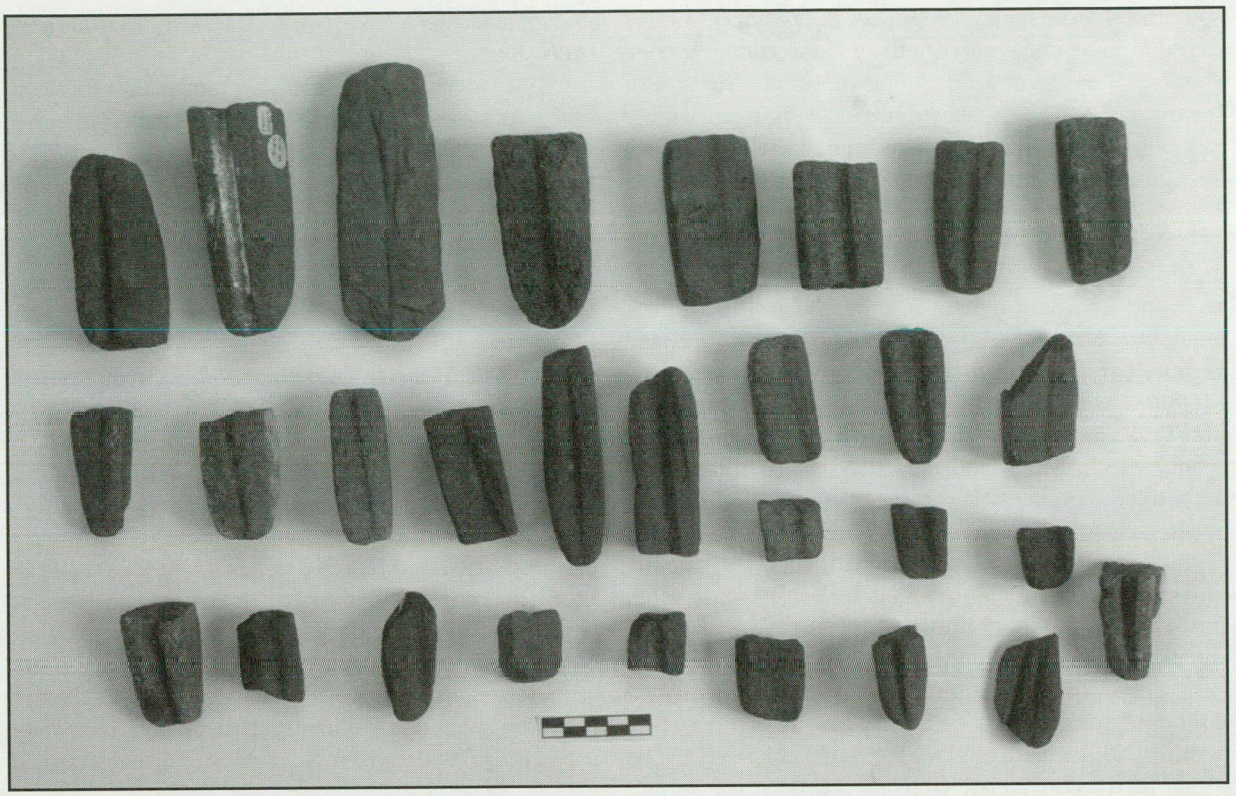


Figure 44. Abraders—Markley House.

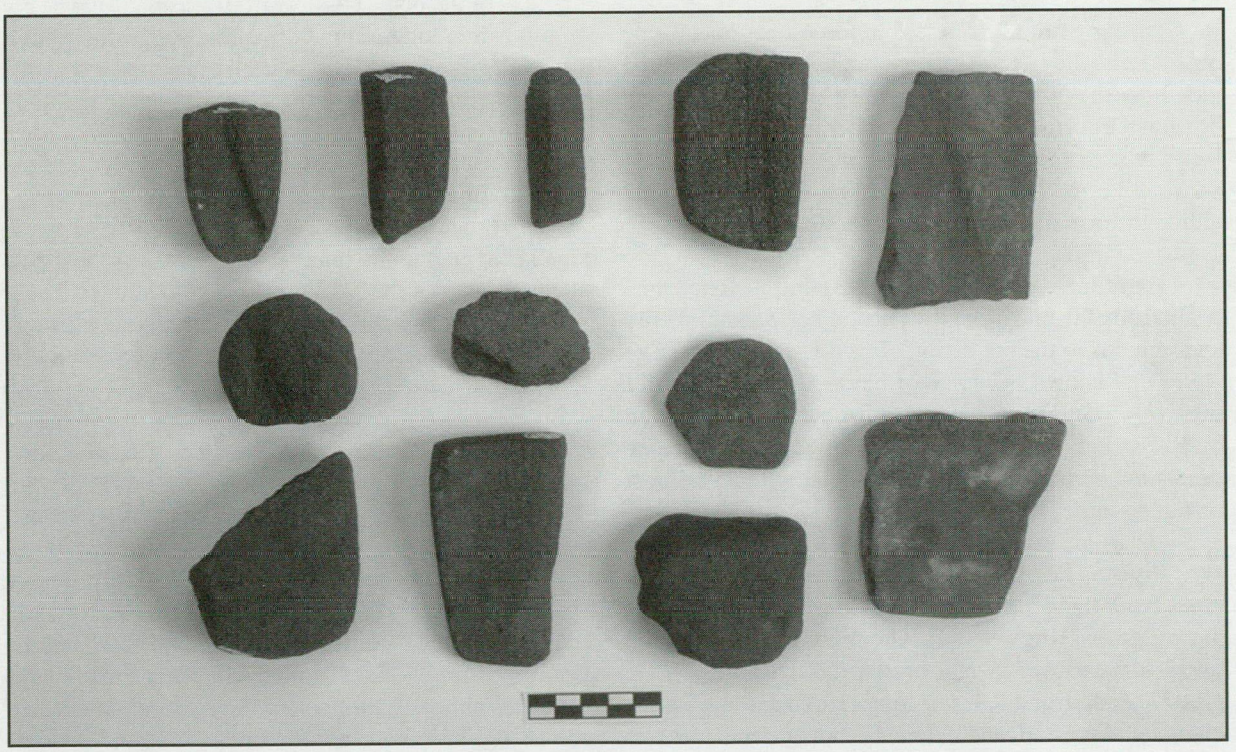


Figure 45. Abraders—Markley House.

sometimes quite heavy, on greater or lesser portions of the edge. The one unmodified cobble would have been suitable as a hammerstone, but it shows no evidence of having been used for that purpose. The split cobble also shows no evidence of battering, although it could have broken while being used as a hammer.

Manos. The Whitefords catalogued three manos or, as they called them, "top stone of grinder." All were from the floor and remain in the collection with their catalogue numbers. All are of Dakota sandstone. One is more or less rectangular in both plan view and cross section. Although not illustrated here, it is similar to and only slightly smaller than the mano from Kohr House No. 1. The Markley House specimen measures 13 x 105 x 39 mm. One surface is unmodified, and the other surface is slightly convex and overall smooth.

A second mano is a fist-sized, flattened cobble. Its basic measurements are 100 x 87 x 50 mm. Both faces are slightly convex and show evidence of grinding use.

The third mano is another more or less fist-sized cobble. It measures 91 x 85 x 51 mm. Its cross section is trapezoidal, making its two faces unequal in size. The larger face is convex and well smoothed from grinding. The smaller face shows no evidence of grinding but does have a pit that measures 19 mm in diameter and 3 mm deep.

"Soap Stone." The Whitefords catalogued one object from the house floor as "soap stone." I have no idea how they arrived at this designation. The object bearing the correct catalogue number is in the collection. It is a tabular piece of limestone, measuring about 106 x 56 x 22 mm. It may have been ground on one edge, although for what purpose is uncertain.

Pigment. The Whiteford catalogue listed one "paint rock" from Cache 4. This object was numbered and remains in the collection. It is a 15.08-gm piece of ochre that shows evidence of having been ground for pigment. The Dakota sandstone formation does contain small pockets of ochre, and this piece retains some sandstone matrix on one edge, indicating that it almost certainly came from this source.

Pipes. The Whiteford catalogue listed two stone pipes from the floor of Markley House; both remain in the collection (Figure 39a). The more complete of the two is the stem of a light brown (5YR6/4) limestone pipe. The stem is 50.9 mm long, 19.1 mm in exterior diameter at the end, and 9.9 mm in bore diameter at this same point. The fragment extends past where the bowl joins it and tapers to a point. The bowl is almost entirely gone.

The second stone pipe is in four pieces that conjoin to form about one-half a bowl of another light brown specimen. The exterior is plain and smooth. A groove encircles the upper part of the bowl just below the smooth lip. The interior is pink, probably from having been smoked.

Bone Artifacts

Hoes. The Whiteford catalogue listed 11 bone hoes in the Markley House collection. Seven of these are from the floor, and the other four are from Cache 4. These objects remain in the collection and are identified by their Whiteford catalogue numbers. They are quite variable, and several probably are not best classified as pieces of hoes. Most, however, are identifiable as modified portions of bison or deer scapulae and probably were used as hoes. They reflect manufacture by removal of the protuberances and spines of the scapula and, in at least one case, perforation of the tool for hafting. These particular specimens are fragmentary, suggesting that they were worn out and discarded tools.

Knives. Three objects were identified as bone knives in the Whiteford catalogue. All remain in the collection. They are a variable group. One small fragment of flat bone, possibly from a scapula, has heavy striations in a longitudinal direction, suggesting that it may well have been used for cutting tasks.

A second piece is a fragment of a large mammal long bone. It was cut and polished and used for uncertain purposes. It now is burned and in poor condition.

The final piece is from a bison tibia. It was fractured and then cut obliquely across the shaft. The cut edge is beveled to the interior. The entire piece is polished on most of the exterior surface. Knife probably is not the proper term for this specimen. It is identical to the class of bone tools that Brown (1981:95-97) called tibia digging bits.

Shaft Straightener. A specimen from Cache 3 that remains in the collection was listed as "rib with hole drilled" (Figure 46). While it is that, it is best called a shaft straightener (Brown 1981:97). It is an approximately 179-mm-long segment of a rib, probably from a bison, with a bi-directionally-drilled perforation. The specimen is broken across the perforation, but the hole is measurable as 12.5-mm in diameter. Small dents or gouges about 27 mm below the perforation on each side of the specimen appear intentional and provide convenient grips for the thumb and forefinger.



Figure 46. Shaft straightener—Markley House.

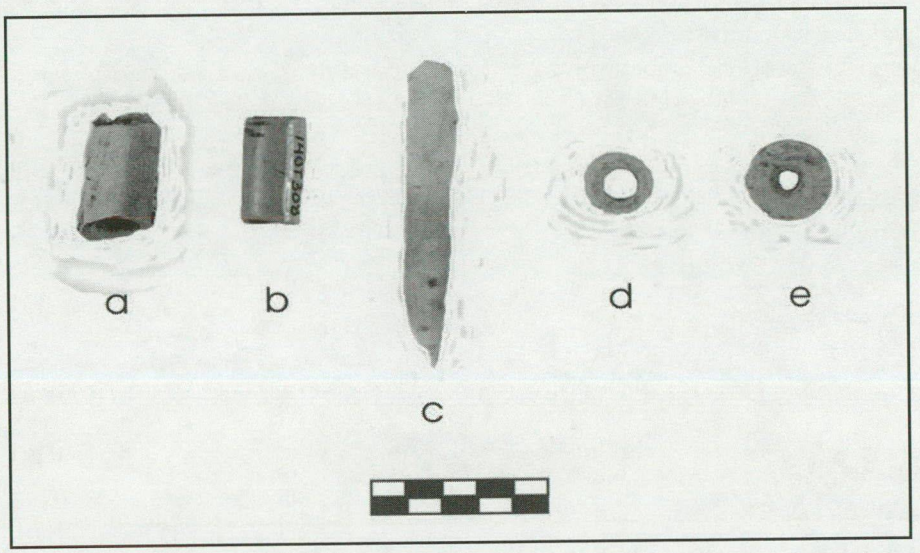


Figure 47. Ornaments: a-b) beads, c) shell pendant, d-e) shell beads—Markley House.

Awls. The Whitefords catalogued six bone "needles" from Markley House. All remain in the collection with their catalogue numbers. They are more properly described as awls or, in at least two cases, polished bone rods. Four are splinter awls made from fragments of mammal or bird long bones. Another is complete; it retains the articular end of the long bone and has a sharp point. The final specimen retains an articular end of a small but solid long bone. The other end is cut transversely with a second short longitudinal cut. While its purpose is not clear, such a piece would be suitable for producing the notches on projectile points (compare Whittaker 1994:149).

Beads. The Whiteford catalogue listed two bone beads from the floor of this house. Both remain in the collection with their Whiteford catalogue numbers still legible. One is a 14.2-mm-long specimen, cut from a bird bone and heavily polished on the ends and exterior (Figure 47b). The other is 16.4 mm long. It was cut from a mammal bone by ringing and snapping (Figure 47a). The ends were not smoothed. This bead is burned to the point of being calcined.

Unmodified Animal Bone. Unmodified animal bone was catalogued from the floor and cache pits of this house. The catalogue entries were mostly indefinite



Figure 48. Shell hoes—Markley House.

as to the quantity of this bone, and the catalogue numbers may or may not have been written on the bones. The collection as it exists today does have a quantity of unmodified animal bone, probably representing selective collection of larger bones. I have not attempted to systematically identify this material, but I have noted that it is a mixture of species, including bison, deer, large bird, and a few smaller animals.

Shell Artifacts

Hoes. The Whiteford catalogue identified eight shell hoes from the Markley House floor. Of these, four are identifiable in the collection (Figure 48). As with the Kohr House No. 1 shell hoes, the specimens from Markley House were made on large, thick shells and were perforated to facilitate hafting.

Beads. The Whiteford catalogue did not list shell beads from Markley House, but two are present in the collection (Figure 47d-e). Neither bears a Whiteford catalogue number, but both were indicated in the KSHS records as having come from 14OT308. The larger bead is 10.7 mm in exterior diameter and 4.1 mm thick with a 2.8-mm-diameter perforation. The smaller specimen is 8.1 mm in diameter and 2.1 mm thick with a 4.1-mm-diameter perforation.

Pendant. A single shell pendant also is present in the collection (Figure 47c) but is neither listed in the

Whiteford catalogue nor labeled with a Whiteford catalogue number. It is probably complete and is 40.2 mm long and 6.2 mm in maximum width. It is not perforated. Shell pendants and beads such as these Markley House specimens occur in some quantity in the Salina Burial Pit (Roper 2002a).

Unmodified Shells. Unmodified mussel shells apparently were abundant in Markley House, and the Whitefords collected and catalogued some of this material. The catalogue listed 68 shells, almost half from Cache 4 and the remainder from the floor or the other three caches (Table 8, see page 39). The collection as we have it, though, contains 81 unmodified mussel shells. I have not attempted to systematically identify them, but I can note that they represent a mixture of species.

Discussion

The Markley House collection is by far the largest of the Whiteford house excavation collections. This is partially due to the Whitefords retaining object classes, particularly ceramic body sherds, retouched flakes or debitage, and unmodified animal bone, that they did not systematically retain in the other houses. Still, this does not fully account for the large collection volume. In fact, the outstanding peculiarity of this house is the sheer number of objects within several artifact classes: a minimum of 64 ceramic vessels represented by rim sections, 32 scrapers, an astounding 49 abraders, and parts of 11 scapula hoes—and, in spite of less selectivity, recovery still was not comprehensive.

There is another, more subtle contrast with Kohr House No. 1: the condition of the artifacts. I noted that Kohr House No. 1 had objects in apparently serviceable condition; the restorable pots, abraders in the process of manufacture, and the unfinished pipe were particularly notable. The Markley House collection, though, seems composed of objects in a more worn-out state. There were no restorable pots, hammerstones were heavily battered (of course, I wonder if one ever really wears out a hammerstone, short of breaking it), abraders were broken, scapula hoes were fragmentary, pipes were finished and broken. The house assemblage, therefore, has more of an aura of a planned abandonment. The quantity of large artifacts not in cache pits might argue against this. However, we do not have any data on the spatial disposition, either horizontally or vertically, of material within the house and house fill; therefore, we cannot evaluate the various possible abandonment scenarios (compare papers in Cameron and Tomka [1993] on house abandonment and debris signatures for different abandonment modes).

Along a different dimension, Markley House has some other peculiarities that may be of some consequence. For one thing the house is circular. This is not the only circular house with Smoky Hill phase pottery (see the Aerhart House section of this paper or Johnson 1973:274). I will have more to say about this in the comparative discussion at the end of this paper. Another thing, though, is the composition of the ceramic assemblage. Much of the material can be accommodated within Hedden's (1992, 1994) Smoky Hill phase pottery typology, but some cannot, and there is the matter of those two Great Bend-style pot handles, assuming they really are from this house. Again, I will discuss this further in the conclusions of this study. For now I will simply note that the Markley House on several grounds seems to be late—perhaps surprisingly late.

Aerhart House

Site Description and Setting

The Aerhart site is now designated by State of Kansas site number 14OT305. It occupies a position [redacted] in the Solomon River valley, on the [redacted] side of the valley, about [redacted] north-northwest of the Minneapolis site (14OT5) and [redacted] of the Markley site (14OT308). No records in either the state site files or the documentation for the Whiteford donation gave any indication of the extent of this site or the number of houses it contained. The records did suggest that 14OT305 was the same site that Floyd Schultz called the Burns site (14OT2), where he excavated one house in 1932. However, this is not correct as the Whitefords' Lamar site (14OT304) was the same as Schultz's Burns site.

The Whitefords excavated one house at the Aerhart site in late summer 1934. A catalogue entry was dated September 1934, but we cannot be certain if that was when the site was excavated or when the collection was catalogued and, if it was the latter, how long after the excavation that the collection was catalogued. Given that it was the chance encounter with the NSHS crew at Paint Creek in about July 1934 that apparently propelled the Whitefords into excavation, the Aerhart House excavation probably was done in August or September 1934.

