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Contents

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KANSAS ANTHROPOLOGICAL ASSOCIATION

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

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STERNS ON WINCHELL: AN ADDENDUM TO REYNOLDS' "A REAPPRAISAL OF WINCHELL'S *PALEOLITHS OF KANSAS*"

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Based on unpublished field notes, this paper highlights the criticism by F. H. Sterns, a Harvard-trained archeologist, of N. H. Winchell's monograph Paleoliths of Kansas. In this volume Winchell argued for a long succession of Paleolithic and Neolithic cultures in Kansas. Sterns surveyed and investigated sites in the Missouri River valley, including as far west as Wabaunsee County, Kansas. While there, he also looked for evidence to support Winchell's thesis. He did not find it. The paper supplements information in Reynolds "A Reappraisal of Winchell's Paleoliths of Kansas."

In editing Reynolds' (2008) article, "A Reappraisal of Winchell's *Paleoliths of Kansas*," I added extensive endnotes to augment Reynolds' arguments, which among other things called attention to the published archeological literature commenting on aspects of Winchell's thesis. To briefly review, Winchell (1912), after study of selected stone tools in the Jacob V. Brower Collection from the vicinity of Alma, Wabaunsee County, Kansas, concluded that they provided evidence of tool reuse by a long succession of Paleolithic and Neolithic cultures in Kansas in the glacial and post-glacial epochs. Winchell's thesis ran counter to prevailing notions regarding the timing of the settlement of the Americas and garnered its share of both supporters and detractors. This paper reports another contemporary criticism of Winchell's thesis by Frederick H. Sterns of Harvard University. A single paragraph appeared in Sterns' (n.d.) unpublished 1915 season field notes, curated by the Peabody Museum of Archaeology and Ethnology. His brief comments called into serious question the veracity of Winchell's claims.

Between 1912 and 1915, F. H. Sterns, a Nebraska native working for the Peabody Museum at Harvard University, led several expeditions to examine sites in the Missouri River valley of Kansas and Nebraska (Gradwohl 1978). Sterns and his field party spent much time examining archeological localities between Omaha and Kansas City, including earthlodge sites reported by avocational archeologists Mark E. Zimmerman, a resident of White Cloud, Kansas, and Robert Gilder of Omaha, among others (Sterns 1914, 1915a, 1915b.). Excavations of some of these sites in the Omaha area subsequently formed the basis for Sterns' (1915b) dissertation. He was employed by Warren King Moorehead of the Robert Peabody Museum at Phillips Academy in Andover, Massachusetts, to head up field survey of portions of the Arkansas River in 1917. The two men quickly fell into disagreement, which resulted in a suit against Sterns. The details of this episode remain to be fully explicated, assuming that the archival record is adequate to the task.

Although Sterns expended most of his effort on Missouri River valley sites, he did venture as far west up the Kansas River valley as Wabaunsee County, Kansas, in summer 1915. The lure westward was, of course, a concentration of sites reported by the late Jacob V. Brower in his books *Quivira* (Brower 1898) and *Harahey* (Brower 1899). In his notes, Sterns (n.d.:37) commented

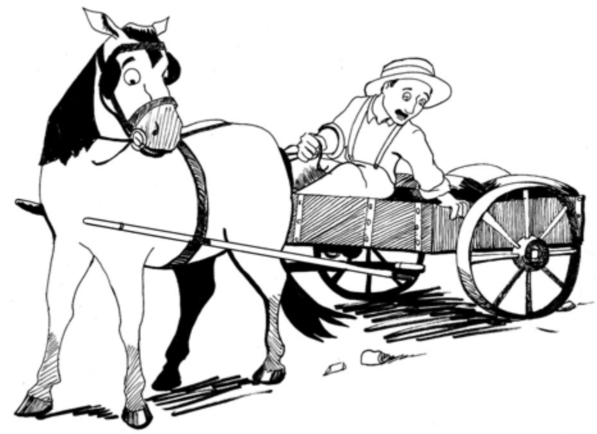
> In his Quivira and Harahey, Brower listed a large number of village sites as occurring on Mill Creek between Maple Hill and Alma. We went over this ground, and looked up the properties on which there were supposed to be sites. We could find temporary

> camps almost everywhere. But there was no evidence of any reasonably permanent village. Brower seems to have called any place a village where a few flints occurred.

A few years later Sterns (1918) argued that the human occupation of the Great Plains predated contact with European societies by centuries but after the adoption of horticulture. Early populations kept to the fertile valleys of the major rivers, and those sites found farther out into the Plains "are merely camping places such as one would expect in a horse-buffalo culture, and not the remains of permanent villages" (Sterns 1918:235). Of course, such a view formed as result of this and his other forays into the Plains. In any case, even though the locality offered few of the sorts of sites in which Sterns was most interested, it did afford an opportunity to try to find in the field evidence for the succession of Paleolithic cultures inferred by Winchell.

Of the book Sterns (n.d.:37) was clearly aware, as he noted that the area was ". . . the same region [in which] Winchell discovered his 'Paleoliths of Kansas'." In addition to looking for village sites, his field party also ". . . examined all the flints we found and others in local collections such as at Alma, but [we] were unable to find any evidence of the sort of thing he described." In closing Sterns (n.d.:37) added one final observation: "We gathered a number of flints in roads. These had been chipped by wagon wheels within recent years and yet they showed sometimes several stages of patination."

With these remarks Sterns offered a serious challenge to Winchell's thesis—one grounded no less in firsthand observation in the area where Winchell's alleged paleoliths were found and on materials from a similar (i.e., surface) context. Although he probably was not aware of it, his observation also pinpoints what made those flints singled out by Winchell as proof of a long succession of cultures so special: alteration and exposure to the elements. As Reynolds' study of the extant flints made clear, all bore evidence of re-chipping, in this instance by a semi-skilled flintknapper using an iron billet. In Sterns case on those specimens that had not been altered, evidence of multiple patinas was largely non-existent whether found in the field or in private collections. When alteration occurred, as when the pressure of passing wagon wheels popped new flakes from chert debris or tools/tool fragments lying about on the road, exposure to moisture, dirt, and horse droppings led to patination of the newly exposed surfaces. Sterns made no effort to elaborate and publish on his observation. In all likelihood, while the topic of the early settlement of the Plains was one of interest to him, Sterns (1918), as with many in the profession, evidently accorded Winchell's volume little respect. Indeed, although concerned with the early settlement of the region, in this latter paper Sterns did not even allude to Winchell's work or to the possibility of settlement in so distant a time.



Whoa, Newton! That's enough knapping for one day!

Illustration by Rob Fullmer.

ACKNOWLEDGMENTS

I stumbled on Sterns' notes in graduate school, as there were copies in the University of Kansas Museum of Anthropology's archives. I recently rediscovered my copies of them while sorting through my personal archives. My statement regarding Sterns and Moorehead derives from letters between Moorehead and Joseph B. Thoburn in the Oklahoma Historical Society Archives. Thank you to Rob Fullmer for creating the illustration.

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THOMAS R. OVERTON: PORTRAITS FROM THE FAMILY ALBUM

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Wisconsin Historical Society

This brief paper presents several previously unknown images of Thomas R. Overton, one of the co-excavators of the 12 Mile Creek Paleoindian site. The images are presented courtesy of heirs of Thomas Overton's brother.

In Volume 30 of *The Kansas Anthropologist*, I published a short biographical sketch of Thomas Riley Overton, who in 1895 was a co-excavator with H. T. Martin of the famous 12 Mile Creek Paleoindian locality in Logan County, Kansas (Hawley 2009). At the time the article was published, only one image could be found depicting Overton. When the photograph was taken in 1894, he was employed as an assistant to Samuel Wendell Williston, a professor at the University of Kansas in Lawrence.

The article came into the hands of descendants of William E. Overton, Thomas' brother. In early September 2011 one of them contacted me with several images in the family's possession. Over the years these had been sent by Thomas and Jessie to his older sister, Susan E. (Overton) Winchell, who lived for a time in Santa Barbara, California, but died in Phillips County, Kansas, in 1932. The photographs were duly ensconced in the family album for safekeeping. The email reads, in part:

> Thomas Riley Overton is a 2xgreat uncle of mine. My line descends from James Merian Overton's oldest son, William Edmond Overton. My immediate Overton family had no idea of the Long Island Quarry and the life of Uncle Tom Overton. In your article, you indicated that there were no known pictures of T R Overton, besides the photo in your article. We do have some pictures of Thomas Riley Overton and his wife Jessie Heydt Overton. We also have an old picture that we thought very strange until I read your article. The picture is of Tom Overton [with an "X" over his head; back of picture states "Tom Overton], an old man [his father James Merian Overton], and other family members sitting on a large mound of bare earth. Now I wonder if this is not a picture of the fossil diggings on the family farm (email to M. F. Hawley, September 8, 2011).

The family otherwise has little additional information regarding Thomas and Jessie, although a 1939 family history compilation by Thomas' nephew alleges that he worked as a lumber salesman in a lumber yard at one point. Updated material at *Ancestry.com* furnishes another "new" tidbit of historical information: California voter registration records indicate that the couple resided in Santa Barbara County from 1920 to 1929. Voter registration suggests that the couple moved from Santa Ana to Santa Barbara, probably to be closer to Susan Overton and her children, and then back, as other voter registration documents put the couple in Santa Ana in 1914; this is also where they resided when Thomas passed away in 1935.

Many questions naturally remain regarding Overton's life, including when or why the couple moved west and when Thomas turned away from preaching, which was not mentioned in his short death notice (Hawley 2009:8). Regardless of the answers, it seems clear that T. R. Overton was never again involved in paleontological collection after leaving Williston's employment. Through the kindness of the family, the pictures are presented here for the first time.

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At the Quarry. Ca. 1884–1891. The oldest of the pictures, this one shows Thomas with X above his head. An old man to his left is not identified and may be his father James Overton. If the picture were taken in 1891, which is possible, then the old man might be Judge Elias P. West, a former federal judge, who was then a paleontological collector for Kansas University. West died in January 1892; the 1891 season at the Long Island Quarry was his last. The other people are presumably family members and friends. The picture was almost certainly taken at the Miocene-age Sternberg Quarry, aka Long Island Quarry, in Phillips County, Kansas, between 1884 and 1891.

Thomas R. Overton. The picture, which shows Thomas with a Bible on his lap, was probably taken in the late 1890s. The back of the picture reads, "Susan—Here is the D.D." This suggests that Overton attended a seminary and may have obtained a *Divinitatis Doctor* or Doctor of Divinity prior to taking up preaching in Timber Hill Township in Bourbon County, Kansas.

Thomas R. Overton and Jessie M. (Heydt) Overton. Image dates ca. 1910–1913. The picture was sent as part of the couple's Christmas card to Thomas's sister, Susan. By this time the couple may have relocated west, possibly even to California. As Thomas is again shown with a Bible in hand, he may have continued to preach. Note what appears to be a Southwestern pottery vessel on the shelf to Thomas' right. This might indicate that the Overtons were living in the Southwest around 1910–1913. Jessie's parents lived in New Mexico. Even if the image were taken in California, the presence of this vessel might lend a small measure of support to the suggestion that the couple followed Jessie's family to New Mexico before moving on to California.

Thomas R. Overton in the fullness of life. This picture is of an older Thomas, ca. 1930. Thomas R. Overton died in 1935.

ACKNOWLEDGMENTS

I am greatly indebted to the descendants of William Overton for bringing these images to my attention and allowing their publication. The sender wishes to remain anonymous. Wisconsin Historical Society textile curator Leslie Bellais was of invaluable assistance in tightening the date ranges for the images, based on clothing styles. Mike Everhart concurred that the first image was likely taken at the Long Island Quarry, as it is definitely not Smoky Hill or Pierre Chalk, the two formations that Overton is known to have worked in for Williston. Barry Worley at the Kansas Historical Society did his best to enhance the quality of At the Quarry.

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THE HORSETHIEF SITE AND UPPER REPUBLICAN ADAPTATION ALONG THE EDGE OF THE HIGH PLAINS

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In April 2008 the Pawnee Watershed District, headquartered in Jetmore, Kansas, contracted Missouri State University's Center for Archaeological Research to mitigate impacts to the Horsethief site (14HO308) in advance of dam construction on Buckner Creek, Hodgeman County, Kansas. Key questions addressed in this report regard the chronological placement and cultural affiliation of the site, spatial uses of the site by the prehistoric inhabitants, site function, seasonality, subsistence, and economy. This report provides detailed information regarding the 2008 excavations and the results of specialized lithic, ceramic, archaeobotanical, and faunal analyses.

The Horsethief site is an Upper Republican manifestation on the southern periphery of the culture area. Upper Republican use of 14HO308 occurred sometime during the latter half of the twelfth century and/or early thirteenth century (between ca. A.D. 1150–1225). The site was intensively occupied for a relatively brief time during this interval. The inhabitants were large game hunters who supplemented their diet by foraging for an assortment of other resources.

Evidence was found for one semisubterranean structure and several smaller exterior roasting and/or smudging pits. An array of activities appears to have been undertaken at the Horsethief site. These included cooking and food consumption, bone grease manufacturing, hide scraping, clothing manufacture or maintenance, pottery and bead making, and stone tool manufacture and maintenance. The presence of ceramics, a diverse assortment of lithic materials, a faunal assemblage that reflects the transport of selected parts to 14HO308, bone tools and ornamental items, and an assortment of plant foods (but not cultivated products) indicate that the Horsethief site was not a hunting camp per se, but a site where an assortment of everyday activities occurred. It was a settlement to which a series of logistical hunting and foraging activities were tethered.

INTRODUCTION

By Neal H. Lopinot and A. Holly Jones

In April 2008 the Pawnee Watershed District, headquartered in Jetmore, contracted Missouri State University's Center for Archaeological Research (CAR) to mitigate impacts to the Horsethief site (14HO308) from proposed dam construction on Buckner Creek, Hodgeman County (Lopinot et al. 2010). Based on previous Phase III research at 14HO308 by C. Tod Bevitt and Anne M. Bauer (2003), it was determined that the site was an extremely important archeological resource in southwestern Kansas, having the potential to answer questions regarding human adaptations during ca. A.D. 800–1200, or late Early and early Middle Ceramic times.

The agreed-upon scope of work mandated that the data recovery plan should permit the determination of certain research objectives:

1. Answer questions regarding the chronological placement and cultural affiliation of the component(s) represented at the Horsethief site.
2. Ascertain spatial uses of the site by the prehistoric inhabitants, including the identification of structures, other features, and activity areas.
3. Determine site function within the context of a regional settlement system and the seasonality of the identified component(s).

4. Collect a representative sample of artifacts and other pertinent data (e.g., features and artifact locational information) to assist in site interpretation.
5. Collect data concerning subsistence and the economy of the Horsethief site inhabitants.
6. Obtain a series of radiocarbon ages and compare them with other assays from sites in the region to refine the absolute dates of occupation at 14HO308.

This report is divided into seven sections:

- overview of the environment and taphonomic processes affecting the Horsethief site;
- data recovery plan, methods of excavation, identification of features, and the general results of excavation;
- detailed description of the lithic assemblage;
- description of the methods of ceramic analysis, attributes of the ceramic assemblage, and conclusions regarding temporal-spatial classification, function, and form;
- description and interpretation of the archaeobotanical assemblage;
- description of the faunal assemblage, including the methods of analysis and conclusions regarding processing, diet, and seasonality;
- synthesis of the investigation results and conclusions bearing on research questions presented in this section.

Each section of the report addresses data recovery methods, analyses, results, and conclusions. Each contributing author provides knowledge from his or her area of specialization and may exhibit differences in theoretical perspective. It is hoped that at the intersection of these various perspectives lies a holistic view of the past activities of the prehistoric people who lived at the Horsethief site.

Previous Research at the Horsethief Site

The Horsethief site, located in Hodgeman County of western Kansas (Figure 1), was discovered in a cutbank along Buckner Creek during a Phase II survey in 1986 (Timberlake 1988). At the time in situ materials were noted to occur to a depth of about 1 m. Timberlake (1988) obtained a small collection of artifacts, including debitage and bison remains. Mandel (1994) conducted a geomorphological study of the entire Pawnee River drainage, including Buckner Creek. Subsequent site visits by archeologists from the Kansas State Historical Society (KSHS) in 1992 and 1997 resulted in the recovery of sand-tempered ceramic sherds, bison bones, an unnotched triangular arrow point, and other lithic artifacts composed of a variety of local and nonlocal raw materials (Bevitt and Bauer 2003:1).

In 2002 the KSHS conducted Phase III testing at the site (Bevitt and Bauer 2003). Six 1x1-m units were excavated to depths ranging from 45 cm below surface (bs) to 95 cm bs. All removed sediments were screened through 1/4-inch hardware cloth, and flotation samples were collected from features and cultural zones (Bevitt and Bauer 2003:23). In addition five backhoe trenches were excavated to better assess the stratigraphy and horizontal distribution of artifact-bearing deposits.

Bevitt and Bauer (2003:26) defined four cultural zones: Zone A (15–45 cm bs), Zone B (59–62 cm bs), Zone C (71–74 cm bs), and Zone D (80–83 cm bs). Zone B was defined by "a small diffuse hearth . . . and associated cultural material," whereas a hearth also was identified in Zone D, which exhibited the "densest concentration of artifacts" (Bevitt and Bauer 2003:26). Radiocarbon samples from Zones B and C yielded virtually identical uncorrected ages of 875 ± 30 radiocarbon years before present (rcybp) (ISGS-A0346) and 885 ± 25 rcybp (ISGS-A0347), respectively, whereas a third sample of charcoal from the hearth in Zone D dated to 1110 ± 70 rcybp (ISGS-5304) (Bevitt and Bauer 2003:28).

Diagnostic projectile points found at 14HO308 in 2002 included unnotched and notched triangular arrow points and a corner-notched dart point, although the latter was a surface find. Two pottery wares were identified. One ware exhibited a smoothed-over cordmarked (or, as often termed by Plains archeologists, cord-roughened) exterior and was tempered with "medium-grained sand with whitish caliche inclusions" (Bevitt and Bauer 2003:35). The second ware was plain, had a thinner wall thickness than the cordmarked ware, and was tempered with fine sand (Bevitt and Bauer 2003:35). Faunal remains included bone elements from bison (*Bison bison*), prairie dog (*Cynomys* sp.), crow (*Corvus* sp.), and unidentified birds and

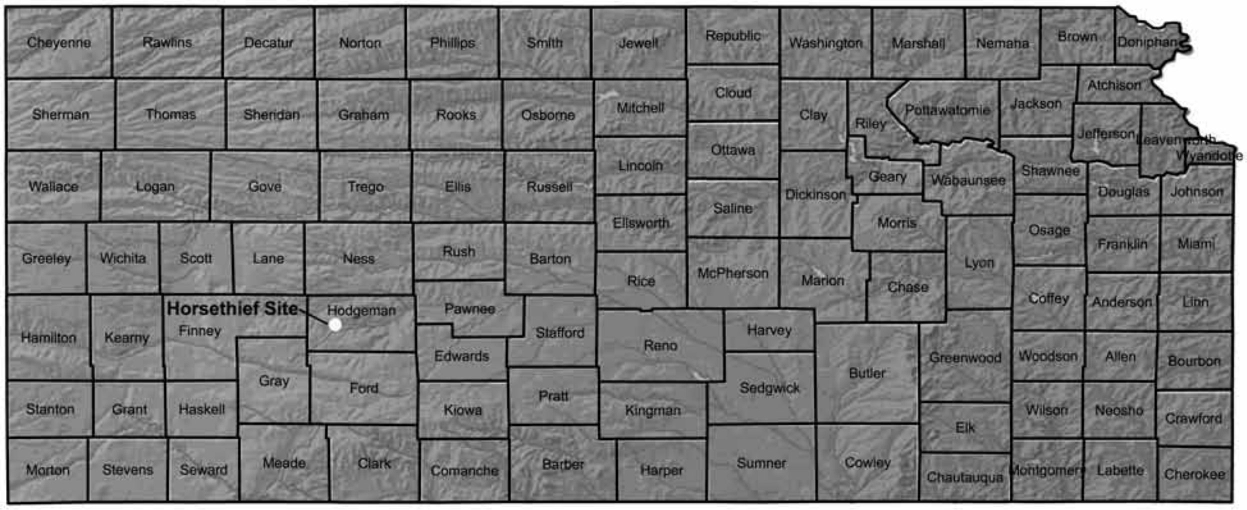


Figure 1. General location of the Horsethief site in western Kansas.

rodents. Although flotation samples were collected as the result of testing, no archaeobotanical analysis was conducted, and the samples apparently were not accessioned. However, hackberry (*Celtis* sp.) seeds were found by screening.

Based on the results of the Phase III work, Bevitt and Bauer (2003:36) determined that the site was a "short-term, special-function campsite," used intermittently during late Early Ceramic and early Middle Ceramic times. Test excavations demonstrated that the site contained diagnostic pottery and projectile points, other lithic tools, faunal remains, and features. Situated in "a void between several identified cultural areas," the authors (Bevitt and Bauer 2003:36) recommended that the Horsethief site was eligible for the National Register of Historic Places under Criterion D for its potential contributions to prehistory and particularly for "its ability to contribute information about the Middle Ceramic period and cultures in western Kansas."

General Temporal and Cultural Context

Taxonomic schemes currently advocated by archeologists working in the central Great Plains region were initially developed by archeologists associated with the Inter-Agency Archeological Salvage Program in the Middle Missouri valley (Stephenson 1954), the Midwestern Taxonomic System (McKern 1939), and John L. Champe (1946), Donald J. Lehmer (1954, 1971), Albert C. Spaulding (1956), and Waldo R. Wedel (1967). What began as a tentative classificatory scheme of archeological traits in the Great Plains continues to be reworked to reflect continuities within more specific spatiotemporal parameters. The archeological unit termed Central Plains tradition (CPt) of the Plains Village pattern was introduced by Lehmer (1954).

One criterion for membership in the Plains Village pattern group is evidence of horticultural activity, whether that practice was limited or large-scale. A number of sites that exhibit the majority of definitive criteria for inclusion in the Plains Village pattern, and more specifically the CPt, are present in western Kansas and portions of adjacent states, but they lack evidence for food production. Taxonomic placement of pottery-bearing, non-horticultural sites dating to late prehistoric times in southwest Kansas has been perceived as problematic. Donna C. Roper (2006a:126–127) addresses this issue by characterizing the CPt as a time-transgressive (east-to-west) period between the Plains Woodland broad-spectrum strategy and large-scale intensive agriculture. Such a model permits selective adoption of variable traits through time and across space, particularly important in understanding social groups that existed in unpredictable and extreme environments.

Western Kansas has not received as much attention from the archeological community as other parts of the Great Plains. However, an interested contingent of knowledgeable researchers has consistently pursued the time-space continuum in this area, providing a foundation for the current investigation. The following discussion is a general overview of the findings of previous archeological research pertaining directly or indirectly to western Kansas and the A.D. 500–1500 time period. Given the possible presence of a relatively ephemeral late Early Ceramic component at 14HO308, a very brief overview of this period is presented.

The primary occupation of the site dates to the early Middle Ceramic period and, based on the sparse ceramic assemblage in combination with other site attributes, is tentatively assigned as an Upper Republican manifestation of the CPt or one that is closely related to it. Given that virtually all of the material evidence derives from this manifestation, research and current issues relating to Upper Republican phase archeology are discussed in greater detail later in this section. The focus is on evidence from residential sites as opposed to burial sites, although it is recognized that mortuary behavior and associated material culture have aided in the establishment of several spatiotemporal taxonomic units.

The Ceramic period is divided into Early, Middle, and Late periods. The Early Ceramic period (A.D. 1–1000) in Kansas is contemporary with the Middle and Late Woodland periods of the Midwest (Hoard and Banks 2006:8). The Late Woodland in Kansas is defined primarily by the presence of undecorated or cordmarked ovoid to conoidal pottery vessels with slightly flaring rims and constricted necks; chipped-stone and ground-stone tools (both dart and arrow points, scrapers, drills, abraders, celts, manos, metates, etc.); ovoid or circular pole-supported house structures with wattle-and-daub walls; and several burial forms (cremation, extended, and semi-flexed direct burial) (Adair 1996; Calabrese 1967; Johnson and Johnson 1998; Logan 1990, 2006:84–85).

In western Kansas the Plains Late Woodland (ca. A.D. 500–1000) is represented by what has been defined as the Keith variant. People of the Keith variant are believed to have been semi-sedentary hunter-foragers (and perhaps low-level food producers) who lived at least part of the year in homesteads or small hamlets along streams, on hilltops, and, with less permanence where present, rockshelters. The houses at open-air settlements were oval to circular semi-subterranean structures with superstructures "constructed of small poles, . . . likely covered with skins, mats, or possible wattle and daub" (Bozell 2006:95–96).

Variability in the types of projectile points and pottery suggests that the Keith variant encompasses a fairly long timespan. Keith variant sites appear to document a shift from corner-notched dart points to Scallorn and triangular arrow points or from atlatl to bow-and-arrow technology (Johnson and Johnson 1998:209). Although the most definitive ceramic is the calcite-tempered Harlan Cord-roughened type, other types of cordmarked pottery also have been delineated. Considerably more subsistence data are needed, although it is generally asserted that the Keith variant people subsisted on an assortment of hunted animals, occasionally fish and mussels, and several wild seeds and fleshy fruits. Because Keith variant sites are sometimes characterized by structures and substantial midden deposits suggestive of a high degree of sedentism, the possibility of horticulture is often suggested (e.g., Blakeslee et al. 1986:26).

In this portion of the Plains region, the most relevant taxonomic units of the early Middle Ceramic period (A.D. 1000–1250) consist of the Bluff Creek complex, Plains Border variant, Upper Republican phase, Solomon River phase, and Smoky Hill phase. Given that these taxonomic units are both spatially conterminous and temporally coeval or nearly so, there is little wonder that a great amount of overlap in material culture exists. In fact, the Smoky Hill phase was established by Wedel (1959) from sites that originally were considered Upper Republican, the Solomon River phase similarly was defined by Richard A. Krause (1969, 1970), and the Plains Border variant represents a loosely defined construct for inclusion of numerous sites that occur in the Central-Southern Plains border area (Bevitt 1999). In general the Middle Ceramic period is characterized by homesteads on low terraces adjacent to streams and extended villages of varying sizes (Brosowske and Bevitt 2006:182–183); bone and stone tools for hunting, butchering, hide preparation, and clothing manufacture; and pottery, storage pits, and evidence suggestive of broad-spectrum reliance on both wild and cultivated plants, minimally including maize, beans, squash, and sunflower. The distinctions for different taxonomic units are largely based on ceramic differences, spatial distribution, and earthlodge forms.

In Kansas the distribution of the Bluff Creek complex is limited primarily to the Chikoskia River drainage in Harper and Sumner counties along the border of Oklahoma. Although it is not considered to be a CPt manifestation, it is described briefly here due to its geographic nearness and its purported temporal overlap with the Upper Republican phase. Originally defined by Gordon N. Keller (1961), the Bluff Creek complex is thought to date to A.D. 1100–1300, although radiocarbon ages are few and considered to be mostly unreliable (Blakeslee 1994). Structures were oval to subrectangular in form and were constructed on the ground surface. As for nearly all CPt phases, the primary vessel form is the globular cordmarked jar, although base shapes are variable and a variety of tempers (sand, bone, calcium carbonate, and shell) were used. The lithic assemblage is similar to that found at other CPt sites, but a considerable dependence on Florence A chert from the Flint Hills is evident (Brosowske and Bevitt 2006:197). Subsistence was relatively generalized, with bison and maize as first-line resources.

The concept of a Plains Border variant was created to account for more than 100 unaffiliated sites along the Central-Southern Plains border of southwest Kansas and northwest Oklahoma, extending into the northern part of the Texas Panhandle (Bevitt 1999). It was defined for sites almost exclusively south of the Arkansas River, but "its northern and eastern boundaries are not fully known" (Bevitt and Bauer 2003:17). Current dates from sites in this region suggest that the Plains Border variant dates mainly to ca. A.D. 1200–1400, but some sites included in this unit probably date even earlier or later than this. In any case houses were quite variable in design from east to west, although they were typically subterranean (Bevitt and Bauer 2003:17; Brosowske and Bevitt 2006:Figure 11.10).

Ceramics were generally cordmarked, and temper inclusions were variable. According to Bevitt and Bauer (2003:17), Plains Border variant sites can be distinguished by "the relatively high percentage of decorated ceramics, . . . the presence of Southwestern trade items," and the predominant use of Alibates and Smoky Hill cherts. The occupants appear to have practiced a mix of maize farming, hunting, and foraging (Adair 2006:259). Excavated sites assigned to this taxonomic unit include the Bell (14CM407), Booth (14CM406), and Lundeen (14MD306) sites, located in Comanche and Meade counties of southwest Kansas. Occupations of the Bell and Booth sites, formerly assigned to the Wilmore complex, may be a few hundred years younger than the Horsethief site habitation (see Drass 1998:439–440). The occupation of the fortified Lundeen site also appears to be later by at least a century or more.

The Solomon River phase was originally proposed by Krause (1969:88–90), who pointed out several distinguishing characteristics between some earlier sites in that locality and sites in the Medicine Creek valley in the "classic" Upper Republican area. Sites assigned to this phase are represented in the Glen Elder locality (Waconda Lake area) of north-central Kansas. Three types of sites were noted: (1) earlier farming hamlets with six to ten substantial earthlodges that were clustered and occurred on terraces of the North and South forks of the Solomon River; (2) later dispersed hamlets of three to four less substantial earthlodges strung out along the banks of tributaries of the main streams; and (3) seasonal fishing or hunting camps characterized by an apparent lack of house features (at least insofar as they have been defined to the east) and by middens, often comprising shell heaps. Such a model, however, was deconstructed by Kerry A. Lippincott (1976) and more recently by Donald J. Blakeslee (1999). Furthermore, the relevance of a Solomon River phase versus an Upper Republican phase remains debatable, although it is discussed here as a separate entity.

Krause (1995) later defined the Sumpter and Dubbert subphases of the Solomon River phase, which he considered as part of a larger Upper Republican variant. Increasing numbers of radiocarbon dates have shown that the Solomon River phase appeared earlier than ca. A.D. 800–900 and lasted until ca. 1250–1300 or as long as the Upper Republican phase (Blakeslee 1997, 2002; Krause 1995:313). Overall, attributes of Solomon River ceramic and lithic assemblages are very similar to those found at sites assigned to the Upper Republican phase (see below). However, besides the aforementioned earlier onset for the Solomon River phase, some proportional differences in rim forms and decorative motifs, as well as variability in house forms and other aspects of material culture, distinguish this phase from the Upper Republican phase (Blakeslee 2002:171–177; Steinacher and Carlson 1998:240). Mussels and walnuts apparently were dietary supplements, but bison and produced plant foods were probably the mainstays of the food quest. Maize was recovered at several Solomon River sites (Cutler and Blake 1973), indicating a reliance on horticulture (Adair 1994:324).

Sites of the Smoky Hill phase (ca. A.D. 1100–1350) occur primarily in north-central Kansas and south-central Nebraska, lying between the areas defined for the Upper Republican and the Nebraska phases. Smoky Hill phase sites occur along both major and minor streams and exhibit one to several square to rectangular earthlodges (Steinacher and Carlson 1998:248–249). However, at least two sites, the Minneapolis (14OT5) and Whiteford (14SA1) sites, are characterized by substantially greater numbers of lodges, although the contemporaneity of the lodges is questionable. In other words the greater number of lodges simply may represent a longer sequence of site occupation, with new lodges constructed as old ones deteriorated or were abandoned for other reasons.

Sand-tempered cordmarked jars with both unthickened and collared rims are common. Rim decorations, if present, are typically simpler in design than decorations on Upper Republican pottery, and Smoky Hill wares display a variety of tempers in paste recipes. Lithic tools are similar to those found at other Plains Village sites and include both notched and unnotched arrow points, end scrapers, flake cutting and scraping tools, grooved abraders, manos and metates, and celts. Subsistence appears to have emphasized large ungulates (bison, deer, and elk), although an array of other game was procured, including fish and mussels. Identified cultigens include corn, beans, squash, and sunflower (Blakeslee et al. 1986:27; Steinacher and Carlson 1998:250). Foraging for wild plant resources was likely important, but the Smoky Hill phase (as for nearly all CPt phases) is poorly understood due to limited archaeobotanical research.

Upper Republican

The principal occupation of 14HO308 can be assigned to the late prehistoric Upper Republican phase (ca. A.D. 1000–1350) (Blakeslee 1999; Bozell and Ludwickson 1998). William Duncan Strong (1933:278–279, 1935:245–250; also see Wedel 1935a, 1935b) initially defined this phase as a prehistoric cultural complex characterized by people who practiced horticulture supplemented by hunting and lived in single lodges or in small, unfortified villages. Although first identified along the middle reaches of the Republican River in southwest Nebraska, the extent of this phase today includes contiguous portions of western Kansas, northeast Colorado, and a small portion of southeast Wyoming. The Horsethief site location extends the Upper Republican culture area perhaps to its farthest southern limit during its florescence (A.D. 1120–1250) (Kivett and Metcalf 1997:163; Wedel 1986:130). Since 1935 the area has changed dramatically in spatial extent and location (Blakeslee 2002:170–171, Figure 10.1). However, the original core area of the Upper Republican drainage basin, including its well-studied tributary, Medicine Creek, remains a fulcrum for studying Upper Republican phase adaptational variability.

Lehmer (1954:143–147) subsumed the Upper Republican phase under the CPt in the process of delineating a larger culture area, characterized by horticultural economies, earthlodges, and particular ceramics and lithic tools. Upper Republican peoples apparently preferred living in secondary stream valleys, as opposed to the main river valleys (Wedel 1986:99–100). At least for the Upper Republican village sites in the eastern part of the culture area, houses were of single-post construction, having square to subrectangular forms with covered entryways (mainly facing south, southeast, or east) and centrally located hearths (Kivett and Metcalf 1997:167; Roper 2002a; Wedel 1986:104). Although defined in part by the presence of cultivated crops (primarily maize) and bison scapula hoes, Upper Republican today includes sites occupied by both gardener-hunters living on the Loess Plains and hunter-foragers living on the High Plains.

Typical ceramic vessels produced throughout the Upper Republican phase are globular-shaped jars, characterized by rounded shoulders and bases, restricted necks, and cordmarkings on exterior surfaces (Wedel 1959:559), although plain-surfaced examples also are represented. Collared rims, sometimes with incised or trailed decorations, occur commonly on Upper Republican jars (Wedel 1986:106). The pastes were generally tempered with sand or fine gravel (Wedel 1959:559). The lithic assemblage includes triangular notched and unnotched arrow points, diamond-shaped Harahey knives, and end scrapers, among other chipped-stone and ground-stone tool forms (Wedel 1986:108). Osseous tools include a variety of sewing, piercing, scraping, flint-knapping, excavating, and fishing implements. The bone and shell technology also includes examples of pendants, gorgets, beads, and bracelets or bow guards (Wedel 1986:108–110).

The following information from selected sites in both the eastern and western portions of the area encompassed by the Upper Republican phase will put the Horsethief site data into context.

Some High Plains Upper Republican Sites. Among sites of considerable relevance in understanding the nature of activities at 14HO308 is the Pottorff site (14LN1) (Wedel 1953), located on the High Plains northwest of the Horsethief site in Lane County. Although evidence of houses is generally lacking at sites on the High Plains (Wood 1990:5), and it has even been stated, "High Plains sites were not house sites" (Roper 1990:4), excavations of the Upper Republican component at Pottorff A identified two structures. Both were semicircular in plan and smaller than their eastern counterparts, although house forms of the Middle Ceramic period in the Central Plains appear to have been variable in both size and shape (Blakeslee 2002:165–171; Roper 2002a). No "traces of charred corn, beans, cucurbits, or other plant food remains, wild or domestic, were noted," but bison scapula digging tools were recovered (Wedel 1953:397). Bison remains dominate the faunal assemblage, but bones of other mammals and grouse were noted, along with a variety of mussels. Approximately 30–40 ceramic vessels are represented, all of which are cordmarked on the exterior. Of the 28 rims in the collection, approximately half (N = 15) are unthickened (direct), and the remainder (N = 13) are collared (Wedel 1953:398–399). Besides the above-mentioned scapula digging tools, worked bone includes awls, a fishhook, and tubular beads. Two mussel shell pendants and a circular shell bead also were recovered from the site (Wedel 1953:407).

The lithic assemblage is quite diverse, reflecting a wide array of activities. Chipped-stone tools include triangular arrow points, a few drills, Harahey knives, end scrapers, and side scrapers, among others. The arrow points consist of 68 unnotched, 31 side notched, 27 triple notched, 5 with two pairs of side notches, and 5 with two pairs of side notches and a basal notch (Wedel 1953:402–403). Non-chipped stone includes manos, shaft smoothers, abrading stones, a limestone pipe, hammerstones, a possible amazonite pendant fragment, and faceted hematite and limonite (Wedel 1953:405–407). Considering the great variety of artifacts and animal remains, the implication is that the Pottorff site was a residential locus of more than brief seasonal duration despite the apparent lack of cultigens.

The Coal-Oil Canyon site (14LO1, 14LO401) on the High Plains in Logan County shares many characteristics with the Pottorff site and, as shall be seen, with the Horsethief site. Despite the similarities, however, the functions of these sites might have been different. Coal-Oil Canyon is multicomponent and characterized by an absence of stratigraphy throughout most of the site. The mixed nature of the deposits renders the cultural affiliation of most artifacts uncertain; however, the Upper Republican component appears to be dominant (Bowman 1960, 1996; McLean 1996). No structures and only a few hearths were defined at the site (Bowman 1960:15–16), but a large number and variety of artifacts were recovered (see McLean 1996:Tables 1–17). Represented ceramic vessels consist primarily of globular, cordmarked, sand-tempered jars, although some pottery is plain. Both unthickened and collared rims are represented. The lithic assemblage contains both notched and unnotched arrow points, knives (including "classic" Harahey knives), end scrapers and side scrapers, drills, sandstone abraders, ground sandstone fragments presumably from grinding slabs, a few manos, and much red and yellow ocher (Bowman 1960:54–62, 65). Worked bone includes awls, a possible needle fragment, fragments of a possible bow guard and a necklace, and tubular beads, whereas worked shell comprises a disk bead and another ornamental item (Bowman 1960:63–64). Bison remains were noted as abundant, but most faunal remains were discarded, and no plant remains were described.

Studies of the Donovan site (5LO204), an Upper Republican High Plains site in northeast Colorado, also provide a basis for evaluating data from 14HO308. Nineteen strata have been defined at the Donovan site, of which 11 represent separate

Upper Republican occupations dating from shortly after A.D. 1000 to ca. 1300 (Scheiber and Reher 2007:346, 349). Ceramic density was generally low relative to that for other artifact types. Represented vessel forms and rim design elements are virtually indistinguishable from those found at eastern Upper Republican sites, including sites in the Medicine Creek drainage in southern Nebraska. A wide variety of lithic and bone tools were represented. Most of the lithics were made from Flattop chalcedony. However, some Smoky Hill chert from exposures of the Niobrara Formation in southwestern Nebraska and/or northwestern Kansas also occurred at the site (Scheiber and Reher 2007:353–354). Faunal procurement was focused on bison, but the remains of at least 29 other taxa were identified (Scheiber and Reher 2007:355). Other than noting the recovery of hackberry seeds in screen samples, apparently no effort was made to analyze plant remains in flotation samples.

The Upper Republican faunal assemblages from 5LO204 were a major focus of study by Scheiber (2001, 2007; Reher and Scheiber 2007). Body part representation indicated that selected parts were brought to Donovan from kill sites. "Elements of the axial skeleton, especially the thoracic vertebrae and ribs, are extremely rare" (Scheiber 2007:303). Based on bone representation, percussion impacts to bone, and the relatively small size of fragments, long bones and mandibles apparently were smashed for extraction of marrow, and cancellous elements were smashed to size them for extracting grease by boiling in ceramic vessels (Scheiber 2007:306). The site was interpreted as an animal processing camp, focusing on bison procurement and marrow/grease extraction.

Upper Republican Sites in the Medicine Creek Valley. The Medicine Creek valley has been the epicenter of research on the Upper Republican phase since A. T. Hill began site excavations in the area in 1933 (Roper 2002b:144). The most substantial research in the Medicine Creek valley was that of the Nebraska State Historical Society (NSHS) and the River Basin Survey (RBS) during 1946–1948 (Blasing 2002), which resulted in reports by Marvin Kivett (1949; Kivett and Metcalf 1997). A brief summary of this work and later work by Wood (1969) and Roper (1996) is presented here.

Kivett and Metcalf (1997) reported on excavations at 12 Upper Republican sites in the Medicine Creek valley, a tributary of the Republican River. In 1947 and 1948 NSHS and RBS teams excavated 49 house floors, a large number of associated intramural and extramural features, and midden deposits. The sites occurred either immediately adjacent to creeks or on nearby high well-drained terraces. Kivett and Metcalf (1997:163) suggested that the occupations of two-thirds of the 12 excavated sites occurred during the time interval A.D. 1120–1250, based on averaging multiple mean dates. Houses were either rectangular or square, with floor areas ranging widely from 31.8 m^2 (342 ft^2) to 152.5 m^2 (1,641 ft^2). All house floors had central hearths, and 1 to 7 storage pits occurred in 38 of 47 house floors that were mostly or entirely excavated (Kivett and Metcalf 1997:168). The walls of at least some of the houses were plastered (Kivett and Metcalf 1997:Figure 61; Smith 1969:11).

A total of 39,969 artifacts, including "2,820 Upper Republican rim sherds and 4,554 classifiable Upper Republican artifacts (whole or fragmentary) made of stone, bone, antler, and shell," were recovered (Kivett and Metcalf 1997:94). The vast majority of the sherds came from sand-tempered cordmarked or smoothed-over cordmarked jars (Kivett and Metcalf 1997:Appendix II). Less common vessel forms consist of miniature vessels or pinchpots and "bowls," the latter also having constricted necks and being relatively tall (e.g., Kivett and Metcalf 1997:Figure 127), unlike the shallow bowls found at Nebraska phase and Steed-Kisker phase sites to the east.

The lithic assemblage exhibits the same variety of chipped-stone and ground-stone tools found at High Plains Upper Republican sites. As for sites on the High Plains, most toolstone apparently was procured from local sources. Local Smoky Hill chert generally was preferred for chipped-stone tools (Kivett and Metcalf 1997:103–105), although some exotic materials, including Flattop chert and even a few pieces of obsidian, were recovered. Kivett and Metcalf (1997:105) noted, "projectile points are relatively scarce in the Medicine Creek Upper Republican sites." Unless underrepresented due to excavation techniques, this probably relates to the importance of plant-food production with a lesser emphasis on hunting compared to activities undertaken by residents of High Plains Upper Republican sites.

The worked bone, teeth, antler, and shell materials are quite diverse (Kivett and Metcalf 1997:131–150). Of course, the diversity reflects the large number of sampled sites. Twenty-two categories of worked bone were described. Bison scapula digging tools and knives are the most abundant of these. Kivett and Metcalf (1997:131) noted the recovery of "229 scapula hoes and an additional 529 fragments of bison scapulae." Examples were found at all 12 sites. Although elemental data were not presented in their study, Falk (1969b:Table 8) provided convincing evidence that the occupants of the Mowry Bluff site (25FT35) obtained scapulae to the near exclusion of other bison parts.

Ornamental items include bone beads, shell beads, and shell pendants. These were found at 9 of the 12 sites studied by Kivett and Metcalf (1997:Table IIIA). Bone and shell beads also were recovered from Mowry Bluff (Falk 1969a:41), 1 of the 12 sites investigated earlier by the NSHS and RBS teams. A relatively diverse faunal procurement strategy was indicated for Upper Republican times in the Medicine Creek valley. Kivett and Metcalf (1997:Table IVB) documented some 35 different species. Bison remains were ubiquitous, apparently a first-line animal resource, but the majority of sites also had remains of antelope, beaver, raccoon, rabbit, box turtle, catfish, pocket-book mussel, and white heelsplitter mussel. For mussel exploitation, however, the mapleleaf mussel also was important at the Mowry Bluff site (Stansberry 1969:Table 13), pointing to a high degree of local opportunistic exploitation of faunal resources.

Upper Republican human-plant relations are poorly known since most work was undertaken prior to flotation, and the samples consist of unsystematically collected grab samples of conspicuous items. For example, based on the analysis of macrobotanical remains from 25FT70, another of the 12 sites, maize, beans, squash, sunflower, and nut shell were identified (Cummings and Rylander 1988). However, smaller seeds and other materials were not represented. In the absence of flotation, only corn was reported as a food remain from the Mowry Bluff site (Wood 1969), although Cutler and Blake (1973:31) also recovered squash, domesticated sunflower, and groundnut (*Apios americana*) remains from two sites assigned to the coeval Solomon River phase.

The only report on an Upper Republican site for which large flotation samples were collected, processed, and analyzed was that by Puseman (1996) for House 4 at 25FT22. Besides the obvious domesticates, seeds of chenopod, knotweed, amaranth, and plum/chokecherry were recovered, along with walnut shell. Based on both archeological data and modeled caloric data, Nepstad-Thornberry et al. (2002:201–202) suggested a very mixed diet for Upper Republican people in the Medicine Creek valley, with produced foods comprising about half of the diet. More specifically, they estimated that subsistence might have consisted of maize (30 percent), other cultigens (20 percent), wild plant resources (20 percent), large game (20 percent), small game (5 percent), aquatic resources (4 percent), and fowl (1 percent).

Models of Upper Republican Adaptation

The definition very early of two types of Upper Republican phase sites—those in the east occupied by gardener-hunters and those in the west lacking evidence of food production—led many to assume that the western sites represented seasonal hunting camps or stations of the eastern farmers (see Roper [1990] for a historical overview and evaluation of the *hunting-camp model*). Unfortunately, archeological evidence to support this model was not presented in the early literature on Upper Republican. Instead, it was assumed that the dual maize-village and bison-hunting-camp adaptation of historic tribes living on the Plains, particularly the Pawnee, applied to late prehistoric times.

Peter W. Bowman (1960) might have been one of the first to question the hunting camp model in his discussion of the Upper Republican occupation at the Coal-Oil Canyon site. He questioned why people "would travel scores or hundreds of miles on foot solely for the purpose of obtaining meat" (Bowman 1960:66). More important, however, was his brief discussion of the likely nonportable nature of the pottery, some of which had been extensively used and the bulk of which he believed to have been manufactured locally. Although no structures were found and only a few hearths were identified, Bowman thought that the Coal-Oil Canyon site was much more than a "meat camp."

Among others, Wood (1971) recognized that

High Plains Upper Republican sites had similar artifact inventories to those from sites to the east with evidence of horticultural activities, although he initially viewed such sites on the High Plains as hunting camps. The hunting-camp model appears to have dominated his thinking at the time, not just for Upper Republican, but also for a coeval Steed-Kisker manifestation to the east (Wood 1968). Nearly 20 years later Wood (1990:3) lamented the fact that there continued to be “virtually no new information” on Upper Republican sites on the High Plains of northeastern Colorado. In the brief journal article, a revised version of a paper given at the 1978 Plains Conference, he evaluated the evidence for and against the use of Upper Republican sites on the High Plains as camps or stations, occupied by hunters from farther east, as opposed to a resident population. His assessment was inconclusive, although he (Wood 1990:6) summarized with the following insightful statement.

> The resident hypothesis appears to have an edge in its favor at this time, but neither hypothesis can be accepted without reservation: the field evidence is simply too slim. A carefully formulated research program designed to collect data bearing on this problem is sorely needed. Until the time such a program is carried out, further discussion will be more provocative than productive.

In the very next issue of the same journal, Roper (1990) evaluated the hunting-camp model. Based on careful comparison of artifact assemblages from 21 Upper Republican sites and modeled material culture expectations for Pawnee hunting sites derived from ethnographic observations (see Roper 1991), the hunting-camp model was rejected. Instead, the evidence seemed to support the presence of a resident Upper Republican High Plains population. In rejecting the hunting-camp model in favor of a *resident population model*, Roper (1990:16) also noted that the Upper Republican horticultural village sites to the east in the Medicine Creek drainage were characterized by a diversity of faunal remains, including bison and many of the same animals represented at sites in the High Plains.

Wedel (1953:503, 1959:16, 1986:33) repeatedly emphasized the potentially adverse affects of limited rainfall on agricultural productivity west of 100° west longitude. In following Wedel’s lead, Roper (2009) noted the concordance in distribution of the two types of sites: sites demonstrating some degree of food production occurring east of that meridian and purely hunting-foraging sites occurring to the west on the High Plains. This bilateral distribution is linked to east-to-west climatic and attendant vegetational gradients, characterized by critical decreases in annual precipitation and changes from “tall-grass prairie, to mixed grass prairie, to short-grass plains” (Roper 2009:22). Rather than viewing this as an approximate longitudinal barrier, however, Roper (2009:24) suggested that it was a threshold for moving back and forth from one adaptive stance to another. In evaluating the apparent variability in adaptation, she (Roper 2009:24) recently argued that the Upper Republican phase “constituted a large and heterogeneous, fluidly organized population that maintained considerable flexibility in adaptation and adopted varying structural poses as conditions warranted.”

Barlow (2002) provided a potentially applicable model of opportunistic settlement-subsistence in her evaluation of the Fremont culture. The modeled variability in strategies emphasized “the economic importance of maize and in the degree to which people inhabited central places or employed residential mobility to exploit maize fields and wild food procurement areas” (Barlow 2002:69). In her cost-benefit analysis of different subsistence strategies, Barlow (2002:79) suggested that one end of the spectrum probably involved a strategy involving low-cost investments in field preparation and planting, as well as harvesting. It involved dry farming with no field maintenance during the growing period. Although risky, this allowed Fremont peoples to intensify their foraging and hunting activities during the growing season. In historic times the Cheyenne also practiced such a low-cost gardening strategy, leaving their maize gardens to hunt and forage elsewhere (Moore 1987:145).

This *low-cost gardening strategy model* represents a version of the hunting-camp model, although it has potentially different seasonal implications. At least in the Central Plains, some level of provisioning would be expected, and such provisions might have included maize and other cultigens. As Wood (1990:4) noted, “only a single grain of corn is known from one of the High Plains sites, at Agate Bluff

(Irwin and Irwin 1957:22)." Nonetheless, trade could account for this occurrence. Furthermore, it is apparent that very little archaeobotany has been undertaken in conjunction with investigations of High Plains sites, so this model for the Upper Republican phase cannot be ruled out.

Evaluating Various Models of Upper Republican Adaptation

More chronological data are certainly needed to evaluate various scenarios. However, existing evidence indicates that Upper Republican peoples were locally opportunistic. Food production east of the 100˚ west longitude must have been risky, and extended droughts might have caused shifts in adaptive poses, if not actual interregional movements of people to particular areas where hunting and gathering were optimal. Under such conditions one would expect a more diversified subsistence strategy, one that did not just emphasize bison, although the local abundance of bison or other resources could have precluded the need to diversify. Roper (2002c:193) suggested that Upper Republican uses of sites in the Medicine Creek valley and in the High Plains perhaps involved a shift in residence and mobility strategies. Such strategies were not based on seasonal cycling, but rather on annual or multiannual variability in climatic conditions (years or periods of high rainfall or drought) and natural resource availability.

Standard deviations for Accelerator Mass Spectrometry (AMS) radiocarbon dating continue to be smaller and smaller, but the measurement of shifts in adaptive poses is probably still beyond our current ability to measure time in sufficiently fine increments. Even so, it is essential that archeologists obtain not just a few radiocarbon ages for a particular component but large suites of ages that will allow a finer scale assessment of time-space systematics and adaptation. Furthermore, the types of materials dated for late prehistoric sites must be identified, and there should be a new effort to submit materials from short-lived plants or animals, rather than only wood charcoal from potentially long-lived trees.

One of the key elements in evaluating seasonal versus annual interregional mobility is *occupational seasonality*, although seasonal indicators are often lacking or difficult to evaluate. One of the shortcomings in past studies of the hunting-camp hypothesis is the traditional emphasis on animal remains, with little or no systematic large-scale research on plant remains, particularly from High Plains sites. Furthermore, zooarchaeologists working with High Plains faunal assemblages have placed little emphasis on seeking evidence of occupational seasonality.

No doubt some Upper Republican sites represent hunting camps with a focus on bison in particular, but many High Plains sites identified as hunting camps likely were used for much more than that. Other than Puseman's (1996) archaeobotanical study for a site in the Medicine Creek valley, the analysis of substantial assemblages of flotation-recovered plant remains from Upper Republican sites has been largely wanting. In fact, such studies could demonstrate that a large number of sites lacking evidence of food production and earthlodges, in fact, were occupied multiseasonally if not year-round by peoples invested significantly in foraging, particularly for plant resources. In a more general vein, evidence from plant remains may call into question the commonplace use of the term "hunting camps." It is essential that both animal and plant remains be studied systematically before simply ascribing the concept of hunting camps to nonhorticultural Upper Republican sites. Unlike many Upper Republican sites with shallow and often much-disturbed deposits, the buried component at the Horsethief site provides the opportunity for a more balanced series of specialized analyses needed to better evaluate subsistence and economy.

Another means of evaluating interregional residential mobility is through archaeometry, and more specifically the chemical analysis of pottery and potential clay sources. A recent study by Roper et al. (2007) has been encouraging with respect to delineating compositionally distinct CPt pottery groups and identifying east-to-west and west-to-east interactions among groups. However, two age-old problems cannot be reconciled using this evidence to resolve mobility strategies. First, did at least some pots arrive at sites by people moving about the landscape? Second, were those pots manufactured by the same people moving from one locale to another (e.g., from the Loess Plains to the High Plains or vice versa), or were the clays or finished pots obtained as the result of trade?

Clearly, evidence from 14HO308 will not provide a basis for understanding Upper Republican phenomena in all its poses over a 300-year period. However, it does have the potential to evaluate at least the resident population model, the low-cost gardening model, and what is defined here as the locally opportunistic model, none of which are necessarily mutually exclusive. Furthermore, the evidence from the Horsethief site provides the opportunity to evaluate the relevance of concepts such as hunting camps or hunting stations.

SETTING AND ENVIRONMENT

By A. Holly Jones

The Horsethief site is located at the convergence of three major physiographic divisions of Kansas: the High Plains proper, the Plains Border or Dissected High Plains, and the Arkansas River Lowland (see Wedel 1953:Figure 2). The site is situated along the ecotone of the Smoky Hills and the High Plains (Mandel 2006a:Figure 2.1), where the landscape has been irregularly broken by stream and wind erosion. More specifically, 14HO308 occurs on a terrace immediately adjacent to Buckner Creek at an elevation of about 734.6 m (2,410 ft) above mean sea level. In this locality downcutting by perennial Buckner Creek has contributed to the exposure of flat-topped outcrops of the Ogallala formation on the south side of the valley. The north side of the valley is more gently sloping and lacks such bedrock exposures, a likely result of greater erosion and redeposition of loessial sediments due to its south-facing, and therefore warmer and dryer, aspect (Mandel 1994:38).

Buckner Creek is a major tributary of the Pawnee River, which is in turn a major southwest Kansas tributary of the Arkansas River. The Pawnee River flows eastward from its headwaters in Gray County and drains into the Arkansas River near Larned. Buckner Creek, a fourth-order tributary, also issues from Gray County (Figure 2). Buckner Creek joins the Pawnee River near Burdett in Pawnee County. Both the Pawnee River and Buckner Creek comprise the Pawnee-Buckner River sub-basin in Hodgeman, Pawnee, and Ness counties. Other major tributaries of the Pawnee River include Hackberry Creek and Sawlog Creek.

Several aquifers are present in the Pawnee-Buckner sub-basin (Fishel 1952:7). The Pawnee-Buckner Alluvium, the Ogallala-High Plains, and the Dakota aquifers provide groundwater in the Pawnee-Buckner sub-basin. In Hodgeman County the Pawnee-Buckner Alluvium encompasses an area measuring about 3.2 km (2 miles) in width and 30.5 m (100 ft) in thickness at its maximum. The unconfined portion of the Dakota aquifer and the Ogallala-High Plains aquifer are found in the western part of the sub-basin in Hodgeman County (Fishel 1952).

Geomorphology

Mandel's (1994) geomorphic study of site 14HO306 on Buckner Creek yielded information useful to this study regarding soil types, buried paleosols, and depositional histories. According to Mandel (1994:38), Buckner Creek has altered the valley and terraces through lateral migration, resulting in steep cutbanks. In archeological terms site detection is enhanced by cutbank exposure. During the Late Holocene (4000 B.P. to present), Buckner Creek and other small-order streams transitioned from agents of erosion and sediment transport to agents of aggradation. Sediment accumulation within these valleys permitted soil genesis, resulting in stable landforms (Mandel 2006b:39–42).

Mandel (2006b:41) contended that the period of 1600–1000 B.P. (A.D. 400–1000) was particularly significant with respect to soil formation in small stream systems of western Kansas. Modern climatic moisture patterns in western Kansas were established ca. 8000 B.P./6000 B.C. (Bryson et al. 1970; Mandel 2006b:40) and are characterized by intense, but sporadic rainfall in the dry sub-humid to semi-arid climate. Thus, soil development in the Buckner Creek valley was punctuated by flooding events and sedimentation (Mandel 2006b:40).

Archeological sites in alluvial environments with episodic heavy precipitation, as is the case at the Horsethief site, are more likely to sustain catastrophic flood impacts than areas where rainfall is more consistent yet less intense (Brown 1997:38). Alluviation and sedimentation rates are important factors affecting the taphonomic history of an archeological site and concomitant vertical artifact densities (Kirkby and Kirkby 1976). Certainly, factors

Figure 2. Buckner Creek at the Horsethief site, view northwest.

such as climate, environment, sediment availability, and flood history play a critical role in burial processes, but human and other biological influences are also important agents (Kirkby and Kirkby 1976; Schiffer 1987; Stein 1983). In addition lateral migration of stream channels poses a significant threat to buried sites (Brown 1997).

The study area, approximately 16 km (10 miles) west-southwest of Jetmore, Kansas, lies at the physiographic border of the High Plains and Dissected High Plains sections of the Great Plains Province of the Interior Plains (Shoewe 1949). Fenneman (1931) referred to this area as the "Plains Border." Shoewe (1949) delineated a narrow extension of the Central Lowland Province that thrusts into the region from the east. Haworth (1897:42) used the term "Kearney Hills" to designate the area of the Smoky Hills west of Salina within the Central Lowland Province. Shoewe (1949:309) stated that Jetmore "marks the eastern border [of the Kearney Hills]" and that "excellent ceramic clays are exploited in this physiographic unit," although it remains to be determined if such clays were good for the production of prehistoric pottery as well as historic bricks.

The surficial deposits of Hodgeman County are of Quaternary, Tertiary, and Cretaceous age (Moss 1932). The Quaternary sediments consist of localized deposits of sand, silt, and gravel, located within and adjacent to the valleys of the Pawnee River and its tributaries. These unconsolidated deposits eroded from the underlying Ogallala Formation during the last 1,000,000–2,000,000 years. A mantle of loess blankets the divides and ridges between stream valleys. The Tertiary deposits, which are exposed along the Buckner Valley edge south of 14HO308 (see Figure 3), are confined to the Ogallala Formation. This formation is composed of sand, silt, and gravel deposits derived from the Rocky Mountains and transported by streams considerable distances to

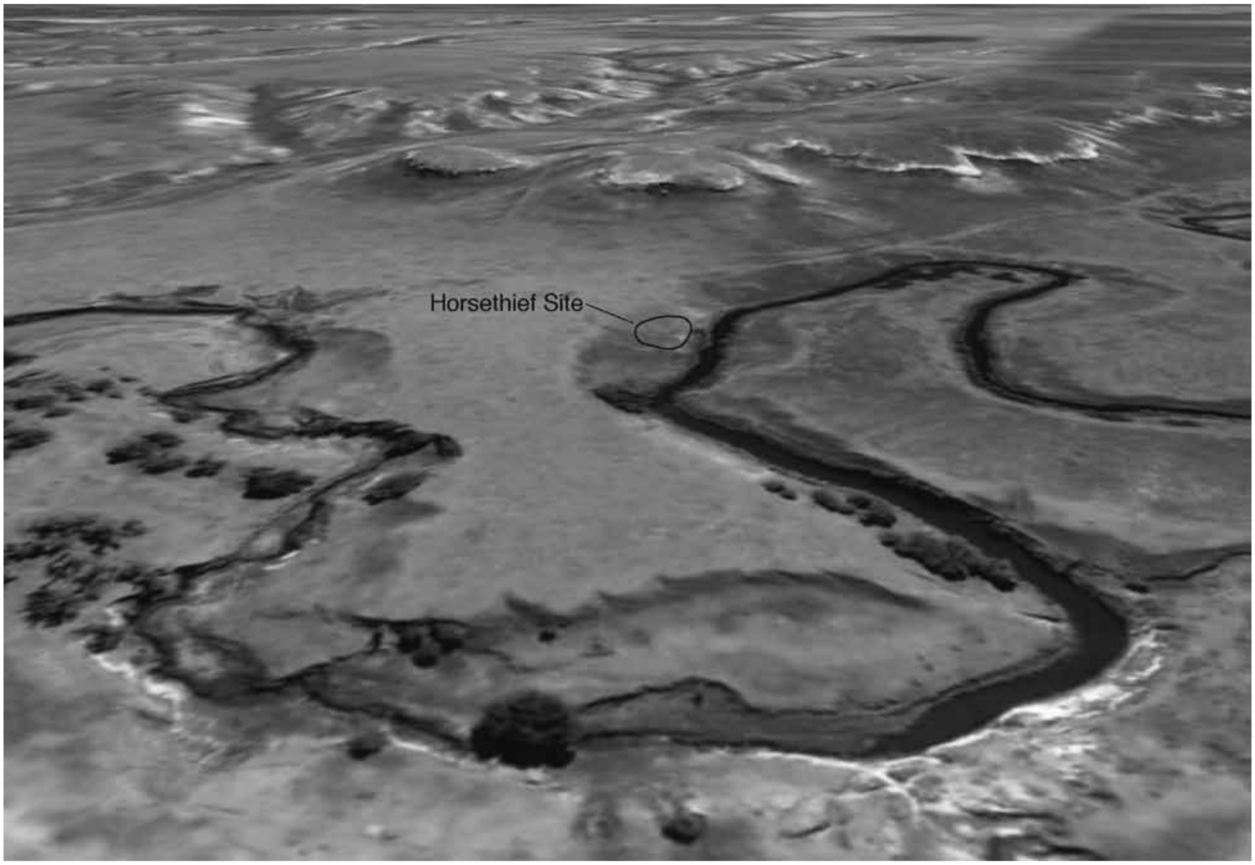


Figure 3. Location of the Horsethief site in relation to exposures of the Ogallala Formation.

the east. Much of the Ogallala is poorly consolidated, but some mortar beds are locally cemented by calcium carbonate. The Cretaceous formations are composed of chalk (Niobrara), shale (Carlile and Graneros), limestone (Greenhorn), and sandstone (Dakota).

Climate, Fauna, and Flora

The Horsechief site is located at 100º 03 west longitude, or essentially on the subsistence-dependent precipitation threshold discussed by Wedel (1953, 1986) and more recently by Roper (2009). Changes in climate, but particularly drought conditions, no doubt played a key role in affecting subsistence and settlement strategies throughout Central Plains prehistory. For example, studies by Tomanek and Hulett (1970) demonstrated how historic droughts of more than three years in length have led to significant changes in vegetation cover in the mixed prairie near Hays, Kansas. These include decreases in plant biomass, changes in vegetation composition, and similar variability in dependent animal populations (Tomanek and Hulett 1970:208–210). A factor of some importance to consider with respect to human adaptation is that droughts are followed by rebound periods. It might take several years of favorable climatic conditions for an area to rebound from the effects of droughts, and the composition of subsequent vegetation might be significantly different from pre-drought character. Based on the data presented by Tomanek and Hulett (1970), vegetational recovery following a three- to five-year drought might take a roughly equivalent amount of time. Given foraging groups' preferences for particular species, substantial changes in species distribution could have elicited substantial changes in foraging strategies or even movement to other locations where preferred resources were sufficiently abundant for lifeway maintenance.

By and large climatic conditions prevailing during the Upper Republican occupation of 14HO308 were similar to those of today (see discussion in Blakeslee 1999:11–16). The average annual precipitation for Jetmore, located about 16 km to the east, is 51.6 cm (20.31 inches), with 23.6 cm (9.28 inches) or nearly half falling during the months of May, June, and July (Kansas State Research and Extension 2009). The average frost-free date for Jetmore is April 23, and the 95 percent frost-free date is May 14, whereas the average date for the first frost is October 11. Based on these dates, Jetmore has an average of 173 frost-free days.

Kuchler's (1974) map shows the project area within the bluestem (*Andropogon*)-grama (*Bouteloua*) mixed grass prairie, but immediately east and south of a finger transitional between bluestem tall grass prairie and mixed grass prairie. Critical forces affecting the ecoregion include drought, high winds, temperature extremes, dryland cultivation, cattle grazing, and, to some extent, fire (Knopf and Samson 1997). Grazing and browsing fauna, such as bison, elk, deer, and pronghorn, once commonly roamed the western Great Plains, and carnivores, such as grizzly bears, gray wolves, and coyotes, also were present. Historic tribes on the Great Plains observed that wolves culled a substantial number of bison calves each season (De Smet et al. 1905), a process that likely occurred in pre-Columbian times as well.

According to Bogan (1997) and Kaufman and Kaufman (1997), the abundance, richness, and diversity of fauna in the central Great Plains have changed over time. Extirpated species include black bear (*Ursus americanus*), grizzly bear (*Ursus arctos*), gray wolf (*Canis lupus*), black-footed ferret (*Mustela nigripes*), wolverine (*Gulo gulo*), mountain lion (*Felis concolor*), lynx (*Lynx lynx*), elk (*Cervus elaphus*), and bison (*Bison bison*). Extant species are numerous and include mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), coyote (*Canis latrans*), badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*), weasels and mink (*Mustela* sp.), northern river otter (*Lutra canadensis*), prairie dog (*Cynomys* spp.), plains pocket gopher (*Geomys bursarius*), Ord's kangaroo rat (*Dipodomys ordii*), moles (*Microtus* sp.), mouse-eared bats (*Myotis* sp.), least shrew (*Cryptotis parva*), and many taxa of mice. While certainly not an exhaustive list, the above provides an overview of past and present species in the ecoregion. (For an in-depth discussion of ecological systems in the Great Plains, see Knopf and Samson 1997.)

It is important to know the behaviors, characteristics, and habits of burrowing animals within any given region to better interpret the taphonomic history and seasonality of an archeological site. Prairie dogs (*Cynomys ludovicianus*) exhibit tunneling and chambering habits, as do kangeroo rats. More than 412 species of kangeroo rats (*Dipodomys* spp.) have been identified in arid and semi-arid environments throughout the world. They all share certain habits, and one germane to this study is their propensity to dig deep burrow systems and cache food stores in compartments or chambers. Kangaroo rats are nocturnal and, because they do not hibernate, collect primarily grass and other seeds for winter sustenance. They require little water and are considered xerocoles, meaning that they are adapted to desert environments. As their kidneys are four times more efficient than those of humans, they obtain enough water from dry seeds to keep them hydrated (Davis and Schmidly 2009; Krutch 1955; Patton 2005). Adult *Dipodomys* measure approximately 25.3 cm in total length, with the tail itself measuring about 15.9 cm in length, and body weights vary between 60–70 g. Their young are born in subterranean chambers and do not venture out for approximately four weeks when they weigh 40–50 g. A Texas study (Davis and Schmidly 2009) found that the Ord's kangaroo rat (*Dipodomys ordii*) requires workable soils in a prairie environment, particularly rangelands subject to grazing where vegetation is sparse. They collect seeds from a wide variety of desert annuals and shrubby trees, such as mesquite, and were found to cause significant crop damage in some areas (Davis and Schmidly 2009).

Faunal assemblages from western Kansas dating to the Early Ceramic period (ca. 2000–1000 B.P.; A.D. 1–1000) and the Middle Ceramic period (1000–500 B.P.; A.D. 1000–1500) show exploitation of ungulates, such as bison, pronghorn, and deer; however, a wide variety of small mammals, fish, mussels, and birds are often represented as well. Scott D. Brosowske and C. Tod Bevitt (2006:186–187) observed, "At small sites, hunting appears to have focused on a broad range of species, and nearly every animal found in the region is recovered in the faunal inventory." In reference to Odessa Phase villages, they stated that bison dominated faunal assemblages and bone processing for grease and marrow were major activities at these locales.

Except for a narrow strip of scattered gallery trees and shrubs along Buckner Creek, mixed grass prairie prevails in the Horsethief site area. This prairie type is dominated by big bluestem (*Andropogon gerardii*), little bluestem (*A. scoparius*), side-oats grama (*Bouteloua curtipendula*), and blue grama (*B. gracilis*) (Kuchler 1974:591). Other grasses and herbs common to the area include Black Sampson echinacea (*Echinacea angustifolia*), wild rye (*Elymus canadensis*), blazing star (*Liatris punctata*), evening primrose (*Oenothera serrulata*), scurfpea (*Psoralea tenuifolia*), and dropseed (*Sporobolus asper*). Locally native shrubs and vines that produce edible fruits and other useful plant parts include morning glory (*Ipomoea pandurata*), smooth sumac (*Rhus glabra*), elderberry (*Sambucus canadensis*), riverbank grape (*Vitis riparia*), and soapweed (*Yucca glauca*). Although dwarf hackberry (*Celtis tenuifolia*) is the most common tree near 14HO308 today and likely was during late prehistoric times (see Archaeobotany section), other trees that occur in the area consist of green ash (*Fraxinus pennsylvanica* var. *subintegerrima*), red mulberry (*Morus rubra*), cottonwood (*Populus deltoides*), wild plum (*Prunus americana*), choke cherry (*P. virginiana*), and willow (*Salix* spp.).

Archaeobotanical studies for sites in western Kansas dating to the Early Ceramic period have resulted in the identification of the remains of wild plants, nuts, grape, and grasses (Bozell 2006). For the Two Deer site (14BU55), a terminal Early Ceramic period site in Butler County, Kansas, Mary J. Adair and Marie E. Brown (1981) noted the presence of sunflower, marsh elder, goosefoot, pepo squash, and maize. Middle Ceramic-period sites in southwest Kansas and northwest Oklahoma also indicate a reliance on maize, in addition to a broad-spectrum hunting and gathering strategy (Adair 2006:258; Bevitt 1999; Brosowske and Bevitt 2006:186–187). Wild plants represented in archeological assemblages in western Kansas include bulrush, carpetweed, dock, goosefoot, hazelnut, hickory nut, knotweed, marsh elder, panic grass, pawpaw, pigweed, plum cherry, purslane, sand plum, and spurge (Adair 2006:256; Brooks 1994: Table 8; Brosowske and Bevitt 2006:186; Drass and Turner 1989).

Although the Great Plains has been likened to a Great American Desert (referenced in Wedel 1953:499), sustainable resources were available for groups targeting a hunting-and-gathering strategy during the Early and Middle Ceramic periods. Environmental conditions in this ecoregion undoubtedly imposed certain limitations on particular activities; however, it is assumed that the cultural responses to those limitations contributed to the observed variability among archeological sites west of the 100th meridian. As Wedel (1953:499) stated, “It is abundantly clear that the climatic variations which characterize the region spatially from east to west also have their counterparts in fluctuations through time. In the perspective of archeology it appears that the native subsistence economies were also confronted with the need for re-adjustments from time to time.” Examination of the material culture documented at the Horsethief site will shed light on questions regarding human adaptation in western Kansas and the western Plains in general.

EXCAVATIONS

By A. Holly Jones and Neal H. Lopinot

Methods

A site datum was established using a large nail, the location of which was recorded using a Trimble GeoXH GPS unit with submeter accuracy (4212523.9N, 407006.9E, Zone 14). The southwest corner of each unit served as a local datum from which all measurements within that unit were obtained. All unit datums relate to the site datum. Piece-plotted artifacts and features were recorded with a Sokkia Total Station and georeferenced using the GeoXH GPS unit. The elevations of each unit datum were recorded via the total station data collector. A difference of approximately 2 cm was noted between the datum established by CAR versus the centimeters below surface (cm bs) unit measure employed by the KSHS in 2002. All measurements were recorded in metric units.

Based on previous excavations and a data recovery plan devised by the Kansas State Archeologist and Kansas State Historic Preservation Office (SHPO), a block grid consisting of 2 x 2-m (Units 1–3, 5, and 6) and 1 x 2-m (Units 4, 7, 12, and 13) units was established immediately east of Units X2 and X6 (Figure 4), excavated in 2002 by the KSHS (Bevitt and Bauer 2003). Five 1 x 2-m excavation units were laid out in an arc formation 15 m southeast, east, and northeast of the block grid (Figures 4 and 5), but only four (Units 8–11) were excavated due to the paucity of material in Units 10 and 11.

Excavation techniques included shovel skimming and hand troweling in 10-cm arbitrary levels to a minimum of 100 cm bs. A 0.25 x 0.25-m control column was maintained in each unit, with individual flotation samples removed at the end of each level. Flotation samples were processed at the CAR laboratory (for a description of flotation methods, see Archaeobotany section). All other soil was dry screened through 1/4-inch hardware cloth in the field.

All diagnostic artifacts found in situ were piece plotted using the total station. At the end of each level, photographs were taken of the unit floor, an excavation level form was completed to record all observations and samples taken, and a plan view map of the unit floor was drawn. A photograph log and field notes were maintained throughout the project. Profiles were drawn of unit walls at the completion of each unit excavation, noting soil colors, contacts, textural changes, artifacts, geofacts, and bioturbation. Unit walls were lightly scraped and dampened with a water sprayer immediately prior to recording the profiles. At the completion of each excavation unit, a soil probe was pushed an additional 80 cm through the floor of the final level to ascertain the presence or absence of more deeply buried cultural deposits. The probed soils were visually examined for artifacts, soil changes, and charcoal.

Artifacts found in screens were bagged according to unit, level, and quadrant. Artifacts that received a piece-plot (PP) number were bagged according to that number in addition to all other provenience information. Occasionally, single classes of artifacts found clustered together, such as bone or ceramics, were piece plotted as an “association.” These associations were collected together with one piece-plot number. During the first two days of excavation, all bone measuring 3 cm or greater was piece plotted. Due to a significant increase in the amount of bone encountered after the second day, this measurement was increased to 5 cm or greater. Charcoal and bone were wrapped in aluminum foil prior to being placed in labeled paper bags.

Features were assigned feature numbers in the order in which they were encountered. Features were delineated in plan view by hand troweling. They were subsequently cross-sectioned. Typically, one-half of each feature was excavated (unless relatively small) and screened, whereas the other half was collected for flotation. All feature dimensions (perimeter, beginning depth, and ending depth) were recorded with the total station. In addition feature plan views and profiles were handdrawn on graph paper. All pertinent feature information (e.g., dimensions, content, soil descriptions, volume collected, and Munsell colors) was notated on feature forms. Artifacts within features were collected and bagged according to unit, level, quadrant, and feature number.

Twelve bucket-auger holes (BAs) were located in an arc 30 m southeast, east, and northeast of the block excavation area. The BAs were excavated to depths ranging from 60 to 190 cm bs, depending on cultural content. The BAs were excavated in 20-cm levels, and soil from each level was visually examined and screened for artifacts and changes in soil color/texture. Observations for each level were recorded for each BA.

Artifacts and flotation samples were processed at the CAR laboratory. Laboratory Supervisor Gail Emrie managed all aspects of artifact cleaning, processing, flotation, and curation. Artifacts were cleansed with mild dishwashing liquid diluted in water and lightly brushed with soft toothbrushes. Jones and Emrie developed an Excel inventory that included basic identification and provenience information relative to a catalog number for each artifact. The catalog number was created in accordance with standards established by the KSHS, where the materials are permanently curated. All artifacts were labeled according to their provenience within a unit, level, and/or feature, unless they were piece plotted. Piece-plotted artifacts were given PP numbers. Archival pens were used to label individual artifacts. The numbers were then sealed with a thin coat of clear nail polish. All artifacts and flotation samples were stored in clear, plastic archival bags, notated with the appropriate catalog number, site number, date, provenience information, excavator’s initials, and contents. A catalog of artifacts collected

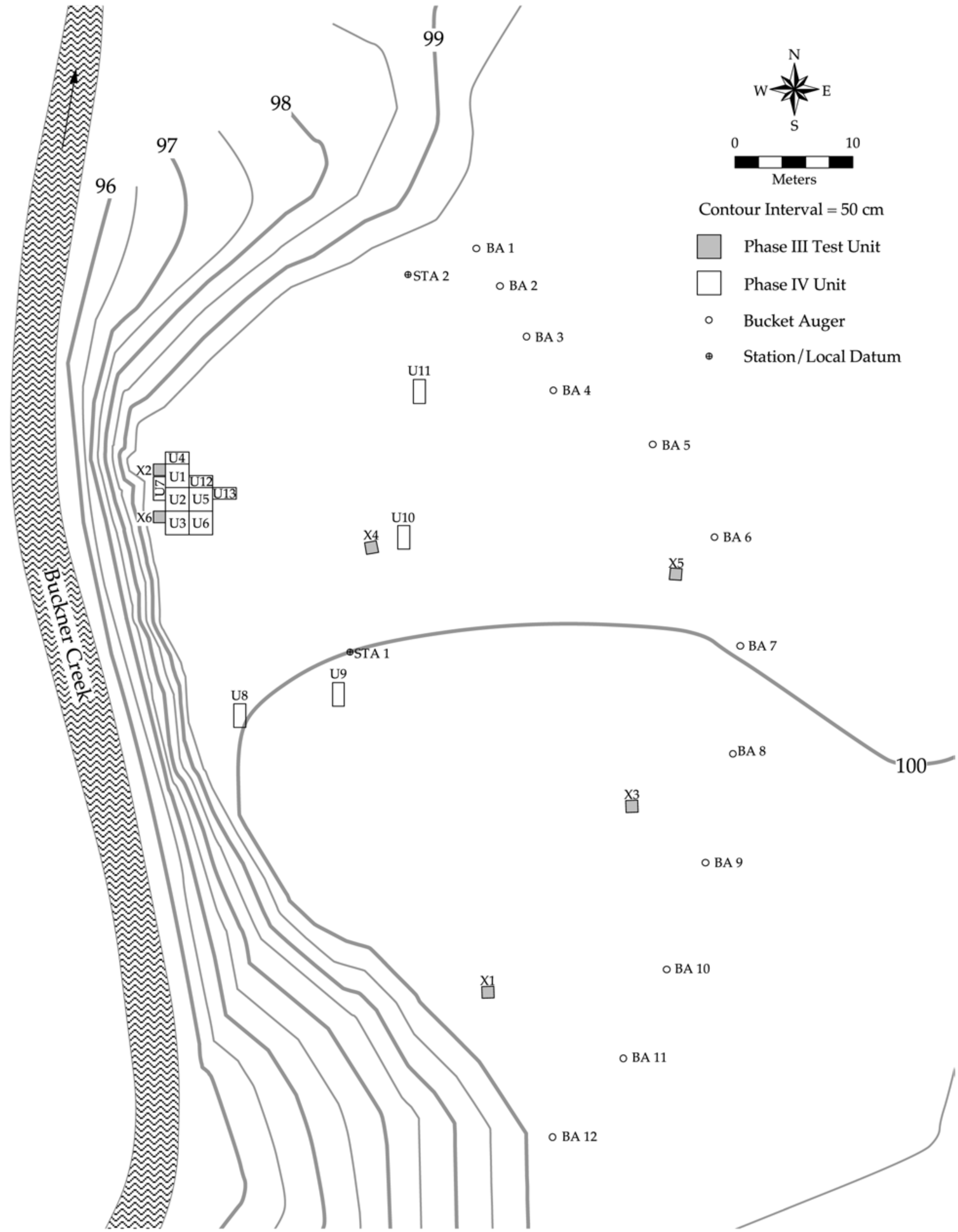


Figure 4. Overview of excavation units at the Horsethief site.