The site, as plotted in the state site files, is about [redacted] of the river, but the river meanders so heavily in this area that it is entirely possible that the channel was much closer to the site in past times (Figure 49). A second-order stream (as drawn on the 7.5' quadrangle map) flows to the Solomon in a course about [redacted] of the site and was a possible alternative source of water. As plotted, the site appears to be on a [redacted]



Figure 49. Generalized topographic setting of the Aerhart site.

[redacted] Its elevation of [redacted] amsl places it about [redacted] above the river but yet adjacent to and with immediate access to the river bottoms. The valley wall, which here is loess rather than bedrock (Ross 1991), is dissected but rises very gently and is never elevated more than [redacted] feet above the site for over a mile in any direction. Alone among the sites described in this study, the Aerhart site is on an upland soil, the [redacted] a soil formed in [redacted] The site, however, is not far from areas of terrace soil.

Architecture

Three floor plans of Aerhart House 1 exist. Two were sketches in Mabel Whiteford's hand (Figure 50), and the other was a more finished drawing in two versions (one with a legend and one without a legend) in the A. T. Hill papers at the NSHS (Figure 51). There also was a photograph of the completed house (Figure 52). The three drawings and the photograph were entirely consistent with one another in portraying this as a circular, or essentially circular, house with an entryway extending to the south. Inside dimensions shown on Mabel Whiteford's sketch maps indicated that the house measured 28 feet 0 inches along the north-south axis and 28 feet 6 inches along the east-west axis, although a legend on one sketch said that the east-west dimension was 28 feet 9 inches. The entryway was 5 feet long and 5 feet wide, according to the sketch map labels.

The house wall was formed by 19 posts, and the entryway was marked by 2 more posts extending beyond the house perimeter. Diameters and depths of the wall and entryway posts were not separately listed, and the only indication of their size was the notation on the labeled drawing in the A. T. Hill papers, suggesting that the perimeter and entryway posts were 6 inches in diameter and 15-20 inches deep. Assuming that the drawing was accurately scaled, wall post spacings were measured from the drawing and ranged from 2.7 to 6.3 feet with a mean of 4.55 and median of 4.35 feet. Spacing actually was a little more consistent than the range suggested, with the right side posts fairly consistently around 4 feet apart, the back wall posts about 5 to 6

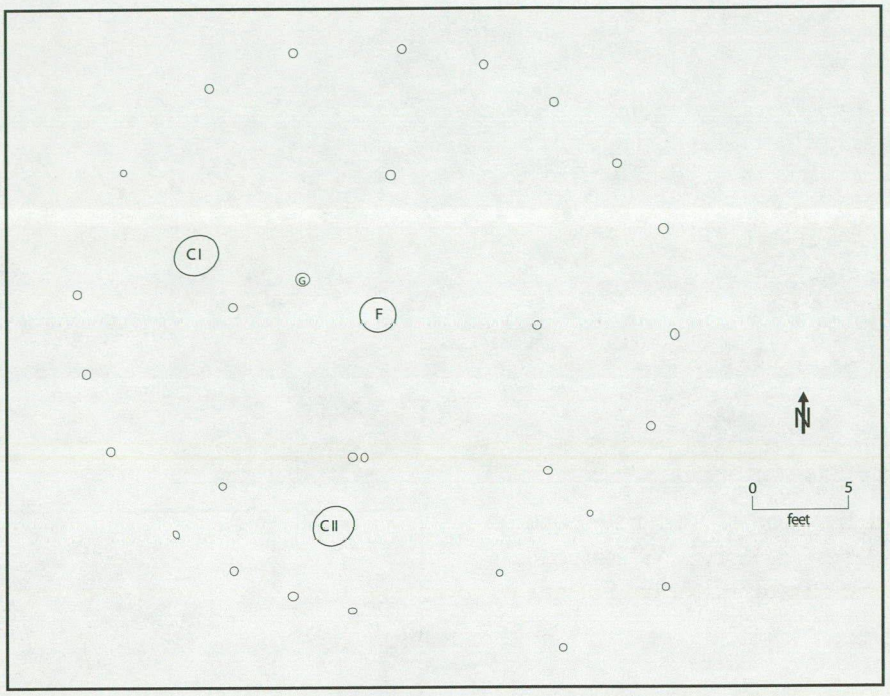


Figure 50. Whiteford floor plan of Aerhart House (redrawn from Whiteford original at Kansas State Historical Society, Topeka).

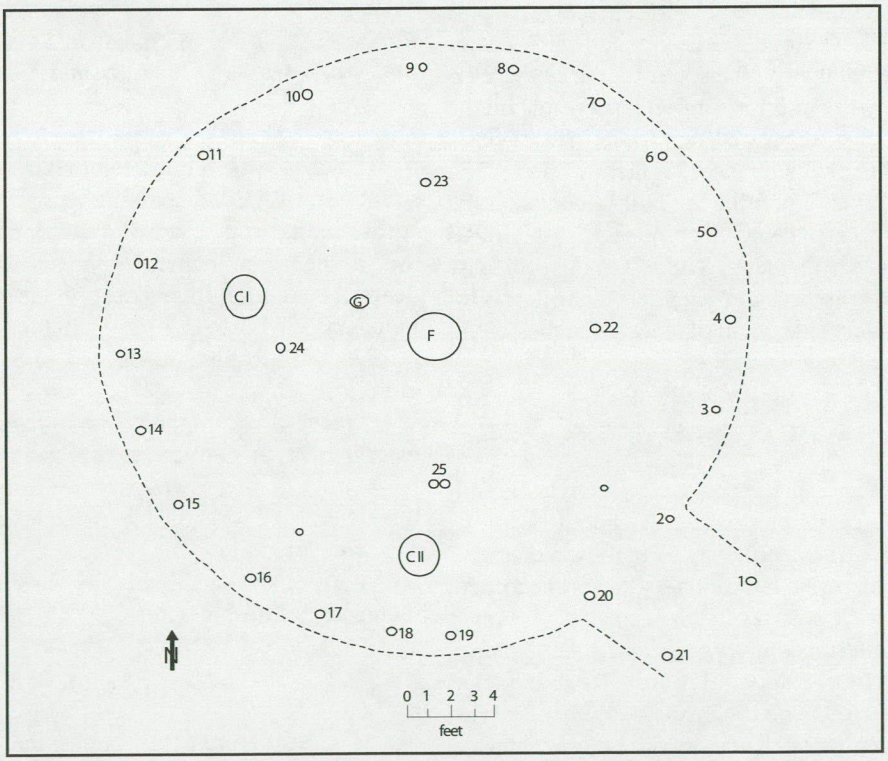


Figure 51. A. T. Hill floor plan of Aerhart House (redrawn from original at Nebraska State Historical Society, Lincoln).

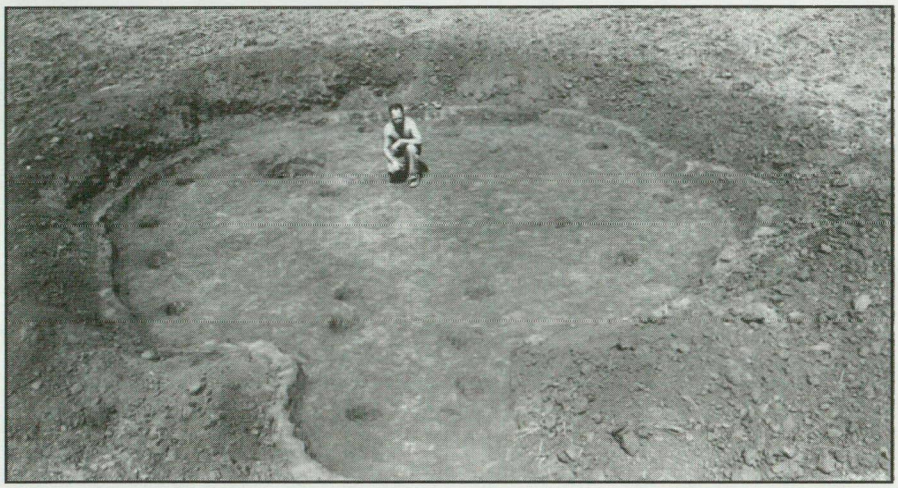


Figure 52. Photograph of Aerhart House (Negative Number 74.46.135, Whiteford Collection, Kansas State Historical Society, Topeka).

feet apart, and the left side posts again around 4 feet apart. Toward the front, spacing became irregular, with the extremes of the range occurring in consecutive spaces toward the left front of the wall perimeter.

The traditional four interior posts were placed at the cardinal directions and were represented by five post molds, two of them (together designated #25) nearly adjacent to one another on the south corner of the rectangle formed by the interior supports. Legends on the Whiteford sketches suggested that these interior posts were 9 inches in diameter and 17 inches deep. The legend on the labeled map in the Hill papers said the same thing for all but the north corner post, which was listed as 12 inches in diameter. The rectangle formed by the interior posts was measured as 10 feet along the northeast and southwest sides, and 10 feet 10 inches along the northwest and southeast sides.

Features

Features other than the post molds include the central hearth, two cache pits, and a "grinding bowl" or "grinding rock." The hearth was 32 inches in diameter and 12 inches deep. No additional data were recorded. The grinding rock was plotted within the rectangle formed by the interior support posts and 3 feet 2 inches west-northwest from the central hearth. It was depicted as roughly circular, but no dimensions or other descriptive data were recorded. If the drawings were accurate and reasonably to scale (and they are at least consistent from one to another), then it might have been about 9 inches in diameter.

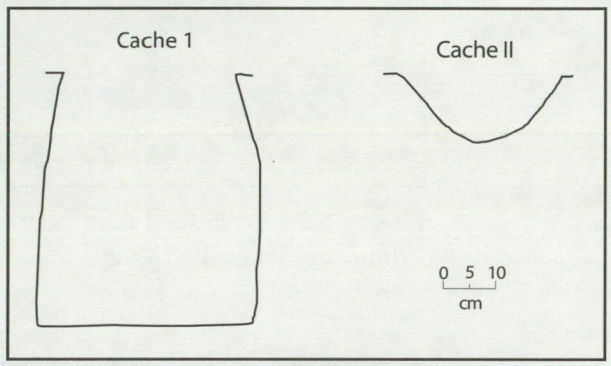


Figure 53. Approximate profiles of Aerhart House cache pits.

Cache I was in the western part of the house, just southwest of the axis passing along the entryway and across the hearth. It was 24 inches in diameter at the top, 30 inches in diameter at the bottom, and 36 inches deep. Its volume, therefore, was about 20,866 cubic inches or 9.7 bushels. The Whitefords did not draw a profile of this feature, but one was approximated as Figure 53a.

Cache II was in the southern part of the house. It was 23 inches in diameter at the top and 10 inches deep. No bottom diameter was listed. From the photograph this shallow pit appeared basin shaped and possibly with a profile something like Figure 53b. If this is reasonably correct, the cache volume was about 2,497 cubic inches or 1.2 bushels.

Collection

The Whiteford catalogue for the Aerhart site collection contained 85 entries. This was their first house excavation and the first collection that they catalogued. They did not list quantities of objects, but few entries

seemed to refer to object lots—rim sherds being the major exception—or indefinite quantity items. As was their practice later, however, the Whitefords used the site and, where applicable, cache pit number codes seen throughout their catalogue. They also wrote the numbers on the artifacts. Table 9 summarizes the collection as catalogued and also lists the contents of the collection as it currently exists at the KSHS. Some discrepancies in frequencies of objects appear because I classified some objects differently than did the Whitefords. This is most apparent with the chipped stone.

Table 9. Catalogued Objects—Aerhart House.

Object Class	Whiteford Catalogue				In Collection
	Floor	Cache I	Cache II	| |	
Pottery				| |	
rim sherds*	1			| |	12**
body sherds	not cataloged			| |	5
whole pot	1			| |	
Projectile points				| |	
notched	5			| |	4+2 frag
triangular	11			| |	5
"arrow"	2			| |	
Flake knives				| |	10
End scrapers	35		1	| |	31
Chipped stone celt	1			| |	
Abrader	1			| |	2
Hammerstone	1			| |	1
"Round sand rock"			1	| |	1
Bone				| |	
hoe	3	1	1	| |	5
needle	4			| |	4
scraper	1			| |	1
bead	1			| |	
unmodified*	2		1	| |	8
Shell				| |	
bead	1			| |	1
hoe	4		1	| |	4
unmodified*	1			| |	41
ornament	1			| |	
Mud dauber nest	2			| |	4
Posthole wood	1			| |	1

* Count of listed lots; quantity of objects in lots not recorded.

** Number of rim sections, some are composed of conjoined sherds.

Pottery

Without having the quantity of rim sherds recorded in the catalogue, we cannot be sure that the collection as it now exists contains all the recovered pottery. The collection otherwise seems to be nearly intact, so we probably do have all or most of it, except for the whole pot listed in the catalogue. The pottery collection is almost entirely rim sherds. Unlike at Kohr House No. 1, where body sherds were collected but not catalogued, apparently most body sherds were not even collected at Aerhart.

The 12 rim sherds listed in Table 9 include 3 that actually are composed of 2 conjoining sherds each, 1 that is composed of three conjoining sherds, and 2 that do not conjoin but almost certainly are from the same vessel. In other words the collection contains 17 rim sherds, representing 11 vessels. Of these, four are identified as Riley Flaring Plain, three as Riley Flaring Tool-Decorated, three as Riley Collared Plain, and one as an example of the unnamed type that Wedel called a "coconut" pot.

The four Riley Flaring Plain vessel rims (Figure 54) come from what seem to have been large and fairly thick pots. Exterior surfaces are cord roughened with varying degrees of smoothing at least to the neck. In three cases cord roughening continues to the lip; the fourth rim is smoothed. Rims are high, measuring 22.5, 23.5, 26.3, and 28.4 mm tall. Lips are overall rounded. No decoration appears on either lips or rims.

The three Riley Flaring Tool-Decorated vessels are similar to the Riley Flaring Plain vessels except for the addition of tool decoration on or near the lip (Figure



Figure 54. Riley Flaring Plain rim sherds—Aerhart House.



Figure 55. Riley Tool-Decorated rim sherds—Aerhart House.

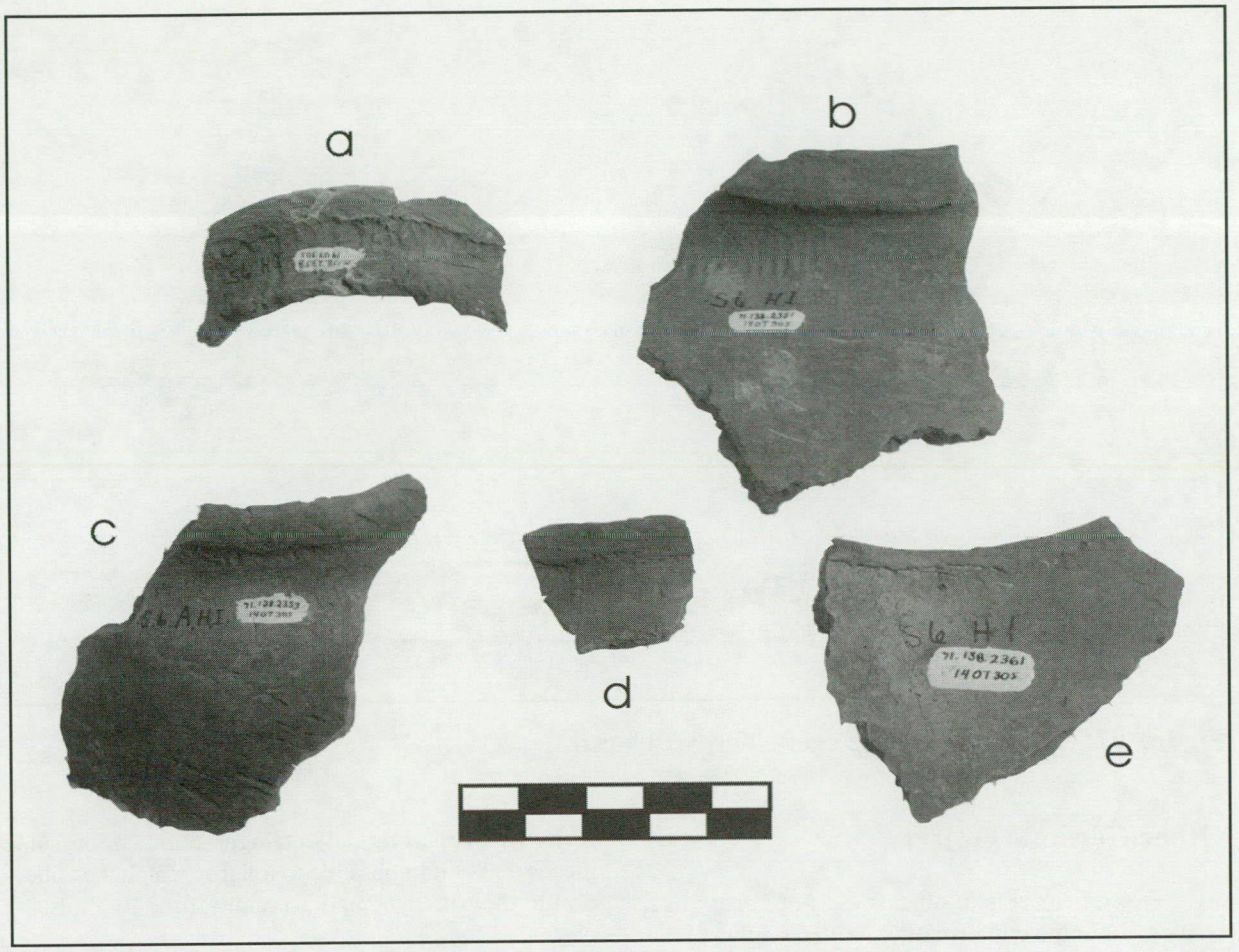


Figure 56. Riley Collared Plain rim sherds—Aerhart House.

55). All three vessels are cord roughened to the lip, and no partial smoothing appears. Lips are flattened and squared off, with some clay pushed over the exterior edges of the lips in all cases. Two lips exhibit left-right tool impressions. Right-left impressions appear on the front edge and upper rim portion of the third of these vessels. Rim heights are 31.4, 32.5, and 35.6 mm.