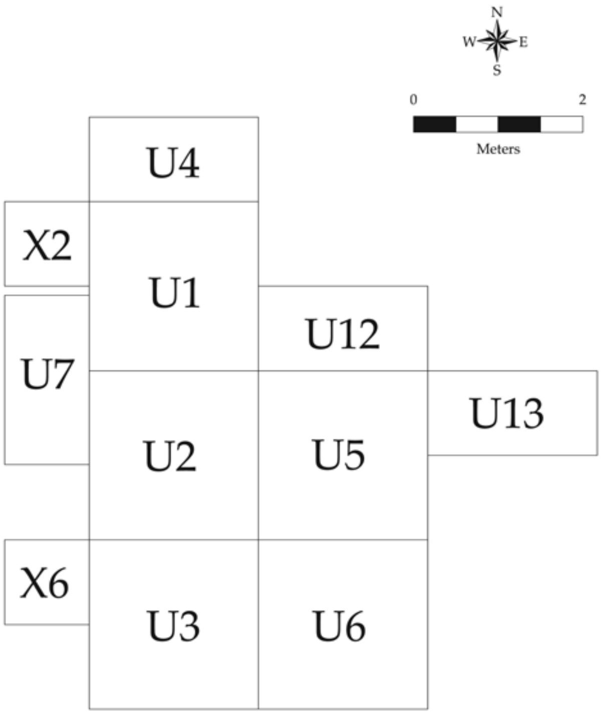


Figure 5. Plan view of block units. Note: X2 and X6 were 1 x 1-m units excavated in 2002.

as a result of screening and piece plotting was presented in Lopinot et al. (2010:Appendix 1).

Stratigraphy

Stratified soil horizons at the Horsethief site exhibit characteristics typical of a Mollisol in a prairie grass environment. The mapped soil series for the site location is Bridgeport silt loam, which is a soil that is rarely flooded (Natural Resources Conservation Service 1999). This soil type develops from calcareous fine silty alluvium on floodplains and low stream terraces. Taxonomically, it is defined as a mixed, superactive, mesic Fluventic Haplustoll.

Phase IV investigations at 14HO308 produced 7-m-long north-south and east-west profiles within the main block excavation area. A 6-m-long north-south profile is depicted in Figure 6. Profiles of four 1 x 2-m units (located 15 m to the east, southeast, and northeast of the main excavation block) and 12 BAs also were examined. Soil horizons in all excavation units were consistently silt loams with fine subangular blocky structures and diffuse to gradual smooth boundaries.

Disturbances from bioturbation were noted throughout the main block and outlying 1 x 2-m units. The bulk of the bioturbation consisted of vertical- and horizontal-oriented krotovina or animal burrows. (One intact rodent skeleton was discovered in a krotovina in the west wall of the main excavation block.) Krotovina disturbances were especially common in the upper 50–60 cm. For example, approximately 50 percent of the floor at 20 cm bs (base of Level 2) in Unit 1 was mapped as rodent burrows. The voids of recent animal burrows and at least one ant nest typically measured 10–30 cm in diameter, although the largest was 48 cm in diameter. Krotovina also occurred at depths of 80–90 cm bs. At this depth animal burrows ranged 10–20 cm in diameter.

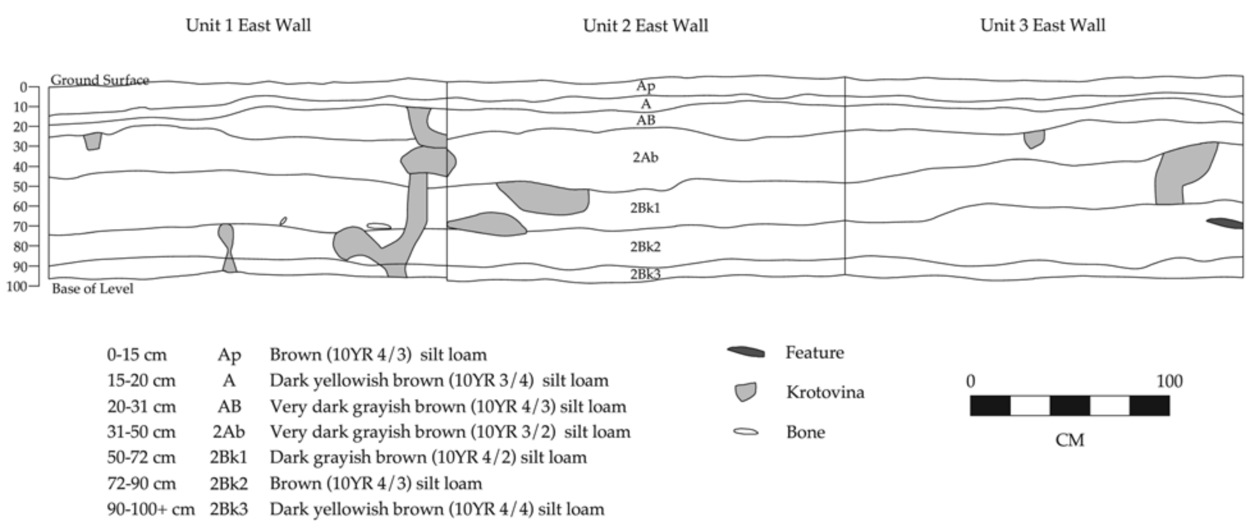


Figure 6. East wall profile of contiguous Units 1–3.

A generalized soil profile for the Horsethief site exhibits seven soil horizons (Figure 6). The top 15 cm is a disturbed plow zone (Ap); however, the lower portion of the modern A horizon is preserved just below the base of the plow zone at approximately 15–20 cm bs. A transitional AB horizon formed at 20–31 cm bs. A distinct, dark buried A horizon (2Ab) occurs at about 31–50 cm bs, but no definite cultural deposits were associated with it. This buried soil is underlain by three Bk horizons between 50 cm and 100 cm bs. The late prehistoric deposits are located predominantly in the upper half of the approximately 18-cm-thick 2Bk2 horizon at about 72–82 cm bs.

The soil profile at 14HO308 is similar to the upper solum that was described at a cutbank exposure of Buckner Creek at 14HO306, located a short distance downstream (Mandel 1994:38–50). At that location Mandel (1994:Figure 55) documented a buried A horizon (paleosol) that was only slightly deeper (46–61 cm bs) than the buried A horizon at the Horsethief site. As at 14HO308, no cultural remains or radiocarbon ages were associated with this upper paleosol at 14HO306. If this upper paleosol is the same as the buried soil at the Horsethief site, then it is less than 800 years old.

Features

Twenty-two possible features were detected and mapped during the 2008 field investigations at the Horsethief site. Only those defined below 70 cm bs are shown in Figure 7. Of the 22 possible features, 7

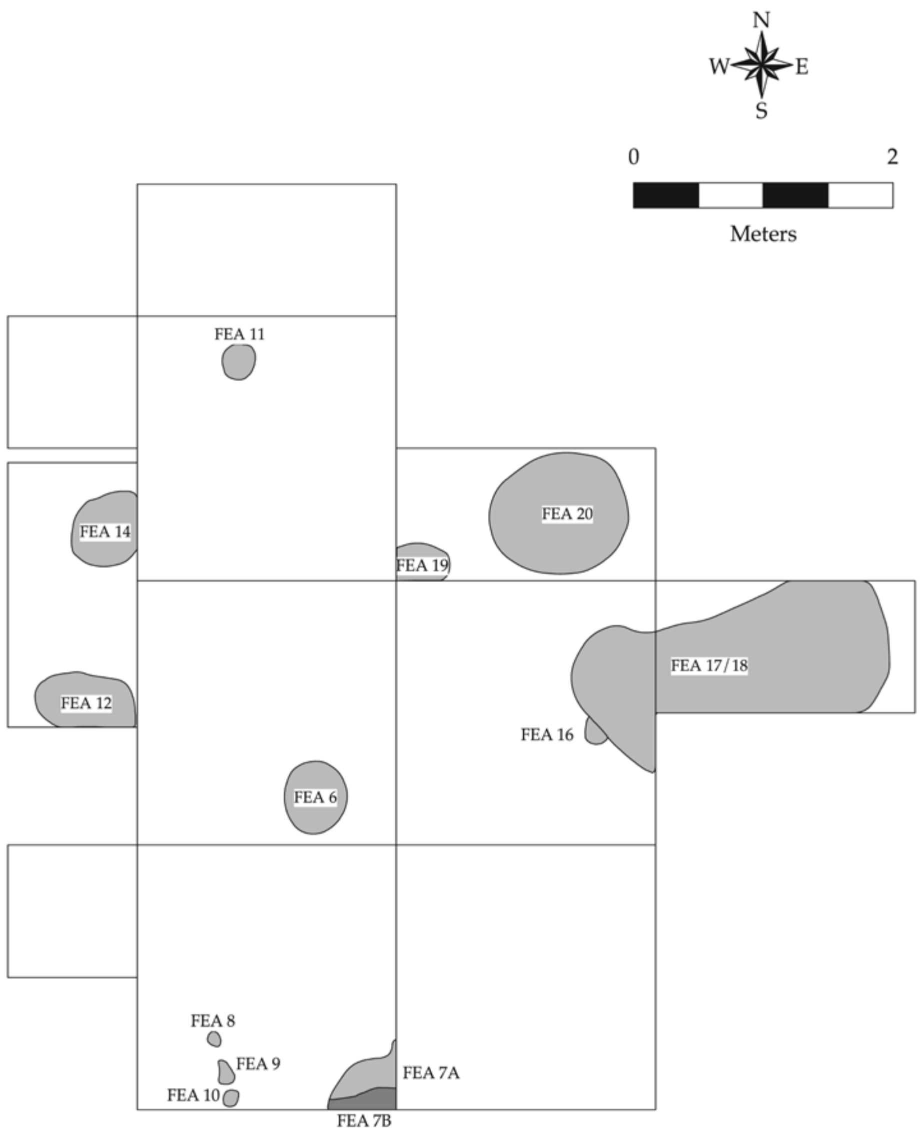


Figure 7. Features located at depths greater than 70 cm bs.

recorded above 70 cm bs were determined noncultural through examination of their dimensions, the presence of bioturbation, and/or both macro- and micro-fill contents. Features 1, 2A, 2B, 3A, 3B, 13, and 15 likely represent the activities of post-burial taphonomic processes, with rodent activity being the most pervasive. Two others (Features 4 and 5) also might represent noncultural features but are discussed as possible features later in this section. Decisions regarding natural versus cultural origins were based on (1) the relative abundance of cultural material and uncharred rodent fecal pellets, (2) the presence or absence of observed krotovina, and (3) formal characteristics (i.e., regular versus amorphous boundaries and dimensions).

The definition of cultural features herein should not be regarded as exacting. The great extent of krotovina cannot be overemphasized (e.g., see Figures 8 and 9). Throughout the period of field activities, high winds also contributed to the variable desiccation of deposits, making the definition of features very difficult. Despite repeated wetting, complete outlines of some features within the block area (i.e., Features 7A, 7B, 12, 14, and 19) could not be identified. The very localized and variable drying/water absorption of deposits is readily evident in Figure 10. Bioturbation also contributed to the difficulty of defining the edges of some features. In fact, some or perhaps even all of the cultural features have been disturbed, and the contention for human agency for

Figure 8. Prairie dog tunneling at base of Level 5 in Unit 7.

Figure 9. Recent disturbances evident within north wall of Unit 1.

Figure 10. Feature 6 plan view.

all features above 70–80 cm bs (Level 8) is questionable. Descriptions of all observed anomalies are provided below.

Noncultural Features. Feature 1 in Unit 3 was first encountered at 40 cm bs. It extended to a maximum depth of nearly 90 cm bs and measured 86 x 93 cm. It was described as a large dark area containing charcoal, burned bone, and shell. A flotation sample was obtained from the upper part of Feature 1. It did not yield much charred material, but it does contain a relatively high concentration of fecal pellets. A large krotovina bisected the south half of the feature. The feature was very difficult to define during the excavation of Unit 3, appearing and disappearing depending on soil moisture conditions. Its shape also proved irregular as excavations continued downward within Unit 3. Only seven bone fragments were recovered from Feature 1. It might have represented a collapsed prairie dog chamber, with the uppermost part used later by mice.

Feature 2 comprised two zones (A and B [also referred to as Features 2A and 2B]), both semicircular in shape, which extended from the east wall of Unit 1 in Level 5 (40–50 cm bs). Zone A was described as a dark brown (10YR 3/3) silt loam with a few charcoal flecks and a few faunal fragments. Feature 2 measured 135 x 50 cm. It did not differ in color from the surrounding soil matrix; instead, it was distinguished by a concentration of charcoal. Zone B was a darker (10YR 3/2) semicircular zone within the center of Zone A. Zone A measured 136 cm at its maximum diameter, whereas Zone B measured 38 cm in diameter. Although Feature 2B exhibited a change in soil color, other factors indicated that it formed as a result of rodent activity.

Features 3A and 3B were first thought to be postmolds due to their darker color and form, as well as the presence of charcoal flecks. As each contained less than 10 liters, the entire fills of these features were collected as flotation samples. Analysis of the two samples indicated that Features 3A and 3B likely were formed by rodent activities. Feature 3A measured 17 cm in diameter, and Feature 3B measured 14 cm in maximum diameter. Both diameters were within the range for the majority of observed krotovina at 14HO308. In addition both flotation samples contained relatively high densities of rodent fecal pellets.

Feature 13 was encountered at 45–55 cm bs in the north half of Unit 8. It measured 40 cm in diameter. It was recorded as a dark stain but was not readily evident until 50 cm bs due to the dark color of the buried A horizon (2Ab). Feature 13 extended into the east wall of the north half of the unit. The west half of the feature was collected as a 6-liter flotation sample. No artifacts were found in the fill, and this feature was suspected to be noncultural in origin (see Archaeobotany section).

Feature 15 was determined to be noncultural. It appeared as a small concentration of limestone rocks at 107 cm bs in the north half of Unit 9. A krotovina extended from the west wall and continued into the group of limestone rocks. Although a few pieces of cultural material were present within the krotovina, no evidence of human activity could be identified.

Cultural Features. Feature 4 was discovered at 27 cm bs in the south wall of Unit 3. It consisted of an ash-like (10YR 4/2) deposit that contained bone and charcoal. No color difference between the feature fill and the surrounding soil matrix could be discerned until the soil was observed in dry conditions. A 10-liter sample was collected for flotation. The maximum diameter of the feature within Unit 3 was 91 cm (east-west), and it appeared to terminate at 60 cm bs. Flotation analysis (see Archaeobotany section) indicated that Feature 4 was possibly cultural in origin, containing wood charcoal, seeds, microdebitage, and faunal remains. It might represent a hearth or roasting pit.

Feature 5 was identified at 57 cm bs in the southeast quarter of Unit 3. It was relatively shallow, terminating at 65 cm bs. Recorded as ovoid in shape, it measured 35 x 50 cm. Feature 5 was delineated by color (10YR 5/3) from the surrounding matrix. At least 21 pieces of charcoal were mapped in plan view, and 2 pieces were collected as the result of screening. A 10-liter sample was collected for flotation. It contained wood charcoal, seeds, microdebitage, and faunal material (see Archaeobotany section). Although Feature 5 was somewhat variable in thickness, it is believed to represent a shallow roasting pit.

Feature 6 (Figure 10) was encountered at 74 cm bs in the southeast quadrant of Unit 2. Its maximum horizontal dimensions were 50 x 56 cm, and it appeared to terminate at 97 cm bs. Two zones were noted within Feature 6. Zone 6A was described as a very dark grayish brown (10YR 3/2) silt loam containing white limestone flecks and fine roots. In profile Zone 6A extended 74–84 cm bs. Zone 6B was recorded as an ashy dark grayish brown (10YR 4/2) fill. Both zones exhibited relatively high frequencies of faunal material. Both burned and unburned bone were noted at 89 cm bs and 91 cm bs. The south half of the feature was collected as a flotation sample. Thirty-eight burned bone fragments, 25 unburned bone fragments, and 4 flake fragments were collected from the feature fill during screening. (For a discussion of the results of the flotation analysis, see Archaeobotany section.) Judging from the contents of the feature fill and its dimensions, Feature 6 might have been a hearth.

Feature 7 (Figure 11) was initially delimited as one feature, but later it was divided into two features (Features 7A and 7B). Feature 7 was first observed at 74 cm bs and terminated at 84 cm bs in the southeast quadrant of Unit 3. Feature 7A was recorded as an amorphous stain, identified as a reddish yellow (7.5YR 6/6) area of burned earth with dark brown (10YR 4/3) and very dark brown (10YR 2/1) mottles. Humified wood, four bone fragments, and five lithic artifacts were collected during screening of Feature 7A fill. Feature 7B was noted as a stain (10YR 4/3) immediately to the north of Feature 7A. A 10-liter flotation sample was obtained from Feature 7A, and a 5-liter flotation sample was obtained from Feature 7B. The maximum horizontal dimensions of both Features 7A and 7B measured 91 x 50 cm. Feature 7 (A and B) might have represented part of a house floor.

Feature 8 was discovered at 88 cm bs in the southwest quadrant of Unit 3 and terminated at 91 cm bs. It was recorded as a thin, small lens of charcoal and burned earth, measuring 11 x 8 cm. All of Feature 8 was collected as a flotation sample, as it was believed to be a surface hearth. In profile it

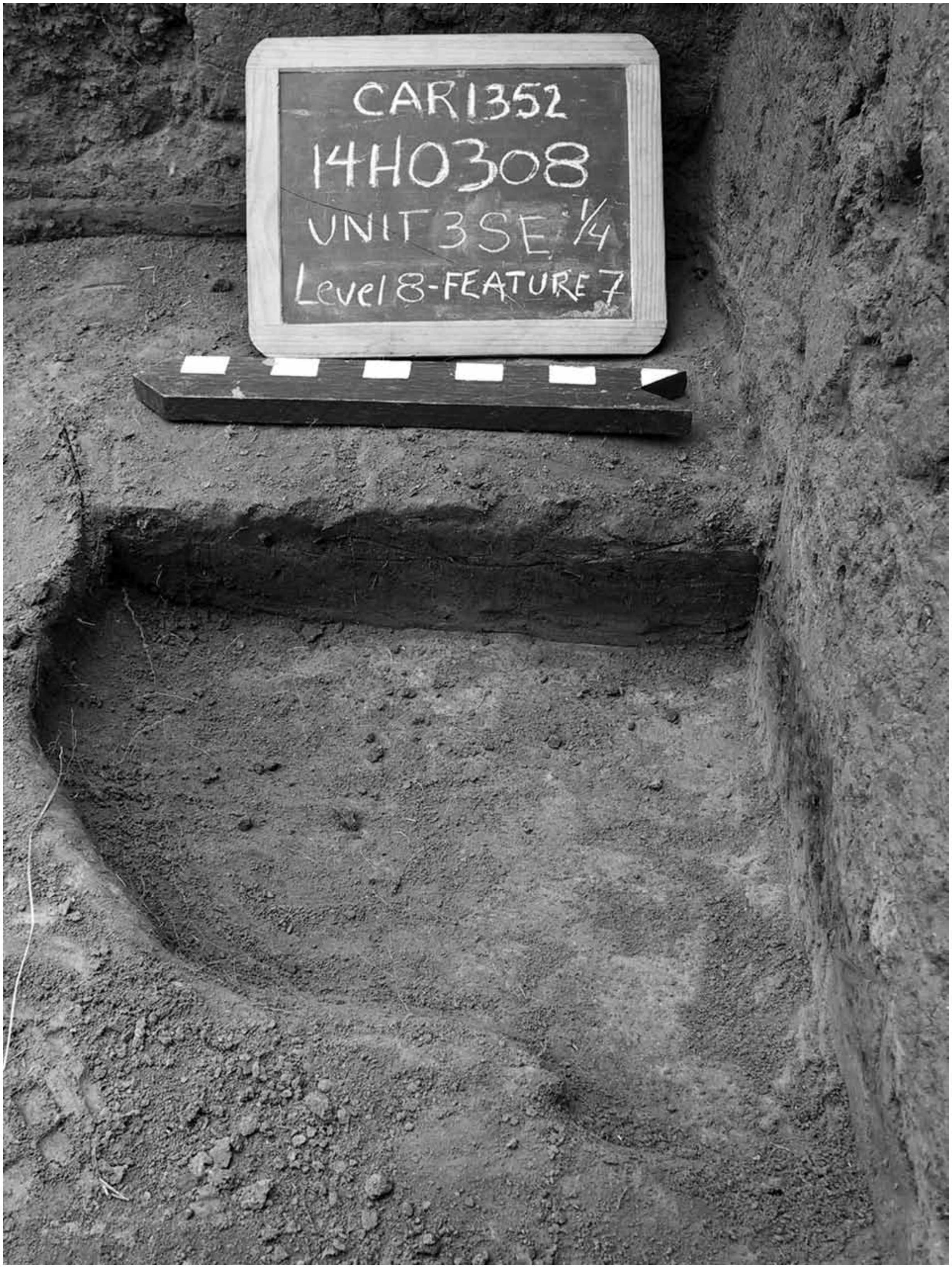


Figure 11. Feature 7 profile.

was highly irregular with diffuse lobes penetrating downward into the surrounding matrix.

Feature 9 was noted at 90–90.5 cm bs in the southeast quadrant of Unit 3. It also was a thin lens of burned material, measuring 23 x 15 cm in plan view and exhibiting a kidney-bean shape. No flotation sample was collected. It also might have been a surface hearth.

Feature 10 consisted of another thin deposit of burned material, observed at 90–91 cm bs in the southeast quadrant of the southwest quadrant of Unit 3. The maximum horizontal dimensions were 13 x 11 cm. No flotation sample was collected. Like nearby Features 8 and 9, Feature 10 was likely a surface hearth.

Feature 11 was delineated as an area of burned earth and charcoal that measured 30 x 25 cm. It occurred at 86–91 cm bs in the northwest quadrant of Unit 1. In profile Feature 11 exhibited a basin shape with well-defined boundaries. No artifacts were observed in the feature fill, which was collected in its entirety as a 4-liter flotation sample. Feature 11 possibly represented a hearth or small roasting pit, but it also might have been a rodent burrow.

Feature 12 was located in the south half of Unit 7. It occurred at 75–80 cm bs, and its maximum horizontal dimensions were 76 x 48 cm. A krotovina, measuring 28 cm at its maxiumum width, bisected the feature. The feature was described as a large area of charcoal, flakes, and bone on either side of the krotovina. A total of 48 artifacts were collected from the fill during screening: 13 faunal remains, 10 of which were burned, 34 lithic artifacts, and 1 piece of charcoal. A 10-liter flotation sample was taken from the west half of the feature, which might have been a hearth.

Feature 14 was identified at 75 cm bs in the north half of Unit 7. It was described as an area of burned earth, measuring 50 x 53 cm, that terminated at 82 cm bs. Burned bone, charcoal, burned earth, and flakes were collected from the feature during excavation. A vertically oriented rodent burrow bisected this feature. Twelve artifacts were collected: nine burned bone fragments and three flakes. Feature 14 might represent a cooking pit.

Feature 16 comprised a small (20 x 23 cm) association of burned mammal bone that occurred at 72–76 cm bs in the southeast quadrant of Unit 5.

Feature 17 (Figure 12) was delineated as an area of burned earth, charcoal, and artifacts. The feature

Figure 12. Feature 17 plan view.

occurred at 78–89 cm bs in the east half of Unit 5. A krotovina, measuring 24 cm in diameter, extended from the east wall into the southeast portion of the feature. A second smaller krotovina was noted near the northern boundary of the feature and measured 5 cm in diameter. Feature 17 yielded 37 artifacts, one of which is an arrow point of the Harrell style. The other items consist of 10 pieces of burned earth, 9 faunal remains, and 17 lithic artifacts in addition to the arrow point. Feature 17 appears to have been part of a small pithouse.

Feature 18 was the most complex feature encountered at the Horsethief site. It was first identified in plan view at 73 cm bs, roughly in the center of Unit 13. As Feature 18 was being defined in profile, it became evident that it was much larger. It encompassed the majority of the floor of Unit 13 and clearly extended into the south and west walls, merging with Feature 17.

A hearth or refuse from a hearth was encountered within the center of Unit 13 when Feature 18 was first exposed. Solid burned earth and charcoal layers were present above and below a concentration of ash (Figure 13). Beyond this possible hearth, Feature 18 was composed of relatively homogeneous artifact-laden fill. In profile it was basin shaped with well-defined boundaries where exposed. A 30-liter flotation sample was collected from 60–70 cm bs in the west half of the feature and from each subsequent level below that.

This feature, particularly the homogeneous fill around and below the possible hearth feature, yielded the greatest number of artifacts (N = 726) among all the site's features (Table 1). The highest density of material in Feature 18 was found at 73–90 cm bs, although additional material occurred at 90–100 cm bs (Level 10) and 100–110 cm bs (Level 11). Faunal remains had the greatest frequency (N = 590); nearly 56 percent or 329 bone fragments were burned. Feature 18 yielded 8 projectile points, 2 unifaces, and 86 pieces of debitage. Lithics were most numerous at 80–100 cm bs (Levels 9–10), but this is probably a result of combining two 10-cm levels during excavation of this feature. A more accurate reflection of the vertical distribution is the numerical data for bone and pottery, which were most abundant at 60–80 cm bs (Levels 7–8). Thirty-four pieces of pottery were found, with the majority coming from the upper fill (60–70 cm bs). Feature 18 also yielded charcoal from the wood of the cottonwood/willow family (Salicaceae), ash (*Fraxinus* sp.), box elder (*Acer negundo*), and plum/cherry (*Prunus* spp.).

Features 17 and 18 most likely represent exposed portions of a small semi-subterranean structure. Supporting this assertion is the fact that

Figure 13. Feature 18 profile.

Table 1. Feature 18 Artifact Counts.

	Faunal		Lithics			Other		
Depth (cm bs)	Burned	Unburned	Projectile Point	Uniface	Debitage	Plant	Daub	Totals
60–70	225	28	1	1	13	1	22	291
70–80	84	150	1	1	29	1	10	276
80–100	6	75	5		42	4	1	133
100–110	14	8	1		2		1	26
Totals	329	261	8	2	86	6	34	726

screened and flotation samples from Feature 17 contained daub or plaster fragments. At the maximum exposed extent, Features 17 and 18 together measured 2.47 m in length and an estimated 1.46 m in width. During use of the presumed structure and hearth, a considerable amount of refuse accrued in the fill.

Feature 19 was discovered in Unit 12 at 71 cm bs and extended to a depth of 94 cm bs. It was described as a very dark grayish brown (10YR 3/2) circular stain, measuring 39 cm in diameter. However, the stain extended into the west wall in the southwest quadrant of Unit 12 and possibly into Units 1, 2, and 5. Feature fill contained charcoal, faunal material, and lithic debitage. The visible portion of the profile indicated that Feature 19 was a U-shaped pit. A 10-liter soil sample was collected for flotation. Only two pieces of unburned bone and five pieces of lithic debitage were recovered.

Feature 20 was observed at 74–86 cm bs in Unit 12, although a burned area was visible higher at 70 cm bs. Fill consisted of a mixture of hard-packed burned earth, containing charcoal, bone, lithics, projectile points, pottery, and hackberry seeds. The feature was bisected from east to west, and a 10-liter flotation sample was collected. In profile the feature was primarily basin shaped, although the base was somewhat irregular and exhibited several diffuse lobes. A distinct area of burned earth, measuring 16 cm at its maximum east-west width, comprised the center of the feature. Overall, Feature 20 had maximum horizontal dimensions of 110 x 94 cm. A total of 55 artifacts were recovered from the fill, of which faunal remains (N = 38) were most frequent. Three projectile points and 12 pieces of lithic debitage also were recovered. Feature 20 is interpreted as a hearth/trash pit.

Artifact Distributions

A total of 5,818 artifacts was collected from non-feature contexts during screening (Table 2). In descending order of abundance, the materials consist of faunal remains, lithic artifacts, plant remains (primarily wood charcoal), and pottery sherds. Although other vessels are represented, most of the pottery derives from a single, highly fragmented vessel (see Pottery Analysis section).

Artifact densities and cultural features at 14HO308 indicate the occurrence of a relatively intensive occupation, represented primarily at 70–80 cm bs (Level 8). The initiation of site use might have begun earlier, but it is likely that many artifacts from 70–80 cm bs were bioturbated down into 80–110 cm bs (Levels 9–11) since site abandonment. Possible later uses of the site might be indicated by Feature 4 at 27 cm bs and Feature 5 at 57 cm bs. However, the great extent of rodent activity at the site, particularly in these higher

Table 2. Vertical Artifact Distributions from Non-Feature Contexts.

Depth (cm bs)	Faunal	Lithic	Plant	Pottery	Totals
20–30	39	7			46
30–40	43	6			49
40–50	55	29			84
50–60	101	79	9		189
60–70	297	125	39		461
70–80	1,456	1,522	83	22	3,083
80–90	441	979	35	118	1,573
90–100	195	113	22	1	331
100–110		1	1		2
Totals	2,627	2,861	189	141	5,818

levels, cannot be ignored. Quite possibly these two features represent rodent chambers, and all of the artifacts found above about 70 cm bs have been bioturbated upward.

An intensive occupation is indicated for 70–90 cm bs (Levels 8–9) by an increase in cultural material overall, changes in class richness, and an increase in the number (N = 12) and nature of cultural features. In this component lithic specimens (N = 2,501) occur at the highest frequency. Plant macroremains collected from non-flotation contexts (N = 180), primarily in the form of charcoal and seeds, have a much greater frequency than that observed for higher levels. Cultural features from this occupation indicate the presence of at least one semi-subterranean structure, as well as extramural hearths and roasting pits. One U-shaped pit (Feature 19) might have served initially as a cache pit, but was filled later with charcoal, lithic, and faunal debris.

The spatial distribution of piece-plotted artifacts within the block excavation area is shown in Figure 14. With the exception of pottery, the overall distribution of various types of artifacts appears to be relatively random and representative of mixed secondary deposits or midden. There are areas within units relatively devoid of piece-plotted artifacts, but this is probably a function of the variability in soil moisture during excavation. Despite repeated wetting of the deposits following each day of excavation, sediments within portions of some units were considerably more compact than others. Where sediments were compact, troweling and shovel skimming were quite difficult, and excavations often involved "chunking" within levels. This method resulted in the identification of far fewer piece-plotted artifacts, with a greater proportion recovered by screening. Furthermore, no artifacts within feature fills were piece plotted. Those that appear in Figure 14 to have occurred in features were actually distributed above or below features. Insofar as the variability in compaction is concerned, it is suspected that the less compact, moisture-absorbing soils represent locations of older krotovina. Thus, the overall spatial distribution of artifacts is somewhat suspect, although some patterning with respect to pottery, chert debitage, and bone has been identified (see Lithic Analysis, Pottery Analysis, and Faunal Assemblage sections).

AMS Dating

Five AMS radiocarbon dates were obtained from Beta Analytic (Figure 15). Beta-256288 represents wood charcoal obtained from a flotation sample from 80–90 cm bs (Level 9) of Unit 2. Samples Beta-256289 and Beta-256290 are also wood charcoal, obtained from flotation samples from 70–80 cm bs (Level 8) and 90–100 cm bs (Level 10) of Unit 12. Two plum pit fragments were taken from Feature 17 and 18 flotation samples. Because they are produced annually, it is assumed that fruit pits would provide more reliable dates than wood. If wood from old trees was burned, it might yield radiocarbon ages considerably older than the occupation that produced the burned wood (i.e., the "old wood effect"). Insofar as the potential for old wood dating is concerned, hackberry trees (the dominant wood in the prehistoric charcoal assemblage) may attain ages of as much as 150–200 years (Fowells 1965:141). Although the wood charcoal submitted for radiocarbon dating by Bevitt and Bauer (2003) was not identified, in all probability most consisted of Ulmaceae (elm/hackberry family) wood (see Archaeobotany section for wood analysis). The AMS samples for 70–80 cm bs (Level 8) of Unit 12 (Beta-256289) and 80–90 cm bs (Level 9) of Unit 2 (Beta-256288) also consisted of Ulmaceae wood, presumably hackberry. Box elder wood was submitted from 90–100 cm bs (Level 10) of Unit 12 (Beta 256290).

Radiocarbon ages provided by Bevitt and Bauer (2003) were obtained by the standard radiometric technique, not by AMS. According to Beta Analytic, the advantages of AMS over standard radiometric dating are (1) primarily statistical error is reduced for older (>10 kya) and smaller samples (<0.3 g), (2) less material is required so it is less destructive, and (3) precision is independent of sample size. Given that 14HO308 is not older than 10,000 years, the difference between the two methods is negligible in this instance.

Table 3 presents details concerning the samples and ages, whereas Figure 15 shows the calibrated (intercepts and 1-sigma and 2-sigma) calendrical ages (B.C./A.D.) obtained from both the 2002 (Bevitt and Bauer 2003) and 2008 excavations. Examination of the 2008 unit samples indicates a discrepancy. Sample Beta-256289 yielded a

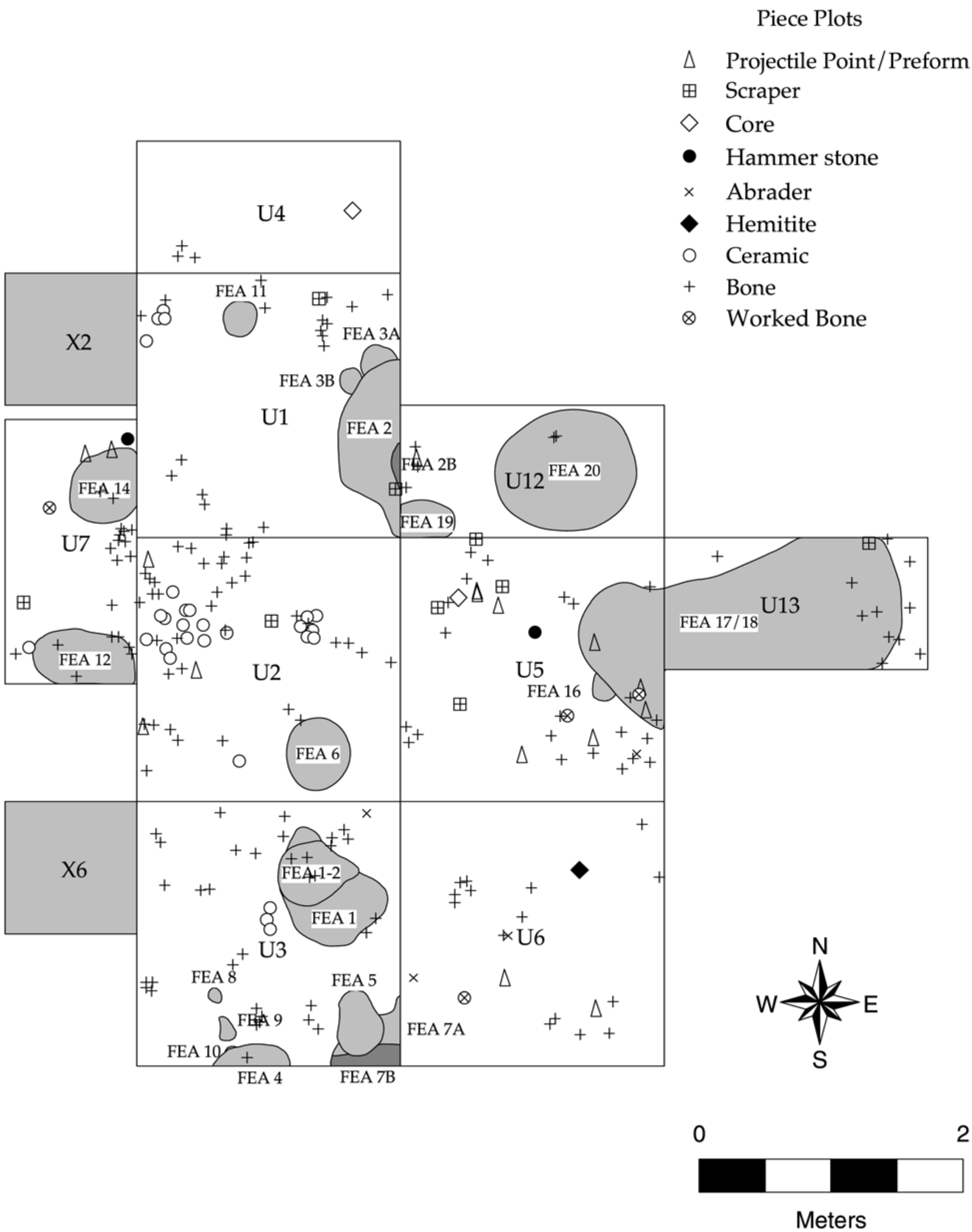


Figure 14. Spatial distribution of piece-plotted artifacts.

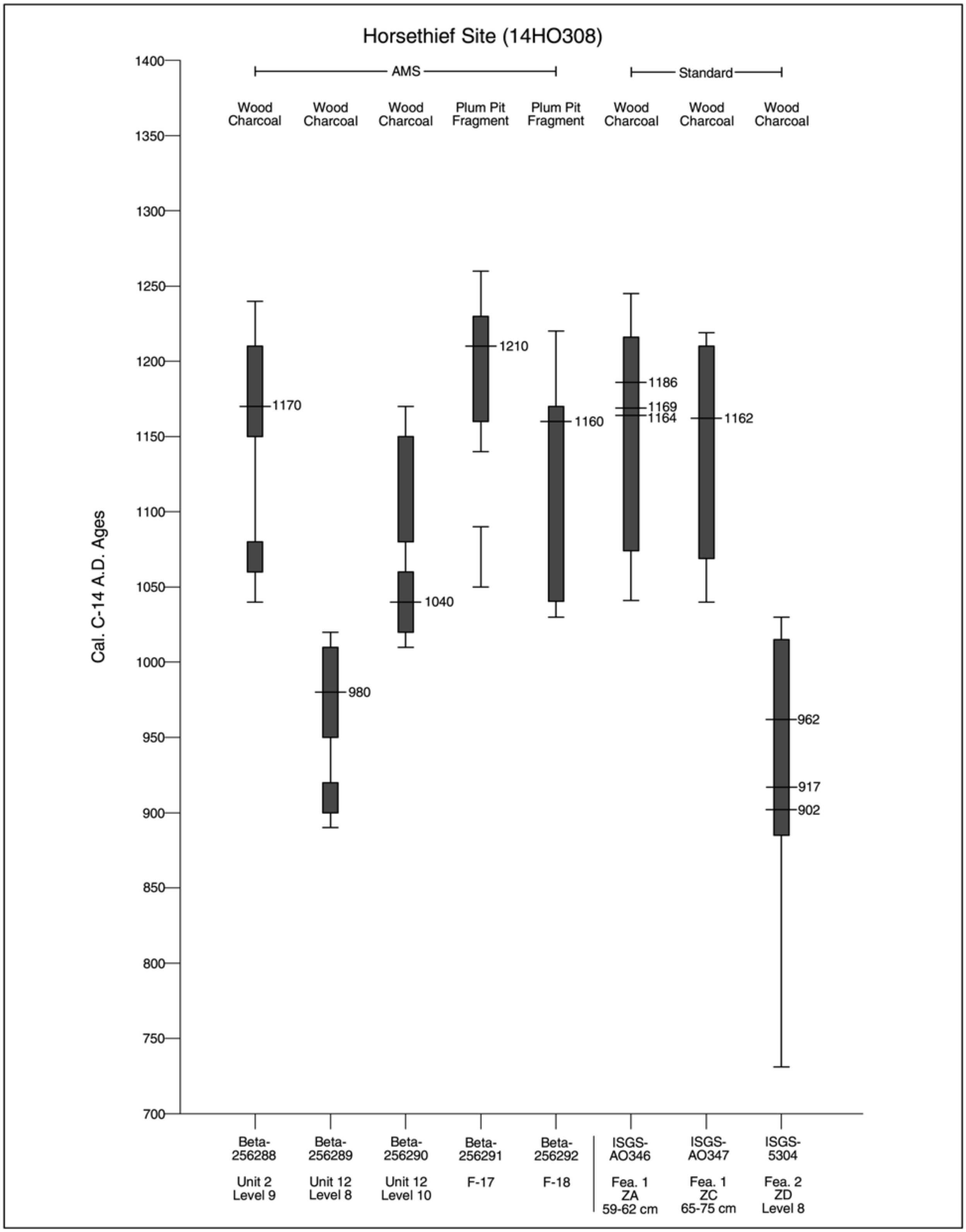


Figure 15. Radiocarbon dates.

Table 3. Radiocarbon Ages.

Sample No.	Dating Method	Provenience	Depth	Dated Material	Radiocarbon Age	13C/12C Ratio	Calibrated Intercept(s)	1σ Calibrated	2σ Calibrated
ISGS–A0346	Standard	Feature 1 – Zone B	59–62 cm bs	Wood Charcoal	870 ± 30	–24.4	A.D. 1160 A.D. 1170 A.D. 1190	A.D. 1070–1220	A.D. 1040–1250
ISGS–A0347	Standard	Zone C	65–75 cm bs	Wood Charcoal	885 ± 25	–26.1	A.D. 1160	A.D. 1070–1210	A.D. 1040–1220
ISGS–5304	Standard	Feature 2 – Zone D	80–83 cm bs	Wood Charcoal	1110 ± 70	–24.9	A.D. 900 A.D. 920 A.D. 960	A.D. 890–1020	A.D. 730–1030
Beta–256288	AMS	Unit 2, Level 9	80–90 cm bd	Ulmaceae Wood Charcoal	880 ± 40	–24.4	A.D. 1170	A.D. 1060–1080 A.D. 1150–1210	A.D. 1040–1240
Beta–256289	AMS	Unit 12, Level 8	70–80 cm bd	Ulmaceae Wood Charcoal	1080 ± 40	–24.2	A.D. 980	A.D. 900–920 A.D. 950–1010	A.D. 890–1020
Beta–256290	AMS	Unit 12, Level 10	90–100 cm bd	Box Elder Wood Charcoal	960 ± 40	–22.7	A.D. 1040	A.D. 1020–1060 A.D. 1080–1150	A.D. 1010–1170
Beta–256291	AMS	Feature 17	78–89 cm bd	Plum Pit	850 ± 40	–24.7	A.D. 1210	A.D. 1160–1230	A.D. 1050–1090 A.D. 1130–1140 A.D. 1140–1260
Beta–256292	AMS	Feature 18	80–90 cm bd	Plum Pit	910 ± 40	–24.4	A.D. 1160	A.D. 1040–1170	A.D. 1030–1220

2-sigma (α<.05) calibrated calendrical date range of A.D. 890–1020 (1060–930 B.P.) with an intercept at A.D. 980 (970 B.P.). While this date is commensurate with the age of the 2002 ISGS-5304 sample, it was obtained from Level 8 (70–80 cm bs), which is higher in the stratigraphic column than Beta-256288 (80–90 cm bs) and Beta-256290 (90–100 cm bs).

One possible explanation for this stratigraphic reversal of dates is the "old wood effect," which may also explain the 2002 ISGS-5304 date range of A.D. 880–1010 (1070–940 B.P.). Disregarding Beta-256289, the remaining four AMS ages (2-sigma, α<.05) have a date range of A.D. 1010–1260 (1070–690 B.P.), with intercepts at A.D. 1040 (910 B.P.), A.D. 1160 (790 B.P.), A.D. 1170 (780 B.P.), and A.D. 1210 (740 B.P.). These dates are congruous with the 2-sigma (α<.05) ISGS-AO346 and ISGS-AO347 sample dates from the 2002 study that range from A.D. 1040–1250 (910–700 B.P.).

A second possible cause for the stratigraphic reversal of dates is simply bioturbation. Given the ubiquitous rodent burrows, the displacement of charcoal fragments up or down could be expected. If lithic artifacts and bone can be displaced, so can wood charcoal. Should the two early dates (ISGS-5304 and Beta-256289) reflect the actual timing of human site use rather than the "old wood effect," then it must be concluded that the site was first occupied near the end of the Early Ceramic period or ca. A.D. 900–1000.

Summary

Based on three radiocarbon ages that were internally consistent and the tentatively identified stratigraphy at the Horsethief site, Bevitt and Bauer (2003) defined four cultural components as the result of their testing efforts. From top to bottom, these were designated Zone A (15–45 cm bgs), Zone B (59–62 cm bgs), Zone C (71–74 cm bgs), and Zone D (80–83 cm bgs). Features identified as hearths were identified in Zones B and D. The interpretations of the stratigraphy, multicomponent nature, and age of 14HO308 were relatively parsimonious with the data available to Bevitt and Bauer (2003) at that time. However, subsequent data recovery has yielded greater information, allowing a more refined perspective on the site.

The stratigraphy, radiocarbon ages, vertical and horizontal feature locations, and artifact density distributions indicate that the Horsethief site primarily represents a single major occupation, dating sometime during the period of ca. A.D. 1150–1225. Meager and debatable evidence exists for possible earlier and later occupations. However, the pervasive bioturbation observed throughout the excavations, but particularly in the younger deposits, invites considerable skepticism about earlier and later site usage (Bevitt and Bauer 2003). If such did occur, it was extremely limited in duration and left little obvious evidence other than perhaps a few hearths (Features 8–10 and maybe Feature 11) and small pit features (Features 4 and 5).

Features 8–10 might represent hearths resulting from early episodes of brief and intermittent use of 14HO308 as a campsite or bivouac. All three occurred within 2–3 cm vertically of one another and at least 10 cm below all of the features associated with the primary occupation of the site. Feature 11, a hearth or roasting pit, represents the only other feature recognized in Level 9. The use of these four features could have occurred a few centuries earlier than the primary occupation, conceivably during the dated interval of A.D. 900–1000.

Despite the potential presence of earlier and later components at the Horsethief site, it can be considered a single-component site. This assertion is supported by a columnar series of flotation samples from Unit 12 (Figure 16), as well as a variety of other data discussed elsewhere in this report. As such, there is an overwhelming amount of evidence to suggest that the site was intensively occupied only once for a relatively short period of time (i.e., perhaps one or a few decades at most). The analyses of lithics, ceramics, and biological remains assume that such was the case.

LITHIC ANALYSIS

By Jack H. Ray

This section presents descriptions and interpretations of lithic artifacts that were recovered during investigations at the Horsethief site. The analyzed lithic assemblage was derived from 13 test units and 8 cultural features. Various types of data pertaining to the lithic analyses were presented in Lopinot

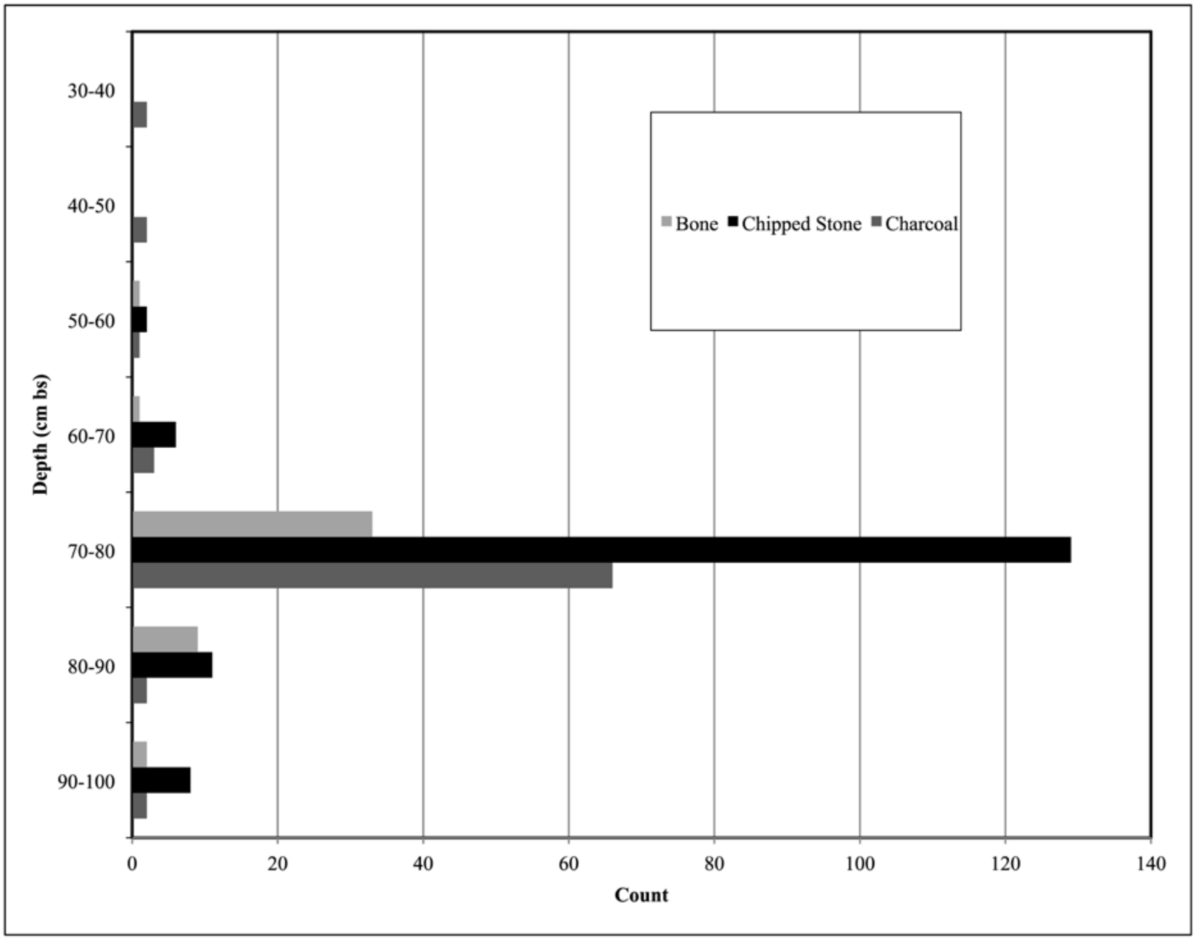


Figure 16. Counts of various materials in flotation column from Unit 12.

et al. (2010:Appendix 2). The section opens with a description of locally available chipped-stone resources (some previously undescribed) and extralocal chipped-stone resources that are present in the assemblage. It is followed by analytical sections that discuss chipped-stone artifacts, groundstone artifacts, other lithic items, and procurement and use of chipped-stone raw materials.

Raw Material Resources and Availability

Artifacts recovered from 14HO308 were made primarily of local raw materials, but artifacts made from extralocal resources also were found. As defined for this study, local resources occur within 10 km of the site, nonlocal resources occur between 10 and 100 km from the site, and exotic resources occur at distances greater than 100 km (Ray 2007:24–25).

Local Resources

A series of raw material types derive from the Ogallala Formation (Banks 1990:95), which caps the plateau-like uplands in the project area and a large portion of Hodgeman County (Moss 1932:13). These uplands comprise the eastern edge of the High Plains in Kansas. The late Tertiary (Pliocene-age) Ogallala Formation is composed of stream-lain sand, silt, and gravel deposits. Gravel deposits occur in all three members (Valentine, Ash Hollow, and Kimball) of the Ogallala Formation (Bayne and O'Conner 1968:59). The gravel deposits were derived from the erosion of pre-Pliocene sedimentary and igneous rocks to the west, especially from the eastern flanks of the Rocky Mountains, but also from sedimentary rocks in eastern Colorado and extreme western Kansas (Bayne and O'Conner

1968:58). These sediments were transported and redeposited by ancient dynamic stream systems as far east as western Kansas, including Hodgeman County. The late Tertiary deposits are generally poorly consolidated, but some "mortar beds" are locally cemented by calcium carbonate. Some of the largest redeposited clasts (large pebbles and small cobbles) from the Ogallala that were composed of siliceous materials were tested and used by local prehistoric knappers. The majority of Ogallala gravels are pebble size, but some small cobbles are fist size or 7–9 cm in diameter (Rolfe Mandel, personal communication 2009). As an example, one small rounded redeposited cobble of quartz that was used as a hammerstone at the Horsethief site measures 7.8 cm across the long axis.

Locally, knappable pebbles and cobbles can be found in situ in the Ogallala and in colluvial aprons along the lower slopes of buttes and mesas. Ogallala gravels, however, are more concentrated in certain locales. In localized areas of the Pawnee River basin, gravels eroded from the Ogallala were reworked and redeposited on elevated strath terraces by Pleistocene streams (Bayne and O'Conner 1968:59; Moss 1932:12). Mandel (1994:43) noted a 1.5-m thick veneer of well-rounded, unconsolidated alluvial gravel (much of which was siliceous) on an erosion surface above a T-1 terrace along Buckner Creek only about 1 km northeast of 14HO308. The beds of the modern Pawnee River and its larger tributaries also contain Holocene gravels reworked from the Ogallala Formation and the Pleistocene strath terraces (Moss 1932:12). In addition to the redeposited gravels, secondary silica replacement of parts of mortar beds has produced localized pockets of in situ opalite. The bulk of this material would have been procured directly from outcrops or from loose talus deposits directly below the outcrops.

Six types of chippable Ogallala rocks have been identified in the Horsethief site lithic assemblage. These chipped-stone raw materials consist of Ogallala chert, Ogallala quartzite, Ogallala quartz, Ogallala rhyolite, Ogallala petrified wood, and Ogallala opalite.

Ogallala Chert. The most abundant chipped-stone rock type in the Ogallala gravels is chert. The cortex of Ogallala chert is always highly corraded (subangular to subrounded) from long distance alluvial transportation. The cortical surfaces of the finest-grained chert pebbles exhibit many impact (Hertzian cone) fractures. The matrix of these rounded chert gravels exhibits a wide variety of colors, internal structures, and textures, as they are derived from numerous rock formations in the Rocky Mountains. The chert is predominantly dark, but lighter colors also are present. Some of the colors include very dark gray (10YR 3/1), dark gray (10YR 4/1, 7.5YR 4/1), gray (10YR 5/1; 7.5YR 5/1, 6/1), pinkish gray (7.5YR 6/2), light gray (10YR 6/1), very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), brown (7.5YR 5/2), grayish brown (10YR 5/2), weak red (10R 4/3, 4/4, 5/3, 5/4), red (10R 4/6, 2.5YR 5/6), and reddish yellow (7.5YR 6/6).

The matrix of some chert pebbles is composed of a solid color, but many pebbles exhibit a mottling of dark colors, and others exhibit a mottling of light and dark colors. Thin flakes of some pebbles are translucent. Macro- and microscopic fossils are uncommon. Textures vary from coarse to medium to fine. Some of the Ogallala chert that is mottled weak red, light gray, and white resembles Alibates chert. Don G. Wyckoff (1993) has demonstrated that redeposited clasts of Alibates chert occur in the Canadian River valley in the panhandle of western Oklahoma. An Alibates look-alike chert, called Day Creek, also occurs in western Oklahoma and southwest Kansas (Banks 1990:92). However, the Alibates look-alike material found at 14HO308 is presumed to have come from local redeposited chert gravel in the Ogallala Formation. Whereas mottled red, gray, and white Ogallala chert can be confused with Alibates chert, brown and yellow Ogallala chert can be misidentified as Smoky Hill chert.

The vast majority of Ogallala chert does not fluoresce under long-wave or short-wave ultraviolet (UV) light. However, a small percentage may fluoresce light green under short-wave UV light. For example, of 121 flakes exposed to UV light, only 4 percent fluoresced light green under short-wave UV, and none fluoresced under long-wave UV light. All five flakes, possibly from the same redeposited pebble, were thin biface flakes and dark gray to brown in color but translucent along thin edges. Short-wave UV light can be used to differentiate red and white Ogallala chert that does not fluoresce from Alibates chert, which does.

Ogallala Quartzite. Like the chert gravel, cortical surfaces of pebbles and small cobbles of Ogallala quartzite are highly corraded. The size of these quartzite gravels may be slightly larger overall because quartzite is tougher and does not break apart as easily as more brittle chert. The most common colors are gray (10YR 5/1, 6/1), light gray (10YR 7/1), and brown (7.5YR 5/2). The quartzite is typically composed of medium- to fine-grained, angular to subrounded, and moderately to poorly sorted quartz sand grains, which are tightly cemented by silica. Some quartzite pebbles also contain angular to subrounded feldspar crystals. Ogallala quartzite does not fluoresce under UV light.

It is important to note that the redeposited Ogallala quartzite gravel described here should not be confused with the in situ deposits of Ogallala quartzite that occur near the bottom of the Ogallala Formation in the northwest quadrant of Kansas (Frye and Swineford 1946:40). None of this bedded quartzite, including a distinctive green quartzite (Banks 1990:95; Stein 2004:9, 2006:278), occurs in the Horsethief site assemblage.

Ogallala Quartz. Ogallala quartz differs from quartzite in that it is not composed of cemented quartz sand. The matrix consists of homogeneous, nongranular milky colored quartz. The milky appearance makes it opaque for all but the thinnest flakes. Unlike the smooth conchoidal fracture of chert, quartz exhibits a "wrinkled" fracture surface similar to that of quartzite under microscopic examination. All of the flakes of Ogallala quartz found at 14HO308 were flaked from amorphous crystalline quartz masses rather than clear quartz crystals.

Ogallala Rhyolite. Rhyolite is an extrusive (volcanic) aphanitic (fine-grained) igneous rock that is commonly porphyritic (larger crystals in a finer-grained background or groundmass) and contains appreciable quantities of feldspar and quartz phenocrysts. Rhyolite contains more silica than trachyte and dacite. Only one flake fragment of rhyolite was recovered from Feature 18. That specimen is fine grained, very dark gray (5YR 3/1), and contains a single light reddish brown (5YR 6/3) feldspar phenocryst. Rhyolite does not fluoresce under UV light.

Ogallala Petrified Wood. This material represents the replacement of wood by silica in such a manner that at least part of the original form of the wood is preserved. Not all parts of a pebble of petrified wood retain a wood-grain appearance. In those that do, wood-grain areas are generally reddish brown (5YR 4/3). Petrified wood that does not exhibit wood grain is usually a homogenous very dark brown (10YR 2/2), black (10YR 2/1, 7.5YR 2/1), or very dark gray (5YR 3/1) color. Petrified wood found at the Horsethief site is invariably fine grained. It does not fluoresce under UV light. Ogallala petrified wood that retains no evidence of wood grain bears a strong resemblance to, and can be easily misidentified as, Knife River flint. Although most of the artifacts made from petrified wood are presumed to be from redeposited gravels of the Ogallala Formation, those that do not exhibit a corraded cortex might have been made from other sources of petrified wood (e.g., sources in eastern Colorado).

Ogallala Opalite. Unlike the above five redeposited raw materials, Ogallala opalite represents an unusual rock type that formed in situ by secondary silica replacement of calcium carbonate deposits. It typically occurs as a mottling of opaque milky white and translucent light gray areas. A variety of terms have been used to refer to this material, including opal (Franks and Swineford 1959; Hughes 1979), opalite (Lintz 1997), opal and opalite (Banks 1990:95), opaline chert (Schultz 1979), silicified caliche, silcrete (Caran 1988), chert (Bayne and O'Conner 1968:59; Frye and Swineford 1946:38), Kimball chert, and Kimball chalcedony.

Opal is not pure silica. It contains small quantities of sodium, potassium, calcium, and aluminum, and it also contains more water (generally 3–9 percent) than chert. It is usually light colored and may be translucent to opaque. The hardness of opal generally ranges from 5.5 to 6.5, but Franks and Swineford (1959:187) reported a hardness range of opal in the Kimball member to be 4.5 to 6.0, with the softer material being the waxy white areas. Opalite is a term that is often used to refer to an impure colored variety of common opal (Banks 1990:154). Macroscopically, the opal-like material found at 14HO308 appears to be a combination of both opal and chert, with the softer white parts being opal and the harder gray parts being chert. A minority of the material appears to grade to chalcedony.

Two small flakes from the Horsethief site were analyzed by X-ray diffraction (XRD) to determine the mineral composition of this unusual raw material. One sample was a tertiary flake (1.8 g) from Level 8 of Unit 2 that was milky white and appeared to be opal or opal-like. The other sample was a flake fragment (1.2 g) from Level 9 of Unit 2 that was light gray and chert-like. Both samples were pulverized and placed in a Bruker D8 Discover XRD machine.

The XRD data revealed that both samples were composed primarily of quartz and that they exhibited a crystalline structure similar to chert rather than an amorphous structure like opal. The opal-like sample also exhibited a second crystalline phase. The XRD graphs of the two samples were similar with the exception of two extra peaks (2-Theta centroid values 22º and 36º) that were produced by the opal-like sample. Both extra peaks are consistent with cristobalite. Cristobalite is a polymorph of quartz, and according to the American Geological Institute glossary entry for opal, "some so-called opal gives weak x-ray patterns of cristobalite" (Neuendorf et al. 2005:452). A possible explanation of the opal-like material is that it started out as true opal and that it has now largely, but not entirely, recrystallized to microcrystalline quartz (Tom Plymate, personal communication 2009). Because this unusual material might have originated as opal (but was subsequently altered) and to reduce potential confusion with redeposited chert (gravel) that also occurs in the Ogallala Formation, the term opalite is used in this report instead of opal or chert.

Although opalite appears to be restricted to the Kimball member in the vicinity of Scott County (Bayne and O'Conner 1968:59; Franks and Swineford 1959:186), Larry D. Banks (1990:95) indicated that it occurs in outcrops throughout the Ogallala Formation, implying that it also occurs in the Valentine and/or Ash Hollow members. Banks' observation is supported by John C. Frye and Ada Swineford (1946:44), who indicated that "chert" has been observed at many stratigraphic positions (at the top to near the bottom) in the Ogallala Formation. For now this raw material should be referred to as Ogallala opalite. If it can be demonstrated by future comprehensive surveys that knappable deposits of opalite are restricted to the Kimball member, then the term Kimball opalite will be more appropriate.

Opalite occurs as irregular masses and nodules in indurated beds of silt and sand, often called "mortar beds," cemented by calcium carbonate. In Scott County opalite was found in mortar beds up to 0.9 m thick and located 3–5.8 m below the top of the Ogallala Formation (Franks and Swineford 1959:186). Nodular deposits of opalite up to 7–10 cm in diameter were noted within a mortar bed in the Ogallala escarpment near 14HO308 during the testing investigations (Tod Bevitt, personal communication 2009). In the headwaters of the Smoky Hill River, tabular chunks of opalite measure up to 2–3 cm thick and 10–15 cm long (Janice McLean, personal communication 2009). The source of the silica in the Ogallala opalite is thought to be primarily Pleistocene volcanic ash from which silica was deposited by downward percolating water during a time of extreme aridity at the end of the Pliocene (Franks and Swineford 1959:195; Frye and Swineford 1946:37).

The first reference to Ogallala opalite as a toolstone for prehistoric knappers appears to have been by Jack T. Hughes (1979) in a study of the Palo Duro Creek basin in the panhandle region of Texas. A much more detailed description of this unusual raw material was given later by Christopher Lintz (1997:107–124) for the same Palo Duro Creek locality. Banks (1990:95) also mentioned the presence of a "brown to tan and more rarely, a whitish opal" in the Ogallala, but his description of the material was very brief. Overall, there has been relatively little discussion of this unique raw material as a prehistoric chipped-stone resource. Although there are similarities between the opalite that occurs in southwest Kansas and the opalite described by Lintz (1997) for the panhandle of Texas, there are apparent differences. The following is a detailed description of the opalite that occurs in Hodgeman County, Kansas.

The cortex of Ogallala opalite is rough, irregular, and chalky. It is typically about 1–3 mm thick. The matrix generally consists of a mottling of shades of gray and white. Gray colors range from light brownish gray (10YR 6/2) to light gray (10YR 7/2, 7/1) and gray (2.5Y 6/1). Gray colors predominate and usually comprise the groundmass in which white areas appear. White (N 9/0, 10YR 8/1) areas typically occur as irregular, relatively thin borders just beneath the chalky cortex or as small irregular, subangular, or pillow-like structures in the gray matrix. In areas where white dominates (especially near the cortex), the reverse is true, and small subangular gray structures may occur in a white matrix. Occasionally, black dendrites penetrate the matrix.

Gray areas are dull and nonlustrous, whereas white areas are lustrous, often exhibiting a waxy sheen. Thin flakes of Ogallala opalite that are gray are translucent when held up to a light source, whereas white areas are opaque. Ogallala opalite appears to be nonfossiliferous. It is fine grained and produces conchoidal fracture very similar to chert. Ogallala opalite fluoresces under UV light, but its response is strongest under short wave. Waxy white areas fluoresce light green to bright green under short-wave UV light, and they fluoresce off white under long-wave UV light. Nonlustrous gray areas fluoresce light gray to light brown under long-wave UV light, whereas these areas fluoresce very weakly (gray to brown) under short-wave UV light. Ultraviolet light, especially short wave, helps differentiate Ogallala opalite from Smoky Hill chert, which rarely fluoresces under UV light (see below).

The Ogallala formation occurs in parts of eight states in the central and southern Plains, extending from the Texas panhandle to the southern border of South Dakota; however, knappable deposits of opalite do not occur throughout this area. Lintz (1997:Figure 1) indicated that indurated beds of opalite occur in the panhandles of Texas and Oklahoma, western Kansas, and southwestern Nebraska. The distribution of Ogallala opalite in southwest Kansas is not well known. Franks and Swineford (1959) documented it in Scott County, and Peter W. Bowman (1960:7) mentions a "white waxy chert" and a "bluish-white translucent opal-like material" in the vicinity of the Coal-Oil Canyon site in western Logan County that is Ogallala opalite. Analysis of initial-stage reduction debitage (i.e., decortication flakes) during the current project indicated that it also occurs near the Horsethief site. Undocumented localized deposits may occur in Ford, Gray, Finney, and Lane counties, located south and west of Hodgeman County. Frye and Swineford (1946:Figure 1) indicated that in situ "chert" in the Ogallala is much more widespread, occurring in Clark, Ness, Ellis, Trego, Logan, Wallace, Smith, and Rawlins counties in western Kansas and in Yuma County in northeastern Colorado. The knapping quality of the chert in these areas is undetermined.

Nonlocal Resources

Two nonlocal (10–100 km distant) chipped-stone resources are represented in the Horsethief site lithic assemblage. One of these (Smoky Hill chert) has been described as a constituent of the principal chert-bearing formation of the central Great Plains between the Rocky Mountains and the Flint Hills of Kansas (Banks 1990:96). The other (trachyte) is routinely found on prehistoric sites in western Kansas but in relatively minor quantities.

Smoky Hill Chert. This raw material was formed by silica replacement of chalk located in the uppermost levels (Smoky Hill member) of the Niobrara Formation (Banks 1990:96; Hattin 1982; Stein 2004). Although referred to as Smoky Hill chert by some geologists (Banks 1990; Hattin 1982), several other names have been applied by archeologists. These include Niobrarite, Niobrara jasper, Republican River jasper, Smoky Hill jasper, and Smoky Hill silicified chalk (Bevitt and Bauer 2003; Holen 1989; Stein 2004, 2006; Wedel 1986; Wright 1985). The name Smoky Hill chert is used in this report because jasper is a variety of chert and because the siliceous material in the Smoky Hill member occurs in colors other than red, brown, and yellow (e.g., gray, green, black, and white). C. Martin Stein (2004) presented the most thorough study and description of this chipped-stone resource to date.

The replacement of the chalk is thought to be similar to the silicification of localized deposits of chert and quartzite in the overlying Ogallala Formation (Frye and Leonard 1949:30). Smoky Hill chert occurs in discontinuous beds up to at least 10 cm thick that fragment into tabular nodules. It also occurs in flattened nodules, which served as natural preforms that required only decortication and thinning. The cortex is irregular and chalky, similar to that on Ogallala opalite. The matrix of Smoky Hill chert exhibits a variety of colors. The majority is brown and yellow, but it also occurs in gray, green, black, red, and white (Banks 1990:96; Stein 2004:5). The bedded chert may be banded with alternating colors. Black dendrites penetrate the matrix of some pieces, especially along incipient fracture planes. Stein (2004:47) noted that yellowish brown (10YR 5/6) and dark yellowish brown (10YR 3/4) were the colors most often represented in artifacts manufactured from Smoky Hill chert. Many small (often microscopic) specks may occur throughout the matrix.

Smoky Hill chert is nearly always nonlustrous and opaque, except for an occasional translucent (white or light gray) band sandwiched between opaque bands. Although marine and nonmarine fossils occur in Smoky Hill chalk, they are rare and difficult to identify in the chert, perhaps due to the replacement process. Pockets of unsilicified chalk and incipient fracture planes hamper conchoidal fracture in some nodules of Smoky Hill chert. The texture is typically medium grained, but it may grade to coarse and fine grained. White Smoky Hill chert can be difficult to differentiate from Ogallala opalite, as both have chalky cortexes; however, Smoky Hill chert often has a thin dark band adjacent to the chalk cortex, whereas Ogallala opalite does not.

Although chalky cortical surfaces may fluoresce bright green, the matrix of Smoky Hill chert typically does not fluoresce under either long- or short-wave UV light. Only one specimen out of nine samples of Smoky Hill chert provided by Stein exhibited a weak favorable response under short-wave UV light. One white and yellow sample from Horsethief exhibited two narrow light green stripes.

Chert-bearing deposits of Smoky Hill chert occur primarily in the southwest quadrant of Nebraska and the northwest quadrant of Kansas. The distribution of Smoky Hill chert in Kansas is better known than Ogallala opalite. The Niobrara Formation crops out in 23 counties in Kansas (Hattin 1982:7); however, Smoky Hill chert may not occur everywhere the formation crops out. For example, the Niobrara Formation crops out in the extreme northwest corner of Hodgeman County, but the chert-bearing Smoky Hill member is absent in that area (Moss 1932:19–21). The Smoky Hill member does crop out in the north and west part of Ness County, approximately 40–70 km to the northwest of 14HO388; however, it is unclear if chert is present in those areas. Smoky Hill chert was found along the main stem of the Smoky Hill River and lower portions of its tributaries in Trego and Gove counties (Hattin 1982), approximately 70–90 km northwest of the Horsethief site. The most abundant chert deposits appear to occur approximately 100–200 km north in Trego, Gove, Graham, Sheridan, Phillips, and Norton counties. In those counties Stein (2004:6–35) documented a number of reductive workshops associated with Smoky Hill chert outcrops. Smoky Hill chert was a commonly exploited chipped-stone resource throughout the prehistoric past (Stein 2004, 2006:276).

Trachyte. Trachyte is an extrusive igneous rock with an aphanitic texture. It is composed chiefly of alkali feldspar with minor amounts of biotite, hornblende, or pyroxene (Bates and Jackson 1984:531). Chemically, trachyte contains less silica than rhyolite and more potassium and sodium than dacite. This igneous rock type was spelled "trachite" by Robert K. Blasing (1990), Bevitt and Bauer (2003:31), and Stein (2006:280). However, "trachyte" is the preferred spelling according to the standard International Union of Geological Sciences (IUGS) classification of igneous rocks.

Although trachyte rocks are often porphyritic, the artifacts made from trachyte at 14HO308 exhibit a relatively uniform and essentially nonporphyritic groundmass. A few flakes, however, contain a sparse scatter of black, columnar- or granular-shaped hornblende phenocrysts. Cortical surfaces on trachyte artifacts from the Horsethief site are invariably small and difficult to analyze. Some cortical areas appeared to be obviously corraded, whereas other cortical areas did not appear to have been significantly abraded by stream action. The color of the trachyte found at 14HO308 is very dark gray (N 3/0) to black (N 2.5/0). Trachyte does not fluoresce under UV light.

Blasing (1990) conducted a mineralogical analysis of trachyte specimens that he collected from gravel deposits in Trego County. The material is typically found as cobbles and small boulders (10–30 cm in diameter) on wide terraces along the Smoky Hill River and its tributaries, especially Big Creek (Blasing 1990). This trachyte is presumably from the same or similar Rocky Mountain source as that found at the Horsethief site. However, because some of the cobbles of trachyte exhibit limited corrasion of the cortical surfaces, Blasing (1990) left open the possibility that the trachyte found on archeological sites across western Kansas might have been procured from a closer unknown (possibly now buried) source. Until the exact source of this material is determined, it is assumed to have been collected by prehistoric knappers from gravel deposits that were derived from the Rocky Mountains and redeposited in the Smoky Hill River drainage basin of western Kansas.

Exotic Resources

Three high-profile exotic chert resources were identified in the 14HO308 chipped-stone assemblage. The source areas for each of these raw materials occur more than 250 km from the project area. Two of these cherts (Edwards and Alibates) occur outside the state of Kansas, whereas one (Florence chert) occurs in east-central Kansas.

Edwards Chert. Edwards chert is a high-quality chipped-stone resource that occurs in the Edwards Plateau area of central Texas. It derives from more than one formation in the Cretaceous-age Edwards Group (Banks 1990:60). It occurs in nodular form and in thin- and thick-bedded deposits. Some of the chert beds measure up to 30 cm or more in thickness (Banks 1990:61). The cortex is typically rough and white. The cortex on some nodules is relatively thin and hard, whereas on others it may be up to 2 cm thick and chalky.

Edwards chert generally occurs in various shades of gray (10YR 5/1, 6/1), dark gray (10YR 4/1), very dark gray (10YR 3/1), light gray (10YR 7/1), and white (10YR 8/1), but it also occurs in a wider range of colors (Frederick and Ringstaff 1994). The chert may be a single color or a mottling of light and dark grays. It typically exhibits a dull luster and is opaque except near the edges of thin flakes. The texture is usually fine grained. The highest quality Edwards chert is generally found between Austin and Georgetown (Banks 1990:60). Hofman et al. (1991) showed that UV light can be a reliable aid in differentiating Edwards chert from other Plains cherts. With few exceptions, Edwards chert fluoresces various shades of orange, yellow, and tan under both long-wave and short-wave UV light (Frederick et al. 1994; Hofman et al. 1991:Table 1). One piece of Edwards chert in the CAR/MSU collection also fluoresced light green under short-wave UV light. As a high-quality and abundant resource, Edwards chert was transported and exchanged over large distances from Paleoindian (Hofman et al. 1991:306) to Terminal Prehistoric (Ray 2007:335) times. The northern border and the heart of the large source area of Edwards chert lie approximately 700 km and 900 km southeast of the Horsethief site.

Alibates Chert. Alibates chert, also known as Alibates agatized (silicified) dolomite, is another high-quality chipped-stone resource that was widely traded across the Plains. Indeed, Banks (1990:91) stated, “Alibates materials probably have received greater distribution temporally and culturally on a geographic basis that any other single chert type.” Although variable, the primary colors of Alibates chert are weak red (10R 4/2, 4/3, 5/2), light gray (2.5Y 7/1), gray (2.5Y 6/1; N 6/0, 5/0), dark gray (N 4/0), and white (N 8/0; 10YR 8/1). The material is typically gray or white with weak red bands or a mottling of all three colors. It generally exhibits a moderate luster. Fossils are rarely evident. Its fine-grained texture contributes to favorable knapping qualities. Alibates chert responds differentially under long- and short-wave UV light (Hofman et al. 1991:300). Dark (weak red and dark gray) colors do not fluoresce, whereas the white and light gray colors typically fluoresce light or dark green under short-wave light and remain white under long-wave light.

In situ and residual deposits of Alibates chert occur in a relatively restricted area along the Canadian River in the north-central portion of the Texas panhandle. This primary source of Alibates chert is approximately 330 km southwest of the project area; however, redeposited pebbles and cobbles of Alibates have been found considerable distances down the Canadian River valley in western, central, and even eastern Oklahoma (Wyckoff 1993, 2005). Alibates look-alike cherts occur elsewhere in the Plains (Wyckoff 2005:99). Some redeposited gravels in the Ogallala Formation also mimic Alibates chert; however, UV light can be used to differentiate cherts from the two sources. Unlike Alibates, red and white Ogallala chert does not fluoresce under short-wave UV light.

Florence Chert. The Flint Hills physiographic region provided the only abundant source of knappable chert between the Smoky Hills in western Kansas and the Ozarks in southern Missouri. Although several chert types occur in the Flint Hills (Haury 1979), chert from the Florence member of the Barneston Formation was one of the most intensively exploited, especially during late prehistoric times (Vehik 1990). Cherie E. Haury (1979, 1981, 1984) provided detailed descriptions of Florence chert, also known as Kay County chert and Maple City chert. Florence chert has been divided into several varieties, but the two most abundant and commonly exploited are Florence A and Florence B. Florence A chert is typically light gray (2.5Y 7/1, 7/2), pale brown (2.5Y 7/3), and gray (2.5Y 6/1) and narrowly banded, often with a wood grain appearance. Florence B is usually light gray (N 7/0), gray (N 6/0, 5/0), and dark gray (N 4/0) and may occur as a solid color or as mottled light gray and dark gray. Both varieties are fossiliferous, but fossils are typically more abundant in Florence A. Fossils include fusulinids (especially Florence A), gastropods, ostracodes, crinoid fragments, and siliceous spicules. Neither variety is lustrous. Texture is generally coarse to medium, although areas just beneath the cortex on some specimens may be fine-grained. Another variety of Florence chert (Florence D) is similar in color to Florence B, but it is generally finer grained and may exhibit banding near the cortex. The cortex on Florence chert nodules is generally irregular, white, and 5–10 mm thick. Florence chert typically does not fluoresce under either long- or short-wave UV light; however, cortical rinds occasionally exhibit a weak fluorescence.