The Riley Collared Plain vessels are somewhat variable. One of them has a cord-roughened exterior, and cord roughening extends to the base of the collar. The 10.8-mm-high collar is undecorated but is diagonally cord roughened (Figure 56a). The lip is more or less pointed and is undecorated.

The second of these vessels has a smoothed-over-cord-roughened exterior surface (Figure 56b). Its 11.8-mm-high collar has faint traces of depressions paralleling the lip. These do not appear to represent incised decoration, however, and may be the remains of cord-impressions. The lip is flattened and is not decorated.

The third of the Riley Collared Plain vessels is represented by two conjoining sherds (Figure 56c-d). The body was initially deeply cord roughened and then smoothed, but not to the point of completely obliterating the cord marks. The collar is 8.0 mm high and is thin and convex. It, too, was initially cord roughened and then incompletely smoothed. The lip is pointed and undecorated.

The eleventh vessel has a lip but no neck or rim (Figure 56e). Its exterior was smoothed, again probably over initial cord roughening. The lip is rounded with a small roll of clay pushed onto the exterior surface. The vessel is undecorated.

The collection contains only five body sherds, possibly from a single vessel, but not one of the vessels represented by a rim. We have no indication of their provenience within the house. The exterior surfaces are finely cord roughened and undecorated. Thicknesses range from 3.8 to 6.6 mm, with most parts falling in the 4.0 to 4.8 mm range.



Figure 57. Other ceramic objects—Aerhart House.

Other Ceramic Objects

Two other ceramic objects did not appear in the catalogue but have information written on them showing that they came from this house. One is part of a boat-shaped object (Figure 57a), clearly intentionally formed, with a narrow incised groove running most of its length. The function of this object is not certain.

The other piece is an effigy (Figure 57b). A pinched ridge in the center, flanked by shallow punctates—one a slit, the other wider—suggest that this effigy might portray an owl. This probably was a pottery vessel rim-rider, although it could not have come from any rim now represented in the collection.

Chipped Stone Artifacts

As Table 9 shows, the Whitefords catalogued 5 notched points, 11 triangular points, 2 points called only "arrow" with no further description, and 36 end scrapers. Of these 54 objects, 52 remain in the collection. As the last column of the table shows, however, I have classified them somewhat differently, while at the same time understanding why the Whitefords identified the objects as they did. I recognize 4 notched points, 5 triangular points, 2 specimens that probably are fragments of broken notched points, 10 more or less triangular knives, and 31 end scrapers. Less than perfect legibility of the original catalogue numbers on some pieces makes it impossible to reliably match the collection to the catalogue and account for the two missing pieces.

Projectile Points. The four notched points are all rather different from one another (Figure 58h-k). All are side notched and have overall triangular blades. Two have concave bases, and two have straight bases. All are Florence chert. Two additional specimens, also of Florence chert, probably are the blades of side-notched points broken above the shoulders.

The five triangular points, each called "three point arrow" in the Whiteford catalogue, are small specimens with overall straight bases and lateral margins, and corners varying from pointed to sub-rounded (Figure 58b, d-g). Four of the five are Florence chert; the fifth is a pinkish homogeneous chert that may be heat-treated Tahlequah chert.

Knives. Ten objects probably are best called knives. They include several specimens that the Whitefords called triangular points ("three point arrows") and several that they identified as scrapers. However, the former are large for projectile points. The latter were probably called scrapers because the bases of the specimens are convex and meet the lateral margins at rounded points of juncture, but they do not have the

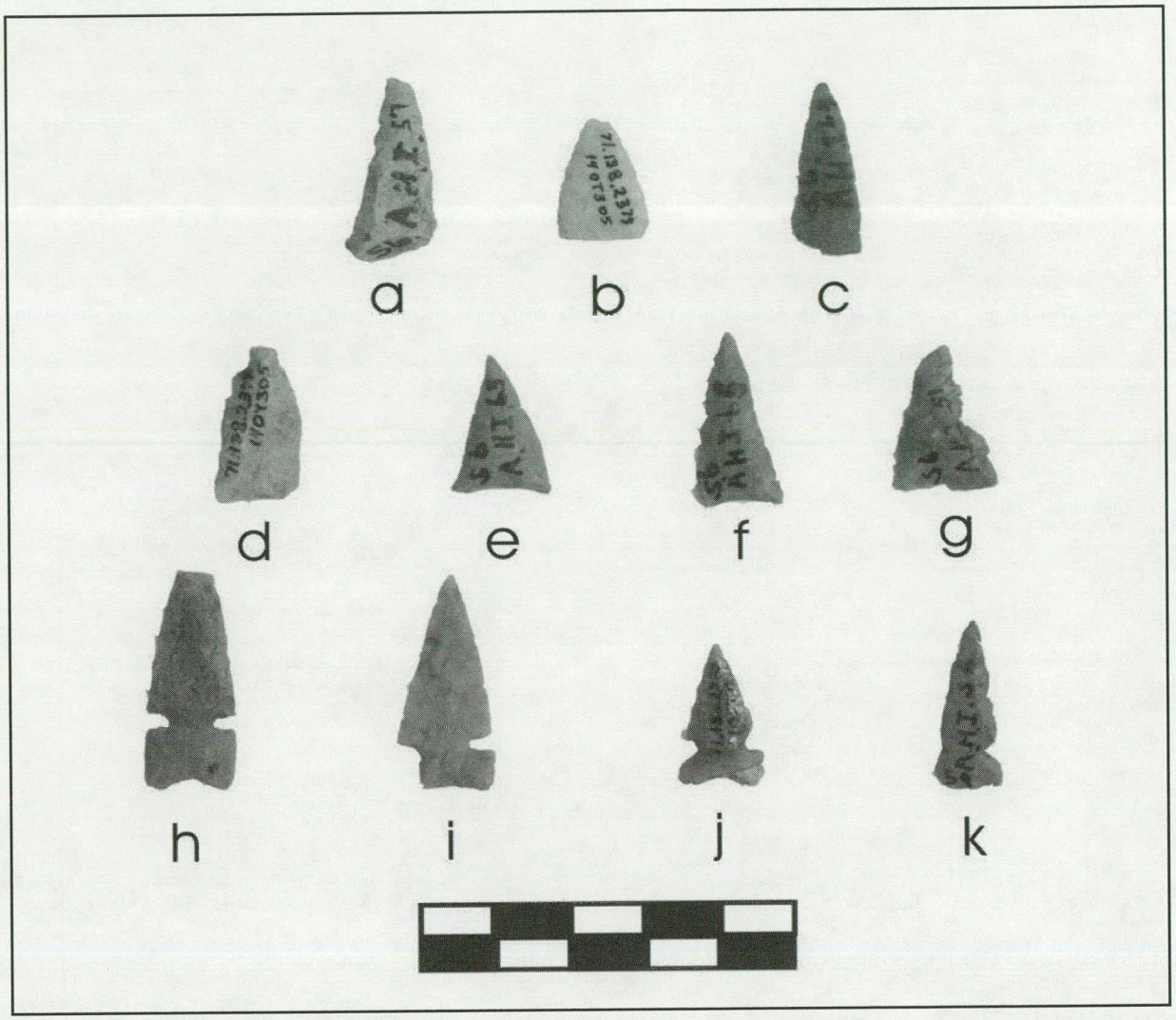


Figure 58. Projectile points—Aerhart House.

steep unifacial working edges of scrapers. All specimens are bifacially retouched, although sometimes not very extensively. These pieces probably represent expedient cutting or general purpose tools, basically made on large flakes.

End Scrapers. In spite of my reclassification of some of the objects that the Whitefords catalogued as scrapers, the collection still contains 31 end scrapers, all but one of which are complete (Figure 59). Lengths vary from 25.9 to 75.1 mm, widths from 18.1 to 30.4 mm, and thicknesses from 5.4 to 13.6 mm. All were made of Florence chert. There is some variation in proportion and also a tendency for most specimens to be in the 20–25-mm width range, despite the fact that the longest specimen is nearly three times as long as the shortest specimen (Figure 60). Scrapers probably were periodically resharpened at the distal or working end, an act that would tend to shorten but not necessarily narrow them. This could enhance a perception that scrapers probably were manufactured on relatively uniform blade-like flakes.

Celt. The Whitefords catalogued one object as a "part of flint ax," a term I recast as chipped stone celt. I cannot identify this object in the collection, either by catalogue number or by form. We have no other information about it.

Ground Stone Artifacts

Abraders. One grooved abrader is two conjoining segments that together comprise the entire object (Figure 61a). It was made of Dakota sandstone and measures

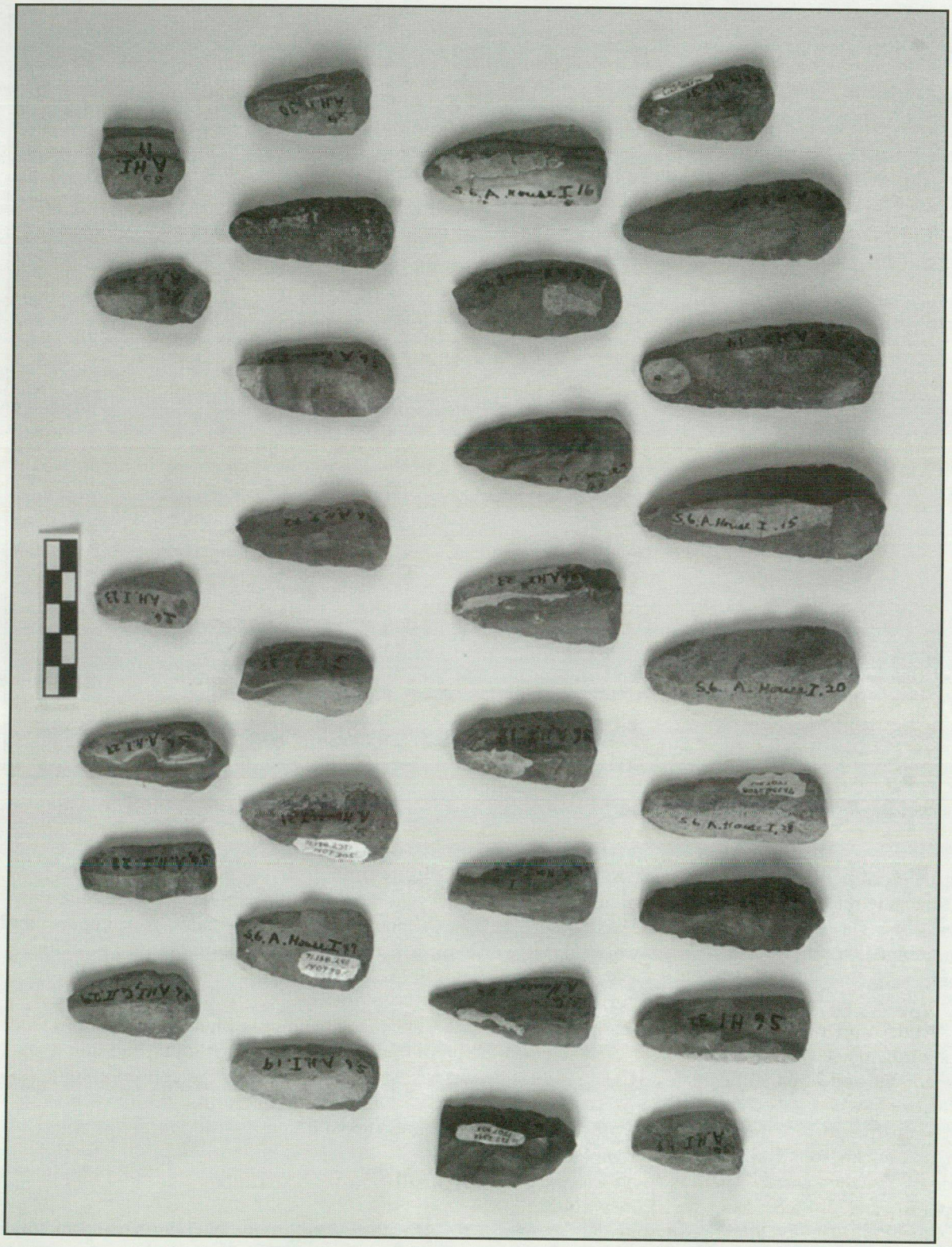


Figure 59. Endscrapers—Aerhart House.

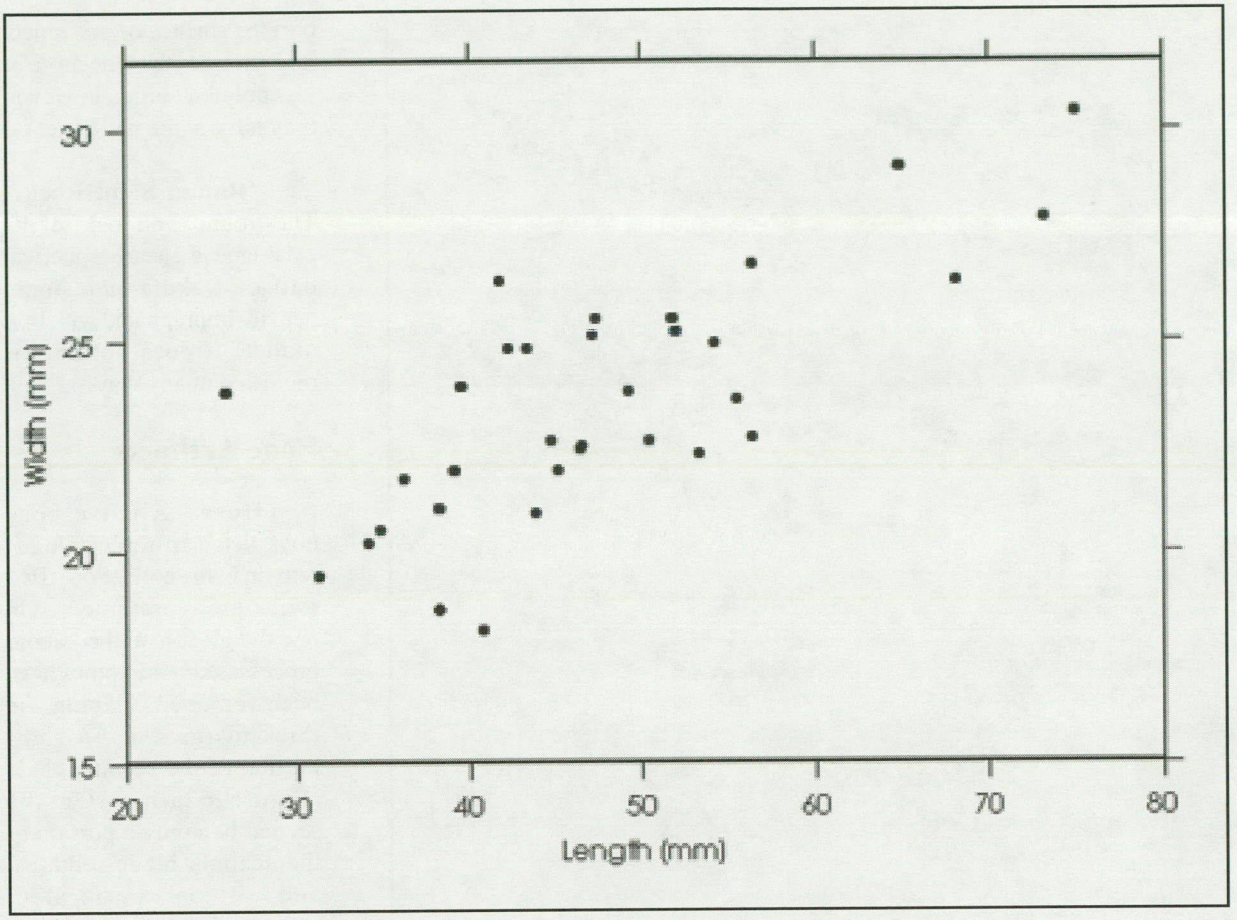


Figure 60. End scraper length versus width—Aerhart House.



Figure 61. Abraders—Aerhart House.

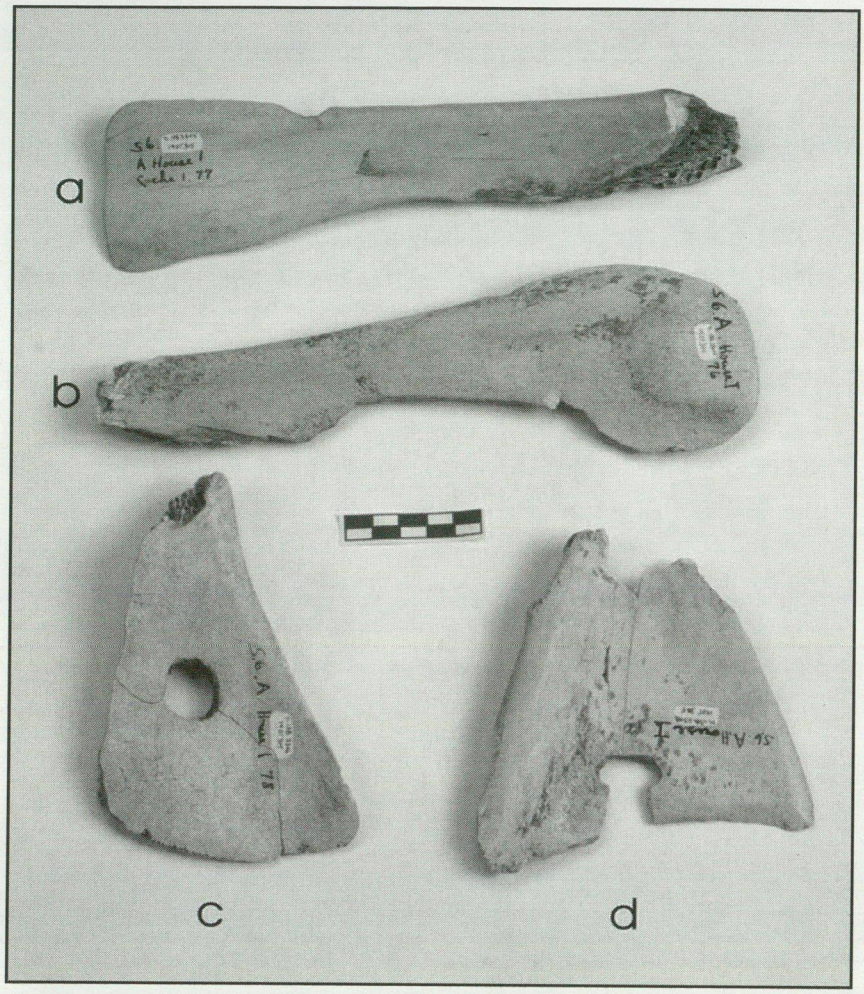


Figure 62. Scapula hoes—Aerhart House.

108.7 mm long and 35.7 mm wide. Abraders often were shaped to a regular parallelogram-shaped cross section with the groove on the widest face, but this specimen, while partially formed, is irregular, with a U-shaped groove running the length of one face. Several additional shallow grooves run part of the length of the sides of the artifact.

A second abrader is a tabular piece of Dakota sandstone (Figure 61b). It is more or less D-shaped in plan view and measures 104.6 mm long, 43.4 mm in maximum wide, and 15.2 mm thick. The faces are unaltered, but the edge is modified all around. The convex part of the D is ground smooth, while the straight edge has a U-shaped groove running its entire length. This is a complete artifact.

Hammerstone. A single fist-sized cobble in the collection probably is the object identified as a hammerstone in the Whiteford catalogue. For the most part the surface of this object is worn smooth. One more or less pointed corner, however, may have some battering.

"Round Sand Rock." The "round sand rock" of the catalogue is a nearly spherical ball of Dakota sandstone, heavily impregnated with iron oxide. It does not appear modified in any way.

Bone Artifacts

Hoes. All five bone hoes listed in the catalogue remain in the collection. Two forms are represented. On one the glenoid and coracoid processes and the spines have been removed, leaving the thick margins and a short portion of the scapula blade (Figure 62a-b). On the second hoe only a portion of the scapula blade remains, and it is perforated, presumably to facilitate hafting (Figure 62c-d).

"**Needles**." All four bone objects that the Whitefords called "needles" remain in the collection; however, I would not call any of them needles. One is a short (53.7 mm long) but complete splinter awl (Figure 63c). A second 82.4-mm-long piece probably is the medial portion of a broken awl (Figure 63b). A third piece, 52.0 mm long and broken at each end, is a medial section of a polished bone rod (Figure 63f). The fourth is an antler, probably deer, that appears unmodified but is damaged at the distal end and perhaps was a flaker (Figure 63h).

Scraper. A piece identified in the catalogue as a bone scraper remains in the collection. It is a flat piece, probably from a scapula blade, that is about the size and shape of a chipped stone end scraper (Figure 63e). Its rounded end is deliberately beveled, as on an end scraper, and the wear is similar also.

Bead. The single bone bead listed in the catalogue is not in the collection as it currently exists.



Figure 63. Bone objects—Aerhart House.

Unmodified Bone and Teeth. Three catalogue entries cover unmodified animal bone but do not specify how much bone there should be. The collection contains three pieces identified in the catalogue as "vertebras," but which are actually bison toe and ankle bones from Cache II. The object with the catalogue number corresponding to an entry reading "large teeth" is a single bison tooth. It is possible, of course, that more were recovered. Another catalogue entry reads "curved bones." The only object with this catalogue number is a partial and possibly modified rib of an unidentified small animal. Three other pieces are not labeled. All are burned black to the point of being partially calcined in one instance. Two are antler pieces, and one is from a metapodial. This last might have been cut, but otherwise these pieces are unmodified.

Shell Artifacts

Bead. A single shell bead, listed in the catalogue as "snail shell bead," remains in the collection. It is indeed a gastropod shell, and it does have a perforation, but whether the perforation was deliberate or accidental is not particularly clear.

Hoes. Four shells identified as hoes in the Whiteford catalogue are still in the collection, but only two of them actually are perforated in the manner of shell hoes from other sites described in this paper. Each is a *Megalonaias giganta* or Washboard mussel shell, altered as are similar specimens from other sites.

Unmodified Shells. "Clam shells" appeared as a single catalogue entry without a quantity. The collection



Figure 64. Shell ornament—Aerhart House (Negative Number 74.46.132, Whiteford Collection, Kansas State Historical Society, Topeka).

contains 41 unmodified mussel shells, representing a variety of species.

Ornament. The collection as it now exists does not contain an ornament. However, we know on other grounds that an effigy pendant, cut from a mussel shell, was recovered from one of the cache pits; presumably this is the "ornament" listed in the catalogue as coming from Cache II. So unique is this object that it served as the cover art for both editions of the Whitefords' (1937, 1941) booklet on Kohr House No. 1 and the burial pit, even though it was not from either of those sites, nor was the Aerhart site otherwise mentioned in the booklet. A legend on the card for KSHS photograph 74.46.132 (Figure 64) said that the pendant was given to Herschel Logan in gratitude for his assistance with the booklet. Logan (1941) subsequently published a brief note about this object, describing the circumstances of its finding but not the object itself.

The pendant now can be described only from the photograph. No scale was included, but Logan's (1941:96) article contained what was said to be an "actual size reproduction." Measuring from this photograph, the pendant was about 33 mm tall and 35 mm wide. Whether it was intact cannot be reliably determined, but there was an indication that it might not have been. In his somewhat romanticized account, Logan (1941:96) queried, "Was it placed there [on the bottom of the pit] by its proud owner after the leather thongs to hold it around her neck had worn through its eye?" This phrase, to which I have added emphasis, might imply breakage across the open perforation at the top of the pendant. Close inspection of the photograph reveals some damage on the left side of the perforation in particular. Logan seemed to regard this object as representing a thunderbird. This is a possible interpretation, but other interpretations also are plausible.

Other Objects

Mud Dauber Nest. Two listings of mud dauber nests in the catalogue apparently referred to the four nests or fragments of nests in the collection. All were from the floor of this house.

Posthole Wood. The posthole wood mentioned in the catalogue is still in the collection in the original paper bag. No indication is given on the bag, catalogue entry, or map as to which post mold this wood came from. The wood in the bag is decayed but not charred. It is identifiable but has not yet been identified.

Discussion

The Aerhart House was the first Whiteford-excavated house. Collection was undoubtedly selective, as it was in all houses they excavated—and in houses excavated by anyone for the next several decades. If we can assume that the Whitefords' collection procedure was somewhat more selective than at Markley House but probably not markedly different than at the Kohr site houses, then the Aerhart site collection is neither notably large nor notably small. Perhaps the most outstanding characteristic is the large number of scrapers that it yielded. In fact the number is virtually equivalent to the number of scrapers in the Markley House collection.

The Aerhart House, like the Markley House, was circular. The pottery is readily accommodated within the Smoky Hill phase pottery typology, but I could not escape the feeling as I worked with it that it seemed to sometimes anticipate Great Bend pottery. Once again, I would guess on several grounds that the Aerhart House might be fairly late.



Figure 65. Generalized topographic setting of the Lamar site.

Lamar House

Site Description and Setting

The site containing what the Whitefords designated as the Lamar House is numbered 14OT304 in the state site files. This site is in the [redacted] valley, a short distance below [redacted] Township about [redacted] southwest of the town of [redacted] and [redacted] in [redacted] County (Figure 2). Judging from the legal location and other available information, it appears to be the same site as Schultz's Burns site (14OT2). It is at least in the same half-section as the Burns site and, therefore, very near it. A house map in Guy Whiteford's hand had an inset of the quarter-section containing the site, showing it to be composed of two houses. If the plotting was precise, then the two houses were about 80 or so feet apart with the closer of the two (House 1) about [redacted] of a bend in the creek.

Pipe Creek is incised into the Dakota sandstone for much of its length. Its course is sinuous, and it broadly moves from one side of its valley to the other. The valley rarely widens to more than about 1/2 mile and occasionally is less than 1/4 mile. About 10 1/2 miles above its confluence with the Solomon River, the stream flows along the north edge of its valley at the base of its north bluff, and there is a fairly broad exposure of terrace on the south side of the creek. The Lamar site lies on this terrace exposure about [redacted] The elevation at the front edge of the terrace is [redacted] feet amsl. The toe slope of the southeast valley wall of Pipe Creek is at least [redacted] feet to the [redacted] (Figure 65). Above the [redacted] however, the valley wall rises relatively rapidly to a high point about [redacted] above the [redacted] some [redacted] southeast of the site. The soil series mapped for this part of the terrace is the [redacted] (Atkinson and Grimwood 1980:sheet [redacted]).

The Whitefords excavated House 1 in the summer

of 1935. Unfortunately, they had some unsolicited and unwanted assistance, as Guy Whiteford reported in a spring 1936 letter to A. T. Hill:

> The house site we were working on last summer was destroyed by someone before we were able to finish it. They dug some very nice trenches through the caches, and just tore the whole place up. We had found what I took to be a grass lined cache, but our industrious helper had dug a trench through this cache making it impossible to tell anything about it. (G. L. Whiteford to A. T. Hill, letter, 24 March 1936, A. T. Hill Papers, Nebraska State Historical Society, Lincoln).

The excavation must have been nearly complete when the vandalism occurred, though, for the records from the site included a complete floor plan that showed the walls, entryway, interior support posts, central hearth, and cache pits. Whiteford's letter to Hill said that they "took some pictures of the house site that are not much good," and his assessment of the photograph quality was correct. The Whiteford photograph donation to the KSHS contained only one image from the Lamar House, and it was neither good nor helpful. The artifact collection also is limited.

Architecture

The Lamar House was a trapezoidal, although almost square, structure, oriented north-south by east-west, with an entryway extending to the south (Figure 66). The Whiteford floor plan listed the dimensions as follows: north (back) wall, 28 feet 11 inches; west (left side) wall, 28 feet 3 inches; east (right side) wall, 27 feet 8 inches; south (front) wall, 29 feet 8 inches; west (left) side of entryway, 10 feet 2 inches; and east (right) side of entryway, 10 feet 6 inches. These were outside dimensions, however, and they overestimated the floor area within the house. Remeasuring the dimensions from the scaled drawing suggested that the north-south dimension (the house length) was about 27 feet 2 inches, give or take an inch or two, and the east-west dimension (the house width) was about 28 feet 3 inches, give or take an inch or two. The entryway appeared to have been accurately centered on the front wall and to have extended only 8 feet beyond the front outer wall. The entryway width was recorded by the Whitefords and also was drawn on the map as 42 inches.

The house wall was represented by 24 post molds, numbered 1 through 24, on the house floor plan. The northeast and southwest corners were squared, while the northwest and southeast corners were subrectangular. Wall post mold diameters ranged from 8 to 15 inches with a mean of 11.9 and median of 13 inches (Table 10). The diameter of post 16 was not listed. Depths ranged from 9 to 20 inches with a mean of 14.8 inches and median of 14 inches. Wall post spacing was measured from the drawing as ranging from 2 to 6.5 feet with a mean of 4.6 feet and median spacing of 5 feet. These are aggregate statistics, however. Post spacings at the two subrectangular corners were 2 and 2.5 feet, and only one other post spacing was less than 4 feet. Back wall posts were spaced 5 to 6 feet apart with a median of 5 feet. Side wall posts were spaced 5 to 5.5 feet apart on the left side (median = 5 feet) and 3 to 6.5 feet apart on the left side (median = 4, with only one post spacing more than 4.5 feet). Front post spacing ranged from 4 to 6 feet with a median of 4.5 feet, but the posts on the left side of the front were spaced at 4- to 4.5-foot intervals, while posts on the right side of the front were spaced at intervals of 5 and 6 feet.

Nine more posts were found inside the house. Four of them, labeled A, B, D, and E, were the interior support posts. They ranged from 13 to 15 inches in diameter and from 26.5 to 33 inches in depth. The other five posts parallel, or more or less parallel, the south (posts F and H) and east (posts 25–27) walls. These were smaller posts, ranging from 7 to 11 (median = 10) inches in diameter and 10 to 20 (median = 15) inches in depth. Of uncertain function, they may have been interior facilities, such as a wind baffle or beds. Six more posts, I–N, aligned with wall posts 1 and 24 to form the entryway. Dimensions were given for only three of these posts and range from 7 to 10 inches in diameter and 9 to 16 inches in depth. No post C appeared on the Whitefords' map.

Features

The Lamar House contained, in addition to post molds and the house floor, a central hearth, four cache pits, and two grinding stones. We have no information concerning the central hearth, other than the notation on the Whiteford map that it was 36 inches in diameter, 8 inches deep, and filled with wood ash. Nor do we have any information for the two grinding stones, other than their plotted locations (Figure 66). They were not drawn to scale on the house map.

Cache pit dimensions also were incomplete (Table 11). Top diameters were recorded for all four cache pits, depths for only three of them, and bottom diameters not at all. Therefore, it was impossible to draw approximate profiles or to calculate volumes. Additional data were available for only two pits. A post mold, measuring 7½ inches in diameter, was recorded

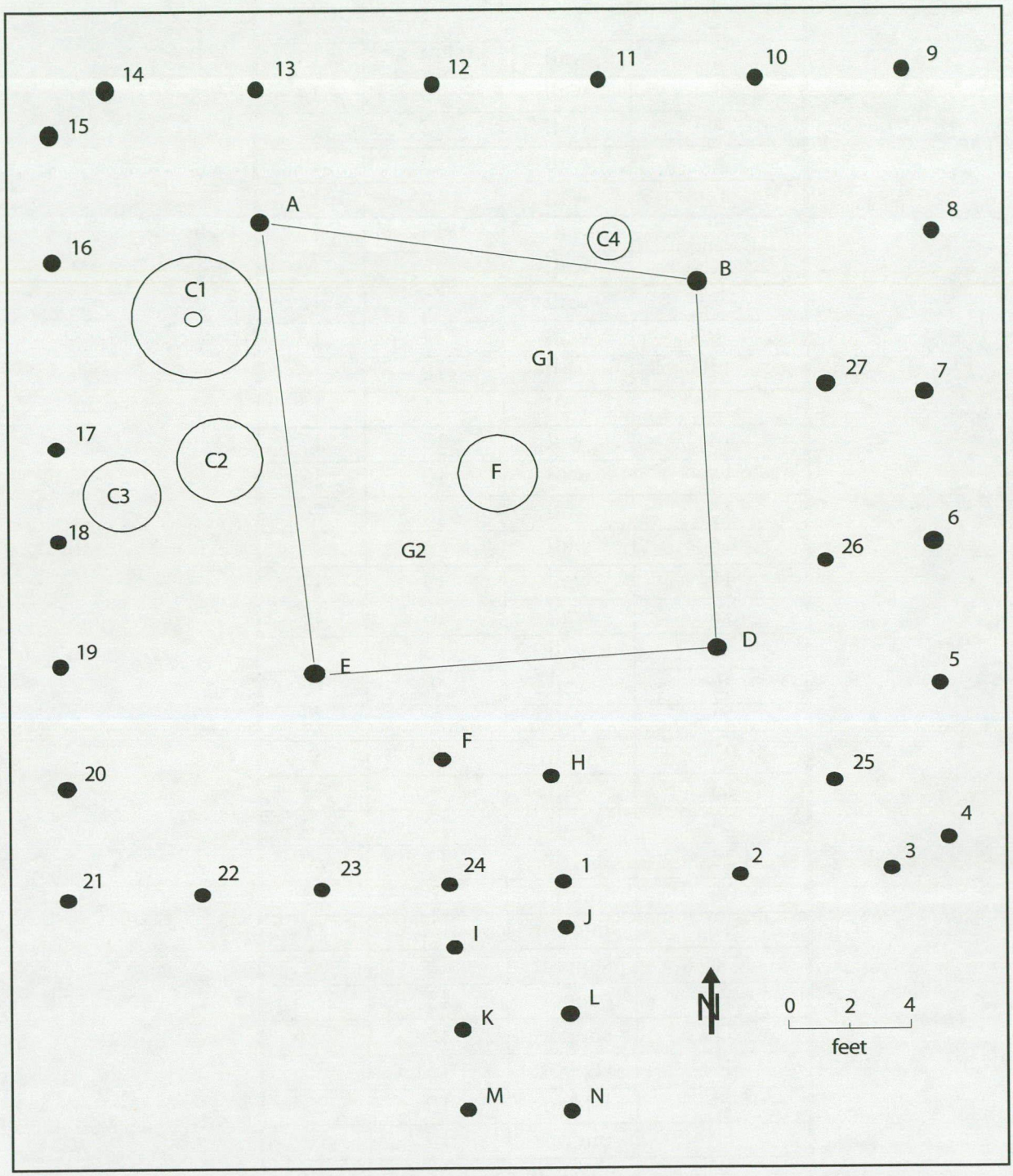


Figure 66. Whiteford floor plan of Lamar House (redrawn from Whiteford original at Kansas State Historical Society, Topeka).

Table 10. Post Mold Data from Lamar House.

Post Number	Position	Diameter	Depth
1	wall	14	13
2	wall	13	13
3	wall	13	14
4	wall	13	15
5	wall	13	14
6	wall	14	15
7	wall	14	20
8	wall	15	16
9	wall	12	18
10	wall	12	15
11	wall	10	16
12	wall	11	14
13	wall	10	17
14	wall	10	18
15	wall	14	20
16	wall		
17	wall	13	14
18	wall	13	15
19	wall	13	14
20	wall	9	10
21	wall	9	14
22	wall	8	9
23	wall	8	13
24	wall	12	14
25	interior	11	20
26	interior	7	15
27	interior	7	11
A	support	15	32
B	support	13	26.5
D	support	15	26.5
E	support	15	33
F	interior	10	20
H	interior	10	10
I	entryway	8	10
J	entryway	10	16
K	entryway		
L	entryway	7	9

Table 11. Cache Pit Data from Lamar House.

Cache Number	Diameter Top	Bottom	Depth
C1	54	ng	23
C2	44	ng	48
C3	39	ng	ng
C4	15	ng	11
ng = not given			

in the center of the bottom of Cache 1. Cache 3 was the pit that Guy Whiteford referred to when he told A. T. Hill that he thought one of the caches in the house was grass lined. While grass lining is possible, in the bottom of cache pits I have observed what appeared to be fiber but was identified as vascular bundle fragments from monocot stems of willow or cottonwood twigs (Puseman 1996:276).