Florence chert can be found nearly the entire length of the Flint Hills, which extend from north-central Oklahoma north-northeasterly through Kansas to almost the Nebraska border. Florence A chert occurs primarily in the southern Flint Hills, with extensive quarries located in Kay County, Oklahoma, and Cowley County, Kansas (Banks 1990:101; Haury 1984:95–96; Stein 2006:Table 16.5; Wedel 1959:479), whereas Florence B and Florence D are found primarily in the central and northern portions of the Flint Hills (Haury 1984:93). The source area of Florence chert is approximately 260–310 km east of 14HO308. Although Florence chert apparently was exploited throughout prehistory, it was a major trade commodity during late prehistoric times (Brown 1996:649; Thomas and Ray 2002; Vehik 1985, 1988, 1990). Florence chert also has been found in small quantities at Middle Archaic and Early-Middle Woodland sites in the chert-rich Ozarks (Ray 2007:327).

Chipped Stone Artifacts

The entire chipped-stone assemblage from the Horsethief site was analyzed and classified by artifact type and raw material type. Other attributes exhibited by the chipped-stone artifacts were also examined. These included presence/absence of intentional heat treatment and the type of cortical surface, if present.

Debitage

The 14HO308 debitage was subdivided into core debitage (pieces from which flakes were struck) and flake debitage (unutilized waste debris). Relatively few (N = 11) pieces of core debitage are represented in the chipped-stone assemblage. Most (N = 7) of these are pebbles that were tested (three or fewer flakes removed) and subsequently discarded due to unfavorable raw material or small size. Six are redeposited pebbles of chert, quartzite, and petrified wood from the Ogallala Formation that measure 35.9–48.4 mm along the long axis. One tested chunk of Ogallala opalite qualifies as a small cobble at 69.4 mm across the long axis.

Three pebbles are amorphous cores that exhibit unsystematic flaking from two or more striking platforms. All were knapped from redeposited Ogallala chert and measure 33.9–47.4 mm across the long axis. One 47.2-mm-long tabular core was knapped from a tabular chunk of Ogallala opalite. The relative lack of tested cobbles and cores at the Horsethief site suggests that the bulk of initial testing and reduction of pebbles/cobbles occurred at the lithic source(s) rather than at the site.

More than 2,600 pieces of flake debitage were recovered from the 13 excavation units. An additional 142 flakes were collected from 8 cultural features. Some of these (N = 598) measured <1 cm^2 and were classified as small flakes, considered too small for artifact typing and raw material identification. They were counted only with no additional analysis. Flakes measuring ≥1 cm^2 were divided into five categories based on platform configuration and percentage of cortex present on the platform and dorsal surfaces. Three categories (primary, secondary, and tertiary) are generally indicative of early-stage core reduction, whereas biface flakes indicate middle- to late-stage biface reduction and rejuvenation. The only flake category that is not diagnostic is flake fragment, which lacks a striking platform and is, therefore, unidentifiable as to flake type.

Flake debitage ≥1 cm^2 was confined primarily to the lower levels of the excavation units (Figure 17 and Table 4). More than half (55.6 percent) of the

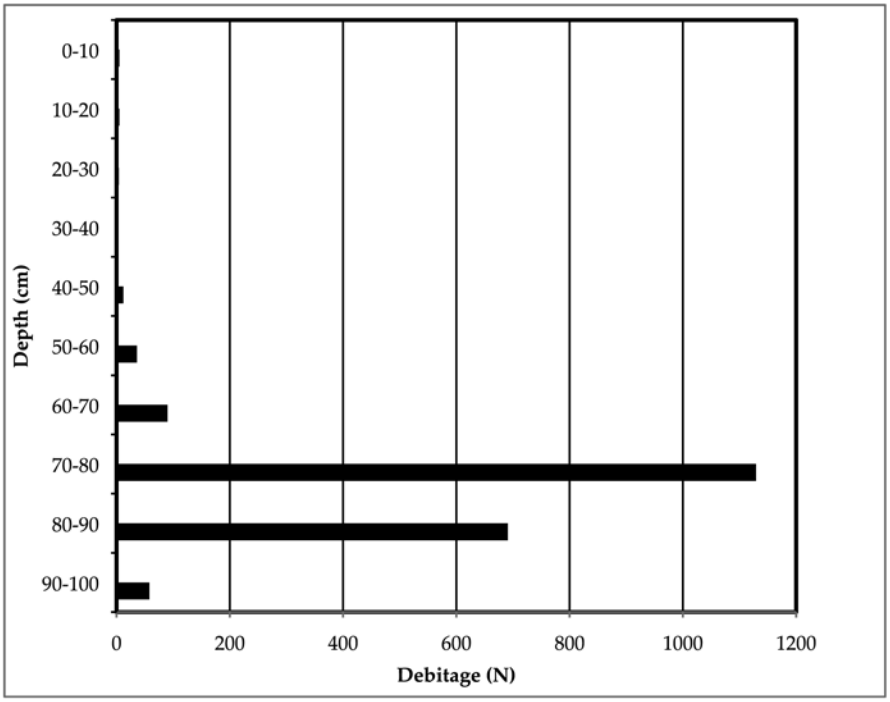


Figure 17. Flake debitage by depth.

flake debitage was recovered from 70–80 cm bs and another one-third (34 percent) came from 80–90 cm bs. The debitage from these two levels combined comprise 90 percent of all the flake debitage that was recovered from 14HO308. Flakes from other levels comprise between .1 and 4.4 percent of the total. These data suggest that the primary, if not the only, prehistoric occupation of the site was buried 70–90 cm bs. The small amount of flake debitage found above and below this horizon was probably due to bioturbation processes. This contention is supported by both archaeobotanical and zooarchaeological data.

Of more than 2,000 pieces of flake debitage (Table 4), biface flakes comprise the majority (44.2 percent) of all flake debitage, but flake fragments are nearly as common (41.3 percent). Although not quantified, the relative thickness of the flake fragments indicates that most are probably broken biface flakes. If nondiagnostic flake fragments are excluded, then biface flakes comprise three-quarters of the flake debitage. Secondary flakes comprise 12.7 percent of non-flake fragments, tertiary flakes comprise 7.5 percent, and primary flakes comprise only 4.6 percent. These percentages indicate that the production of bifaces was the primary knapping activity at the site. A similar focus on the reduction of bifaces appears to have occurred at the late prehistoric Bell, Booth, and Lundeen sites located in Comanche and Meade counties (Bevitt 1999:29, 46, 71).

This apparent emphasis on biface reduction technology contrasts with that of late prehistoric groups living in areas to the east. In the Ozarks a shift in reduction technology from one geared toward the production of large bifaces to one geared toward the production of flake blanks and flake tools began during the Late Woodland period (A.D. 450–950) and was complete by Early Caddoan or Early Mississippian times (ca. A.D. 950) (Kelly 1984; Koldehoff 1987; Ray 1998, 2004:50–51; Ray et al. 2006:210–211). This technological shift appears to have coincided with the appearance of the bow and arrow.

Preforms

Preforms are unfinished bifacial tools that were rejected or abandoned prior to completion for various technological reasons (aborted preforms) or that broke during the manufacturing process and were subsequently discarded (failed preforms).

Primary Bifaces. Primary bifaces generally represent early-stage preform failures that broke during the reduction process or whole preforms that were aborted due to raw material flaws or poor execution of knapping techniques. They typically

Table 4. Artifact Types by Level.

	Level																					
	1		2		3		4		5		6		7		8		9		10		Total	
Artifact Type	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Core Debitage																						
Amorphous															2	66.7	1	33.3			3	100.0
Tested Cobble																	6	100.0			6	100.0
Tabular/Conical													1	100.0							1	100.0
Subtotal													1	10.0	2	20.0	7	70.0			10	100.0
Flake Debitage																						
Primary Flake	1	1.8											2	3.6	25	45.5	24	43.6	3	5.5	55	100.0
Secondary Flake									1	0.7	1	0.7	7	4.6	83	55.0	53	35.1	6	4.0	151	100.0
Tertiary Flake									2	2.2			5	5.6	52	57.8	27	30.0	4	4.4	90	100.0
Biface Flake	3	0.3	2	0.2	2	0.2			3	0.3	13	1.4	32	3.6	512	57.1	311	34.7	19	2.1	897	100.0
Flake fragment	1	0.1	3	0.4	2	0.2	2	0.2	6	0.7	22	2.6	44	5.2	457	54.5	276	32.9	26	3.1	839	100.0
Subtotal	5	0.2	5	0.2	4	0.2	2	0.1	12	0.6	36	1.8	90	4.4	1,129	55.6	691	34.0	58	2.9	2,032	100.0
Informal Tools																						
Utilized Flake													4	8.7	27	58.7	12	26.1	3	6.5	46	100.0
Formal Tools																						
AP Preform															11	50.0	8	36.4	3	13.6	22	100.0
Fresno AP															2	100.0					2	100.0
Harrell AP													2	22.2	4	44.4	2	22.2	1	11.1	9	100.0
Huffaker AP															4	80.0	1	20.0			5	100.0
Washita AP															8	66.7	2	16.7	2	16.7	12	100.0
Washita/Harrell AP															3	100.0					3	100.0
Unidentifiable AP Frag													2	33.3	3	50.0	1	16.7			6	100.0
Primary Biface											1	20.0			3	60.0	1	20.0			5	100.0
Secondary Biface									1	7.7	1	7.7			9	69.2	2	15.4			13	100.0
Tertiary Biface															2	100.0					2	100.0
Side Scraper													2	13.3	7	46.7	1	6.7	5	33.3	15	100.0
End Scraper			1	3.0											26	78.8	4	12.1	2	6.1	33	100.0
Graver															1	100.0					1	100.0
Subtotal			1	0.8					1	0.8	2	1.6	6	4.7	83	64.8	22	17.2	13	10.2	128	100.0
Total	5	0.2	6	0.3	4	0.2	2	0.1	13	0.6	38	1.7	101	4.6	1,241	56.0	733	33.0	74	3.3	2,217	100.0

are large, thick bifaces with irregular sinuous edges that often retain some cortex.

Five primary bifaces were recovered. Four of these were found 70–90 cm bs, whereas the fifth was found 50–60 cm bs. Two of the primary bifaces are depicted in Figure 18a-b. One failed during the thinning process, as indicated by a diagonal fracture across the blade (Figure 18a). This biface was made from a tabular chunk of Ogallala opalite that has chalky cortical surfaces on both faces. It measures 107.2 mm long, 53.5 mm wide, and 16 mm thick. The other primary biface was aborted during manufacture because stacked step fractures and collapsed platforms developed along both edges. Poor raw material quality (chalky inclusions and incomplete silica replacement) contributed to the crushing and collapsing of platforms along the biface edges. This early-stage preform, which was knapped from Smoky Hill chert (Figure 18b), measures 93.3 mm long, 54.2 mm wide, and 20.4 mm thick. The size of these primary bifaces suggests that they might have been preforms for beveled knives, such as Harahey knives.

Secondary Bifaces. Secondary bifaces generally represent middle-stage aborted or failed preforms. Cortical surfaces typically have been removed by extensive, systematic soft-hammer percussion, although occasional small relict areas of cortex may be present. Edges are still sinuous but less so than the edges of primary bifaces. Secondary bifaces may be nearly as large as primary bifaces, but they are typically thinner and more lenticular in cross section.

Thirteen secondary bifaces were recovered from excavation units. Eleven of these were recovered 70–90 cm bs. An additional secondary biface fragment was found in Feature 17. Most of these secondary bifaces are small proximal, distal, or edge fragments of failed middle-stage preforms. The distal end of one failed secondary biface is

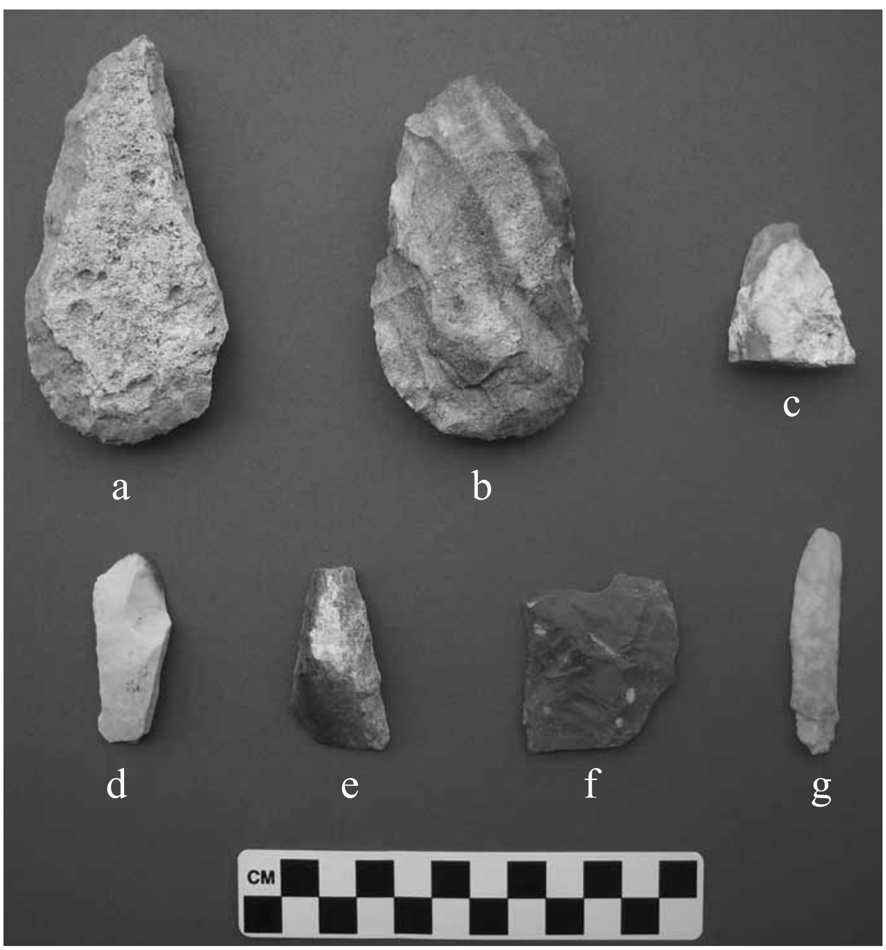


Figure 18. Bifaces and unifaces: (a-b) primary bifaces; (c) secondary biface fragment; (d-e) side scrapers; (f-g) utilized flakes. Ogallala opalite (a, c, g); Smoky Hill chert (b, d-f).

depicted in Figure 18c. Chalky areas in the Ogallala opalite probably contributed to the fracture of that specimen.

Tertiary Bifaces. Tertiary bifaces generally represent the near-end product of projectile points/knives. They are smaller, thinner, and shorter than secondary bifaces, and they have nonsinuous edges, are well thinned, and typically lack relict cortical surfaces. Tertiary bifaces from workshop assemblages represent late-stage preform fragments of unfinished tools that failed during final thinning and shaping. However, tertiary bifaces from habitation sites may include fragments of finished bifacial tools, such as thin unnotched knives or midsections and distal ends of projectile points/knives. Two tertiary bifaces were recovered from the Horsethief site. Both are very small, thin fragments that probably represent parts of arrow points or failed late-stage arrow point preforms.

Arrow Point Preforms. Twenty-two triangular bifacial artifacts were recovered from excavation units and classified as arrow point preforms. Another specimen was found in Feature 18. These 23 unfinished arrow points were rejected or abandoned prior to completion (Figure 19). Most (N = 14) are preforms that were aborted in the early and middle stages of arrow point production. Some of the apparent reasons that the preforms were abandoned include excess thickness, inadequate length, asymmetrical edges, humped or stacked areas on the dorsal surface, and severe curvature of the ventral face of the flake blank. The remaining arrow point preforms (N = 8) failed during the reduction process. One of these (Specimen 171-PP 149) apparently broke as the initial side notch was being created. A diagonal fracture extends from that notch to the base, and the opposite edge is unnotched. Unfinished (abandoned or broken) arrow point preforms are common at late prehistoric sites. At least 90 arrow point preforms were recovered from the Coal-Oil Canyon site (Bowman 1960:54).

Arrow points from 14HO308 were manufactured from small, thin flake blanks. Nearly three-quarters of the arrow point preforms (N = 17) exhibit smooth, undulating surfaces on one face that represent the ventral surfaces of flake blanks. Six specimens were flaked entirely on both faces, obliterating any evidence of relict ventral surfaces. Only three arrow point preforms retain the original striking platforms.

Figure 19. Arrow point preforms: (a) Florence B chert; (b) Alibates chert; (c-e) Ogallala opalite; (f) Ogallala chert; (g-l) Smoky Hill chert.

Two of these have faceted platforms, indicating that they were made from biface thinning flakes, and one exhibits a flat unfaceted platform of a secondary (decortication) flake. Although sample size is much too small, it appears that some flakes might have been intentionally removed from cores as blanks for arrow points, whereas other arrow point blanks were selected from some of the larger waste flakes produced from biface thinning.

Measurements of basal width, length, and thickness were obtained for arrow point preforms and finished arrow points. It is not surprising that unfinished arrow point preforms are larger in every dimension than finished arrow points. The averages for basal width and length are 2.5–4.3 mm greater, and the average thickness is .5–1.6 mm greater than those for finished Washita, Harrell, Huffaker, and Fresno arrow points.

Tools

Arrow Points

Diagnostic arrow points comprise the largest category of chipped-stone tools. Twenty-eight specimens were found in excavation units, and 12 were recovered from 3 features (Features 17, 18, and 20). Of those recovered from excavation units, the majority (82.1 percent) were recovered 70–90 cm bs, with two and three specimens coming from 60–70 cm and 90–100 cm bs, respectively (Table 4).

Based on side and basal notches, the arrow points can be divided into at least three types. Unnotched specimens may represent a fourth arrow point type, or they could be unfinished arrow point preforms.

Washita. Washita arrow points (Figure 20) exhibit two side notches and a straight to slightly concave base (Bell 1958:98). The edges of the stem on some specimens are straight. Stem edges on other specimens expand slightly to the base, which results from placing side notches in a triangular preform. Thus, the stem and/or the base is always the widest part of the point. Washita points have relatively long stems or haft areas compared to the shorter stems of side-notched Caddoan arrow points such as Reed, Morris, and Haskell (Bell 1958:60–61, 76–77, 98–99; Brown 1996:445; Perino 1968:32–33; Turner and Hester 1993:236). This difference is due to the placement of side notches slightly higher on the preform of Washita points relative to the placement of side notches on Caddoan side-notched arrow points. Side notches on Washita points are typically about one-third of the distance from the base to the tip on unresharpened specimens or ones that have undergone limited resharpening (Figure 20a) and near the center of the triangle on specimens that were resharpened repeatedly (Figure 20b, d, and h). Side notches were typically placed perpendicular to the edge of the triangular preform as opposed to parallel to the straight base. Blade edges are straight to slightly convex. Twelve Washita arrow points were recovered from excavation units, and three more were found in features. One Washita arrow point was recovered as the result of test excavations (Bevitt and Bauer 2003:Figure 14c).

Harrell. Harrell arrow points (Figure 21) are similar in shape to Washita with the exception that Harrell points have an additional notch in the base (cf. Bell 1958:30–31 and 98–99). Ellen S. Turner and Thomas R. Hester (1993:217) include specimens without basal notches in the Harrell type, but only specimens with basal notches are considered to be Harrell in this report. Like Washita, blade edges are straight to slightly convex, stems or haft areas are relatively long, stem edges are straight to slightly expanding, and basal margins are typically straight but may be slightly concave. Harrell is the most common arrow point type represented at the Horsethief site. Nine Harrell arrow points were recovered from excavation units and seven more came from features.

Huffaker. Huffaker arrow points (Figure 22) resemble Washita and Harrell points in that blade edges are straight to slightly convex, stems may be relatively long, stem edges are straight to slightly expanding, and bases are straight to slightly concave (Bell 1960:58–59). Bases may be unnotched like Washita (Figure 22b) or notched like Harrell (Figure 22a, c-d) (Turner and Hester 1993:217); however, they differ in one stem attribute. In addition to the primary side notches, smaller and shallower

Figure 20. Washita arrow points: (a) unidentified chert; (b) Florence B chert; (c) Alibates chert; (d-g) Smoky Hill chert; (h) Ogallala quartzite.

Figure 21. Harrell arrow points: (a-b) Florence B chert; (c) Alibates chert; (d-i) Smoky Hill chert; (j) unidentified chert.

a

b

c

d

e

f

Figure 22. Selected arrow points: (a-d) Huffaker; (e-f) Fresno. Smoky Hill chert (a, d-f); Edwards chert (b); Alibates chert (c).

notches were placed in the edges of the stem, presumably for added haft support. These secondary side notches in the stem are typically half as wide and deep as the primary side notches (Figure 22c-d), and some are barely evident (Figure 22b). One Huffaker specimen (Figure 22a) has a secondary side notch on one edge of the stem but none on the other edge. Huffaker arrow points are less common at 14HO308 than Washita and Harrell arrow points. Five Huffaker arrow points were recovered from excavation units, and one was found in a feature.

Fresno. Fresno arrow points are unnotched triangular points with straight to slightly convex sides and straight to slightly concave bases (Bell 1960:44–45; Turner and Hester 1993:213). Resharpened specimens end up as, essentially, isosceles triangles. With the exception of notches, Fresno points are similar (e.g., length, width, and thickness) to the above three arrow point types. Fresno arrow points may simply represent late-stage preforms for Washita, Harrell, and Huffaker points that, for whatever reason(s), were never notched.

All of the artifacts classified as arrow point preforms (see above) are triangular or trianguloid in shape but appear to be unfinished or abandoned due to technical difficulties in thinning and shaping the preforms or premature breakage. Only two triangular specimens are symmetrical enough and thin enough to be classified as finished Fresno arrow points (Figure 22e-f). However, even these two specimens could be arrow point preforms. One exhibits minimal flaking on the ventral surface and a slight hump on the dorsal surface, and the tip of the other is missing, possibly broken during final retouch just prior to notching.

Washita/Harrell. Four arrow points were classified as Washita/Harrell. These are arrow point fragments that have diagonal fractures across parts of the blade and stem. Enough of the blade and stem are intact to identify at least one primary side notch and that the extant stem edge is unnotched. However, the middle portion of the base is missing, making it impossible to determine if the basal margin had been notched (Harrell) or not (Washita).

Unidentifiable Arrow Points. Six arrow points could not be classified as to type. These arrow points consist of thin distal fragments that broke at or above the juncture of the stem and blade.

Discussion. Excluding 2 unnotched Fresno points, which may actually be preforms for either Washita, Harrell, or Huffaker, 40 notched arrow points were classified as to type. Washita and Harrell occur in nearly equal numbers, whereas only a few Huffaker specimens are represented. Washita and Harrell are the dominant two types of notched arrow points at other sites roughly contemporaneous with the Horsethief site. They comprised 88.1 percent of 210 notched arrow points from the Coal-Oil Canyon site, with the remainder being Huffaker (Bowman 1960:55). Six Washita and at least one Harrell arrow point were recovered from the Bell site (Bevitt 1999:29). It is arguable whether these three notched arrow point types represent variability within a single point type and were made by the same knappers or actually represent two or three distinct arrow point types made by two or three distinct late prehistoric groups.

Several lines of evidence support the proposition that a single set of side notches versus multiple side notches and a notched base versus unnotched base simply represent a range of variability (and possibly idiosyncratic behavior) within a single point type. First, the bulk of the cultural remains at 14HO308 appear to represent a single late prehistoric component. The vast majority of the artifacts were recovered from a relatively thin zone at about 70–90 cm bs and suggest one or only a few successive intensively used encampments where one of the primary activities was hunting (see Archaeobotany and Faunal Assemblage sections). Second, two discrete cultural features contained two types of notched arrow points. Feature 18 yielded six Harrell arrow points and two Washita arrow points, whereas Feature 20 yielded one Washita point and one Harrell point. Third, one arrow point seems to have a mix of Harrell and Huffaker attributes. This arrow point (Specimen 326-PP 199, Figure 22a) has a notch in the base and a set of two notches on one side of the stem, but only one notch on the opposite side of the stem.

Finally, statistical analyses are generally supportive of the proposition that the three notched arrow point types represent a range of variability within a single point type. Although sample sizes for the three projectile point types are small, five attributes of each arrow point type were compared: basal width, stem length, maximum thickness, maximum length, and blade width (Table 5). The Kolmogorov-Smirnov test for small samples revealed that basal width, stem length, maximum thickness, and maximum length are not significantly different among the three arrow point types, whereas blade width is significantly different (Table 6). The stem, i.e., the proximal area below the side notches, is the portion of a projectile point that is least likely to change (or be modified) as a result of blade resharpening during the use life of the tool. If all three point types were made by the same knappers, then the width of the base and the length of the stem should be approximately the same on Washita, Harrell, and Huffaker points. The blade portion of an arrow point is more susceptible to change, depending on whether it has undergone few or many resharpenings prior to breakage or discard. Thus, the extent of blade resharpening can create significant differences in the width, length, and thickness of the blade. Even so, the only arrow point attribute that was significantly different was blade width.

Harahey Knives

There is a conspicuous absence of large beveled knives, often referred to as Harahey knives (Turner and Hester 1993:274), in the Horsethief site assemblage. Beveled knives, presumably used to dismember and butcher animals, are often found in Upper Republican and other late prehistoric lithic assemblages on the Plains (Logan 1996:125–129) and neighboring areas. Several beveled knives were found at the Coal-Oil Canyon and Bell sites (Bevitt 1999:29; Bowman 1960:59). Although no finished or broken beveled knives were recovered from 14HO308, it should not be assumed that the occupants did not use Harahey knives.

Table 5. Attribute Measurements of Notched Arrow Points.

Catalog No.	Blade Width	Basal Width	Length	Maximum Thickness	Stem Length
		Washita			
32-001	14.2	16.1	20.1	3.6	7.0
36-001		15.5			6.6
71-PP20	11.2	13.2	32.0	3.8	6.4
110-001	10.3	14.3	17.9	2.1	6.5
172-001	14.3	16.8		3.5	7.5
177-001					5.4
180-001	11.0		20.4	3.8	5.4
235-001	11.8	14.7		3.1	6.3
235-002	11.5		22.7	2.9	5.4
325-001		16.0			7.6
327-001	11.0	13.7		3.1	5.9
346-001	12.9			4.1	3.7
370.1-014		15.8			6.4
370.2-127					7.0
372-002	10.2	14.8	21.8	3.6	5.8
Mean	11.8	15.1	22.5	3.4	6.2
		Harrell			
76-001	15.7	20.6	36.4	4.3	6.5
112-062	10.3	14.9	17.6	2.9	6.5
166-001	10.8	13.2	18.9	3.5	5.4
167-001	12.0	14.4	20.7	4.0	6.3
169-PP165	10.2	12.3		2.9	7.0
212-001	13.8	16.2			5.5
237-PP137	13.8	16.2			5.5
345-009	9.1	12.2	19.1	2.4	4.6
349-001		14.9			6.1
350-077	10.7	12.4	25.0	4.2	5.0
350-079	12.4	14.0	23.6	3.2	8.0
370-075					4.0
370.1-010	11.1	13.5	22.5	3.3	7.9
370.2-001	15.5	17.0			6.8
370.3-001	14.2	15.5		4.1	7.3
372-001	9.7	11.0	18.3	2.5	5.0
Mean	12.1	14.5	22.5	3.4	6.2
		Huffaker			
172-002		14.7			7.0
172-PP163	10.7	13.0	26.5	3.3	6.8
210-PP179		16.8		5.0	9.5
326-PP199		16.3	24.7	3.7	7.1
348-001	11.2		23.5	3.8	5.5
369-001	10.5	13.3	20.0	3.8	6.1
Mean	10.8	14.8	23.7	3.9	7.0

Table 6. Statistical Analyses of Five Attributes on Three Arrow Point Types.

Attribute	N	Minimum	Maximum	Range	Mean	Standard Deviation
Basal Width (mm)	30	11.0	20.6	9.6	14.75	1.89
Stem Length (mm)	37	3.7	9.5	5.8	6.31	1.14
Maximum Thickness (mm)	11	2.4	4.3	1.9	3.39	0.68
Maximum Length (mm)	19	17.6	36.4	18.8	22.72	4.83
Blade Width (mm)	27	9.1	15.7	6.6	11.83	1.79

Based on the faunal data (Faunal Assemblage section), apparently only selected cuts of bison meat arrived at the site. Most primary butchering or field dressing of bison, therefore, appears to have occurred elsewhere. It is at the kill sites or other animal processing sites where beveled knives were used (and broken and discarded). At the Horsethief site Harahey knives might have been used infrequently; therefore, not many would have been broken and discarded at the site. Alternatively, the lack of Harahey knives may be due to sampling bias. Beveled knives might have been used, but abandoned or broken examples perhaps occurred in unexcavated butchering areas between Units 1–7 and 12–13 and Units 8–11.

In addition there is circumstantial evidence that at least some attempts were made to manufacture Harahey knives at the site. Eighteen failed and aborted primary and secondary bifaces were recovered from Horsethief, primarily 70–90 cm bs. Most of these are fragments of failed preforms, and the original sizes cannot be accurately extrapolated. However, at least two large aborted preforms and one failed preform fragment (e.g., Figure 18a-c) are much too large for arrow point preforms and would be the approximate sizes necessary for Harahey knives. The relatively high percentage of biface flakes found at the site (Table 4) also indicates that biface thinning was a common activity. It appears, therefore, that several attempts were made to produce large bifacial tools.

End Scrapers

End scrapers (Figure 23) comprise the second largest category of chipped-stone tools. Thirty-three were recovered from excavation units, and two were found in Feature 18. More than three quarters (N = 26) of the end scrapers that were found in excavation units are from 70–80 cm bs. Four more came from 80–90 cm bs (Table 4). End scrapers were made by beveling the distal ends of elongated, tear-drop-shaped flakes. The proximal ends of the tear-drop-shaped end scrapers were hafted to adze-like handles made from antler or wood (Creel 1991:43). They are believed to have been used on the hides of bison and other mammals to remove hair and reduce the hides to an even thickness.

Most of the unbroken end scrapers were resharpened repeatedly until the beveled bits retreated to the hafts, whereupon they were no longer useful and were unhafted and discarded (Figure 23c-e, h-n). Four end scrapers with longer blades (Figure 23a-b, f-g) were lost, discarded, or abandoned prior to reaching the exhausted stage. Length, width, and thickness measurements were obtained for as many end scrapers as possible. The mean length for 22 specimens is 32.8 mm, the average width at the bits of 27 specimens is 19.6 mm, and the mean thickness at the bit ends of 31 specimens is 6.3 mm.

End scrapers have a plano-convex profile. The convex surface is the dorsal surface, which is typically humped and may exhibit a dorsal ridge or relict cortex. The recurved distal end of the flake blank was always beveled as the working end. One or both of the lateral edges of the dorsal surface was usually trimmed to make a uniform shape. However, the lateral edges of some are unmodified. The plano surface is the ventral side of the original flake blank, which normally was unmodified. If unbroken, the striking platform and adjacent bulb of percussion are present at the proximal end of the ventral surface. Relict striking platforms reveal whether end scraper blanks were detached from prepared cores or from bifaces. Platforms that are flat (unfaceted) were struck from cores, whereas those that are faceted were struck from bifaces. Platform type

Figure 23. End scrapers: (a-d) Florence B chert; (e) Alibates chert; (f-i) Smoky Hill chert; (j-k) Ogallala opalite; (l-n) Ogallala chert.

determinations were obtained for 19 end scrapers. The platforms of more than two-thirds (68.4 percent) of these are flat and unfaceted, indicating that the end scraper flake blanks likely were knapped from cores. The platforms for the remaining six end scrapers are faceted, indicating that they probably were knapped from biface flakes. These presumably were biface flakes that had fortuitous recurved distal ends and were collected opportunistically from biface thinning debitage.

One end scraper is a refit of proximal and distal ends (Figure 23k). The proximal half (Specimen 169-001) was found 70–80 cm bs in the southeast quadrant of Unit 5, whereas the distal half (Specimen 346-009) was recovered from 70–80 cm bs in the west one-half of Unit 13. They were found in the same level and were separated horizontally by only about 1 m. The distal end of one end scraper (Specimen 345-005), made from exotic Florence B chert, was notched and recycled into a graver.

Side Scrapers

Fifteen side scrapers were recovered from excavation units, and two were recovered from features. Side scrapers were made by modifying one or two lateral margins of elongated flakes (Figure 18d-e). Small pressure flakes were systematically removed unifacially from one edge of a flake, producing a small or pronounced bevel. The irregular shape of side scrapers suggests that they were probably expedient tools that were not hafted.

Gravers

Two artifacts exhibit small spur-like projections that appear to represent intentional graver tips. The spurs are short (3 mm) and were produced by unifacial flaking on either side of the small projections. One graver was made from the stem and neck portion of a broken Washita arrow point, whereas the other specimen was made from a flake. Although the exact function of these apparent gravers is unknown, they might have been used to score bone, antler, and/or wood.

Utilized Flakes

Utilized flakes were not intentionally modified (via pressure flaking) into a specific form or shape to perform a specific task. They exhibit edges that appear to have been modified by use during expedient cutting or scraping (Figure 18f-g). A total of 46 utilized flakes were recovered from excavation units, and 5 more were found in cultural features. Most of the largest flakes (>4–5 cm long) were utilized as expedient cutting/scraping tools. One utilized flake is a refit. Both fragments came from Level 8 in the east one-half of Unit 13.

Ground-Stone Artifacts

Relatively few ground-stone items (N = 8) were recovered from the Horsethief site. Six are related to tool manufacture and/or refurbishing, and two are associated with the production of paint pigment. No ground-stone tools that might have been associated with food production were recovered.

Abraders

The five abraders found at 14HO308 were made from coarse-grained reddish brown sandstone, the source of which is unknown. Two are grooved abraders, and three are flat abraders. The larger grooved abrader (Specimen 112-PP 77; Figure 24a) was found in Unit 3NE at 77 cm bs. It is an elongated, plano-convex, bar-shaped, grooved abrader fragment with one rounded end and one straight (broken) end. It is 95 mm long, 37.3 mm wide, and 24.6 mm thick and weighs 99.5 g. This specimen has one prominent U-shaped groove on the flat (plano) surface that is 11.5 mm wide and 4.7 mm deep. It probably represents one-half of a paired arrow shaft abrader, commonly found in late prehistoric assemblages (Bevitt 1999:33; Bowman 1960:62–63; Flenniken and Ozbun 1988).

A second smaller groove encircles three quarters of the abrader, absent only from the flat broken end. The groove is located 5 mm or less below the plano surface. The groove is straight and U-shaped but more narrow (4.4 and 4.0 mm) and shallow (2.5 mm) than the larger groove on the plano surface. This narrow groove, which probably completely encircled the unbroken abrader, appears to be a misplaced "ringing groove." Ringing grooves were sawed circumferentially into the medial longitudinal axis of a paired arrow shaft abrader preform prior to being split in half (i.e., into two matching halves) (Flenniken and Ozbun 1988:39–40, Figure 4). The relict ringing groove on Specimen 112-PP 77 apparently was not located at the correct position along the medial axis of the preform, so it was abandoned and a new one cut. An errant ringing groove is also evident on an artifact (presumably an aborted arrow shaft abrader) found at the Coal-Oil Canyon site. This rectangular piece of sandstone exhibited a narrow, shallow longitudinal groove on both edges. The groove on one edge was placed approximately in the middle, whereas the groove on the other edge was off center by about 1 cm (Bowman 1960:63).

The second grooved abrader (Specimen 165-PP 144) was found in Unit 5SE at a depth of 72 cm bs. It is a thin (9.2 mm), small (45 mm long and 26.3 mm wide) fragment that exhibits a single narrow, shallow groove, measuring approximately 35 mm long, 6.5 mm wide, and 3 mm deep. This sandstone abrader does not appear to be an arrow shaft abrader; it might have been used to sharpen pointed tools, such as bone awls, needles, and other pointed slender objects of bone, wood, or shell (Flenniken and Ozbun 1988:49).

Flat abraders are also found in late prehistoric assemblages (Bevitt 1999:33; Bowman 1960:62). Each flat abrader from the Horsethief site has one lightly faceted flat surface. The largest flat abrader (Specimen 210-PP 183; Figure 24b) was recovered from Unit 6SW at a depth of 75 cm bs. It is 115.1 mm long, 73.8 mm wide, and 11.7 mm thick and weighs 146.4 g. This specimen probably was considerably larger before it was broken on four sides. The second flat abrader (Specimen 346) was recovered from 70–80 cm bs in Unit 13W. It is much smaller but is approximately the same thickness (10.4 mm) as the above specimen. Although it does not refit, it may be a fragment of the larger abrader. The third flat abrader (Specimen 370.1-030) was found in Feature 18, located 70–80 cm bs in Unit

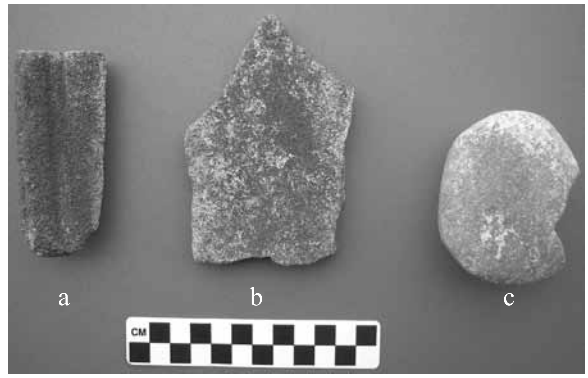


Figure 24. 24 Ground-stone tools: (a) arrow shaft abrader; (b) flat abrader; (c) hammerstone. Coarse-grained sandstone (a-b); quartzite (c).

13E. It is a very small fragment about the size of a quarter. Nevertheless, it exhibits one obvious faceted (or abraded) surface.

All five sandstone abraders appear to have come from a common living surface, 70–80 cm bs in contiguous Units 3, 5–6, and 13. A locus of abrading and arrow shaft manufacture/refurbishing might have occurred in that area.

Hammerstone

One hammerstone (Specimen 172-PP 162; Figure 24c) was piece plotted in Unit 5NE at a depth of 75–79 cm bs. It was made from a small, rounded alluvial cobble of quartz. It measures 77.5 mm long, 58.5 mm wide, and 35.8 mm thick and weighs 236 g. Both ends of the long axis are extensively battered. The battered and crushed surfaces are precisely the kind of use wear that develops during flintknapping when a hard hammer of quartz is used repeatedly to remove flakes from other siliceous materials, such as chert, quartzite, opalite, rhyolite, and trachyte. One edge of the hammerstone between the battered ends was fractured, possibly causing it to be rejected and discarded.

Pigment

Two fragments of hematite recovered from the site are small (0.2 g and 0.3 g) and exhibit at least one faceted (or ground) surface. Both pieces were found in a restricted portion of the site. One fragment was found in Level 8 of Unit 5SE, and the other fragment was piece plotted at a depth of 76 cm in Unit 6NE. This is the same locus and depth in which the sandstone abraders were found. It is possible that the hematite was ground and processed into red ochre and applied to arrow shafts as they were fashioned. However, hematite (red ochre) also was applied to many other objects and artifacts, including hides and clothing.