Collection

The Whiteford catalogue for the Lamar House listed 39 objects (Table 12), composing an assemblage that was small and limited but entirely characteristic of Smoky Hill phase house sites. Only 6 of these 39 artifacts, the 3 abraders and the 3 fish hooks, were in the 1971 Whiteford Collection donation to the KSHS. Of these, two fish hooks are in a Kansas History Museum exhibit where they can be viewed but not closely examined or measured.

Each of the three abraders probably represents less than one-half of the original specimen, although each also retains one end of the original specimen. The original specimens must have been fairly long, though, since the lengths of the fragments range from 58.6 to 89.9 mm. All were made of Dakota sandstone, and all have straight grooves running along one or both faces and one edge. Two specimens were grooved on both faces and one edge. On one specimen both face grooves are faint, and the edge groove is 9.5 mm wide and 2.4 mm deep. On the second specimen one face groove is 10.8 mm wide and 1.7 mm deep, the other is faint, and the prominent edge groove is 9.2 mm wide and 2.3 mm deep. The final specimen is a boat-shaped abrader with a prominent groove, measuring 11.4 mm wide and 2.4 mm deep, on the top face; an edge groove measures 7.4 mm long and 1.6 mm deep.

The one fish hook available for study is a complete specimen made of bone. It is J-shaped with a very sharp point, no barb, and two parallel grooves at the top of the shank. Overall length is 32.05 mm. The two specimens on exhibit are complete. They also are J-shaped, without barbs, and apparently not incised on the shank. The overall size of each is similar to that of the measured specimen.

Table 12. Catalogued Objects from Lamar House.

Class		Frequency
Pottery		
	vessels	1
	rim sherds	3
	"cut circular piece pottery"	1
Chipped stone		
	projectile points	9
	drill	1
	scrapers	6
Ground stone		
	abraders	3
Bone artifacts		
	scapula hoe	1
	needle	5
	scraper?	1
	fishhooks	3
Shell artifacts		
	modified mussel shell	2
	snail shell beads	2
Botanical		
	corn (vial)	1

Discussion

Even without the loss of some specimens prior to the collection's donation to the KSHS, the Lamar House assemblage obviously was limited in quantity, although

showing a diversity characteristic of Smoky Hill phase houses. This might suggest a fairly short occupation. The house plan showed no signs of rebuilding or repair, and this, too, is consistent with a short occupation. In this case the number of cache pits is remarkable.

Lindeman Site

Another Saline County Smoky Hill phase locality at which the Whitefords excavated was what they called the Lindeman site. A note with the collections list that the Whitefords sent to the KSHS at the time of the 1971 donation said that the site was "east of Smoky River [sic], on south side of road, east of Assaria, Kansas." It is thought to be 14SA412, a site officially recorded and numbered in 1968 and whose plotted location matched the description of the Lindeman site location (Figure 2). The Whitefords had a set of 1:125,000 topographic maps, now at the KSHS, on which they plotted the sites that they knew. There was no plotted site at the location of 14SA412, but neither did any other location plotted on those maps match the verbal description of the Lindeman site.

The site very possibly contained at least two houses, but that was not what the Whitefords excavated. Instead, they excavated a single burial. When they did this is not certain. The 1941 edition of their booklet mentioned that they had "recently" excavated "an adult skeleton, with the fragile remains of an infant ... no artifacts were found with the skeletal remains ..." (Whiteford 1941:19). Since this is not mentioned in the earlier edition of the booklet and since a comparison is made with the remains in the burial pit, the excavation presumably was between 1937 and late 1940 or early 1941. Although the description of this burial as "in the south central part of the County" (Whiteford 1941:19) was consistent with the Assaria skeleton, it was not exactly consistent with the note accompanying the collection. That note read, "One skeleton uncovered, a few artifacts. Skeleton photographed and covered up." The Whiteford donation photograph collection contained two photographs of an adult skeleton with a number of objects in the thoracic region. It was not quite possible to tell what these objects were—they did not appear to represent infant bones, and they seemed rather large for "a few artifacts," but that might depend on what the artifacts were. Regardless of whether it was the site mentioned in the booklet and whether this really is 14SA412, the photograph caption said that this was the skeleton from the Lindeman farm.

The skeleton, as the Whitefords noted, was never removed from the ground and was reburied after excavation. A description, therefore, must be done entirely from the two available photographs.

Table 13. Objects from Lindeman Site.

Object class	Frequency
Pot - restored	1
Sherds	5
"Form clay"	1
Side-notched point	1
Triangular points	2
End scrapers	3
Abraders	3
Hammerstone	1
"Paint rock"	1
Bone awl	3
Shell beads	6
Shell pendant	1
Human teeth	6

While this skeleton was that of an adult, a more-precise age and a sex determination could not be made. The skull was crushed and may have been incomplete. Post-cranial elements appeared to include, but were not necessarily limited to, some ribs; lumbar vertebrae; both humeri, radii, and ulnae; the pelvis, possibly reasonably intact; both femora; the right tibia and fibula; possibly the left tibia and fibula as well, although they were beneath the right leg and may not have been completely exposed; the right foot; and at least part of the left foot.

The body was laid on its left side. The legs were flexed and drawn up at a right angle to the torso. The right arm was down by the side. The left one probably was in this position also, although the humerus was out of position. No north arrow appeared in the photograph, but from the position of a few small shadows (of tools propped up against the side of the shallow excavation), it appeared that the body might have been laid with the head either to the east facing south or more to the south facing in a westerly direction, depending on the time of day the photograph was taken.

Collection

The Lindeman site was not one of the 12 numbered sites in the Whiteford collection catalogue ledger. Mabel Whiteford's list of the collection contents, though, listed 34 objects from this site (Table 13). The

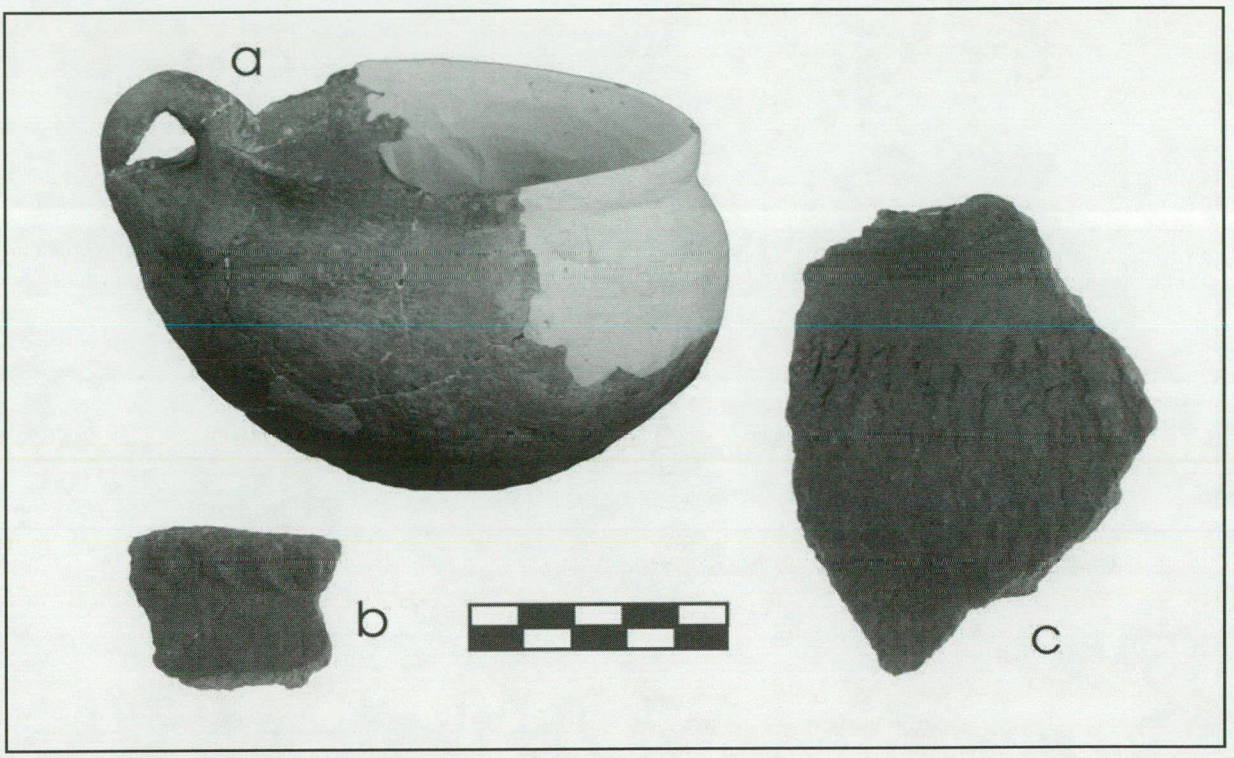


Figure 67. Pottery—Lindeman site.

collection, as catalogued at the KSHS, contained 34 objects including 6 human teeth. However, the list appeared slightly different, probably because of different standards for naming objects. The collection now contains 28 of these objects. The six human teeth were assigned Kansas Unmarked Burial Sites Preservation Board case number UBS1996–23 in July 1996 and were transferred to the Pawnee Nation for reburial in October 2001.

It would seem obvious that the teeth were from the burial, especially since the skull was crushed and it was not even certain that the mandible was with it. Whether the other objects were all from the burial is not clear. The burial photograph did not clearly show any associated objects. Two artifact photographs in the Whiteford collection donation were labeled 14SA412, although that label was added when the collection was accessioned and catalogued at the KSHS. One of these photographs showed the restored pot and another object. The other picture included one side-notched and one triangular projectile point, one end scraper, one bifacial knife, two abraders, one bone awl, and three mussel shells (one of them perforated as on hoes). Both photographs appeared in the second edition of the booklet (Whiteford 1941:20, #1 and #4). The provenience of the objects in the first photograph was not mentioned, but the second object was identified as a deer skull.

The second photograph, though, was captioned as "[a]rtifacts found in a Saline County house site." Some of these objects were in the Lindeman site collection. Nothing in the records indicated that the Lindeman site, as the Whitefords perceived it, was limited to the burial. Indeed, if these were the site and burial mentioned in the booklet, two statements pointed to the site being more than the burial: there did not "appear to be any other burial nearby" and "[o]ther excavations on this site, however, will without question, reveal many other scientific finds" (Whiteford 1941:19). The site form for 14SA412 suggested that the site covered 3 to 5 acres and had two concentrations of material that might have represented lodges. Therefore, possibly some, but probably not all, of the material in the collection was from surface collections or uncontrolled test excavations elsewhere on the site.

Pottery

The pottery element of the Lindeman site collection amounts to one reconstructed vessel and six sherds. These latter include one rim sherd and five body sherds, representing a minimum of five vessels.

The reconstructed vessel is a small Riley Flaring Plain vessel (Figure 67a). It is not complete, and about half the rim from the shoulder up is reconstructed. It is

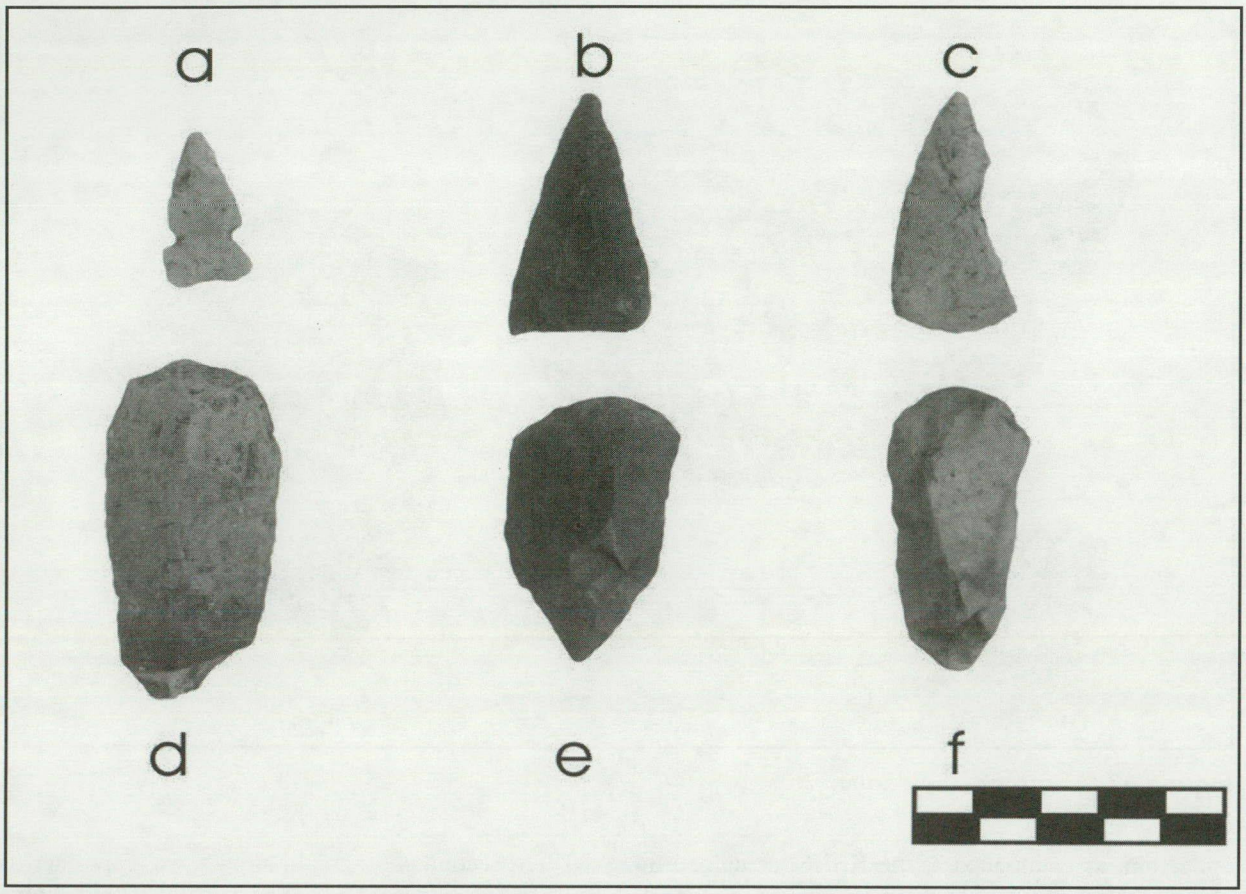


Figure 68. Chipped stone objects—Lindeman site.

approximately 71.8 mm high (excluding the handle) with an interior orifice diameter of 78.3 mm, interior neck diameter of 76.0 mm, and exterior maximum diameter of 104.0 mm. The exterior surface is smoothed and undecorated. The 7.4-mm-high undecorated rim flares slightly above an only slightly constricted neck. The lip is squared and also undecorated. A loop handle is attached at the shoulder and lip. Presumably a second handle was attached to the missing section.

The rim sherd is from a Riley Flaring Pinched pot (Figure 67b). The exterior surface of this sherd was cord roughened at least to the neck. The rim is 10.9 mm high and flaring but not collared. Finger-pinched nodes were attached to the rim immediately below the lip so that the tops of the nodes are flush with the lip. The lip is squared and undecorated.

The five body sherds include three cord-roughened and one smooth-surfaced specimens. The fifth sherd includes part of a neck and lower rim (Figure 67c). It is cord roughened on the body and smoothed through the neck and remnant portion of the rim. No portion of the lip remains, so it is impossible to determine if this was a direct or collared rim and whether or not the rim and lip were decorated. Body sherd thicknesses in this small collection ranged from 4.5 to 9.1 mm, with only one sherd measuring less than 7.0 mm thick.

Stone Artifacts

Projectile Points. Three projectile points include one side-notched specimen and two unnotched triangular points (Figure 68a-c). The side-notched point is complete, as is one triangular point. The other unnotched point is partial. All were made of Florence chert.

End Scrapers. The three end scrapers are complete, keeled specimens (Figure 68d-f). One has a marked spur on the right end of the working edge when observed in plan view with the working edge up; a second has a similar projection that is well worn. The specimens are toward the smaller end of the size range of scrapers from the Whiteford-excavated houses. All are of Florence chert.

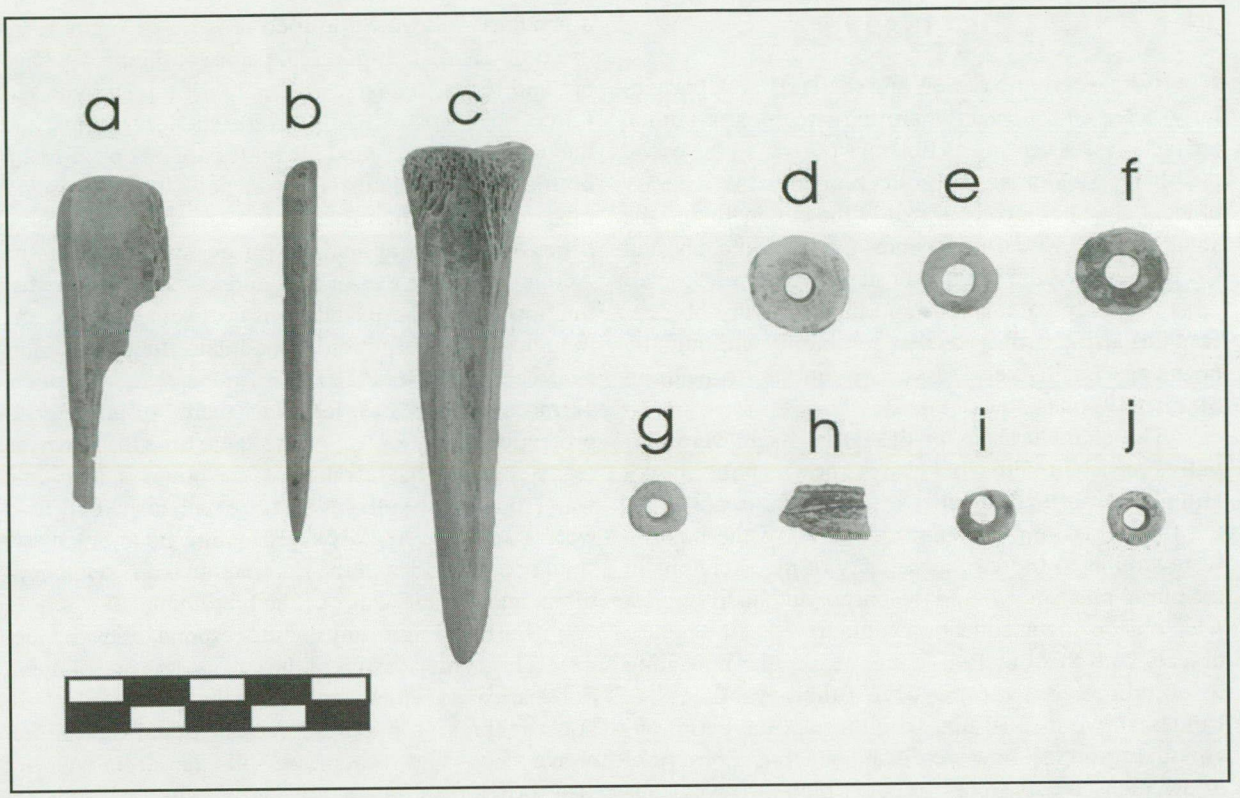


Figure 69. Bone and shell objects: a-c) awls, d-g, i-j) shell beads, h) bone bead—Lindeman site.