Other Lithic Items

Ninety-four rocks other than chipped stone or ground stone were recovered from 14HO308. Most (74.5 percent) of these probably were transported to the site in some manner but are unmodified. The bulk of these are fragments of limestone, including silicified caliche, probably derived from the Ogallala Formation. Other unmodified rocks include seven sandstone, three granite, one rhyolite, one conglomerate, and one chert pebble. Twenty rocks appear to be angular shatter that was produced either by flintknapping or unintentional heating or cooking and food preparation. Fourteen of these are shattered pieces of Ogallala opalite, whereas the rest are shattered redeposited gravels from the Ogallala. Finally, two well-rounded, unmodified pebbles may be gastroliths (gizzard stones).

Procurement and Use of Chipped-Stone Resources

A raw material analysis was conducted on the chipped-stone assemblage to determine patterns of local versus nonlocal procurement and use. It included all tools and all debitage except small flakes measuring <1 cm^2. The bulk of the raw material identifications were made by macro- and microscopic visual examination and comparison with provenienced raw material (geological) samples in the CAR/MSU laboratory. All chipped-stone tools and a select number of flakes that initially were classified as "unidentified" were reexamined under long-wave and short-wave UV light, which helps to differentiate certain stone types in the central Plains area (Hofman et al. 1991:Table 1).

Debitage

Table 7 presents all of the debitage recovered from excavation units by raw material type. Raw material types that are represented by 30 or fewer specimens are presented in the table but are largely excluded from discussions of raw material use due to small sample sizes. The most common raw material type that is represented in the debitage and presumably the most exploited local resource is Ogallala opalite. Comprising nearly half (44.1 percent) of the debitage, this relatively high percentage is one of the highest, if not the highest, reported usage of Ogallala opalite anywhere within the central or southern portions of the Great Plains (see Lintz 1997:118–123). Ogallala opalite, which occurs in situ in the nearby escarpment and in talus deposits at its base, is the closest raw material source to the Horsethief site. It comprises nearly twice as much of the debitage as the second most common (26.1 percent) raw material, Ogallala chert.

Table 7. Debitage by Raw Material Type.

Raw Material	N	%
	Local	
Ogallala Opalite	900	44.1
Ogallala Chert	532	26.1
Ogallala Quartzite	27	1.3
Ogallala Quartz	7	0.3
Ogallala Petrified Wood	14	0.7
	Nonlocal	
Smoky Hill Chert	364	17.8
Trachyte	22	1.1
	Exotic	
Florence A Chert	1	0.0
Florence B Chert	31	1.5
Florence D Chert	1	0.0
Edwards Chert	1	0.0
Unidentified	140	6.9
Totals	2,040	100.0

Ogallala chert occurs locally in redeposited gravels along portions of Buckner Creek but apparently not in the immediate vicinity of the site. There was an obvious selection for chert in the gravel deposits of the Ogallala over other redeposited raw materials (i.e., quartzite, quartz, petrified wood, and rhyolite), which combined comprise only 2.3 percent of the chipped-stone assemblage. If all local raw materials are combined, they comprise nearly three-quarters (72.5 percent) of the debitage from 14HO308. Local raw materials also comprised the majority of artifacts that were recovered from Phase II investigations (Bevitt and Bauer 2003:Table 3). The third-most common (17.9 percent) raw material is nonlocal Smoky Hill chert, which occurs in large quantities in counties to the north of Hodgeman. Nonlocal trachyte comprises 1.1 percent of the debitage, but none of the tools or preforms was made from it. Exotic cherts comprise less than 2 percent of the debitage. Of the 34 exotic chert flakes, all but one were knapped from Florence chert. Approximately 7 percent of the debitage could not be confidently identified as to raw material type.

As indicated in Figures 25 and 26, discrete knapping loci appeared to be associated with the three most commonly used raw materials. Ogallala opalite was especially concentrated in Units 2 and 7.

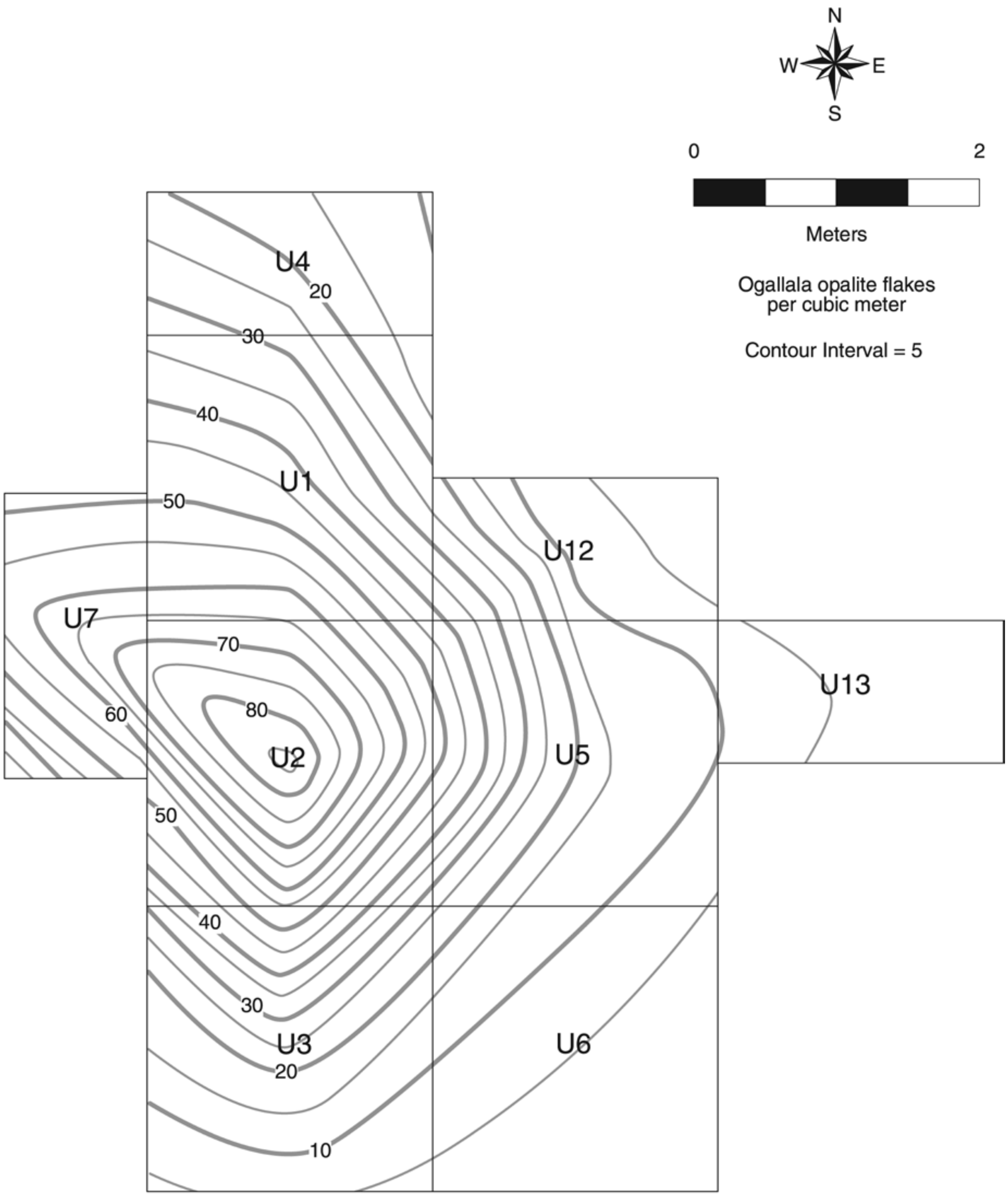
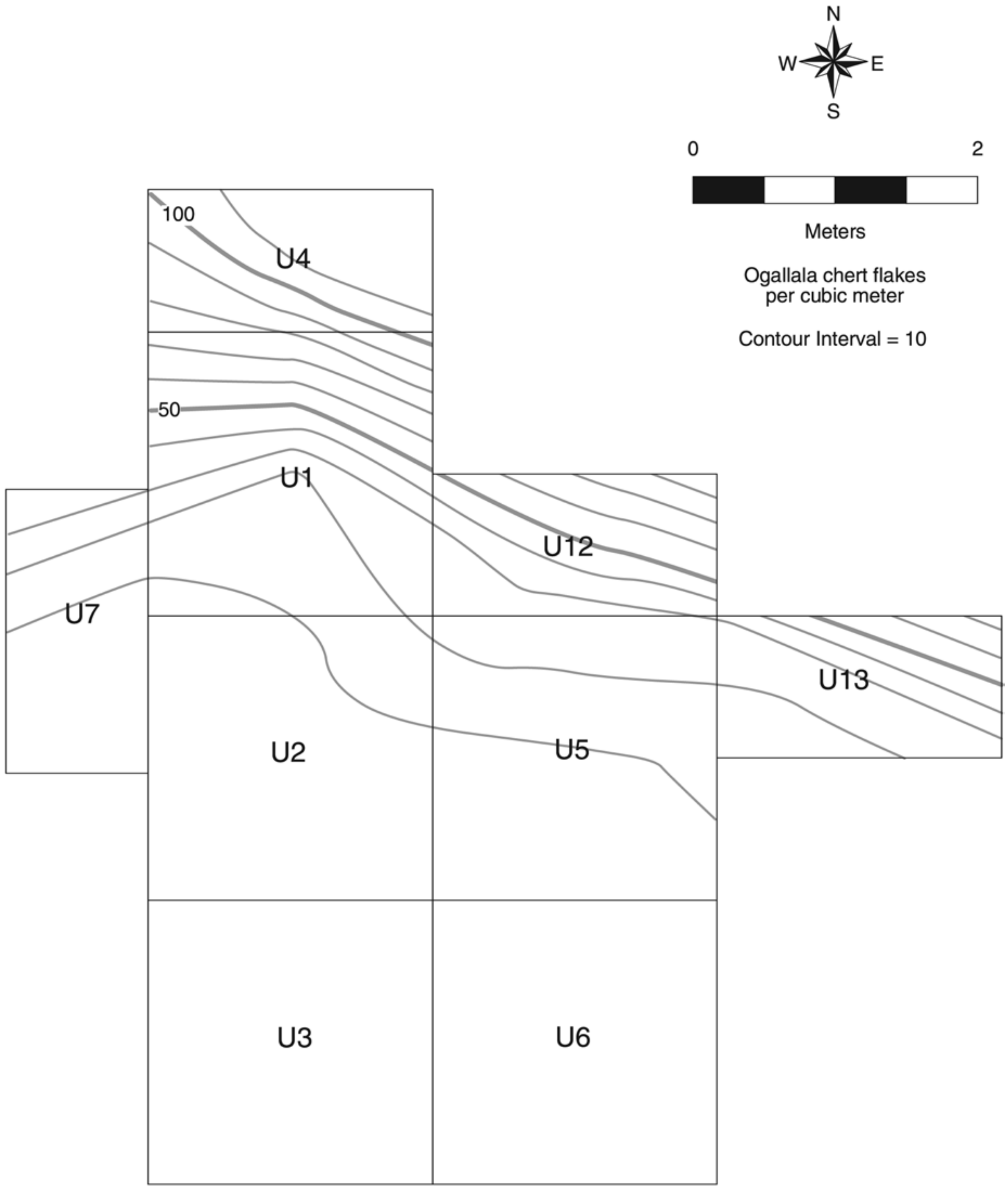


Figure 25. Densities of Ogallala opalite (above) and Ogallala chert debitage (opposite page).

It also occurred in sizeable quantities in adjacent Units 1 and 3, but it was relatively scarce in other units. The heart of the Ogallala chert concentration was in Unit 4. A minimum of 10 separate Ogallala chert pebbles appear to have been worked during the deposition of Level 9 in Unit 4. Lesser quantities of Ogallala chert occurred in nearby Units 1, 12, and 13, with relatively little elsewhere. Smoky Hill chert, on the other hand, was concentrated in Units 5 and 13, located east and southeast of the concentrations of Ogallala opalite and Ogallala chert. The majority of this Smoky Hill debitage consists of small biface flakes that appear to have been knapped from a single late-stage biface.



The relatively discrete concentrations of Ogallala opalite, Ogallala chert, and Smoky Hill chert indicate separate knapping events focused on two local resources and one nonlocal resource. The three concentrations may represent features (knapping debris piles) that were not recognized and isolated in the field. With the data at hand, it is impossible to determine if these knapping events occurred during two or more separate occupations, or whether they occurred during a single occupation. If the three discrete knapping loci were produced during a single occupation, it implies a relatively organized workshop area.

The best indicators of on-site reduction and manufacture of chipped-stone resources are core and flake debitage. Primary, secondary, and tertiary

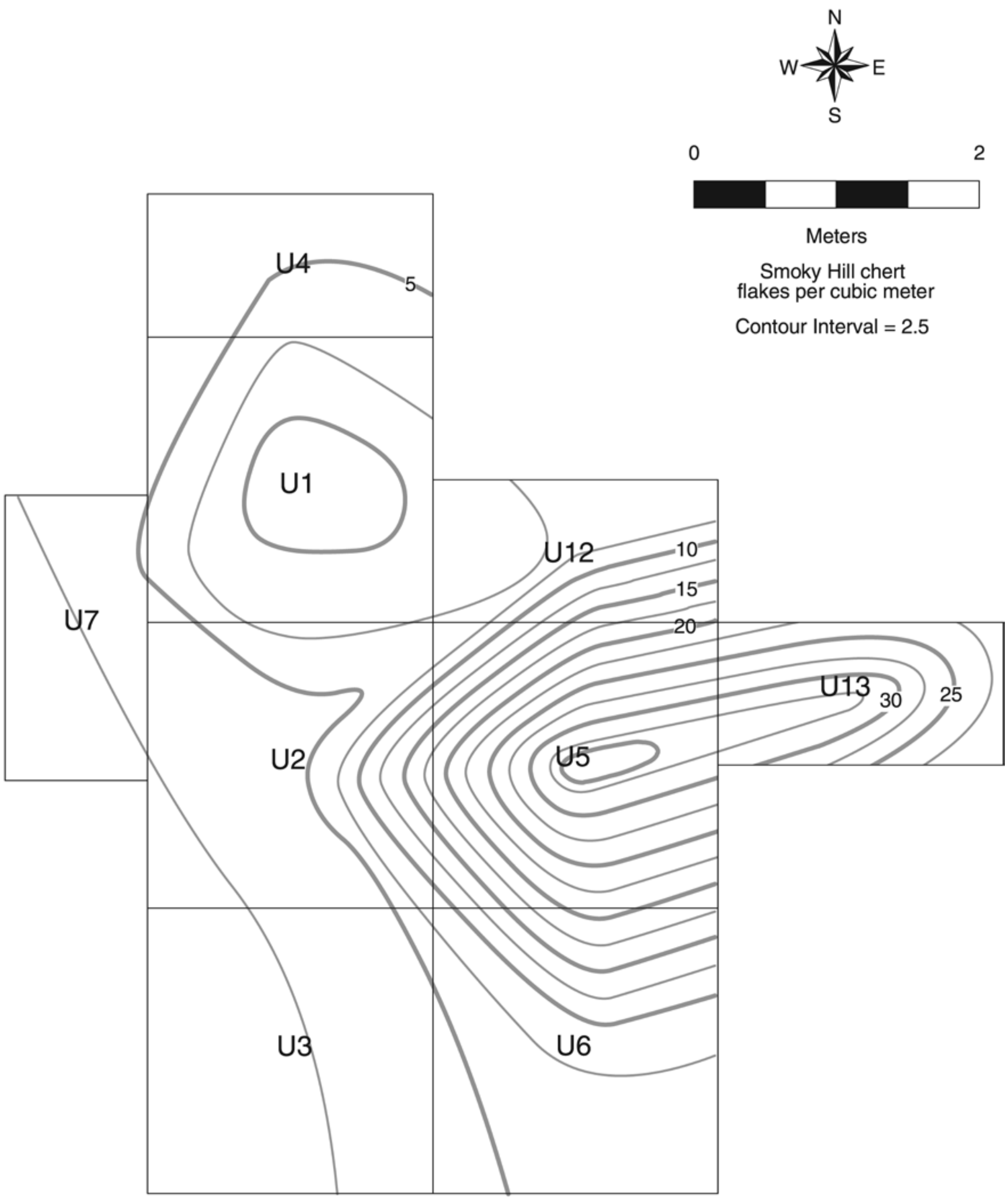


Figure 26. Density of Smoky Hill chert debitage.

flakes generally are indicative of early and middle-stage lithic reduction. Aside from occasional elongated sharp flakes selected for expedient knives or scrapers, the bulk of this type of debitage was not transported from the workshop locale. Biface flakes generally are indicative of middle- to late-stage reduction (thinning) of bifacial preforms. However, biface flakes (especially the smallest biface flakes) also might represent resharpening of the edges of dulled, finished bifacial tools that were transported (e.g., curated in tool kits) many kilometers from the place where they were manufactured. As a result biface flakes are less representative of local resource exploitation. Fragments of the above flake types yield very little information. However, a significantly higher percentage of flake fragments (46.9 percent) are present in Ogallala opalite debitage than in the debitage of Ogallala chert (35 percent) or Smoky Hill chert (37.9 percent). This likely reflects the fact that Ogallala opalite is more brittle, breaking more easily than chert.

Of those flakes with intact platforms (excluding nondiagnostic flake fragments), biface flakes comprise 73.4 percent and 68.1 percent of the two dominant local resources (i.e., Ogallala opalite and Ogallala chert) and 82.7 percent of nonlocal Smoky Hill chert (Table 8). Clearly, most of the lithic reduction at the Horsethief site centered on the manufacture and maintenance of bifaces from multiple resources and not the production of flake blanks for flake tools. Nevertheless, early stage decortication and reduction of each of the above three resources also occurred at the site. However, early stage reduction debitage differed between the local and nonlocal resources. Excluding flake fragments, 26.6 percent and 31.9 percent of local Ogallala opalite and Ogallala chert are comprised of primary, secondary, and tertiary flakes, whereas only 17.3 percent of nonlocal Smoky Hill chert is comprised of primary, secondary, and tertiary flakes. Although some unmodified tabular chunks of Smoky Hill chert might have been transported to 14HO308, most of this nonlocal chert apparently arrived at the site as bifacial preforms that had already been partly decorticated (Figure 18b). All of the debitage made from exotic cherts (Florence and Edwards) are either biface flakes or thin flake fragments and probably represent resharpening of curated tools. Based on a high percentage (81 percent) of middle- to late-stage biface-reduction flakes, it appears that

Table 8. Flakes with Intact Platforms by Raw Material Type.

	Primary flake		Secondary flake		Tertiary flake		Biface flake		Totals	
Raw Material	N	%	N	%	N	%	N	%	N	%
Local										
Ogallala Opalite	11	2.3	55	11.5	61	12.8	350	73.4	477	100.0
Ogallala Chert	37	10.8	60	11.5	12	3.5	233	68.1	342	100.0
Ogallala Petrified Wood							9	100.0	9	100.0
Ogallala Quartzite			3	27.3			8	72.7	11	100.0
Ogallala Quartz			1	50.0	1	50.0			2	100.0
Local Total	48	5.7	119	14.1	74	8.8	600	71.3	1,469	100.0
Nonlocal										
Smoky Hill Chert	6	2.7	20	8.8	13	5.8	187	82.7	226	100.0
Trachyte	1	6.3	2	12.5	1	6.3	12	75.0	16	100.0
Nonlocal Total	7	2.9	22	5.7	14	5.8	199	82.2	386	100.0
Exotic										
Edwards Chert							1	100.0	1	100.0
Florence B Chert							24	100.0	24	100.0
Florence D Chert							1	100.0	1	100.0
Exotic Total							26	100.0	26	100.0
Unidentified			10	11.9	2	2.4	72	85.7	84	100.0
Totals	55	4.6	151	12.7	90	7.5	897	75.2	1,193	100.0

most of the raw material imported to the Bell site also was in the form of bifacial preforms (Bevitt 1999:29).

A sample of the debitage knapped from Ogallala opalite, Ogallala chert, Smoky Hill chert, and Florence chert was size graded in increments of 1 cm^2 (Figure 27) to determine relative percentages of small, medium, and large flakes. The data (Table 9) are presented by all flakes (primary, secondary, tertiary, biface, and fragments) combined and only biface flakes. Only the two local resource types yielded flakes larger than 3 cm^2. Of these two, only Ogallala opalite produced flakes larger than 2 cm^2 in appreciable numbers. The relative size of the debitage appears to be directly related to available raw material size. Ogallala opalite can occur in tabular chunks and nodules up to 10 cm or larger in size, whereas Ogallala chert occurs in redeposited gravels that are primarily pebble size (.4–6.4 cm). Smoky Hill chert occurs in large tabular forms, but the bulk of this nonlocal raw material appears

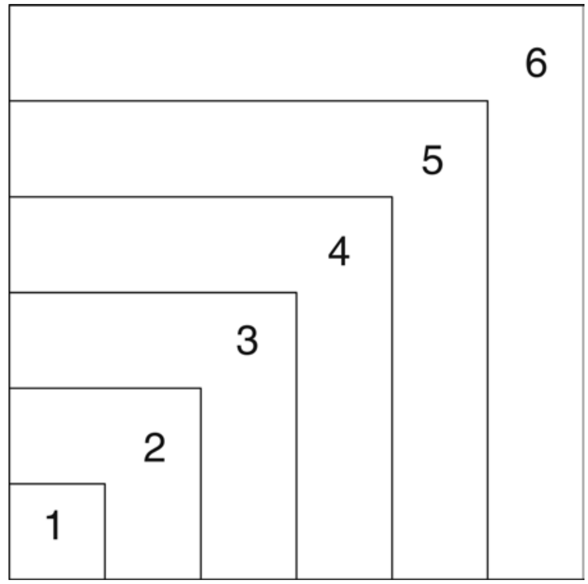


Figure 27. Size grades (cm2) used for measuring flake debitage.

Table 9. Debitage Size Grades for Selected Raw Material Types.

	Local				Nonlocal		Exotic	
	Ogallala Opalite[a]		Ogallala Chert[b]		Smoky Hill Chert[c]		Florence Chert[d]	
Size Grades	N	%	N	%	N	%	N	%
Size 2								
All Flakes	285	75.8	274	91	129	94.2	34	97.1
Biface Flakes	118	80.3	139	95.9	77	92.8	27	100
Size 3								
All Flakes	67	17.8	22	7.3	8	5.8	1	2.9
Biface Flakes	23	15.7	6	4.1	6	7.2		
Size 4								
All Flakes	13	3.5	3	1				
Biface Flakes	3	2						
Size 5								
All Flakes	8	2.1	2	0.7				
Biface Flakes	3	2						
Size 6								
All Flakes	3	0.8						
Biface Flakes								

[a]Catalog Nos. 70, 75, and 236

[b]Catalog Nos 33, 137, 138, and 326

[c]Catalog Nos 170, 212, 346, and 347

[d]Catalog Nos 31, 70, 169, 172, 209, 212, 302, 345, 346, 347, 348, 370, and 370.2

to have arrived at the Horsethief site as small- to medium-size preforms and finished tools that were subsequently thinned and/or resharpened. All but one of the 34 flakes knapped from exotic Florence chert measure 1–2 cm^2 in size and appear to represent resharpening/rejuvenation flakes. The seven flakes of Florence chert found during the Phase II investigations (Bevitt and Bauer 2003:Table 3) also are less than 2 cm^2 in size.

All tested cobbles, cores, and initial-reduction flake debitage (i.e., primary and secondary flakes) that exhibit relict cortical surfaces were carefully examined to determine procurement source. Artifacts with smooth, water-worn cortical surfaces and brown patinas are indicative of chert procured from alluvial (stream-deposited) sources, whereas artifacts with angular, grainy, unabraded, and unpatinated cortical surfaces are indicative of chert procured from residual and/or bedrock sources (Ray 2007:26–29). A total of 210 pieces of debitage exhibits cortex. Of these, a determination of source could be made for 204 artifacts (Table 10). All of the cortical pieces of Ogallala opalite exhibit residual and/or bedrock cortical surfaces, indicating that Ogallala opalite was procured directly from nearby outcrops and/or talus deposits at the base of the outcrops. All cortical pieces of Ogallala chert exhibit alluvial cortex. Redeposited Ogallala chert pebbles and cobbles were procured (1) directly from the Ogallala Formation, (2) from more concentrated gravel deposits on Pleistocene strath terraces, or (3) from Holocene gravel bars of Buckner Creek or the Pawnee River.

The vast majority of the cortical artifacts of Smoky Hill chert indicate that they were procured from residual and/or bedrock sources; however, at least a few appear to have been picked up from gravel bars. Stein (2004:48) indicated that procurement of Smoky Hill chert was primarily from residual surface deposits rather than subsurface quarries. Smoky Hill chert was frequently transported considerable distances from the primary source areas, especially during late prehistoric times. For example, Bevitt (1999:Table 39) reported that nearly 30 percent of the Middle Ceramic lithic assemblage from the Lundeen site was made from Smoky Hill chert.

There appears to have been virtually no intentional heat treatment of any of the chipped-stone raw materials that were recovered as the result of the mitigation excavations. Bevitt and Bauer (2003:31) reported the same for artifacts obtained as the result of test investigations at Horsethief. Less than 15 artifacts (tools and debitage) from the mitigative investigations exhibit evidence of thermal alteration. Nearly all of these were found in Feature 18, which yielded a relatively large quantity of charcoal. These include three flakes of Smoky Hill chert, two flakes of Ogallala chert, three pieces of Ogallala chert shatter, and two pieces of Ogallala quartzite shatter. Three thermally-altered artifacts found outside Feature 18 include one Washita arrow point made from Smoky Hill chert, one utilized flake knapped from unidentified chert, and one unmodified pebble of Ogallala chert. Based on the extremely small number of thermally altered artifacts and potlids apparent on the surface of several of the specimens, all of

Table 10. Cortex Type by Raw Material Type.

	Alluvial		Residual/Bedrock		Totals	
Raw Material	N	%	N	%	N	%
Local						
Ogallala Opalite			66	100.0	66	100.0
Ogallala Chert	100	100.0			100	100.0
Ogallala Quartzite	4	100.0			4	100.0
Ogallala Quartz	1	100.0			1	100.0
NonLocal						
Smoky Hill Chert	2	7.7	24	92.3	26	100.0
Trachyte	2	100.0			2	100.0
Totals	109	100.0	90	100.0	199	100.0

these fire-reddened artifacts probably were burned accidentally. Intentional heat treatment of two of the cherts, Smoky Hill chert and Ogallala chert, is easy to detect since the brown and yellow colors in these cherts turn deep red upon exposure to intense heat. Intentional heat treatment of raw materials appears to have been rare at other late prehistoric sites in western Kansas. For example, less than 5 percent of the debitage from the Bell site was identified as intentionally heat treated (Bevitt 1999:29).

Tools

Formal tools collected from excavation units and those recovered from features were combined to bolster sample sizes (Table 11). Raw material percentages of formal tools do not mirror those of debitage. Only about one-quarter (23.8 percent) of the tools were made from local raw materials obtained from the Ogallala Formation, whereas one-half of all formal tools were manufactured from nonlocal Smoky Hill chert. Exotic cherts comprise 17.7 percent of the formal tools.

A majority of each arrow point type was manufactured from nonlocal Smoky Hill chert. The same is true of unfinished arrow point preforms. If Harrell, Huffaker, Washita, and Washita/Harrell are combined, then nearly half (47.5 percent) of the notched arrow points were knapped from Smoky Hill chert and nearly one-third (30 percent) were made from exotic cherts, including Florence, Alibates, and Edwards. Although the percentage is not quite as high as for arrow points, more end scrapers also were made from nonlocal and exotic cherts (51.4 percent) than local resources (40 percent). The relatively high percentages of nonlocal and exotic cherts reflect the fact that formal tools, such as arrow points and end scrapers (as curated tools), were often transported and deposited a considerable distance from the place where they were manufactured. Because of curation behavior, formal tools such as these are not good indicators of on-site manufacture of formal tools. Even informal or expedient tools (e.g., utilized flakes) were more likely to be made from nonlocal and exotic cherts (53 percent) than local resources (31.4 percent).

Discussion

Even with the paucity of high-quality chipped-stone resources in the immediate vicinity, the lithic assemblage at the Horsethief site indicates that raw materials were procured and attempts were made to manufacture stone tools on site. The bulk of early, middle-, and late-stage reduction was focused on two local resources: Ogallala opalite and Ogallala chert. Although the production of small flake tools (e.g., arrow points and scrapers) would pose few problems, both resources have their limitations for the production of large bifacial chipped-stone tools. Ogallala opalite generally occurs in relatively thin tabular pieces with chalky cortexes that are difficult to remove, whereas Ogallala chert occurs predominantly in small rounded pebbles. Nevertheless, the fact that 44.3 percent of the Ogallala chert flakes and 39 percent of the Ogallala opalite flakes are biface flakes indicates that much of the knapping of these resources involved the reduction or thinning of bifaces. The distribution of these two local resources across the site revealed that they were knapped in two discrete areas. It cannot be determined if the knapping conducted in each area was concurrent or separate.

Judging from the large quantities of flake debitage and the relatively small numbers of formal tools that were made from Ogallala opalite and Ogallala chert, the success rate of producing finished tools from these two local resources must have been somewhat limited. For example, only three arrow points (one Harrell and two unidentifiable arrow point fragments) made from Ogallala opalite and chert were found. Five aborted and broken arrow point preforms also were made from Ogallala opalite and chert. A larger number of unifacial end and side scrapers were manufactured from Ogallala opalite (N = 7) and Ogallala chert (N = 10), yet more scrapers were made from nonlocal Smoky Hill chert (N = 21) than Ogallala opalite and Ogallala chert combined. At least six primary and secondary bifaces of Ogallala opalite and chert appear to represent aborted and failed preforms, presumably intended to be beveled knives. On the other hand, it is possible that broken formal tools that were discarded at the site may not be an accurate reflection of the number of formal tools that were actually made from the two local resources. If the site were inhabited for a relatively short period of time, then most of the finished formal tools that were made from Ogallala opalite and Ogallala chert perhaps were transported elsewhere

Table 11. Tool Type by Raw Material Type.

	Local Resources								Nonlocal Resources				Exotic Resources									
	Ogallala Chert		Ogallala Petrified Wood		Ogallala Quartzite		Ogallala Opal		Smoky Hill Chert		Ogallala Trachite		Edwards Chert		Alibates Chert		Florence Chert		Unidentified		Totals	
Tool Type	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Informal Tools																						
Utilized Flake	3	5.9	3	5.9			10	19.6	24	47.1					2	3.9	1	2.0	8	15.7	51	100.0
Formal Tools																						
Arrow Point																						
Preform	1	4.3					4	17.4	14	60.9	1	4.3			1	4.3	2	8.7			23	100.0
Fresno Arrow																						
Point									2	100.0											2	100.0
Harrell Arrow																						
Point							1	6.3	7	43.8					1	6.3	2	12.5	5	31.3	16	100.0
Huffaker Arrow																						
Point									4	66.7			1	16.7	1	16.7					6	100.0
Washita Arrow																						
Point					1	6.7			8	53.3					1	6.7	4	26.7	1	6.7	15	100.0
Washita/Harrell																						
Arrow Point													1	33.3			1	33.3	1	33.3	3	100.0
Unidentifiable Arrow																						
Point Fragment	1	14.3					1	14.3	4	57.1							1	14.3			7	100.0
Primary Biface	2	40.0					1	20.0	2	40.0											5	100.0
Secondary Biface	2	14.3					1	7.1	9	64.3							1	7.1	1	7.1	14	100.0
Tertiary Biface							1	50.0	1	50.0											2	100.0
Side Scraper	3	17.6			1	5.9	1	5.9	11	64.7							1	5.9			17	100.0
End Scraper	7	20.0			1	2.9	6	17.1	10	28.6					2	5.7	6	17.1	3	8.6	35	100.0
Graver									2	100.0											2	100.0
Totals	16	10.9			3	2.0	16	10.9	74	50.3	1	0.7	2	1.4	6	4.1	18	12.2	11	7.5	147	100.0

before being broken and discarded at the Horsethief site.

In any event the amount of Ogallala opalite and Ogallala chert artifacts at 14HO308 appears to primarily represent opportunistic attempts at the exploitation of marginally knappable resources in an area otherwise devoid of chipped-stone resources. In other words the late prehistoric occupants attempted to refurbish worn out or broken tool kits with tools made from the local inferior quality resources. Although comprising a higher percentage of the debitage than at practically any other recorded site in the Plains, neither resource probably would have comprised half the amount of debitage found at the Horsethief site had it been located in an area where good quality chert occurs in abundance, such as the regions to the north that contain Smoky Hill chert or the panhandles of Texas and Oklahoma that have high-quality Alibates and Day Creek cherts.

Ogallala opalite appears to have been used as a supplemental resource to make primarily expedient unifacial flake tools (e.g., scrapers and utilized flakes), even in the region where Ogallala opalite occurs in large quantities (Lintz 1997:118–123). As at the Horsethief site, the scarcity of bifacial formal tools at sites in the Oklahoma and Texas panhandles indicates the difficulty in producing large complicated tools from Ogallala opalite. Its use elsewhere appears to have been primarily during Late Archaic, Woodland, and late prehistoric times (Lintz 1997:123), whereas the use of Ogallala opalite at Horsethief was strictly late prehistoric. Although no percentage was given, only a few scrapers and choppers (bifaces or preforms) were made from Ogallala opalite at the late prehistoric Coal-Oil Canyon site in Logan County (Bowman 1960:53).

As in other areas where Ogallala opalite occurs, there is no indication of quarrying associated with the procurement of this resource at 14HO308. Instead, most, if not all, of the material probably was collected from talus deposits at the base of local outcrops. Due to the difficulty in making large bifacial tools and the presence of higher quality and more abundant cherts in nearby regions, it is unlikely that Ogallala opalite was a resource that was widely traded across the Plains (Lintz 1997).

Nonlocal Smoky Hill chert comprises less than one-fifth of the debitage, yet it comprises nearly half of all formal and informal tools. It appears that the bulk of the tools made from Smoky Hill chert arrived at the site in finished form (i.e., as curated tools). However, as demonstrated by small percentages of primary, secondary, and tertiary flakes, at least some of this nonlocal chert was probably transported to the site in raw tabular chunks and/or as rough preforms for further reduction. It is unclear whether the procurement of Smoky Hill chert was direct (special expedition trips) or indirect (trade). Only 22 flakes (1.1 percent) of trachyte are represented in the debitage. This nonlocal igneous material, however, typically comprises approximately 10–15 percent of chipped-stone tool assemblages from sites located closer to the source area (Bowman 1960:53).

Apparently no formal tools of exotic chert resources were manufactured at the Horsethief site. All but 1 of the 10 artifacts made from Edwards chert and Alibates chert are tools, and the lone piece of debitage is a small (probable resharpening) biface flake. More than five times as many artifacts were made from the closest exotic chert resource (Florence), found in the Flint Hills. A little more than one-third (35.2 percent) of these are finished tools, the majority (79 percent) of which are arrow points and scrapers. All of the Florence chert debitage consists of biface flakes and thin flake fragments, and all but one of these were small flakes measuring less than 2 cm^2 in size. This indicates that most, if not all, of the Florence chert flakes were deposited at the site during resharpening of beveled knives and/or arrow points. All three of the long-distance exotic cherts probably were obtained through trade. Alibates and Florence cherts also comprised the majority of chipped-stone tools found at the Bell site, located in resource-poor Comanche County to the southeast of the Horsethief site (Bevitt 1999:29).

POTTERY ANALYSIS

By A. Holly Jones

Pottery types are typically used by archeologists to classify archeological sites, based on the belief that the types are temporally and spatially diagnostic of particular cultures or cultural traditions. Thus, a review of previous pottery classification schemes is germane to the problem of classifying pottery from the Horsethief site. One of the primary questions posed by archeologists working in western Kansas is the taxonomic placement of sites that meet criteria for inclusion in established traditions and phases, such as the CPt (Lehmer 1954; Roper 2006a), Upper Republican phase (Scheiber 2006), and Keith phase (Bozell 2006). Understanding how Central Plains archeologists have previously classified pottery, particularly the attributes deemed important in creating divisions, as well as the temporal and spatial dimensions of those divisions, provides a starting point for this analysis.

The primary objective of the Horsethief site ceramic analysis is to further refine the temporal-spatial placement of the site within a framework relative to similar sites in the region. A literature review was undertaken of published research on pottery-bearing sites in western Kansas, eastern Colorado, southwest Nebraska, northwest Oklahoma, northern New Mexico, and the panhandle of Texas. These areas were chosen based on proximity to 14HO308 and on similarities in topography, environment, and the presence of major drainages and their tributaries. These areas were selected purposefully in an effort to abandon current political boundaries and to focus on regional environments. Descriptions of the structural, chemical, mineralogical, and decorative attributes of pottery from these regions were sought for comparative purposes.

As Roper (2006a:105) pointed out, Lehmer's (1954, 1971) Central Plains tradition within the Plains Village pattern was not as clearly defined as his Middle Missouri tradition. In the latter work Lehmer (1971) discussed the similarities and differences between the two traditions. Strong (1933, 1935) and Wedel (1953) refined the two taxonomic subdivisions, providing specific traits for inclusion in the Upper Republican and Nebraska aspects (Lehmer 1954; Roper 2006a:105). Since then, Krause (1969), Blakeslee (1993, 1994, 1999, 2002), and others (Bozell 1995; Bozell and Ludwickson 1998; Roper 2002a, 2002c, 2007) have attempted to further refine the CPt in Kansas.

Lehmer (1971:108) described CPt pottery as having "considerable variation" and being either plain or cordmarked. He also noted that CPt rims were flared with thickened collars and that only cord-impressed pottery was present at sites in central Nebraska, an observation reported earlier by Champe (1936). Following Lehmer's description, Roper (2006a:111) identified Central Plains pottery as dominated by

> . . . [the] grit-tempered globular to subglobular jar, with a circular orifice, restricted neck, and rounded to subangular shoulders that are the widest part of the vessel. Vessel walls converge to a rounded or slightly elongated base. Vessel rims may be direct and usually flaring, or they may be collared. "Collared" rims, though, may be true collared rims or S-shaped rims, and collars may vary considerably in height. Variations on these forms, such as a thickened lip or a wedge lip, occasionally are observed. The predominant exterior surface treatment is overall vertically oriented cord-marking.

Roper (2006a:111) further indicated that exterior surfaces were sometimes smoothed and occasionally treated with a "fugitive red wash." Decorative techniques included incising, noding, and pinching; these typically occur only on the rim and lip. Shell-tempered forms also may occur at CPt sites (Roper 2006a:112; Scott 1995).

Roper (2006a:112) pointed out in her discussion of pottery classification that the criteria for existing typologies have been consistent. However, she (Roper 2006a:113) also noted that variation in rim forms other than direct and collared were not necessarily consistently considered. Other typological criteria relied upon to classify CPt pottery generally consist of decorative techniques and motifs (Roper 2006a:113–114).

Margaret E.Beck (1998) undertook a reanalysis of the ceramics from three houses (Houses 1–3) at the Minneapolis site (14OT5), a CPt site in Ottawa County, which was originally reported by Wedel (1935a, 1959). Beck (1998:287–310) provided detailed information regarding the structural form of Riley Cord-Roughened ceramics and directed her research toward a better understanding of community structure at 14OT5 through the material record, specifically ceramics. In her study Beck analyzed the ceramics from each lodge, rather than analyzing the assemblage as a whole. Such a tactic permitted Beck to compare results among lodges to better document variation per household.