Bone Artifacts

Awl. A single nearly complete awl is 67.6 mm long and probably had a blunt tip (Figure 69c). Much of the surface, particularly near the tip, is heavily polished.

Rod. A heavily polished bone rod tapers to a semi-blunt tip at one end (Figure 69b). The other damaged end may be the original end. The specimen is 50.0 mm long. It is tempting to call this a needle, but it is not eyed.

Bone Object. One other bone object, now in two conjoining pieces that together do not compose the entire artifact (Figure 69a), may be a fishhook blank, although the heavy striations on the surface would seem to suggest otherwise. I presume the bone awl, bone rod, and bone object are what the collection list called bone awls.

Shell Artifacts

Beads. Shell beads include six disc beads and one short tubular bead. All disc beads are complete (Figure 69d-g, i-j). They range in outside diameter from 6.9 to 13.0 mm, with perforations ranging from 2.4 to 4.1 mm and a less-than-perfect correlation of inner and outer diameter. Thicknesses of five specimens are 3.5 to 4.5 mm; the final specimen is very asymmetrical, with its thickness varying from 1.0 to 5.0 mm. The tubular bead is broken lengthwise (Figure 69h). It is 11.3 mm long or "thick" with an outer diameter of 7.7 mm and inner diameter of 3.5 mm.

Cut Shell. A small fragment of obviously cut and worked shell seems complete but has no obvious function. It is essentially flat and square, measuring about 10.4 x 10.5 mm in plan view and 3.2 mm thick. It might be the pendant on the collection list.

Ochre

A lump of ochre is of the soft, earthy variety. Its mass is 0.41 g, and its maximum length is 11.9 mm. It does appear rubbed and probably served as a source of pigment.

Discussion

Whole ceramic vessels and shell artifacts, particularly beads and pendants, are the two most common artifact classes serving as funerary objects in the burial pit. If the Lindeman site collection contains funerary objects, the shell beads, possibly the cut shell, and the small ceramic vessel are the most likely candidates. Put a different way, the Lindeman site collection, while almost certainly containing more than funerary objects, contains artifacts of types that commonly, although by no means exclusively, served as funerary objects in Smoky Hill phase burial sites.

The characteristics of the burial itself were partially consistent with what else is known about Smoky Hill phase mortuary practices. The burial treatment—the flexed position and the orientation of the body—were similar to those of a majority of the skeletons in the burial pit. Since I used the burial pit data to suggest what objects in the collection could have been funerary objects with this burial, it would be circular reasoning to conclude that the possible funerary objects at Lindeman were consistent with those at the burial pit. On other grounds, however, it appears that at best only a few such objects were present, which also was consistent with mortuary ritual as seen in the burial pit. The best known Smoky Hill phase mortuary sites are sites like the Salina Burial Pit that were communal cemeteries containing varying numbers of individuals, rather than individual isolated burials in habitation site context such as this one. To be sure, the burial pit is by far the largest known Smoky Hill phase cemetery in Kansas, but its 180 or so sets of remains undoubtedly are too few to account for everyone who lived and died at the numerous house sites in the Smoky Hill/Saline rivers area. In this cemetery there is no indication of differential access to burial according to age or sex or status. Still, the full range of mortuary behavior of this period is not understood. The single burial at the Lindeman site, therefore, is an additional piece of information to be considered when evaluating regional mortuary patterns.

Comparisons And Conclusions

Settlement Pattern

I commented near the beginning of this paper that the house sites lay along an ecological gradient: the Kohr houses near the confluence of two major rivers, Aerhart and Markley in a major river valley but not at a major confluence, and Lamar in an upstream portion of a tributary valley. Simplified drawings (Figure 6 located on page 12; Figure 25, page 34; Figure 49, page 56; and Figure 65, page 70) show the topographic setting of each site, including rivers, stream bottoms, and the uplands from around the bluff base on up. "Stream bottoms" is an inclusive term, however, denoting a mosaic of floodplains, alluvial terraces, and sometimes—for all practical purposes, such as near the Aerhart site—the toes of long and low slopes. The distinction among these landforms is of some importance, though, for by definition a floodplain floods but a terrace does not (Ruhe 1975:79), nor does a toe slope. Terraces and slope base locations, therefore, afford good protection from floods. At the same time they provide ready access to the resources of the bottoms, including water, floodplain soils—which are replenished by flood waters and most readily tilled with a bone or mussel shell hoe—wood, and the rich mammalian, avian, reptilian, and aquatic fauna of the bottomlands.

Site locations in any culture respond to several factors. The characteristics of the site itself is one of them. For year-round settlements, which the Smoky Hill phase houses represent, important factors included elevation above floods and location on soils that drain well but also form a firm foundation for building. All sites described here—and for that matter Smoky Hill phase and Central Plains tradition sites in general—accomplished this by locating on stream terraces or a slope base that resembled a terrace. In addition to being above floods, the soils of these landforms in this part of the country tend to be silt loams, combining stability for house foundations and comparative ease of digging for postholes and cache pits with the good drainage that was essential for comfort. Furthermore, they avoided moisture, which was one of the major factors in house deterioration (Roper 2002b), and would not have done the food stored in cache pits much good either.

Sites also were placed to afford good access to key resources beyond the immediate house and farmstead footprint. Water, of course, was one of these key resources. Site placement near the front edge of a terrace provided that access to water. I mentioned distance to water in each site setting description, but it is necessary to recognize that these meandering streams may have been closer to or farther from the site at the time of occupation. Regardless, no site was likely too far from water at the time of occupation.

Other resources influencing site location included soils for agriculture; important wild or weedy food plants; wood for building, fuel, and manufacture of various objects; and animals for food and other products (skins, sinew, bones). In some circumstances these resources were sufficiently dispersed across the landscape

to require a location strategy that optimized access to each of several ecological zones. However, this may not have been the case for Smoky Hill phase settlement in central Kansas. The terrace soils in this area are excellent soils for modern agriculture and generally have no limiting factors. They also would have been suitable in Smoky Hill phase times, save for the fact that they generally form under prairie grasses, which would make them difficult to impossible to cultivate with bone and shell implements. Floodplain soils, on the other hand, are equally suitable for agriculture (except for the periodic flooding, of course) and were more amenable to tillage using Plains native agricultural technology. (See Wilson [1987:9] on field placement relative to soils and landforms among the Hidatsa.)

The presence of a dozen or two houses at such sites as Kohr and Minneapolis (Wedel 1934a:218) does not necessarily indicate that these were small villages. They more likely represent accumulations of houses, not all or even any of which were contemporaneous. Certainly sites like Lamar with only a couple of houses, also possibly not contemporaneous, were not small villages. Smoky Hill phase settlement likely was in dispersed autonomous farmsteads. The needs for agricultural land were not huge under such an arrangement. Will and Hyde (1917:108) found that historic-period tribes of the Missouri River drainage cultivated from 1/3 to 1 acre of ground per person, with those tribes "more engaged in hunting" at the low end of this range. Inasmuch as the people of the Smoky Hill phase were not only hunting but also using wild and weedy plants in addition to cultigens, planted acreage may have been on the order of 1 or 2 acres for a family. Such modest needs were easily met within a few hundred yards or less of each house site, even a site such as Lamar that lay along the upstream portion of a tributary.

The terrace edge location also would have provided ready access to many of the wild and weedy plants used for food, as well as to wood. Wild plant foods were considerably more diverse and abundant in the stream-bordering woods than in the prairie, although several plant foods, including the prairie turnip, were procured from the prairie. Wood had to have come from the timber belts lining the streams. As we saw in the biophysical setting section of this paper, however, these timber belts were somewhat limited in extent. In the mid-nineteenth century at least, they were most extensive but still sparse in absolute terms and sometimes discontinuous in the main river valleys and even more limited in tributary valleys. Weedy plants might have been the least restricted in space of these groups of resources. We know that some were cultigens and even field crops at various times and places (e.g., papers in Smith 1992). We also know, though, that they are volunteer plants on disturbed ground. Fallow fields on the floodplains and ground torn up by flooding are excellent habitat for these plants. Disturbances associated with farmstead operations provide excellent opportunities for these plants to invade.

The distribution of faunal resources at first glance might seem a factor that drew settlement toward the uplands, but further consideration suggests that it probably did not. Bison, of course, were associated with both the open upland prairies and the bottomlands. The people of the Smoky Hill phase used them, but they did not focus on them. Lists of fauna from excavated Smoky Hill phase sites (Brown 1981:20-21), as with other Central Plains tradition phases (Bozell 1991), indicate that a diverse fauna was procured. Fish, freshwater mussels, aquatic turtles, frogs, waterfowl, other game birds, and various mammals that most frequently are found along stream banks or in woods were very prominent in the diet. In combination they probably were more of a staple than the large ungulates (bison, wapiti, pronghorn) that came from the prairies and certainly yielded a large quantity of meat when taken. But that and the great mobility of these animals were exactly why they did not play a role in settlement decisions: procurement need not be frequent nor could their location be predicted. It is more advantageous to locate so as to have ready access to the resources whose spatial and temporal availability was predictable and for which more frequent procurement episodes were necessary.

In central Kansas, then, many resources critical to the Smoky Hill phase peoples—water, wood, agricultural soils, wild and weedy plant foods, and many species of fauna—occurred together in a restricted portion of the bottomlands of larger streams. Many Smoky Hill phase sites, including all the sites considered in this study, were positioned so as to have ready access to these resources.

House Form

The four Whiteford-excavated houses for which we have floor plans and architectural data were a diverse lot. Two were rectangular, and two were circular. Good architectural data were available for both rectangular houses and one circular house. An analysis of these data is of considerable interest and is enhanced by the fortuitous circumstance that the three houses included one at a major river confluence (Kohr House No. 1, a rectangular structure), one in a major valley away from a confluence (Markley, a circular structure), and three upstream on a tributary (Lamar, a rectangular structure).

Table 14. House Post Summary.

	Kohr No. 1	Markley	Lamar
Number of wall posts	23	12	24
Wall post spacing - range	2-1/2-7'	6-8'	2-6-1/2'
Wall post spacing - median	4'	7-1/2'	5'
Wall post diameter - range	9-13"	7-12"	8-15"
Wall post diameter - median	11"	10"	13"
Interior post diameter - range	11-15"	13-17"	13-15"
Interior post diameter - median	13"	15-1/2"	15"

The numbers of posts, post spacing, and post diameters for each house were compiled in Tables 2, 6, and 10 and in the text of each house description. Table 14 presents a summary compilation of numbers, spacing, and diameters of wall posts and diameters of interior support posts. Two points especially stand out in this comparison. One contrasts the Markley House with Kohr House No. 1 and the Lamar House. The other contrasts Lamar House with Kohr House No. 1. I will discuss each of these in turn.

Markley House contrasts with Kohr No. 1 and Lamar not just because it was circular, but because a) it was constructed using about half the number of wall posts as the other two houses, b) those posts were considerably more widely spaced than were the posts in the other two houses, and c) the posts were overall somewhat smaller than those in the other two houses. What was going on here? Beyond simple sampling, which seems unlikely to explain the considerably smaller number of posts and their wider spacing in the Markley House, three alternatives are presented.

Recall that, on other grounds, Markley House gave the impression of being late. Perhaps after a couple centuries or so of Smoky Hill phase occupation in this part of the Solomon River valley, timber suitable for house construction was becoming somewhat scarce, and this house reflected occupants making do with what was available. The problem with this, though, is that making do with inferior construction can lead to the house crashing down. Scarcity of timber may be a factor, but getting by does not seem wise.

A second possibility, one not necessarily mutually exclusive with the first, is that stronger woods were used. The woods available in central Kansas woodlands vary considerably in strength. Oak is a much stronger wood than cottonwood, for example (Hoadley 1980:111 among other sources), and smaller oak posts can bear the same weight as larger cottonwood posts. Will (1930:42) related that a Mandan consultant on earthlodge construction indicated the differences in posts sizes if cottonwood rather than oak had to be used. Oak, or at least the oak available in central Kansas, also is considerably more resistant to decay under exposure to moisture than are most other woods available in this area (Hoadley 1980:36). Therefore, it would retain its strength over a longer period and last longer in general. This is discussed in considerably greater detail elsewhere (Roper 2002b). The Whiteford feature descriptions made it clear that many charred posts and beams were preserved in this house, but only a small quantity of this material was saved. Identifying it will be interesting but not definitive.

The third possibility is that the mode of house construction was not the same as that of the other two houses—that is, Markley (and Aerhart, too) may not have been wattle-and-daub or earthlodge-like houses. Unlike some of the other Whiteford-excavated house site collections, the Markley House collection contained no daub. This absence, of course, is not definitive, but it is interesting, especially in light of the otherwise more comprehensive collection and abundant notation of the preservation of structural elements in this house. In addition to moisture, a significant factor in earthlodge longevity was the great weight borne by the structural elements. Most of that weight, of course, was the earth covering. The stresses on the weight-bearing members of a house without an earth covering were far less than those with an earth covering. Posts did not have to be as large or as closely spaced to provide a safe building, and the houses still lasted longer, especially if they were built with moisture-resistant wood. It was not so many centuries later—perhaps not much later at all—in central Kansas that the successors of the Smoky Hill phase people were building pole-and-thatch, but not earth-covered, circular dwellings. There is no reason that every pre-Great Bend aspect house structure had to have

been an earthlodge-like structure. Perhaps this has something to do with why Markley House seemed to be of lighter construction with no evidence of rebuilding or repair yet gave many appearances of having been occupied for a considerable amount of time. Some implications are quite interesting to contemplate.

The contrast between the Lamar House and Kohr House No. 1 was less dramatic but still notable. The Lamar House median wall post and interior support post sizes were larger than those from Kohr House No. 1, although the range of wall post sizes was somewhat greater. Lamar, of course, was the house located well upstream in a tributary valley. If GLO records for central Kansas are a good analogy, then we would expect the stream-lining woods to be considerably less extensive in the vicinity of this site than near the sites in larger river valleys. On the other hand, settlement intensity was far lower than in this valley. A plausible scenario might be that there had been little pressure on the upper Pipe Creek valley woodlands when Lamar House was constructed. In spite of the limited extent of available woods, the Lamar House builders had essentially virgin woodlands for selecting construction material. It also is possible that most of what they had available were woods of lower strength. Again, though, it would have been interesting to have a sample of the woods actually used in this house available for identification.

Smoky Hill Phase Culture History and the Whiteford-Excavated Houses

Waldo Wedel (1959:563) defined the Smoky Hill aspect, designating three type sites for two foci within it: the Griffing site as the representative of the Manhattan focus and the Minneapolis and Whiteford sites as representatives of the Saline aspect. The Smoky Hill aspect now is a phase or variant, and the divisions within it are no longer used. In 1959 the site number 14SA1 included both the burial pit and the surrounding houses. It was only in 1970 that the KSHS redesignated the houses as 14SA414. Even though the Whitefords referred to the houses as the Kohr site, and Wedel used the term in his notes, I think that he referred in his book to the entire 14SA1 as the Whiteford site. Both the Whitefords and Wedel described Kohr House No. 1 in summary format, but it is only with this study that what amounts to one of the Smoky Hill phase type sites is fully described. Kohr House No. 1 is a classic Smoky Hill phase site, with house form, pottery, and other artifacts fully characteristic of that phase. Of course, if the Smoky Hill phase was defined in part on the basis of this assemblage, how could it be otherwise? Some of the other sites, though, especially Markley and Aerhart, are less classically Smoky Hill, even though much of the pottery can be accommodated within Riley Cord-Roughened ware and many other artifacts are not necessarily out of place in Smoky Hill phase context. The obvious question, then, concerns the meaning of this variability.

Change over time is one obvious possibility. Smoky Hill phase chronology is poorly known. It is based on a set of radiocarbon age determinations and several seriation studies, but numerous problems beset each data set. The radiocarbon data set includes 44 age determinations, 15 of which were assayed at the Gakashuin University Laboratory in Tokyo, Japan. Gakashuin dates now are considered suspect and are routinely disregarded in studies of Central Plains chronology (Blakeslee 1994). This leaves 29 age determinations, one of which is in excess of 14,000 years ago and obviously does not date a Smoky Hill phase occupation. The remaining 28 age determinations include some that were run many years ago, using now outdated techniques. While they seem credible, it is not wise to rely too heavily on them. In several other cases, multiple age determinations on samples from a single house are many decades, if not a century or century-and-a-half, apart in time. They probably are affected by the old-wood or other sampling problems and, therefore, do not accurately date the occupation. The Smoky Hill phase radiocarbon chronology, after calibration, suggests a span from perhaps A.D. 1000 or so into the 1300s and perhaps even 1400s, but it provides no solid basis for understanding the internal chronology of this phase.

In principle seriation using pottery types does offer the possibility of ordering Smoky Hill phase sites, measuring the passage of time—albeit without assigning calendar dates, and affording us the opportunity to observe trends in the variation of associated material culture. When I began this study, I figured I would end up attempting to place the pottery data in established seriations of Smoky Hill phase sites (Beck 1998; Hedden 1992; Steinacher 1976). I eventually decided not to do so, not necessarily because I felt that most sample sizes were too small for this (although they were), but because I am not convinced that those seriations really measure time. Any set of sites or collections can be ordered on the basis of their similarity or dissimilarity. However, as O'Brien and Lyman (1999:60) correctly noted, "whether or not the order of units created by a seriation is a sequence in the sense that it actually measures the passage of time is an inference." Assessing the correctness of that inference requires the ordering to be validated by some external means, such as an

observation of the same sequence in a stratified deposit. To my knowledge not one proposed seriation of Smoky Hill pottery has been validated by external means. In fact, the various seriation attempts showed deviations from a smooth ordering, suggesting that the seriated assemblages varied along several dimensions, of which time may or may not be one.

In short we simply do not know why pottery collections vary as they do. Time undoubtedly is involved, but we do not yet know how to measure it. Pottery types, as currently conceived for the Smoky Hill phase and really all of the Central Plains tradition, are index fossils (compare O'Brien and Lyman 1999:185-215) that point us to a particular unit of time: the Middle Ceramic period. They are ubiquitous on sites of that period. Conversely, they are not connected to the typologies of the preceding or succeeding periods. They simply last too long and vary too little to provide the temporal resolution sought in a seriation study. Until this problem is tackled seriously, we will continue to have problems with chronologically ordering Smoky Hill phase sites or seeking to understand how Smoky Hill phase material culture varies through time.

When we do tackle this problem, I suggest that we must do so in a manner that allows us to evaluate the relations between the Smoky Hill phase and the preceding Woodland cultures and, even more importantly, between the Smoky Hill phase and the succeeding traditions on the Central Plains. In this latter category I would include both the Lower Loup phase (protohistoric Pawnee) *and* the Great Bend aspect, particularly the Little River focus. As it stands at present, the typologies for these cultural units—Smoky Hill (really all of the Central Plains tradition), Great Bend, and Lower Loup—are particular to that unit, as if the units are entirely disconnected from or unrelated to one another. I think I know why this is so in terms of the history of Central Plains archeology, but I also think that it is time to cast aside old notions and old ways of doing things and to start to engage with the problem. Grange (1968) developed a pottery typology that accommodated both protohistoric and historic Pawnee pottery, following Wedel's (1938) earlier demonstration of continuity between the Lower Loup phase and the historic Pawnee. The Lower Loup/Pawnee pottery typology, however, was entirely distinct from the Central Plains tradition pottery typologies. Likewise, the Great Bend aspect typology (Wedel 1949) was entirely separate from both Central Plains tradition typologies and the Lower Loup/Pawnee typology. With this situation it is no surprise that, for all practical purposes, we regard these taxa as discrete, bounded, mutually exclusive cultural entities—each of whose culture history we can tell without regard to the others. Certainly there have been attempts to link the Central Plains tradition with the Lower Loup/Pawnee, but none have been convincing, in part because they have been improperly conceived, both theoretically and methodologically. Equally strained, and for the same reasons, are the arguments that see no continuity. And ignoring Great Bend in the analysis is no longer tenable.

What I am suggesting, then, is that we must simultaneously think about long-term cultural continuity in central Kansas and beyond and get over the idea that we can talk about one culture as wholly but exclusively ancestral to another. Whether or not Smoky Hill is ancestral Pawnee is the wrong question. The right question addresses the nature of the relationships among Smoky Hill (and Upper Republican), Great Bend, historic Wichita, Lower Loup, and historic Pawnee. We also have to recognize that, while some changes may have been fairly rapid, others were more gradual, as we would be able to see if we could adequately measure the passage of time within a single phase.

The sites discussed in this study are an excellent case in point. The form and content of Kohr House No. 1 and at least the form of the Lamar House match the ideal for Smoky Hill phase houses, in part for the reason I mentioned earlier in the Kohr House No. 1 case. Markley and Aerhart do not. I am, however, struck by how Markley in particular, and Aerhart to an extent, might anticipate some of the early Great Bend aspect characteristics. For example, the early Great Bend site 14RC306 has a large quantity of cord-roughened pottery, some of it undecorated and some of it with lips exhibiting obliquely incised lines (Loosle 1991:113-114). We call that material Little River Cord-Roughened, but how different is it from Riley Cord-Roughened? Moreover, the 14RC306 houses were circular (Loosle 1991:101-111). They yielded Southwest trade sherds of types dating as early as the early 1400s (Loosle 1991:118). When we maintain separate typologies and notions of cultural separateness for Smoky Hill and the Little River focus (and Lower Loup, too, for that matter), we preclude any possibility of evaluating continuity and change.

I could say much more on this, but I have reached the limits of the supporting data I have at the present time. Clearly, though, I believe there is room for and certainly much need for further intense study of archeological cultures that we used to think we knew something about. Museum collections at various institutions in Kansas are a place to start, as this study should exemplify. In this regard I cannot help but recall the incident that I mentioned in the introduction to this study: The Whitefords went to the Paint Creek site in 1934,

met A. T. Hill and Waldo Wedel, and learned that their archeological collection "had real scientific value." The Whitefords continued to add to their collection, excavating all the houses described here, and that was only part of it. Certainly Wedel soon recognized its value by drawing on it when he defined the Smoky Hill phase. If the present study of the expanded collection all these decades later can help shake our lethargy and goad us into a serious effort to further our understanding of late prehistoric cultural dynamics in central Kansas, then the truth of that assessment, made so long ago, is further underscored.

Acknowledgments. This paper is an outgrowth of a study of the history and archeology of the Salina Burial Pit that I currently am conducting under contract with the Kansas State Historical Society. As I began working on the story of that site, it became apparent that—while the Whitefords' excavations of house sites had been as important to Waldo Wedel's formulation of the Smoky Hill phase, as had the burial pit excavation—the houses had never been fully described. This paper is the result. I don't know that I would have finished it before the burial pit report itself, though, except that in late summer 2001 it came to my attention that Virginia Wulfkuhle needed material for this issue of the journal. I promised this study to her for it, clearly in a moment of naivete as to exactly how much effort it would take to deliver on that promise and unaware of how complicated the fall of 2001 would otherwise become. But all's well that ends well, according to the Bard, and I made it to the end with 2002 only a few days old. I have to first thank Virginia for being patient but also keeping the pressure on—subtly, of course.

My list of acknowledgments for the burial pit study will stretch from sea to shining sea and beyond. Isolating debts particularly pertinent to this side project and trusting I will not commit egregious omissions, I must thank most of the archeology office staff at the Kansas State Historical Society for at some time or other helping me find collections, records, photographs, or maps I needed for this analysis.

Judy Lilly at the Salina Public Library made available to me historical information on the Whitefords and the burial pit. Much of this will be used elsewhere, but some is incorporated into this study.

Mary Knapp at the Weather Data Library at Kansas State University provided the weather data set I analyzed in the biophysical setting section of this paper. She advised me to use data from the Minneapolis rather the Salina weather station.

Several staff members at the National Anthropological Archives at the Smithsonian Institution in Washington facilitated my search through a part of the Wedel papers, looking for his notes on the burial pit and the two Kohr houses.

Jeannette Blackmar, then at the Nebraska State Historical Society, found some useful site information, including a map of Aerhart House, in the A. T. Hill papers at that institution.

I taught courses at the University of Kansas in both spring and fall semesters 2001 and thus was in Lawrence a lot. While there, Mary Adair at the museum of anthropology was always ready to discuss both botanical and central Kansas culture history matters. Some of this is reflected in this manuscript. Looking at all the Smoky Hill pottery on the open shelving in the museum lab also was really helpful to me in thinking about variability in Smoky Hill ceramics.

Big recognition is due Cindy LaBarge and John LaBarge of J&C Imaging in Manhattan. Cindy and John did all the artifact photography, much of it in digital format. Cindy subsequently worked with the raw electronic files to add letters to identify specimens in the photographs, reformat a few photographs, do some occasional cleanup, and get it all onto a CD. She also did most of the line drawings for this paper. The exceptions are the statistical graphs that I produced using Axum 6.0.

I also have to thank the students in the various courses I taught as I worked on this, especially those in the fall 2001 classes. At times they must have noticed my preoccupation with something else.

And, as always, warm hugs to my dog Bonnie, whose zest for a good ball-chasing session prevents me from getting hopelessly ensnared in whatever I am working on at the time.

As a final note, many of the descriptions in this paper are general and do not contain metric or attribute data. This manuscript would have been considerably longer than it is had I included these data in table or even summary form. I did record these data, however. They are on file in my office and are available to interested parties.

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Notes

Book Reviews

Feast of the Dead: Aboriginal Ossuaries in Maryland

Feast of the Dead: Aboriginal Ossuaries in Maryland. DENNIS C. CURRY. The Archeological Society of Maryland, Inc., and The Maryland Historical Trust Press, Crownsville, 1999. xi + 108 pp., 61 figures, 5 tables, notes, references cited, glossary, index. $15.00 (paper). ISBN 1-878399-72-1. *Reviewed by* Jim D. Feagins, St. Joseph Museum.

This small volume resulted from an initial study by Curry in order to comply with the Native American Graves Protection and Repatriation Act (NAGPRA) to determine tribal affiliation of Native American burials in Maryland. However, *Feast of the Dead* focuses on only one type of burial—the ossuary, which in Maryland dates from less than a 300-year period, A.D. 1400 to 1700. Curry claims that in much of the eastern United States, this mode of final interment was initiated during late prehistoric times, continuing through the proto-historic and terminating during the early historic period. As most readers of *The Kansas Anthropologist* are well aware, this time frame is not reflective of the ossuaries from the mid-continental region.

Curry defines an ossuary as "A collective, secondary deposit of skeletal material representing multiple individuals (sometimes hundreds) initially buried or stored elsewhere" (p. 104). This definition somewhat oversimplifies an often complex burial mode and the sequence of events leading up to the final resting place of all (or a portion of) the skeletal remains and associated artifacts. Ossuaries contain mixed disarticulated skeletal elements from various individuals within a common feature. However, Curry has lumped together completely disarticulated remains (scattered as well as in bundles) with partially disarticulated skeletal elements (both in bundles and scattered), and sometimes intermixed with primary (completely or mostly articulated) human burials and occasional associated dog remains in a variety of pit or pit-like features.

From this reviewer's point of view, the main problem with Curry's definition is that all multiple secondary burials are not ossuaries, as he has implied. For example, his definition would include multiple-event interments at a locus, which could inadvertently cause the mixing of many or a few skeletal elements within a feature. This is but one example of a multiple burial scenario, which should not be confused with a true ossuary.

That criticism aside, Curry builds a logical case for most of these secondary remains having initially resided in a charnel or mortuary house for a period of months or years prior to their burial in an ossuary. He bases his case on historic records as well as archeological data. In some cases they appear to have been buried before the final (perhaps secondary or tertiary) reinterment in an ossuary. For ossuary burials in Kansas, one ordinarily expects that primary burials would have been placed on a scaffold (or in a tree, when available) for a length of time prior to a subsoil interment.

A wonderful service has been performed by Curry in gathering information on 32 ossuaries at 19 locations in Maryland from oftentimes donated and poorly documented collections, derived from non-professional excavations conducted in years past. From personal experience, this reviewer realizes that gathering bits of information from a variety of sometimes obscure sources on burial explorations conducted decades ago is usually an extremely tedious and time-consuming task–a task that can lead to many dead ends and sometimes generate conflicting data that makes interpretation difficult. Many of the Maryland ossuaries are now long destroyed, and much of their contents has been misplaced or dispersed.

Feast of the Dead is more than a description of the ossuaries, as Curry attempts to generalize his interpretations and suggestions. His discussion is the most important section of the volume for archeological researchers outside of Maryland. This section is divided into the following topics: site setting, proximity to village sites, cultural group, chronology, periodicity and population, disease and health status, evidence of primary burial treatment, cremation, dog burials, ceremonial fires, evidence of skeletal preparation, arrangement of skeletal remains, cemetery areas, use of skulls as containers, grave offerings and artifact associations, and status differentiation. Finally he asks the question, "Why Ossuaries?" These are all useful and thoughtful topics, well worth the consideration of archeologists from other regions.

Curry is to be commended for his insightful synthesis of an important subject and for making it available to the general public as well as to the archeological community. *Feast of the Dead: Aboriginal Ossuaries in Maryland* can be obtained through your

local book store or from The Maryland Historical Trust Press, 100 Community Place, Crownsville, Maryland 21032-2023. This attractive volume is also attractively priced.

American Muse: Anthropological Excursions into Art and Aesthetics

American Muse: Anthropological Excursions into Art and Aesthetics. RICHARD L. ANDERSON. Prentice Hall, Upper Saddle River, New Jersey, 2000. 235 pages. $29.20 (paper). ISBN 0-13-084313. *Reviewed by* Randall M. Thies.

To what extent does art figure in the life of ordinary Americans? This and related questions are explored in *American Muse* by Richard Anderson, a cultural anthropologist who previously researched the role of art in non-western cultures. Thinking that insights might be gained by a look at ourselves, he turned his attention to people in his own culture, specifically residents of the Kansas City area.

To carry out his research, Anderson used standard anthropological techniques of interview and observation, including such things as videotaping the entire interior of one informant's household, then slowly viewing the tape to record each and every item that could possibly be regarded as art–followed by questions designed to elicit the informant's explanation and perception of these items. Similarly, music was researched from the standpoint of both the artist and the listener by eliciting their views on music in general and, taking a more particularistic perspective, looking at many songs and phrases on a word-by-word basis.

As is the case with anyone who tries to analyze art, Anderson must also grapple with the problem of actually defining the topic, and this is no small problem when it is far more than "fine art" that is under consideration. What is art? When is it fine art? What do ordinary Americans regard as art, and what sort of things are treated as art even though Americans do not usually define them as art? The latter questions comprise the main point of the book: the existence and nature of vernacular aesthetics in America. Not surprisingly, Anderson ends up with a decidedly broad and inclusive definition of art—just about anything that causes aesthetic delight can qualify.

Research of this kind can take you into strange realms indeed, and this is half the fun, as the author investigates wedding art, popular music, tattoo devotees, gardeners, car enthusiasts, cooks and consumers of gourmet food, exotic dancers, and yard artists, along with more "standard" artists, such as painters and poets.

This is an academically inclined book, although it is not overly difficult to read, especially for anyone who has had a class or two in anthropology and is familiar with the jargon and philosophical background necessary for an informed analysis of the topic. *American Muse* could serve as a textbook or assigned reading for college classes in either art or anthropology. Although the book is in many places downright fun to read, the narrative manages to stay on course, continually reasserting its more serious goal of pursuing a philosophical analysis of vernacular aesthetics through the use of anthropological techniques and perspective.

Part of my positive response to this book was an increased awareness of art in my surroundings. In particular, I found yard art to be a compelling topic due to my own compulsion to create beauty (or what I think of as beauty) at home, as well as my recent experiences with the Save Outdoor Sculpture program, which increased my knowledge and appreciation for outdoor sculpture of both the fine art and vernacular varieties. I now find myself taking a new look at the artistic elements of peoples' yards and have begun to incorporate items such as pink flamingos and garden gnome statues in my own yard. They're cheap, mass-produced items, and while they aren't fine art, they do provoke aesthetic delight, so I shall continue to look for more—and I will do so with renewed enthusiasm now that I know that yard art is okay!

American Muse also prompted me to observe and attain a certain amount of puzzlement over the seemingly odd tendency of Americans to juxtapose beauty and ugliness in their artistic "built environment." This tendency is expressed, for example, in the placing by city maintenance workers of a trash can only two feet away from a statue. Are we to see the statue but somehow not see the trash can?

My favorite example of this tendency, however, is in the narrow front yard of an old house in a low-rent part of Topeka. Yard art abounds in this small yard, with an amazing grand total of 26 reflective glass gazing balls of different sizes and colors, surrounded by a menagerie of small concrete and ceramic statues and figurines, wind chimes, and assorted plants. Someone obviously wanted to create an aesthetically pleasing environment—but this desire apparently applied to the front yard only. Beginning at the backyard fence and proceeding out to the alley is an assortment of debris that would dishearten any neighborhood improvement worker: an old washing machine lying on its side, a

tire, old boxes, a broken lawnmower, broken or discarded toys, and trash of all kinds, crammed into a weedy backyard that also serves as a parking lot. How can a person create the beauty and ignore the ugliness?

These are topics that I would have never considered in this depth had it not been for *American Muse*. Like many books of this kind, *American Muse* will cause you to become more aware of your surroundings and the sometimes inexplicable behavior of human beings—another example of why anthropology can be the most mind-boggling of academic pursuits.

Death by Theory, A Tale of Mystery and Archaeological Theory

Death by Theory, A Tale of Mystery and Archaeological Theory. ADRIAN PRAETZELLIS. Alta Mira Press, Walnut Creek, California, 2000. 174 pp. $59.00 (cloth) ISBN 0742503585; $17.95 (paper) ISBN 0742503593. *Reviewed by* Marlin F. Hawley.

Any book entitled *Death by Theory* with "archaeology" in its subtitle begs to be investigated, and, as the subtitle suggests, this book doubles as both mystery novel and primer on archeological theory. Through its pages the reader is introduced to the main currents of the last 50 years of archeology in the United States.

Included is the debate of hoary culture history versus processual archeology, current trends in the discipline, and a variety of theoretical stances adopted by archeologists in the attempt to order and understand the human past or, more accurately, the detritus left behind by people. Even the most superficial appraisal of archeological trends finds theory, either at a general level or in reference to specific theories, of vital importance. Many students have had cause to bang their heads while attempting to grasp the meaning of a particular theory, and not a few survive their schooling with a disdain for anything that smacks of the theoretical. Obviously having run afoul of this tendency, historic archeologist Adrian Praetzellis of Sonoma State University penned *Death by Theory*.