Beck (1998:290–300) identified ceramics to types defined by John Hedden (1992, 1994): Riley Flaring Rim, Riley Flaring Tool-Decorated, Riley Flaring Pinched, Riley Collared Plain, Riley Collared Tool-Decorated, and Riley Collared Pinched. She defined nine attributes to examine the variability within and among the samples: rim length, rim diameter, neck angle, collar height, neck height, decorative type, decorative location, lip form, and temper. Using a similarity matrix, Beck compared the ceramics from the three lodges at the Minneapolis site and two others (Houses B and 23), previously described by Michael Fosha (1994). Houses 1 and 3 appeared the most similar to each other; both had a predominance of Riley Cord-Roughened Plain. A second group of similar cases consisted of Houses 3, 8, and 23; these showed an increase in the percentages of Riley Flaring Tool-Decorated and a concomitant moderate decrease in Riley Cord-Roughened Plain percentages. The results of her analysis did not confirm whether 14OT5 represented a village, but it did bring to light the need for greater measures of ceramic stylistic variability (Beck 1998:307–308).

In another study Beck (1995, 2001) analyzed the ceramic assemblage from the Mugler site (14CY1-A), a Smoky Hill-phase occupation in Clay County. For this site Beck (2001:7) divided the sherds into two categories: Riley Cord-Roughened (Wedel 1959) and smooth-surfaced shell-tempered pottery. Following Hedden (1992, 1994), she further subdivided the former category by rim form. The shell-tempered specimens were assigned to either Majors Opposed Diagonal (Scott 1995) or a form designated as a water bottle. A majority (92.8 percent) of the assemblage consisted of Riley Cord-Roughened; the other 7.2 percent represented shell-tempered wares.

Beck submitted three sherds—one Riley Cord-Roughened and two shell-tempered—for X-ray diffraction. According to the results obtained by the Kansas Geological Survey, the clay minerals in Beck's samples could not be identified because the sherds had been fired within a temperature range that resulted in the breakdown of the clay minerals. According to soil survey reports that Beck (2001:13) consulted, montmorillonite clays are present in Clay County and kaolinite clays found within the Dakota Formation occur "within 1–2 miles (1.6–3.2 km)" of the Mugler site. The minerals detected by X-ray diffraction included quartz, feldspar, and mica-illite. The results of Beck's analysis, which also included petrography, indicated that Mugler ceramics were manufactured from local alluvial clays, particularly montmorillonite sources.

Coal Oil Canyon in western Logan County, with components spanning the Early Ceramic and Middle Ceramic periods, was described in detail by Bowman (1960). Bowman's (1960:20–40) report included detailed pottery descriptions, the results of a refit study, and comparisons with known types at the time of writing. Three vessels were reconstructed, and 11 partial refits provided useful information on vessel form, rim shape, interior and exterior surface treatments, manufacturing methods, and decorative techniques. While its interpretations may be considered outdated, the report does provide valuable plates for visual comparisons (see Bowman 1960:71–76). Bowman's analysis indicated the presence of Woodland and Upper Republican components at 14LO1/401, whereas Roper (2006b) documented a historic Apachean vessel in the collection.

Bowman (1960:20) noted that the ceramics from the Coal Oil Canyon site "are not especially numerous, [but] they seem to be rather varied and undoubtedly several cultural complexes are represented." In his discussion of restored Vessel 1, Bowman (1960:22) remarked that the "body shape suggests Middle Mississippi influence but few if any other Middle Mississippi traits are present in the vessel." He (Bowman 1960:21) described restored Vessel 1 as follows:

> Body shape is globular, the neck merely the point of maximum constriction. The rim is short, rising only 3/4 inches above the neck and is variable in profile: for approximately 1/3 of the circumference it resembles a narrow collar with wedge-shape profile, tapering to a thin lip. The remainder is straight and direct to slightly flaring with a broad rounding lip. It gives the impression that the builder's intention was to form a narrow collar all around but that it was not completed. Viewed from above the rim seems to flare slightly. The uncollared section appears somewhat more flaring on the exterior due to a thickening below the lip.

Bowman (1960:21) also noted two handles on this vessel and a sand and "highly calcareous" temper. He (Bowman 1960:22) suggested that restored Vessel 1 is similar to the ceramics from Upper Republican sites, but the presence of handles is atypical.

Bowman's (1960:23–24) description of restored Vessel 2 indicates a different ceramic form from

Vessel 1. The body is conoidal rather than globular and "slightly asymmetrical." According to Bowman (1960:23), the latter characteristic was due somewhat to the challenges in restoration, "but not entirely." Restored Vessel 2 has shoulders that "slope upward to the neck at a 45 degree angle on the average" and exhibits a wedge-collared rim. Bowman (1960:23–24) reported that restored Vessel 2 has a cordmarked exterior and was tempered with very coarse sand. He suggested that this pot is similar to some ceramics found in Upper Republican contexts.

Restored Vessel 3 is described as "irregularly shaped," with a "straight and direct to slightly flaring" rim (Bowman 1960:24). The body is "spherical" and different in form from either restored Vessels 1 or 2 (Bowman 1960:25). This pot has an undecorated exterior and was tempered with sand. Bowman (1960:26) likened this vessel to those assigned to the historic Pawnee, although there apparently were no other artifacts at the Coal Oil Canyon site indicative of a Pawnee occupation. According to Donna Roper (personal communication 2010), Bowman was wrong in his assessment of this vessel as Pawnee, but the collection does contain some rim sherds that are of Pawnee origin.

A review of the literature on prehistoric clay vessels from northern New Mexico provided useful information on the variability in forms, construction methods, and decorative features. Micaceous gray wares are prevalent in northern New Mexico (Baugh and Eddy 1987; Eiselt 2005; Habicht-Mauche 1987). B. Sunday Eiselt (2005:1) noted that, "Micaceous pottery is a loosely defined group of utilitarian wares in which mica has been intentionally incorporated as a slip, temper, or ceramic paste." In her thorough comparison of micaceous wares from Apachean contexts, Eiselt describes the application of techniques such as light sanding of exterior and interior surfaces, the use of micaceous slurry washes, the inclusion of muscovite and biotite in pastes, and surface smudging to produce darker grayish hues. Excavations at the Bayou Gulch site (5DA265) in central Colorado yielded Athapaskan micaceous ceramics from the Early Ceramic period (Gilmore 2004). Bayou Gulch lies between the Arkansas and Platte rivers and is a multicomponent site dating from the Late Archaic to the Early Ceramic period with an Avonlea component.

Archeological research along Blue Creek in the panhandle of Texas has resulted in the identification of cordmarked vessels termed Borger Cordmarked (Couzzourt and Schmidt-Couzzourt 1996; Holden 1930; Hughes 1984; Hughes and Ellzey 1989; Studer 1931; Wulfkuhle 1984). Excavations were conducted at several Panhandle aspect sites along Blue Creek prior to the construction of Lake Meredith in Moore County, Texas. Panhandle aspect sites are considered part of the Plains Village tradition (Couzzourt and Schmidt-Couzzourt 1996:14). With the exception of a cemetery (LMRA 242), the sites along Blue Creek were described as "small architectural hamlets" (Couzzourt and Schmidt-Couzzourt 1996:11). Excavations in the cemetery established an association between Borger Cordmarked pottery and Washita projectile points. Burials l and 4 contained Borger Cordmarked sherds, whereas Burials 3 and 4 contained Washita points (Couzzourt and Schmidt-Couzzourt 1996:18).

Jim Couzzourt and Beverly A. Schmidt-Couzzourt (1996:38) describe Borger Cordmarked vessels as follows:

> The vessels are globular, with slightly constricted mouths and short necks; they are undecorated. They are tempered with fine to coarse crushed quartzose rock and sand; mica flecks may indicate a micaceous clay paste or the use of crushed granitic rocks for temper.

Alvin Lynn and Steve Black (2009), who have specialized in replicating Borger Cordmarked pots, claim that cordmarking the vessels, using the paddle-and-anvil technique, offers some advantages. They (Lynn and Black 2009) contended that

> The rough surface of a cordmarked vessel provided a good grip for what otherwise might have been a slippery vessel, especially when buffalo bones were boiled to extract grease. This messy process created black-sooted and stained cooking vessels—the Borger Cordmarked pottery found by archeologists is almost always darker in color than the freshly made replicas shown in this section.
>
> Cordmarking also creates more surface area and thus allows more effective transfer of heat (energy) from a cooking fire to the contents of the pot compared to a vessel with a smooth exterior.

Studies of the Odessa phase, Bluff Creek complex, and Antelope Creek phase, dating to the Middle Ceramic period in the panhandles of Texas and Oklahoma, also may provide insights regarding the pottery found at the Horsethief site. These phases were defined as representing groups within the Plains Village tradition (Brosowske and Bevitt 2006; Krieger 1946; Lintz 1986). Borger Cordmarked pottery has been associated with the Antelope Creek phase (Meier 2007). Brosowske and Bevitt (2006:181–182) presented the Odessa phase to incorporate sites formerly attributed to the Antelope Creek phase and Buried City complex of the Middle Ceramic period that lack stone architecture. Brosowske and Bevitt (2006:188–189) provided a very thorough description of Odessa phase ceramics as follows.

> Globular cord-marked vessels with vertical to flaring rims characterize the ceramic assemblage. Rims are frequently decorated, usually greater than 50 percent, with a variety of techniques . . . . Although a wide variety of decorations are represented, the most common are finger-pinching or -impressing and parallel impressed lines along the neck and rim. While lip tabs and handles are present in many assemblages, they generally occur on less than 5 percent of ceramics. Surface treatment varies from unmodified to completely smoothed cord-marking, although some examples with corncob impressions are also present . . . . Tempers most often consist of sand (>80 percent) but also include bone, crushed stone, grog, and grit.

Bluff Creek complex ceramics are highly variable in temper and decorative treatments when present, though generally they are cordmarked and globular in form (Brosowske and Bevitt 2006:198). Though later, Zimms complex (A.D. 1250–1450) ceramics found near Quartermaster Creek in western Oklahoma have rounded bases, sand temper, and smooth exteriors, and they are typically undecorated. Custer phase (A.D. 800–1250) pottery, found near the Washita and Arkansas rivers, is globular in form, tempered with crushed shale or caliche, and has cordmarked exteriors.

Judith A. Habicht-Mauche (1987) examined southwestern-style culinary ceramics from the panhandle region of Texas. Of interest here is her identification of mica tempers within the protohistoric Tierra Blanca Plain type from western Oklahoma and the eastern border of the Texas panhandle (Habicht-Mauche 1987:184). She attributed the source of this temper to local mica-bearing clays. Scraping marks are typically visible on specimens of this type (Habicht-Mauche 1987:178), and vessel walls range 2–7 mm in thickness, though most are within 3–5 mm. The overall form of this type is globular with a slightly flaring rim. Interior vessel walls are generally darker than the exteriors, and this was attributed to possible smudging (Habicht-Mauche 1987:187).

Previous research in western Kansas, eastern Colorado, northern New Mexico, western Oklahoma, and the panhandle of Texas indicated that much variation exists within and among established pottery types defined for the Early and Middle Ceramic periods. Comparison of these examples with the pottery from 14HO308 helps elucidate the fact that the ceramic assemblage from the Horsethief site can be assigned to the Upper Republican phase.

Horsethief Site Pottery

The ceramic sample from the site consists of 245 pottery sherds. Their distribution by unit and level is shown in Table 12. The distribution of piece-plotted pottery within the block excavation area is shown in Figure 28. Excavations in Unit 2 (Figure 5) yielded the greatest density of pottery (N = 215). The vast majority of the pottery occurred in the western part of the block excavation area and represented fragments of a single vessel (Vessel A). A number of initially discovered sherds from this vessel were piece plotted, but sherds were so numerous in Unit 2 that further piece plotting was abandoned in favor of recording the overall concentration of fragments. No pottery was recovered from any of the bucket auger holes, and only one small sherd was recovered from a unit (Unit 9) outside the block excavation area. Furthermore, no pottery was recovered from features. One could question the association of pottery with use of the features, but the number of sherds, other than those from Vessel A, was meager, and the lithic tools found in unit levels and features were essentially identical in all respects. The stratigraphy and radiocarbon dates reinforce the likelihood that the represented pottery was used at the same time as the majority of the features, despite the lack of pottery in those features.

Table 12. Pottery Sherd Distribution by Level and Unit.

	Unit												
Depth (cm)	1	2	3	4	5	6	7	8	9	10	11	12	Totals
0–10									1				1
10–20		1											1
20–30									1				1
30–40													0
40–50													0
50–60													0
60–70													0
70–80	10	17					1					6	34
80–90		195	6	6									207
90–100									1				1
Totals	10	213	6	6		0	1		3		0	6	245

The sample of pottery sherds was divided according to structural element: rim, lip, neck, shoulder, and body, as well as those specimens consisting of one or more of these elements (multi-element sherds). Each sherd was assigned a catalog number that incorporated provenience information. A variety of attributes were recorded for each sherd. These included element, temper, method of construction, exterior surface treatment, post-manufacturing modification, weight (g), thickness (mm), maximum length (mm), and presence of smudging or burning. In addition each sherd was examined under an Olympus SZX12 microscope at 10X, 30X, and 50X magnifications in an effort to identify any residues.

Eleven ceramic element groups are represented in the assemblage (Table 13). Body sherds are the most numerous, representing 62 percent of the ceramics. Rim sherds comprise 21 percent, while neck (4 percent) and shoulder (2 percent) elements occur infrequently. Five multi-element groups consist of body and rim (<1 percent); lip, rim, and neck (<1 percent); neck and shoulder (<1 percent); rim and neck (6 percent); and rim, neck, and shoulder (2 percent).

Body sherd thicknesses range from 2 to 9.5 mm, with a mean of 6 mm and a standard deviation of 1.2 mm. The maximum lengths for body sherds range from a mere .8 to 18.5 cm, with a mean of 4.1 cm. Sherd weights range from only .1 to 54.6 g. Rim sherds display a relatively similar thickness range as body sherds and have a mean of 5.8 mm and a standard deviation of 1.5 mm. Neck and shoulder sherds are somewhat thicker, averaging 6.9 mm and 7.2 mm, respectively. Although it is again noted that the bulk of the pottery is from a single vessel, sherds from other represented vessels yielded similar thickness measurements.

Whereas some sherds are too small or eroded to determine surface treatment with any certainty, cordmarkings or smoothed-over cordmarkings prevail. Some of the smoothing probably derived from use-wear or other forms of use abrasion, while other smoothing appears intentional. The minimum number of vessels is few, but both thickened, decorated and unthickened, undecorated rims are represented, and both have cordmarked bodies.

Several sherds exhibit post-manufacturing modifications. One rim sherd (Specimen 236-PP 130), having a micaceous sand temper with multidirectional cordmarking, exhibits a drilled circular hole, perhaps a suspension hole, measuring 4 mm in diameter (Figure 29). It apparently was added after the vessel was fired. This sherd was found at 70–80 cm bs in Unit 8, south of the main block excavation.

Residues of unknown origin were observed under the microscope on three specimens. Two of the three have deep red residues. Specimen 75-PP

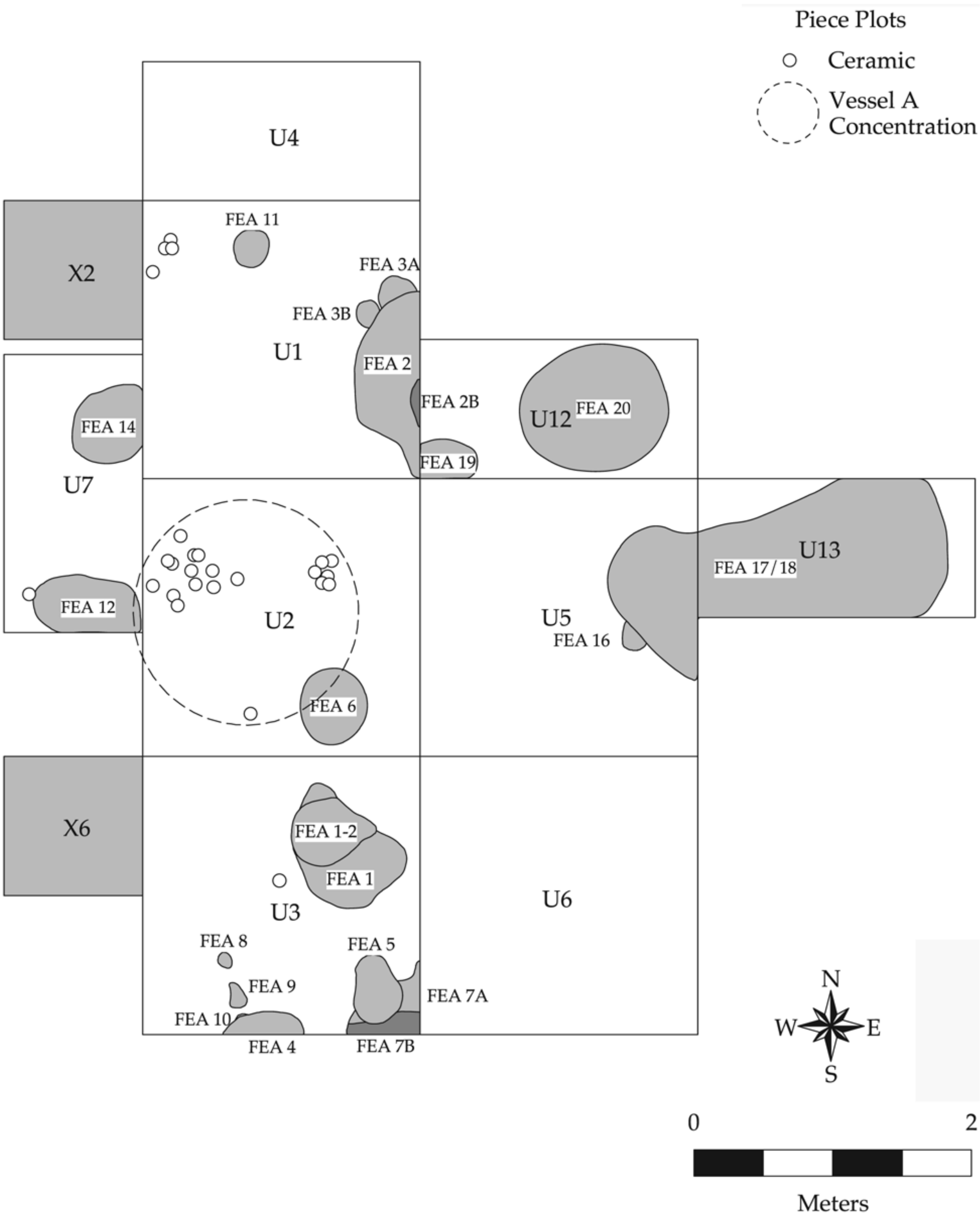


Figure 28. Spatial distribution of piece-plotted pottery.

Table 13. Pottery Elements Present by Unit.

	Unit												
Element	1	2	3	4	5	6	7	8	9	10	11	12	Total
Body	8	126	4	6					3			5	152
Body and Rim		1											1
Lip, Rim, Neck		1											1
Modified Rim							1						1
Neck		8										1	9
Neck and Shoulder		2	2										4
Rim	1	51											52
Rim and Neck		15											15
Rim Lip		1											1
Rim, Neck, Shoulder	1	2											3
Shoulder		6											6
Totals	10	213	8	6		0	1		3		0	6	245

84 has two areas of residue, measuring 18 mm and 9 mm in length, respectively. A third specimen has two areas of orange residue, measuring 15–18 mm. Thirty-eight percent of the sherds exhibit 100 percent exterior smudging or burning, whereas 34 percent are entirely smudge-free. Eighty-three percent of the analyzed pottery exhibits smudging or burning on more than 50 percent of the exterior surfaces.

The majority of sherds are from one pot with micaceous sand temper, designated as Vessel A. One hundred-ninety-five sherds or 80 percent of the total were recovered from the concentration in Unit 2 at 80–90 cm bs. Figures 30 and 31 show the morphological and stylistic characteristics of this pot. It has a direct collared rim with oblique cordmarking. The neck is constricted, and the shoulders represent the widest part of the body. The neck and shoulders are irregularly incised in a vertical orientation, which grades into multidirectional cordmarking all over the body. Reconstruction was made possible by the presence of a mostly complete rim and neck and over 60 percent of the shoulders. Eighty sherds comprising the upper portion of the vessel could be refitted. However, refitting of the body was problematic due to the small size of most the body sherds and the absence of more than 60 percent of the vessel. Although the base of the pot is lacking, the refitted portion is comparable to Bowman's (1960:23–24) reconstructed Upper Republican Vessel 2 (RV2) from Coal Oil Canyon.

Figure 29. Modified rim sherd from Unit 7.

Figure 30. Close-up of Vessel A, partial refit.

Figure 31. Vessel A, partial reconstruction; view from above.

Temper and Sherd Thickness

Table 14 presents the identified tempers by thickness. Thicknesses were grouped into 1-mm categories for summary purposes. Seven temper groups were observed in the Horsethief site pottery assemblage, although some temper groups simply may represent variation within Vessel A itself. Micaceous sand temper was the most prevalent temper type, represented in 76 percent of the analyzed pottery sherds. Micaceous and granitic sand tempers account for an additional 11 percent of the total. Within the micaceous sand temper group, 73 percent of sherds have a thickness range of 5–7 mm. The shards with non-micaceous sand and quartz and calcareous inclusions measure 2–5 mm in thickness. Sherds belonging to the non-micaceous sand with quartz (no observed calcareous inclusions) measure 3–7 mm in thickness (Figure 32). Within the granitic temper type, sherds measure 2–8 mm, with the 2-mm group having the highest frequency of members. All of the non-micaceous sand-and-quartz-tempered sherds were found in Level 8 (70–80 cm bs).

Neutron Activation Analysis

Neutron activation analysis (NAA) is an accepted and well-documented method for obtaining archeological and geological chemical signatures (Bishop and Neff 1989; Cobry 1999; Glascock 1992; Lynott et al. 2000; Neff 1992, 2000, 2001; Speakman and Glascock 2004). It was successfully tested on argillites (claystone) by the author (Mead [Jones] 1999; Glascock and Mead [Jones] 1998) in her dissertation research on argillic stone pipes. To better assess the question of local pottery production at 14HO308, an NAA study was conducted by the Archaeometry Lab at the University of Missouri's Research Reactor (MURR). The results of this study were presented by Jeffery R. Ferguson and Michael Glascock (2008). For a complete discussion of NAA methods at MURR, refer to Glascock (1992).

Five samples were submitted to the MURR Archaeometry Lab. These consisted of three sherds from Vessel A (70-PP 82, 72-PP 72-7, and 75-PP 59-2; designated HR001-HR003) and two sherds from a second pot called Vessel C (31-PP 65-1 and 21-PP 68-1; designated HR004-HR005). All five sherds were found at 79–85 cm bs. The purpose of the study was to obtain chemical signatures from the sample archeological clays to permit comparisons with other known clay compositional groups (CGs) in the region. CGs used for comparison in this study include the Central Plains (CP) Reference Group (Cobry 1999; Speakman and Glascock 2004), Coal Oil Canyon Group (14LO401), Donovan (5LO204, Levels 1 and 4), Kohr House (14SA414), 7 Mile Point (48LA304), and Minneapolis (14OT5). Ferguson and Glascock (2008:7) stated that the CP and Coal Oil Canyon groups are "statistically indistinguishable" (also see Cobry and Roper 2002; Roper et al. 2007).

Table 14. Summary of Tempers by Thickness.

	Thickness (mm)												
Temper Type	1	2	3	4	5	6	7	8	9	10	11	12	Totals
Basaltic-granitic, Quartz, and Calcareous Inclusions							3	1					4
Granitic		3	2	1	1	1	2	1					11
Micaceous Sand	1	1	11	6	41	59	38	9	3	2	7	4	182
Micaceous Sand and Grog						1							1
Micaceous Sand-granitic		3	6	5	9	2	2				1		28
Sand (Non-micaceous) and Quartz			3	2	3	4	1						13
Sand, Quartz, and Calcareous Inclusions		2	1	1	1				1				6
Totals	1	9	23	15	55	67	46	11	4	2	8	4	245

Figure 32. Non-micaceous sand- and grit-tempered sherds. Undecorated rim (left) and body sherd.

Figure 33 is a bivariate plot, showing the Horsethief site samples (plotted with solid triangles and labeled HR001–HR005) in relation to seven other CGs plotted by sodium and potassium. The 14HO308 samples overlap primarily within the CP and Coal Oil Canyon ellipses, with one between the Coal Oil Canyon Group and Kohr House. Interestingly, a search of the entire MURR ceramic database yielded compositional matches only to the Kohr Site (1), Coal Oil Canyon Group (11), and CP Reference Group.

Figure 34 shows the samples plotted by barium and rubidium. Based on these results, all of the Horsethief site samples are found within the CP ellipses. A final bivariate plot (Figure 35) of hafnium and iron base-10 logged concentrations shows the

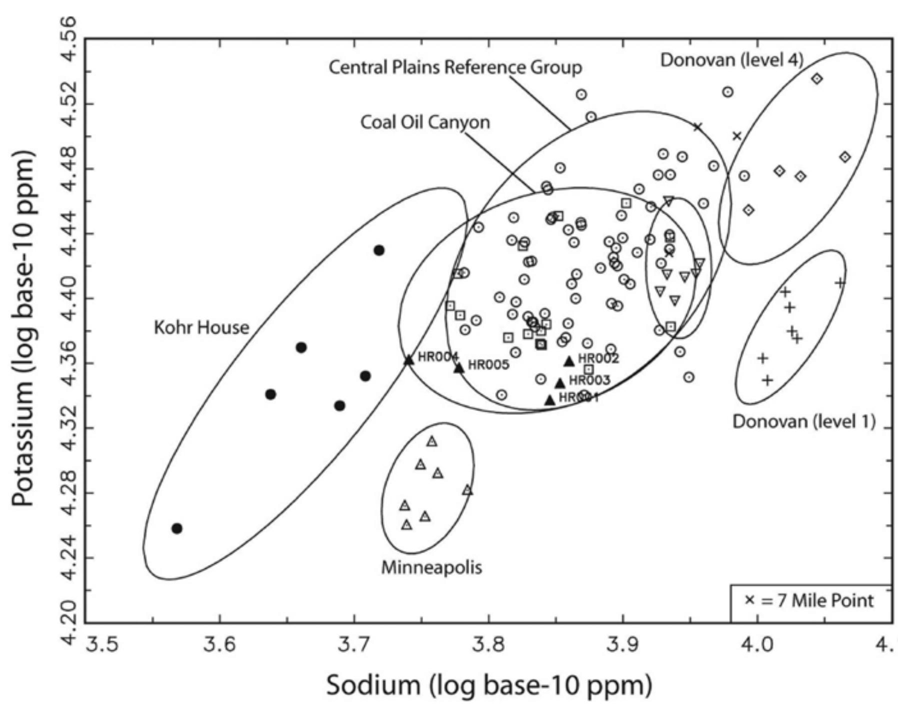


Figure 33. Bivariate plot of sodium and potassium base-10 logged concentrations (from Ferguson and Glasscock 2008:Figure 1).

separation between the samples HR001–003 (micaceous sand) and HR004–005 (sand and quartz). Ferguson and Glascock (2008:8–9) stated that all of the samples are quite similar in composition, but there are some "consistent" distinguishing factors. Samples HR001–003 (micaceous sand) have slightly higher concentrations of arsenic (As), lanthanum (La), lutiteum (Lu), samarium (Sm), ytterbium (Yb), europium (Eu), hafnium (Hf), tantalum (Ta), zirconium (Zr), and sodium (Na), as well as lower concentrations of iron (Fe), scandium (Sc), thorium (Th), and zinc (Zn).

In their conclusions Ferguson and Glascock (2008:9) stated, "The Central Plains is a difficult region for the compositional study of ceramics, because the geology is dominated by a few large and extremely old river systems." This fact, coupled with relatively few comparative samples within the existing CGs, render definitive assignment of the Horsethief site samples to a specific compositional group problematic. Based on the results of the NAA study, Ferguson and Glascock (2008:9) suggested that the ceramic samples from 14HO308 were likely produced from local clay sources, which are primarily indistinguishable from other sources in the region at this time. Addition of more samples from western Kansas to the MURR database could further archeological compositional studies in the region.

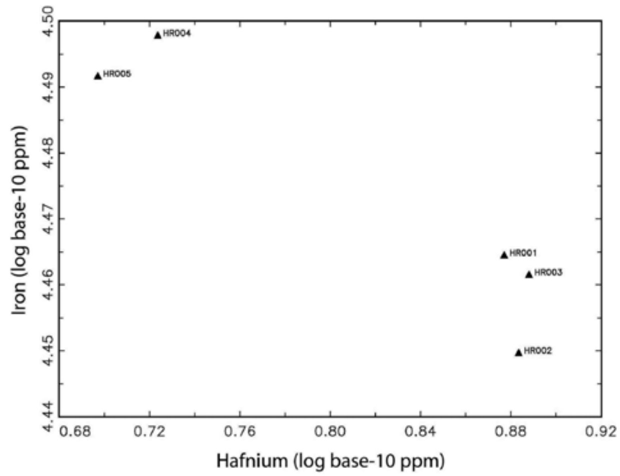


Figure 35. Bivariate plot of hafnium and iron base-10 logged concentrations (from Ferguson and Glasscock 2008:Figure 3).

Conclusions

It is suggested that at least four vessels are represented in the assemblage from the Horsethief site. This determination stems primarily from the results of exploratory statistical tests on single element

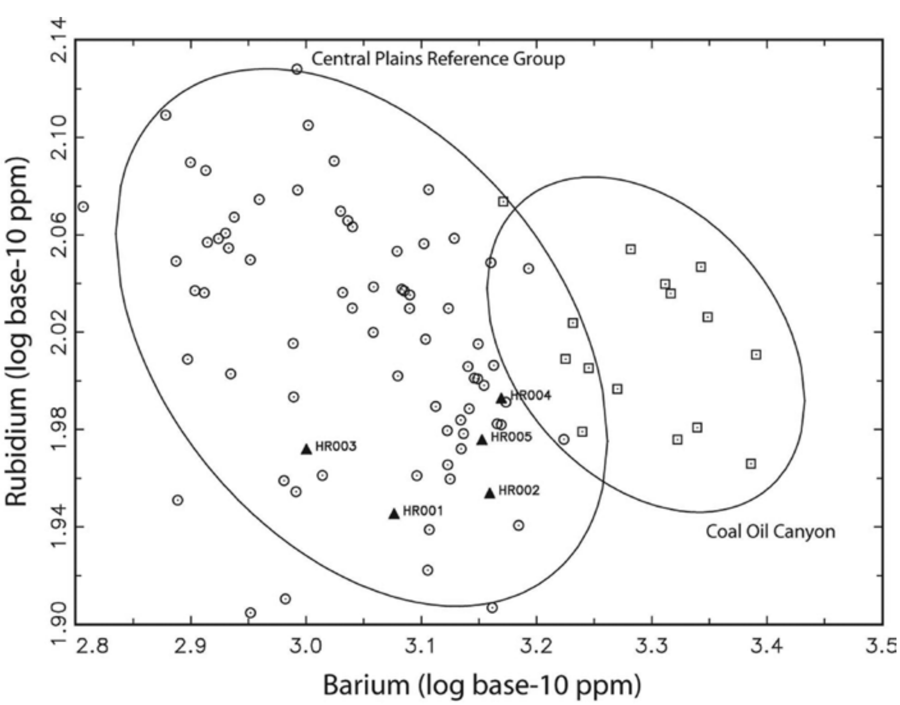


Figure 34. Bivariate plot of barium and rubidium base-10 logged concentrations (from Ferguson and Glasscock 2008:Figure 2).

sherd measurements, identification of tempers, exterior and interior surface treatment classes, and refitting.

Vessel A, which has been partially reconstructed, exhibits a direct collared rim, with vertically incised neck and shoulders, grading into multidirectional cordmarking all over the body. It has a micaceous sand temper. Vessel A might have been manufactured from local clay sources, but NAA analysis indicates only that it is similar to samples assigned to the CP Reference Group and the Coal Oil Canyon Group. Vessel A is morphologically and stylistically similar to RV2, described and depicted by Bowman (1960:23–24, 72, Plate 3). Vessel A is morphologically, stylistically, and chemically similar to pottery of the Upper Republican phase of the CPt (Roper 2006a; Scheiber 2006). In addition an example illustrated by Roper (2006a:Figure 7.3) from the Minneapolis site shares similarities in structure, exterior surface treatment, and overall form; it differs only slightly in rim form from Vessel A. Although 14OT5 has been assigned to the Smoky Hill phase, the similarities point to the fact that many of the phases in the region are somewhat arbitrarily defined.

Vessel B has a basaltic-granitic temper and contains calcareous or bone inclusions. Although very eroded, it appears to be an undecorated ware. The exterior and interior body sherds are unevenly smoothed. Since no rim, neck, or shoulder sherds from this vessel were recovered, little information regarding overall morphology can be extracted.

Vessel C is relatively dark gray, contains calcareous or bone inclusions, and exhibits a slightly flaring undecorated rim, an undecorated neck, and a cordmarked body. Vessel C is similar to Bowman's (1960:34–35, 75, Plate 8) Vessel 5, which is also considered an Upper Republican form. Due to a paucity of physical evidence, little is known of the overall morphology of Vessel C. It is chemically similar to the Coal Oil Canyon and Kohr House groups. Chemical separation between Vessel A and Vessel C is evident, although it is difficult to further differentiate them at this time.

Vessel D is represented by only two body sherds, but it is unique among the Horsethief site ceramics in temper, color, and exterior/interior surface treatments. It is reddish in overall color with exterior Munsell colors identified as 5YR 6/6 and 5YR 6/3 and an interior Munsell color of 2.5YR 5/8. Vessel D exhibits cordmarked surfaces and sand-and-grit temper.

It is conjectured that Vessels A, B, and C were likely manufactured from local clay sources, while Vessel D may be nonlocal. Residue and additional NAA analyses could further elucidate the use and origin of pottery at 14HO308.

ARCHAEOBOTANY

By Neal H. Lopinot

Archaeobotanical research on sites in the Central Plains has a lengthy and distinguished history (see Adair 2003 and 2006 for recent overviews). However, substantially less is known about the paleoethnobotany of peoples living west of the eastern Central Plains, including western Kansas. This is due to the fact that systematic recovery and processing of flotation samples have been wanting for such areas and many time spans (Adair 1996:115–122). In fact, the void in systematically recovered subsistence data for the late Plains Woodland (Early Ceramic) and the early Plains Village (Middle Ceramic) periods in central and western Kansas constitutes one of the primary reasons that the Horsethief site was excavated.

Archaeobotanical data from 14HO308 should begin to fill the gap that currently exists in knowledge of late prehistoric adaptation in the Mixed Prairie region (Kuchler 1974) near the ecotone of the Smoky Hills and the High Plains. The stratigraphic record, radiocarbon dates, and ceramic assemblage indicate that the Horsethief site was occupied primarily by a small group of Upper Republican people during the period A.D. 1150–1225, perhaps even for a very brief time (ca. A.D. 1160–1170), although the site also might have witnessed limited intermittent use during the interval of A.D. 900–1000, as well as after the early thirteenth century. The period A.D. 1150–1225 was a time when food production was commonplace elsewhere in the CPt culture area, and often maize is considered a staple or first-line resource. This was certainly true in the Medicine Creek valley during Upper Republican times (Puseman 1996). However, other coeval sites in the Central Plains, particularly those in the western part of the Upper Republican phase area, have been characterized as having been occupied by hunter-gatherers who practiced little or no food production.

Sample Selection and Analysis Methods

Field sampling strategies targeted columnar level series and feature fills for flotation. One hundred-forty flotation samples were collected and processed, amounting to 1,418.5 liters of sediment and consisting of 116 level samples from Units 1–13 and 24 samples from 17 features. Most samples were 10 liters, although some measured as much as 30 liters. Of the 140 samples 27 were selected for analysis (Table 15). These consisted of 1 sample from Unit 2, 7 samples from Unit 12, and 19 samples from 14 features. The analyzed series constituted 288 liters of sediment. Although this represents only 20 percent of the total, it is noted that a substantial number of the feature samples were analyzed and most of the remaining column-level samples contain very little plant debris. The entire contents of all samples were described in Lopinot et al. (2010:Appendix 3).

The archeological sediments comprising the "flotation" samples were poured into .3-mm-mesh nylon bags, which were then gently agitated and squeezed while a steady stream of water flowed across and permeated them. After the clay to medium-size sand particles filtered through the mesh, the samples were air dried on a clothesline in a garage. Although referred to herein as flotation samples, the process results in sediment-cleaned (except for very coarse sand) samples with no separation of heavy and light fractions.

The sorting and identification of plant remains and other materials was performed using an Olympus SZX12 stereoscopic microscope with a zoom range of 7–90X. The samples were first size sorted using nested No. 10 (2 mm), No. 18 (1 mm), and No. 35 (.5 mm) geological sieves. A pan on the bottom of the three sieves captured materials smaller than .5 mm. Items captured by the larger sieve were fully sorted into categories, such as wood charcoal, bark, tuber fragments, and indeterminate. Bone, snail shell, chipped stone, and other non-plant materials were sorted for the ≥2-mm fractions of all analyzed samples. Debris in each of these categories, whether or not comprised of plant tissues, were counted and weighed. Plant materials weighing less than .005 g are listed as "trace" or "t" in the tabulated data. Fractions containing materials measuring less than 2 mm were scanned for charred and uncharred seeds and seed fragments, as well as plant parts lacking in the sorted ≥2-mm fraction. Non-seed plant tissues that were restricted in occurrence to the smaller fractions are marked "present" or "p" in tabulated data.

Table 15. General Archaeobotanical Data.

No. of Samples	27
Volume (liters)	288
Total Charcoal Weight (g)	19.51
Total Charcoal Count	2162
Mean Fragment Weight (mg)	9
Charcoal Density (g/10 l)	0.68
Charcoal Density (N/10 l)	75.07
Total Seeds (SNE)	541
Seed Density (SNE/10 l)	18.8
SNE/Charcoal (g)	27.7

Wood identifications were attempted for at least 20 randomly selected specimens from each sample. Forty specimens were identified for some of the larger samples, particularly those from Feature 18. Identification was aided by the use of Harold A. Core et al. (1979), R. Bruce Hoadley (1990), Alexis J. Panshin and Carl de Zeeuw (1964), and the comparative wood collection at CAR. For 13 samples wood fragments were limited in number, and all specimens were examined, whereas 2 samples lacked any wood fragments of sufficient size for study.

Whole seeds and seed fragments were counted but not weighed, and a Seed Number Estimate (SNE) was obtained for each identified taxon. SNEs represent units that attempt to control for seed fragmentation. It is a sample-specific minimum number, estimated by counting a specific anatomical part that appears to have maximum representation. At least for a few samples containing abundant numbers of whole hackberry seeds and hackberry seed fragments, SNEs were generated by dividing the weight of seed fragments by the average weight for a sample of complete hackberry seeds from the site. Seed identifications were made primarily with the aid of manuals, such as Linda W. Davis (1993) and Alexander D. Martin and William D. Barkley (1961), and the CAR comparative collection. Seed identifications were made to the finest taxonomic level possible. Seeds classified as indeterminate typically were unidentifiable even to the family level. Most unidentified seeds were poorly preserved, often eroded fragments of seed coats or cotyledonous tissue.