The mystery is harmless, bloodless; not the sort of up-all-night mystery that will win an Edgar Award. Except for a rabbit, no one is hurt, although some egos are bruised. Think Nancy Drew meets the Society for American Archaeology. Praetzellis posits the discovery of an apparent Neolithic tomb, complete with ceramics and an engraving of a goddess, not in continental Europe but on an island in the Pacific Northwest!

Death by Theory chronicles the adventures and misadventures of heroine Hannah Green (come to think of it, isn't that the name of Nancy Drew's stalwart housekeeper?); her nephew, Sean, a neophyte archeologist, aka "shovel bum"; and her colleague, Ian Tuliver, a pompous and *tenured* professor. Throw into the pot, so to speak, a handful of student excavators, the pedantic graduate assistant, the press, a feminist archeologist, a pothunter, a band of New Age goddess worshipers, and a bossy, wealthy patron. With this eclectic mix the author has room to review not only the role of theory in archeology but the practice of archeology in the United States, casting witty glances at tenure, questions of ownership of the past, and cultural resources management versus academic archeology. I found the discussion on the differences between feminist and gender archeology particularly insightful.

Praetzellis manages, amazingly in most instances, to bend every conversation to discussions, often impassioned—these are graduate students for the most part, after all—explicating one or another theoretical position. The characters are more cartoons than real; however, their use as mouth pieces for particular theories aside, Praetzellis has wickedly managed to incorporate most, if not all, of the "types" one encounters within archeology. Witty and engaging, the book nonetheless takes quite seriously its goal of educating its readers in the necessity and substance of the major positions of archeological theory.

True to the pedagogic mission of the book, Praetzellis supplemented it with a brief list of readings and glossary. It is illustrated with drawings and sidebars that summarize theoretical positions. While checking the price on-line, I noticed in the "Readers Who Bought This Book Also Bought" tag that readers who bought the book were buying a variety of books and collections of papers on theory, such as *Archaeological Theory Today* by Ian Hodder, *Archaeological Theory: An Introduction* by Matthew Johnson, *Principles of Archaeological Stratigraphy* by Edward Harris, and *A History of Archaeological Theory* by Bruce Trigger. While I suspect that these are probably recommended collateral texts purchased by students, it nonetheless suggests the book is being used in its intended way. Perhaps *Death by Theory*, which educates as it entertains, is the right approach with its mix of seriousness and silliness.

The book, I hasten to add, should have broad appeal to interested lay readers seeking a painless introduction to theory in archeology. *Death by Theory* is a fun book.

Trails to Tiburón: The 1894 and 1895 Field Diaries of W J McGee

Trails to Tiburón: The 1894 and 1895 Field Diaries of W J McGee. Transcribed by HAZEL McFEELY FONTANA; annotated and with an introduction by BERNARD L. FONTANA. University of Arizona Press, Tucson, 2000. xxx + 168 pp., 59 photographs, 3 maps, appendices, notes, references, index. $35.00 (cloth). ISBN 0-8165-2030-5. *Reviewed by* Jim D. Feagins.

Trails to Tiburón is an insightful little volume that reflects the state of the "science" of American anthropology (both ethnology and archeology) in the late nineteenth century. This publication is centered around McGee's 1894 and 1895 field diaries, detailing two expeditions to the Sonoran Desert of the Southwest, principally in northwestern Mexico. The second expedition reached Isla Tiburón, also known as Shark Island, in the Gulf of California. There the researchers/adventurers were confronted with fear of attacks by the Seri Indians; shortages of food, water, and other supplies; and gale-laced, foul weather in an overloaded, somewhat jury-rigged boat. It was not a pleasant trip, but one packed with adventure. Information was recorded on the geography, geology, flora and fauna, meteorology, and anthropology. Archeological and ethnographic materials also were collected from the areas visited.

W J McGee (he dropped the use of periods after his initials) was a prolific writer, and at the time a well known researcher and administrator in his chosen professions, geology and later anthropology. The fourth of nine children, William John McGee was born in a log house on a farm near Farley, Iowa, in 1853. During his early adult years, he tried being an inventor, salesman, blacksmith, and surveyor before discovering his passions in the fields of geology and anthropology.

After conducting his personal geological and archeological survey of "all" of northeastern Iowa, McGee joined the American Association for the Advancement of Science (AAAS) in 1877. The following year he presented part of his findings at that organization's meeting and soon began publishing in various scientific journals. At the 1878 AAAS meeting, McGee met and impressed the famous John Wesley Powell. Shortly thereafter Powell became director of the newly created Bureau of American Ethnology (BAE), and in 1881 he also became the director of the United States Geological Survey (USGS). McGee was hired as one of the assistant geologists and continued to develop his productive career in that field. He was a workaholic and was recognized as having "... remarkable powers of observation ..." (Hinsley 1976:350).

In 1888 McGee married Anita Newcomb. She was the daughter of Simon Newcomb, a well known astronomer and a person of high status in Washington's social circles. Later Anita graduated from Columbia University's School of Medicine, did postgraduate work at Johns Hopkins, and had a quite remarkable career as a physician. In spite of W J McGee's obvious abilities, Anita's marriage to an Iowa farm boy with fewer than eight years of formal education did not meet the approval of the Newcomb family. After 15 years and three children, McGee's marriage to Anita disintegrated.

McGee followed John Wesley Powell when he left the USGS to assume full time directorship of the BAE in 1893. By this time McGee was a veteran of Washington's political skirmishes and well known in scientific circles. McGee became the BAE's "Ethnologist in Charge," for all practical purposes the second in command. "Powell's health began to deteriorate badly in 1894, and from then until Powell died in 1902, McGee was in fact, if not in name, the bureau's director ..." (p. xiii).

When McGee came to the BAE, his real expertise was in geology. At that point he wished to establish himself as a bona fide ethnologist. This led to his field expeditions in the Southwest (the subject of the diaries described in this volume) to work with the Papagos (Tohono O'odham) and the Seris Indians.

As was typical of anthropologists of the day, McGee was self taught. However, he also carried the philosophical baggage of the times in regard to ideas about human cultural evolution and the ways field observation and exploration were to be conducted. The fieldwork was all encompassing, if not thorough; it was generalized rather than specialized. The work followed the lead of natural history. Therefore, his field diaries should be read with an understanding of the philosophical and methodological contexts of the late nineteenth century.

On the 1894 expedition McGee was accompanied by a teamster, E. P. Cunningham; a Papago interpreter, Jose Lewis; and a BAE photographer, William Dinwiddie. In addition to taking and developing approximately 600 photographs from the trip, Dinwiddie also labeled the artifacts and arranged a display of the Papago and Seri materials for the 1895 Atlanta Exposition.

The interpreter for the 1895 trip was another Papago, Hugh Norris, and the photographer was John Walter Mitchell. In addition, the 1895 adventure included an excellent USGS topographer on loan to the

BAE, Willard D. Johnson. The disappearance of Johnson's maps made during this expedition was a tragedy. (Kansas readers will be interested to note that among Johnson's many later accomplishments was a study of the High Plains water supply system around Meade, Kansas.)

The 1895 trip was the most adventurous of the two. The month of December was cold and windy. The sloop used to haul men and supplies from the Mexican mainland to Tiburón set low in the water. Not only did they at times have to battle to stay afloat, but much of the stay on Tiburón was a struggle to stay warm and dry, protect their feet (their footwear completely wore out), obtain adequate food and water, and face the fear of attack from the Seri. In spite of these formidable obstacles, McGee was not deterred from making museum collections and recording observations. Johnson attended to his map making, and he and others aided with the collections and the many other tasks necessary to complete the expedition and to simply stay alive.

In 1898, three years after McGee's return to Washington, *The Seri Indians* was published, thus securing his position as an American anthropologist. "He used his Sonoran Desert observations in scientific papers concerning sheetflood erosion, the origins of agriculture, the beginnings of the domestication of animals, acculturation across hostile cultural boundaries, the origins of marriage, and the interrelationships among plants, animals, human beings, water, and soil" (pp. xxvi-xxvii).

Many aspects of his Seri volume were discredited by later researchers. Historian Curtis Hinsley (1976:349) stated that McGee's volume was based on his "... sharp eyes and colorful imagination ..." forming a "... slim foundation of careful, sometimes brilliant observations, and a large dose of theory. ..." Nevertheless, McGee's volume provided important information on the Seri Indians, especially when taken within the context of the time in which it was written and the prevalent anthropological philosophies that then existed.

McGee was among the founders of the American Anthropological Association and its journal, the *American Anthropologist*. He was a charter member of the American Association of Museums and helped organize the Archaeological Institute of America. He also served as a president of the National Geographic Society. In addition, he was one of the early founders and promoters of the American conservation movement. While much of his work has been overlooked by modern researchers, McGee's name is attached to 329 publications and he co-authored an additional 14. Not bad accomplishments for an Iowa farm boy with fewer than eight years of formal education!

Trails to Tiburón: The 1894 and 1895 Field Diaries of W J McGee is a delightful volume. The Fontanas have done a quite creditable job of transcribing, introducing, and annotating the publication. The two journals detailing the expeditions were written in small field notebooks and preserved in the Library of Congress. Unfortunately, the photographs taken during the two expeditions and reproduced within the volume were printed in a small format—so small that many of the details are difficult, and in some cases impossible, to discern. This publication can be obtained through your local book store or from the University of Arizona Press, 355 S. Euclid Ave., Ste. 103, Tucson, AZ 85719.

Although practically unheard of today, W J McGee was an energetic, politically connected, well known geologist and anthropologist in his time. His anthropological research reflects the state-of-the-art "science" of the late nineteenth century. In spite of the limitations of the philosophical and methodological thought of his day, McGee was a scientist through and through. At his death in 1912, McGee willed his body to a medical college and his brain to Dr. E. A. Spitzka. "At the same time Spitzka got John Wesley Powell's brain, which McGee had had since 1903. There had been a friendly rivalry between the two men over the size of their brains. Powell won: 1,488 grains to McGee's 1,410 grains" (p. xxix). "It was ... characteristic of McGee that he should have been keeping track of the progression of the prostate cancer that killed him and that his account—as objective as if he had been writing about someone else—would be published posthumously (McGee 1912)" (p. xxix).

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Notes

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Tod is the special projects archeologist at the Kansas State Historical Society, a position that he has held since completing his M.A. at Wichita State University in 1999. His research interests center on the Late Prehistoric period on the Southern Plains with special focus on ceramic analysis, lithic resource procurement, and trade/exchange of exotic materials.

Peter W. Bowman (deceased)

Peter Bowman was the author of several articles on Plains prehistory and history. His most recent article on the Coal-Oil Canyon site appeared in Volume 17, No. 2 of *The Kansas Anthropologist*. At the time of his death in 1998, Bowman was writing a book on bison ecology. The Herl site report, which included the section on the upland sites survey, was completed in 1971 but apparently was never submitted for publication. The Herl site report and all associated documentation (survey maps, site maps, feature profiles, etc.) were recovered from the Bowman estate through the efforts of Jerome Bussen of Wallace, Kansas. These materials were donated to the University of Kansas Museum of Anthropology in Lawrence, Kansas, in September 2001.

Jim D. Feagins

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Jim D. Feagins is a private archeological consultant who also serves as part of the adjunct archeological staff for the St. Joseph Museum. After 30 years as a science instructor for Consolidated School District No. 4, Grandview, Missouri, he retired in 1995. Feagins received a B.S. degree from Pittsburg State University and a M.N.S. degree from the University of Oklahoma.

Active in promoting archeological education, he is president emeritus of the Missouri Archaeological Society. He has also served as president of the Kansas City Archaeological Society and as a vice-president of the Kansas Anthropological Association and the Missouri Association of Professional Archaeologists. His primary area of research interest is in the prehistory of the eastern Central Plains. He is especially interested in evidences of trading during the late prehistoric and early historic periods, cultural resource management, and ceramic technology. Feagins is a life member of the KAA.

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Marlin Hawley is a senior archeologist for the Museum Archaeology Program, State Historical Society of Wisconsin in Madison. He is a member of the KAA.

Greg Jackson

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Greg is engineering manager at Western Resources in Salina. He has been a KAA member for nine years. He maintains a deep yearning to seek out and learn as much as he can about Plains archeology. He enjoys the people who work in all aspects of the field and has been blessed with many wonderful friendships.

Brad Logan

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Brad Logan is senior curator at the Museum of Anthropology, University of Kansas, where he has been director of the Office of Archaeological Research since 1985. He received his M.A. at the University of Nevada, Reno

and his Ph.D. at KU. He has fieldwork and research experience in Kansas, Missouri, Nebraska, Nevada, Colorado, and Wyoming, as well as in southern France and central Austria. His research and publications reflect a broad interest in all prehistoric cultural adaptations of the Central Plains, with a particular interest in those of the ceramic periods. A native Kansan, he is a member of the KAA.

Daniel Pugh

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Daniel Pugh is a student in the Ph.D. program of the University of Michigan Department of Anthropology. He is a native of Kansas and received his B.A. in anthropology from the University of Kansas in 1999. He began doing archeological fieldwork through the KU Museum of Anthropology in 1997. Daniel received his M.A. in anthropology from the University of Michigan in the spring of 2001 and is currently preparing to begin dissertation work. He has done fieldwork and research in Kansas, Utah, New Mexico, Michigan, France, and Hungary. His research interests include integration mechanisms for dispersed communities, emergence of social complexity, and community interaction. He plans to begin dissertation work soon and will focus on interaction between Mississippian and Late Prehistoric communities along the Lower Missouri River Valley.

Harold Reed

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Harold Reed is a native Kansan, born in Salina and has lived there all his life except for four years service in the U.S. Air Force. He has always been interested in Kansas history and became involved in the KAA and Kansas archeology in 1967. He and his wife Margie have attended most of the KAA field schools (even before the KATP) and have enjoyed working in various field positions. They both completed all of the requirements for certification in 1997. Harold is also a life member of the Kansas State Historical Society.

John D. Reynolds (deceased)

John Reynolds was state archeologist of Kansas from 1993 until his death in 1997. He earned a B.A. in English literature and an M.A. in anthropology from Iowa State University. John joined the staff of the Kansas State Historical Society in 1970 as an archeologist I, was promoted to archeologist II in 1978, to state archeologist in 1993, and to assistant director of the Cultural Resources Division in 1994.

For 10 years John was an adjunct faculty member in the Department of Sociology and Anthropology at Washburn University in Topeka. He was active as a leader of Troop 117 of the Boy Scouts of America. The Jayhawk Area Council honored him with the Wood Badge and the District Award of Merit. John presented hundreds of flintknapping demonstrations using Native American-style tools and materials to create projectile points and other stone tools. He developed an expertise in other aspects of experimental archeology, including grass house reproduction.

John was an honorary life member of the KAA. He codirected and taught a number of courses at Kansas Archeology Training Program field schools.

Donna Roper

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Donna Roper received her Ph.D. in anthropology from the University of Missouri in 1975. After 17 years of unrelenting contract work, most of it in the Central Plains and Midwest, she moved to Manhattan in mid-1992. She was soon appointed adjunct associate professor of anthropology at Kansas State University. She continues to do some contract work as well as occasional university teaching and is heavily engaged in research on several aspects of Middle and Late Ceramic period prehistory in Kansas and Nebraska. As part of this, she is completing

a technical report describing and analyzing the Salina Burial Pit and is writing on other aspects of the work of its excavators, Guy and Mabel Whiteford. She has been a KAA member for a little over a decade.

Randall M. Thies

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Randy Thies is an archeologist with the Kansas State Historical Society. His academic accomplishments include a bachelor's degree from Washburn University of Topeka (1974) and a master's degree from Iowa State University (1979). After devoting well over a decade of his career to Central Plains prehistory, in recent years his interests have broadened to include Kansas sculpture, war memorials, and cemeteries.

Notes

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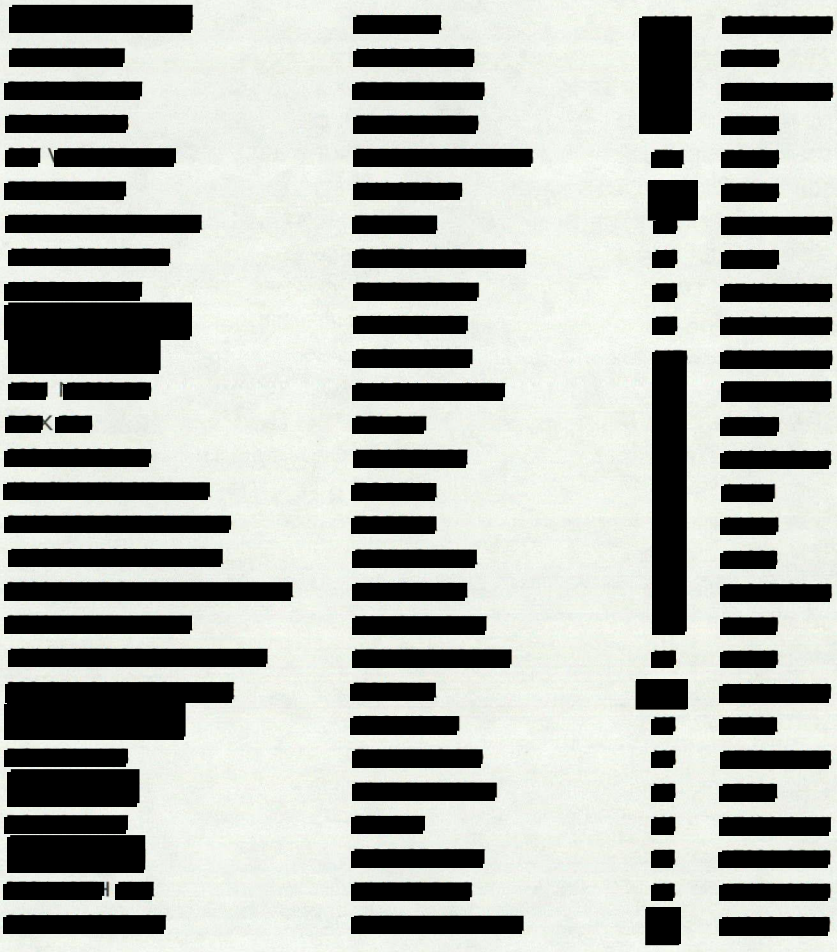
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