Quantitative measures, such as ubiquity indices and density calculations (discussed in Hastorf and Popper 1988; Pearsall 1989), are presented in this section. Such measures have greatly increased researchers' ability to evaluate variability in plant exploitation and the function of features, components, and sites in more detail, but it is important to recognize that they do not provide precise enumerations of similarities or differences in past human-plant relations. Differential preservation and noncultural disturbances are always problems in assessing quantitative data. Such problems are particularly acute for open-air sites where carbonization is essential for preservation and for sites that have suffered from extensive postdepositional disturbance. The plant remains present in a flotation sample typically result from a long series of events involving collection, preparation, consumption or discard, post-depositional preservation conditions, recovery, and identification. The types of materials and how they were processed and used are important considerations in attempts to understand subsistence based on what is and is not seen in the field and beneath the microscope.

At most open-air sites nearly all plant tissues require carbonization for preservation. This necessitates some exposure to fire or heat. This is almost certainly true of 14HO308, although partial carbonization might be expected for some late prehistoric contexts. Unfortunately, another problem stems from the fact that some plant parts were eaten raw or boiled and, therefore, had limited opportunities for exposure to heat sufficient for carbonization. Flowers, leaves, and young herbaceous stems are examples of particularly fragile soft plant tissues that rarely survive preservation and recovery from non-desiccated deposits. In the case of the Horsethief site, edible tubers and other underground parts also could have been of substantial importance to the occupants of the site, yet the sequence of harvest, preparation, and cooking events for such foods would have selected against their archeological visibility relative to their importance.

Conversely, many hard edible tissues, such as grass seeds (e.g., from wild barley and grama grass), would have had a much greater chance of becoming part of the archeological record than soft tissues and tubers or bulbs, for example. To some extent winnowing of small seeds to eliminate chaff would have contributed to the introduction of some seeds into the soil seed banks at sites. If such seeds were parched (dry roasted) before being ground and/or stored, their chances of becoming lost and then becoming part of the archeological record also would have been enhanced. It would have been less likely for small, parched seeds than for large seeds to be retrieved after an accident, thereby increasing their chances to become incorporated into the archeological record.

Some plant parts recovered from archeological deposits also are likely not representative of intentionally exploited resources. Some seeds are already present in the soil as part of the "soil seed bank," and others might have been shed as part of the "seed rain" during the time of occupation. This problem is discussed herein with respect to the ubiquitous remains of hackberry seeds. The seeds of "camp followers" might be dispersed in large quantities near fires, and those of other weedy taxa probably occurred abundantly in the soil throughout sites prior to their use. Still others arrived at sites as "hitchhikers" (i.e., burs and other barbed or spiny fruits that attach readily to clothing and animal fur).

Despite the problems discussed here, quantitative data still provide a good basis for evaluating many human-plant relations, both within a site and among a group of sites within a particular region. At least among similar types of plant remains (e.g., wood charcoal), it is assumed here that more frequently occurring types of plant remains represent more frequently exploited resources.

Considerations of Feature Origins and Time Depth

The great proportion of plant materials derive from features defined at or immediately below 70–80 cm bs, so the archaeobotanical assemblage is considered here as a single unit dating to A.D. 1150–1225. However, there is a possibility that 14HO308 was occupied briefly a few centuries before and after during late prehistoric or protohistoric times. The vertical distribution of features and artifacts indicate relatively intensive site use preceded and followed by more intermittent use. The single columnar series from Unit 12 clearly shows a peak in charcoal density at 70–80 cm bs, and the densities of other materials obtained by flotation and screening point to this level as representing relatively intensive use of the site.

Examination of flotation samples from feature fills supports this scenario. In fact, close examination of the flotation samples from the more recent, stratigraphically higher features defined during mitigation indicates that they may not be cultural in origin. These are Features 1, 2a, 2b, 3a, 3b, 4, 5, and 13. Although the flotation sample from Feature 3b has not been analyzed, it was scanned to assess its contents and implications for cultural versus noncultural origin.

Noncultural origins are suggested for Features 1, 2a, 2b, 3a, and 3b. A noncultural origin for Feature 13 is less certain. The flotation samples from these six features contain very little charred material and no chipped stone. The sample from Feature 3a yielded one small piece of burned bone, and samples from Features 1, 2a, 2b, and 13 lacked bone. Bone also was not observed while scanning a portion of the Feature 3b sample. Significantly, among the six samples considered here, all except the Feature 13 sample contained common to abundant quantities of uncharred fecal pellets. These typically measure 1.5–2 mm in length and .7–1 mm in width. Such fecal pellets also were common in the 30–40 cm bs sample from Unit 12. It is probably no coincidence that all six of the features considered to be noncultural were defined at 40–47 cm bs.

The only other features defined above 70–80 cm bs were Features 4 and 5. The samples from these two features contain moderate to abundant quantities of wood charcoal, some carbonized seeds, and moderate to high proportions of burned hackberry pit fragments, in addition to some microdebitage and bone. Such contents could be considered an indication that these features were cultural in origin. If so, they reflect similar, although less intensive, use of the Horsethief site at least two times after ca. A.D. 1150–1225.

Some features found at 70–90 cm bs also may or may not represent bioturbation. The abundance and variety of cultural materials in flotation samples from Features 17, 18, and 20 indicate that these features are cultural in origin. However, some features (6, 13, 14, and 19) perhaps only represent the subterranean nests or chambers of rodents, or else they have been much disturbed by them. One of the most interesting of these is Feature 6, which is discussed in the seed section below.

Fuel/Construction Materials

Wood charcoal comprises the most abundant plant remain, accounting for 1,711 specimens weighing 16.22 g (Table 16). This represents 78.8 percent by count and 83.3 percent by weight of all materials in the sorted ≥2-mm fractions, including almost 200 pieces of uncharred bark that likely represent recent historic root bark. Wood charcoal occurs in all 25 samples but is represented only by small bits in 3 feature samples and by 9 or fewer fragments in 14 other samples. A total of 287 pieces of wood charcoal were subjected to taxonomic identification. Of these, 284 fragments were identifiable to at least the family level (see Table 17).

Most (N = 205, or 72 percent) of the identified wood charcoal fragments can be assigned to the Ulmaceae or elm/hackberry family. Species within this family that are known to occur today in Hodgeman County and/or adjacent counties consist of American elm (*Ulmus americana*), dwarf hackberry (*Celtis tenuifolia*), and common hackberry (*C. occidentalis*). No systematic effort was made to sort elm from hackberry by microscopic examination of tangential sections of ray cells. However, it is noted that many archeological Ulmaceae specimens exhibit relatively wide bands of early wood pores (often 4–5 pores in width), rays occasionally exceeding 6–7 ray cells in width, and/or common tyloses (bladder-like outgrowths that tend to form as plant vessels cease to function or become injured). These characteristics are typical of hackberry wood, not elm wood.

Ulmaceae wood charcoal occurs in all but three samples that yielded wood specimens for identification. However, these samples together contained only five specimens, so sampling error likely accounts for its absence. In other words Ulmaceae wood is represented in all samples producing three or more fragments for identification. Based on these facts, it could be argued that Ulmaceae wood is essentially ubiquitous. It is probably more than

Table 16. Weights and Counts for Sorted Non-Seed Remains.

		Weight (g)	Count (N)	Ubiquity (%)
Fuel/Construction	Wood Charcoal	16.22	1,711	100.0
	Bark	2.46	261	40.7
	Twig Fragments	0.01	1	18.5
	Grass Stem	t	1	37.0
	Rhizomes	0.03	3	25.9
	Leaf Bud	p	p	3.7
Miscellaneous Other	Tuber/Corm	0.31	35	37.0
	Twisted Fiber	p	p	3.7
	Fruit Peduncle	p	p	3.7
	Root Tissues[1]	0.48	149	3.7
Indeterminate		t	1	3.7
Totals		19.51	2,162	

[1]Appears to be partially humified.

Table 17. Wood Charcoal Identifications.

Provenience	Ulmaceae	Ash	Plum/ Cherry	Maple/ Box Elder	Salicaceae	Diffuse Porous	Indeterm.	Totals
U2, L9	3							3
U12, L4	2							2
U12, L5	2							2
U12, L6	1							1
U12, L7	3							3
U12, L8	20							20
U12, L9			2					2
U12, L10				2				2
F1, 40–50 cm								0
F1, 87 cm	40							40
F2a, 40–45 cm				1				1
F2b, 45–50 cm								0
F3a, 46–56 cm	2						1	3
F4	7							7
F5	20							20
F6, 74–87 cm 20	20							20
F11, 85–91 cm								0
F13, 45–55 cm	2							2
F14, 70–80 cm	4		5					9
F16, 72–76 cm	3					1		4
F17	9		11					20
F18, 70–80 cm	5							5
F18, 80–90 cm	5		15			1		21
F18, 90–100 cm	22	8			10			40
F18, 100–106 cm	1		19					20
F19, 71–94 cm	20							20
F20, 72–82 cm	14		1		5			20
Totals	205	8	53	3	15	2	1	287

mere coincidence that Ulmaceae wood (presumably hackberry) was apparently used more abundantly than any other type of wood, that dwarf hackberry pit fragments are ubiquitous (see later seed discussion), and that dwarf hackberry was noted to abound in the vicinity of the site at the time of mitigative excavations.

Other represented wood taxa consist of plum/cherry (*Prunus* spp.; N = 53), cottonwood/willow family (Salicaceae; N = 15), ash (probably green ash [*Fraxinus pennsylvanica* var. *subintegerrima*]; N = 8), and "maple" (probably box elder [*Acer negundo*]; N = 3). Wood fragments of these were identified in six, two, one, and two samples, respectively. The ash fragments and most of the plum/cherry and cottonwood/willow fragments are concentrated in samples from Feature 18. Conceivably, the greater relative abundance of these three woods in the Feature 18 samples indicates that they were selected as construction materials. In contrast hackberry wood was probably more abundant and was used more generally for fuel and construction.

The distribution of bark is rather disparate, and most occurrences of bark fragments appear to reflect incidental occurrences with wood, the primary focus of exploitation for fuel and construction. Bark occurs in 11 samples from 2 unit-levels and 6 features, including both samples from Feature 1 and 3 samples from Feature 18. A total of 269 fragments, weighing 2.43 g, occur in these samples.

Concentrations of bark or bark-like materials were noted for three feature samples. These derive from Features 1 (87 cm bs), 6, and 11. Of these, the deep sample from Feature 1 yielded the greatest amount of remains identified tentatively as bark, much of which appeared to be only partially charred/humified. Some of the 20 specimens identified as bark-like materials from Feature 11 also are clearly uncharred. Given that carbonization is essential for preservation of prehistoric remains at 14HO308, then the uncharred or partially humified bark likely represents more recent disturbances, perhaps from roots, of the Features 1 and 11 fills.

Carbonized bark and wood charcoal occur in roughly equal numbers in the sample from the upper portion of Feature 6. Given the shape and size of this basin-shaped feature in addition to the presence of ash-laden fill at the base, Feature 6 might have functioned as a hearth. If wood was in short supply, perhaps bark also was used for fuel in this feature. It is also known that bark was commonly used in hide and pottery smudge pits to create smoke (Binford 1967, 1972).

The analyzed Feature 6 sample also contains a relatively great quantity of hackberry seed remains. A comparatively high percentage of the hackberry pits and pit fragments have been burned, and both burned and unburned whole pits also have gnawed holes. It is possible that this hearth was established in an area of prior rodent activity. Alternatively, it may not represent a hearth, but rather the results of an effort by the occupants to burn the nest(s) or other chambers of vermin. The abundant evidence for rodent activity throughout the late prehistoric deposits at the site probably points to a recurrent problem faced by the residents, particularly if the site was occupied during cold weather when heat would have attracted assorted vermin.

Other fuel/construction materials at the Horsethief site are few. They include a probable leaf bud, bits of twigs, and grass stem fragments. A single bud occurs in the Feature 19 sample, whereas small twig fragments are represented in the uppermost column sample (30–40 cm bs) from Unit 12 and in samples from Features 2a, 6, 17, and 18 (70–80 cm bs). As would be expected for a site in the Mixed Prairie region of Kansas, grass stem fragments occur in greater numbers. They occur in at least 10 samples and are associated with small rhizomes (also almost certainly from grasses) in four of those samples (i.e., from Features 1, 4, 6, and 19). Other occurrences of grass stem fragments were noted for the sample from 30–40 cm bs of Unit 12 and for samples from Features 5, 11, 13, and 18 (two samples).

Miscellaneous Non-Seed Materials

There are relatively few materials other than fuel residues and seeds in the archaeobotanical assemblage. These other materials include (1) a single small piece of a twisted bast fiber in the sample from 80–90 cm bs within Feature 18, (2) a small fruit peduncle in the Feature 20 sample, and (3) scattered small charred fragments from tubers or other swollen underground stems (but not bulbs) or roots. The latter occur in samples from 70–80 cm bs and 80–90 cm bs of Unit 12 and from Features 1, 14, 17, 18 (all four level samples), 19, and 20. Some of the identifications are highly questionable as they are based on very small fragments of tuber-like tissues; those from Features 14, 17, 18, and 20 are more certain. Samples from these four features contain all but two (.01 g) of the 38 (.31 g) tuber-like tissue fragments found in the larger sorted ≥2-mm fractions.

Despite the uncertainty in identification as even tubers (some specimens may in fact be derived from swollen, tuberous parts of roots), the ethnobotanical record provides an abundance of accounts regarding the historic importance of underground plant parts to Native American groups living in central North America. Wedel (1986:128) noted that some Upper Republican sites are located in the vicinity of wetlands that would have supported and continue to support plants, such as arrowhead and cattail, which produce edible underground stem parts, as well as other parts of potential technological and medicinal importance.

The swollen tuberous taproots of various species of scurf pea (*Psoralea* spp.) were among the most important of these in the Central Plains (Hedrick 1919:469; Yanovsky 1936:38). One species (*P. esculenta*), referred to variously as prairie turnip, prairie potato, and Indian breadroot, was widely exploited in the Plains, could have served at times as a staple vegetable food during the spring and summer, and served at other times (e.g., during periods of drought) as an emergency food (Reid 1977). Prairie turnip has been identified for an Upper Republican site (14ML15) and for a historic Kansa site (14RP1) (Cutler and Blake 1973:30–31), but such archeological occurrences appear to represent rare examples of preservation. As Reid (1977:322) has noted, ". . . archaeological evidence for procurement and preservation of *P. esculenta* will be [essentially] nonexistent at open habitation sites." The same holds true for other plants with useful underground stem parts (i.e., tubers, corms, rhizomes, and bulbs) or tuberous roots.

Seeds

The total SNE of 1,308 is comprised of 163 whole seeds and 4,060 seed fragments. While this appears to be a substantial number of seeds, the majority consists of hackberry seed remains that do not carbonize and may or may not represent food byproducts. Carbonized seeds are actually represented by 59 whole seeds and 1,567 seed fragments. Carbonized seeds are present in 25 of the 28 samples. They are lacking in the samples from Features 2b, 11, and 16. The per-sample distribution of the most abundant and significant seed types is presented in Table 18. Other seeds were itemized elsewhere (Lopinot et al. 2010:Appendix 3).

Fleshy Fruit Seeds

Remains of hackberry are ubiquitous in the analyzed flotation samples from 14HO308. However, remains of wild grape and at least chokecherry/plum are also quite common, and several other fleshy fruits are represented by one or a few specimens each. Depending on how certain fleshy fruits were processed and/or consumed, uncommon or even rare (i.e., singular) occurrences of some seeds may belie substantial usage. Conversely, particular taphonomic trajectories may select for the preservation and common occurrence of other seeds that might have had little or no economic importance.

Hackberry. Hackberry/dwarf hackberry pits are well represented in the ≥2-mm fractions by 104 whole pits and 2,493 fragments, together comprising a SNE of 713. They occur in the sorted ≥2-mm fractions of all but the uppermost sample (40–50 cm) from Feature 1. However, this sample contained very little charcoal, and some hackberry pit fragments also were observed among the smaller unsorted materials. In addition to the ≥2-mm materials, hackberry remains in the .5–2-mm fractions were also sorted for five randomly selected samples. The samples include two from levels of Unit 12 and three from features (Features 1, 17, and 18). The number of fragments in the .5–2-mm fractions of these five samples is 1,462, whereas the ≥2-mm fractions yielded one whole seed and 180 fragments.

Only dwarf hackberry (*Celtis tenuifolia*) has been documented in modern times for Hodgeman County, but common hackberry (*C. occidentalis*) has been recorded for adjacent Pawnee County to the east, as well as Kiowa County to the southeast, Meade County to the south-southwest, and Scott County to the northwest (Stephens 1969:82–85). Because it is known that hackberries are very closely related and hybridize readily (Buck and Bidlack 1998; Fernald 1950:553), no attempt was made to

Table 18. Distribution of Principal Seeds.

Provenience	Hackberry SNE	Wild Grape SNE	Plum/Cherry SNE	Chenopod SNE	Poaceae SNE	Asteraceae SNE
U2, L9	13	1		59		1
U12, L4	2		1	4	2	
U12, L5	4				1	
U12, L6	5	1		2	1	
U12, L7	6	1		3	1[c]	
U12, L8	12		1			
U12, L9	7	1				
U12, L10	3			3	1	
F1, 40-50 cm		1		3		
F1, 87 cm	88	1	1	8	3[c]	1
F2a, 40-45 cm	11	1		1		
F2b, 45-50 cm	3					
F3a, 46-56 cm	6	1	1[a]	3	2	
F4	7	1	1	4	5	
F5	54			2	6	
F6, 74-87 cm	351	1		5	12[c]	
F11, 85-91 cm	11					
F13, 45-55 cm	13	1		4	3	
F14, 70-80 cm	5		1[a]		1[c]	
F16, 72-76 cm	1					
F17	10	1	4			
F18, 70-80 cm	9				1	1[d]
F18, 80-90 cm	23		2[a]			
F18, 90-100 cm	20	1	2[b]		1	1
F18, 100-106 cm	5	3	1	1		
F19, 71-94 cm	63	2		337	3	5
F20, 72-82 cm	42		1[a]			
Totals	774	18	16	439	43	9

[a]Plum (*Prunus americana*).

[b]Chokecherry (*Prunus virginiana*).

[c]Festucoid wild barley-like (*Hordeum* cf. *jubatim*).

[d]Sunflower (*Helianthus* sp.).

distinguish the seeds of these two taxa. Furthermore, specific identification provides no distinct ecological implications, as both dwarf hackberry and common hackberry can be found in similar ecological contexts, such as along Buckner Creek (Stephens 1969:82–85).

The majority of wood charcoal from the Horsethief site has been identified as Ulmaceae (i.e., the elm/hackberry family), and most of that charcoal appears to be hackberry. Given that fact, the abundant representation of hackberry seeds is not surprising. The primary question is whether some or all hackberry seed remains represent the discarded byproducts of human food or whether they merely consist of conspicuous background noise from trees growing on and around the site.

A hackberry fruit has a thin skin (exocarp) overlying a thin layer of fleshy pulp (mesocarp) and then a large hard stone or pit containing a kernel (endocarp). The pits are composed of calcium and do not carbonize, although they can be heat-altered similar to bone. In fact, 16 of the whole pits and 375 fragments exhibit heat discoloration. It is suspected that this was inadvertent rather than intentional. Of the total number of whole pits (N = 5) and pit fragments (N = 231) in the eight analyzed samples from unit levels, only seven fragments (3 percent) show characteristics of burning. In contrast 384 (16.3 percent) of the whole pits (N = 99) and pit fragments (N = 2,262) in feature samples have been burned to some extent. The greatest proportions of burned specimens are evident for Features 1 (87 cm bs) and 6, wherein hackberry remains were also most abundant. Based on their forms and the material contents of the fills, it could be conjectured that these two pits perhaps functioned as cooking facilities; however, see below discussion for at least Feature 6).

Ilias Yanovsky (1936:19) noted the Native American use of hackberry for food in Nebraska, North Dakota, South Dakota, Minnesota, Wisconsin, and New York. At least among the Dakota, the fruits were pounded fine and used as "a flavor for meat," whereas the Pawnee "pounded the berries fine, added a little fat, and mixed them with parched corn" (Gilmore 1919:24). Besides the fleshy portions of the fruit, "the white kernel inside the hard shell is soft and sweetish" (Fernald and Kinsey 1958:162).

In addition to known uses by Native Americans, one cannot ignore the fact that a wide variety of animals, but particularly birds and small mammals, feed on hackberry fruits (e.g., Martin et al. 1951:311–312). This may account for their common occurrence in sheltered and open-air sites in many parts of North America. At least with respect to 14HO308, the abundant occurrence in some deposits of small fecal pellets, presumably from mice, and bioturbation from burrowing animals has already been noted. Identified skeletal remains of mice are few in number, but they are likely greatly under-represented in the piece-plotted and screened assemblages. Small mammal bones, presumably from mice, appear to be common in the sorted ≥2-mm fractions of some flotation samples. White-footed mice (*Peromyscus* spp.) are omnivorous and commonly exploit seeds, fruits, and roots or tubers for food (Martin et al. 1951:261). Considered the most common terrestrial vertebrate in the plains states, the deer mouse (*P. maniculatus*) is known to emphasize the consumption of stored seeds during the winter (Jones et al. 1985:208).

A common feature for whole pits are holes that might have resulted from gnawing or pecking to obtain the kernels inside the hard shells. The holes do not represent the locations where the embryonic roots of the young seedlings would have emerged from the pits. The holes do not occur consistently in the same places on the pit. The radicle would have emerged from along the dehiscing suture that splits the pit into two halves rather than randomly through the shell.

The holes, which almost certainly represent nonhuman alterations, are evident for specimens in several flotation samples. Two samples in particular deserve brief description. The first was a piece-plotted concentration of hackberry pits and pit fragments at 61 cm bs within Unit 2. This concentration included about 15–20 whole pits, most of which display the characteristic holes (Figure 36). Similar holes also were observed in 29 of the 78 whole pits in the Feature 6 sample. These consist of both burned and unburned examples. Some are shown in Figure 37. The fact that many specimens in the Feature 6 sample are complete is alone suggestive of the likelihood that hackberries were not eaten, at least after having been pounded fine.

A control sample was obtained in order to further examine the question of whether hackberries occurred naturally in the soil and broke apart readily due to other factors, or whether they were pounded into small bits on a grinding stone or in a mortar. The utility of any data derived from this control sample depends partly on the assumption that small fragments resulting from pounding by humans would be lost during processing or even discarded disproportionately to that of larger fragments and whole pits. Furthermore, if finely pounded hackberries were being used extensively and on a consistent basis, the proportion of small fragments derived therefrom should exceed the proportion of naturally occurring fragments relative to whole pits found in similar post-depositional contexts.

Unfortunately, questions about the possible use versus natural occurrence of hackberry arose after completion of fieldwork, so collection of on-site or near-site samples in Hodgeman County was not undertaken. However, a 10-liter soil sample was collected from below the canopy of a hackberry

Figure 36. Hackberry pits from 61 cm bs in Unit 2. Image shows characteristic holes resulting from gnawing or pecking. Note: Some pits are filled with dirt.

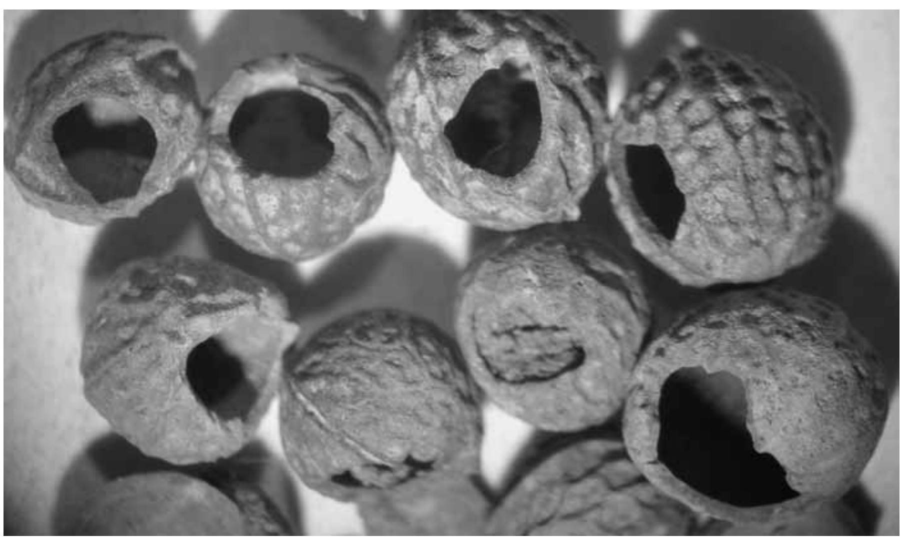


Figure 37. Hackberry pits from Feature 6. Image shows characteristic holes presumably resulting from gnawing or pecking.

tree growing near CAR in Springfield, Missouri. The diameter at breast height for this tree measured 32 cm and an increment core indicated that the tree was 34–35 years old in 2008.

All hackberry remains in the ≥2-mm fraction of this control sample were sorted, but only a small proportion of the materials in the .5–2 mm size range was examined. This was due to the sheer abundance of fragments in the smaller sieve size range. The large fraction of the control sample contained only 8 whole hackberry pits and 510 pit fragments, resulting in a ratio of 63.75 fragments per whole pit. In comparison the ratio of fragments to whole pits for the analyzed Horsethief site assemblage is

23.97 or nearly one-third that for the control sample. A total of 280 fragments was also sorted for 8.25 g of randomly sampled debris in the .5–2-mm size range. Given that another 407.69 g of smaller materials captured by the 1–2 and .5–1-mm sieves were not sorted, one can extrapolate that there are 14,117 fragments in the entire .5–2-mm size range. The proportion of small fragments is also greater (27.25) for the control sample than for the five analyzed site samples discussed above (8.08), indicating that natural fragmentation is substantially greater in the control sample.

All other things being roughly equal, these differences alone indicate the likelihood that natural fragmentation, not processing for food, accounts for much or all of the assemblage of hackberry remains at 14HO308. It is possible that the fruits were consumed as a snack food or else processed in some other manner than by pounding into a fine meal (e.g., boiling to make a condiment or a drink). In fact, it is hard to believe that edible fruits from an abundantly distributed local tree would not be consumed. However, the existing evidence is most parsimonious, with an explanation attributing the occurrence of hackberry remains largely or entirely to nonhuman activities and sporadic fortuitous burning.

Wild Grape. Based on present-day distribution (see Great Plains Flora Association 1977:219–220), wild grape (*Vitis* sp.) remains at the Horsethief site are likely riverbank or frost grape (*V. riparia*). Carbonized fragments of pips or seeds occur in 15 or more than half of the analyzed samples. These consist of 4 samples from unit levels and 11 samples from 9 features. The total SNE of 17 for grape is represented by 58 fragments. Of these, 38 fragments or nearly two-thirds occur in only 2 samples. These samples were obtained from the basal level (100–106 cm bs) of Feature 18 and the fill (71–94 cm bs) of Feature 19. The other 12 samples contained no more than 4 fragments each, with most (N = 8) yielding only a single grape seed fragment. Based on the relative abundance of fragments in two good cultural features (Features 18 and 19), wild grape likely was an exploited food. However, at least some occurrences of one or a few carbonized grape seed fragments may reflect nonhuman deposition and accidental carbonization.

A variety of wild grapes were exploited throughout much of North America by Native Americans (Yanovsky 1936:43–44), and the archaeobotanical record chronicles their prolonged and widespread use in the Central Plains (e.g., Adair 1988:Tables 2.3 and 2.4, 2003:Table 7.14; Adair and Drass 2011). Historically, the fruits were often gathered and stored for winter use (Fernald and Kinsey 1958:272; Gilmore 1919:50). Besides humans, a wide variety of animals feed on wild grapes (Martin et al. 1951:343–344). As the name implies, riverbank grapes likely grew along the banks of Buckner Creek in the vicinity of the site.

Plum and Chokecherry. Remains of plum and/or chokecherry occur in 11 samples. These consist of two unit-level samples and nine samples from seven features. The SNE of 16 is represented by a single whole seed or pit and 307 fragments. The only whole seed is a chokecherry (*Prunus virginiana*) pit in a Feature 18 sample (90–100 cm bs). Plum remains were identified for four samples, whereas specimens in six samples were too small to distinguish between plum and chokecherry. The plum pit fragments from Feature 17 compare most favorably with those from the common wild plum (*P. americana*), a species endemic to the area today (Great Plains Flora Association 1977:146). Wild plum pits, including those from the common wild plum, also have been identified for other late prehistoric, protohistoric, and historic Native American sites in Kansas (e.g., Adair 1988:43; Cutler and Blake 1973:30). It is noted that, to avoid the potential old wood problem for late prehistoric contexts at 14HO308, plum pit fragments from Features 17 and 18 (80–90 cm bs) were submitted for AMS dating.

Elderberry and Sumac. Elderberry (*Sambucus canadensis*) and sumac (*Rhus* spp.) seeds occur in two samples and one sample, respectively. Two seed fragments were identified as elderberry. A fragment from Feature 6 is clearly from an elderberry seed, whereas the identification of elderberry for a seed fragment from Feature 13 is less certain. A complete kernel from a sumac seed is represented in the sample from Feature 18 (100–106 cm bs). Although sumac seeds may occur commonly at late prehistoric archeological sites, elderberry seeds typically are represented by one or a few specimens (see Adair 2003:Tables 7.13–7.16). Elderberry seeds have been reported from Steed-Kisker, Glenwood, Nebraska phase, and Upper Republican sites (Asch and Green 1995; Green 1990; Puseman 1996), but they are likely greatly under-represented at sites in the Central Plains. This is due to the fact that elderberry seeds are not only quite fragile in comparison to many other fruit seeds, but they also are adapted for fecal dispersal. Like many fruits, such as strawberry and blackberry, the fruits of elderberry, including the seeds borne within, would have been consumed whole and likely defecated in a location that would rarely, if ever, be sampled archeologically.

Sumac seeds have not been reported previously from sites in the western part of the Central Plains, although they have been identified for a few sites in the Southern Plains and for a few late prehistoric sites farther east in the Central Plains (Adair 2003:Tables 7.9, 7.14, and 7.16). One seed hardly connotes prehistoric use, especially in light of the extensive amount of bioturbation that has occurred at 14HO308, but the berries from a variety of species were used widely by Native American peoples to make citric beverages (Yanovsky 1936:40–41).

Other Seeds

A variety of seeds other than those from fleshy fruits also are represented in the flotation samples from the Horsethief site. They consist of seeds from an assortment of weedy herbaceous plants and grasses. At least three of them may represent cultivated plants, so the evidence for these will be discussed separately here. The three candidates for cultigens are chenopod, wild barley, and sunflower.

Chenopod. This represents the secondmost abundantly represented seed taxon at the site. Carbonized chenopod seeds are represented in 16 or nearly 60 percent of the analyzed samples. These samples derive from five unit levels and seven different features. The total SNE of 439 is comprised of 45 whole seeds and 903 seed fragments. With relatively few exceptions, the latter consist of testa (seed coat) fragments. Chenopod seeds and seed fragments are concentrated in two samples. These are the 10-liter samples from 80–90 cm bs of Unit 2 and from Feature 19 (71–94 cm bs) (see Figure 38).

Chenopod seeds are commonly found at sites in Kansas, including Upper Republican sites (Puseman 1996), although their specific taxonomic identification and their wild versus domesticated status are often not examined or discussed thoroughly (Adair 2006:257). In the Mississippi River and lower Missouri River valleys, where chenopod seeds occur commonly in late prehistoric contexts, the domesticated forms are often represented archeologically by perisperms with or without attached embryos. This is because the domesticated forms have relatively thin testae, a result of selection for seeds that readily imbibe moisture and germinate synchronously. Carbonization often results in the near to complete destruction of these thin testae, leaving the perisperms (sometimes with attached embryos) or portions thereof relatively intact. This is not the case for the Horsethief site assemblage.

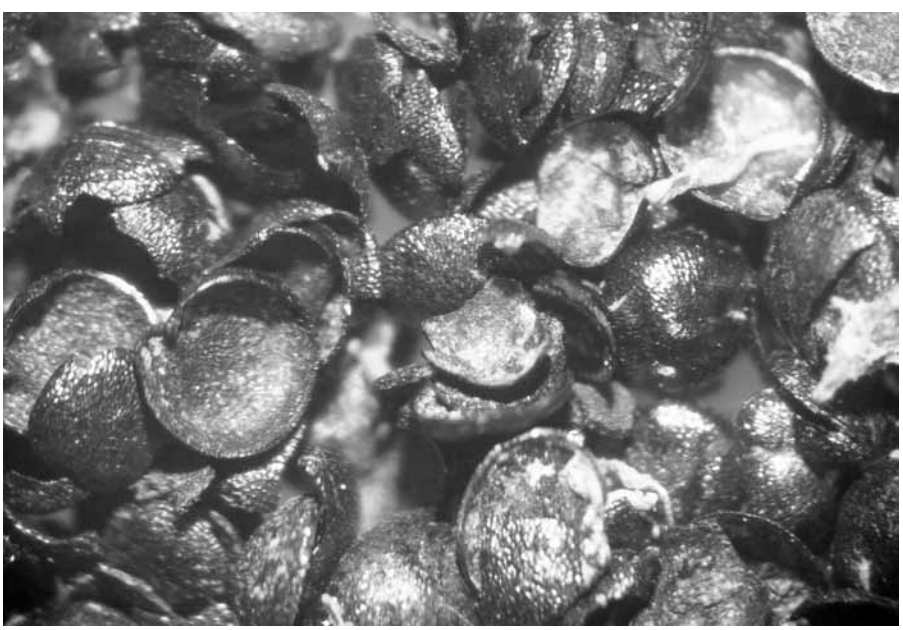


Figure 38. Chenopod seeds and seed fragments from Feature 19.

Instead, few perisperms (with or without embryos) are represented; the vast majority of chenopod specimens consist of seed coat or testa fragments.

Several other attributes of the chenopod population merit detailed description before considering its probable status as wild, quasi-domesticated, or domesticated. First, the chenopod seeds from 14HO308 have reticulate alveolate or "honeycombed" testae (see Smith 1985b:117). Following Wilson (1980), this places the chenopod seeds within the subsection Cellulata, which includes *Chenopodium berlandieri*. They compare favorably with seeds of *C. berlandieri* and are identified as such in this report. At least today *C. berlandieri* also appears to be the only species within subsection Cellulata that is widespread in distribution in this portion of the Central Plains (Great Plains Flora Association 1977:63–67).

Second, seed diameters were obtained for a sample of 50 whole specimens and testa halves from Feature 19. This sample yields a mean diameter of 1.02 mm, with a range of .8–1.2 mm and one standard deviation of .09 mm. This represents considerable homogeneity and is within the diameter range for wild *C. berlandieri* seeds (Fernald 1950:595).

Third, a number of samples also contain uncarbonized chenopod seeds. The seeds in all except one sample appear to differ from the carbonized specimens by virtue of having apparent smooth or semi-smooth seed coats. Such are typical of species within the subsection Leiosperma; species in this subsection are considered to be essentially European in origin (Wahl 1952–53). Although appearing dissimilar, it is noted that no effort was made to scratch away pericarp tissues to obtain an up-front examination of the testa surfaces. However, it was observed that the uncarbonized seeds are mostly larger than the archeological specimens. For instance, a smooth uncarbonized seed in the Feature 6 sample measures 1.8 mm in diameter.

The Feature 5 sample differs by virtue of having numerous, clearly alveolate uncarbonized seeds similar to the carbonized *C. berlandieri* seeds found in Feature 19 and elsewhere at the site. A small sample (N = 15) of these uncarbonized seeds has a mean diameter of 1.11 mm, with a range of 1.0–1.3 mm and a standard deviation of .08 mm. Thus, they are slightly larger, but carbonization shrinkage could account for the slight differences.

Fourth, testa thicknesses were obtained for 60 fragments in the Feature 19 sample. These consist of 30 fragments from the 1–2-mm fraction and 30 fragments from the .5–1-mm fraction. Combined, the two groups produce a mean testa thickness of 32.2 microns, with a range of 18–51 and a standard deviation of about 7. The 30 fragments from the 1–2-mm fraction have a mean of 33.8 microns, with a range of 18–51 and a standard deviation of 7.3, whereas the 30 fragments in the smaller .5–1-mm fraction have a mean of 30.5 microns, with a range of 20–43 and a standard deviation of 6.4. At least in this case, this illustrates the logical expectation that thin testae tend to break into smaller fragments, but the difference is not substantial.

Fifth and finally, none of the whole seeds and large seed fragments exhibit truncated margins. Instead, they have a variety of margin shapes, ranging from acute to round (see Smith 1985b:Figure 7).

In summary, these attributes provide mixed results with respect to existing data bearing on the question of whether the 14HO308 chenopod seeds represent a wild or a domesticated chenopod seed or something in between. The testa thickness range for the Feature 19 population is essentially above that for domesticated chenopod (21 microns or less) and largely below that for wild populations (40–75 microns) described by Smith (1985a, 1985b). The range is similar to that for sympatric (hybrid of wild species and domesticate) weedy chenopod in Mexico, as well as archeological round-margined specimens from Middle Woodland contexts in Ohio that also were thought to represent seeds from sympatric weeds (Smith 1985b:Figure 20).

The thicknesses and the range of shapes are similar to those for two Late Archaic chenopod populations from the Big Eddy site (23CE426) in southwest Missouri (Powell and Lopinot 2005:33). However, the Late Archaic seeds from this site, located along the eastern border of the Plains, were not thought to represent sympatric weeds. Instead, it was hypothesized that they represented a population transitional between a wild and domesticated state—a quasi-domesticated plant. Powell and Lopinot (2005:337) stated

> . . . the Big Eddy specimens likely represent a form of chenopod that was neither wild nor domesticated. Perhaps the seeds were being harvested from

> spontaneous stands that grew on the disturbed soil around the site. It is also within the realm of possibility that chenopod seeds were intentionally sown in these disturbed areas and cultivated.

It is now suspected that such a scenario may be incorrect, or at least an alternative model needs to be considered and examined in the future for populations with intermediate traits and lacking at least some domesticated seeds.

A variety of factors, both internal (e.g., chemical germination inhibitors and promoters) and external (i.e., temperature, moisture and oxygen availability, and light), affect the moisture imbibation and germination processes for seeds (see Bewley and Black 1994; Heydecker 1973). Cellulosic seed coats comprise a physical barrier to imbibation, and greater and more diverse testa thicknesses provide an adaptive advantage for wild and weedy taxa such as *Chenopodium* spp. In turn thinner seed coats would result in reduced dormancy and more synchronized germination of a greater proportion of a seed population. Thus, such seeds have an adaptive advantage in domesticated populations. Although the domestication of *C. berlandieri* involved selection for thinner seed coats (Smith 1985a, 1985b), it also stands to reason that natural selection might favor seeds with thinner seed coats overall in areas where the climate is significantly dryer. If this is true, then the archeological chenopod seeds from both the Horsethief site and the much earlier Late Archaic components at the Big Eddy site might have resulted from the gathering of seeds from wild populations. Such a hypothesis could be examined through the analysis of seeds of *C. berlandieri* from stands located along an east-west transect, stretching from as far east as the Mississippi Valley to as far west as the Rocky Mountains.

Wild Barley. Seeds tentatively identified as foxtail/little barley (*Hordeum* sp.) occur in five samples. The SNE of five is represented by two whole seeds and three seed fragments. Although only one specimen is present in each sample, it is likely that at least some of the poorly preserved seed fragments identified only as Poaceae are portions of foxtail/little barley seeds. For example, some or all of the 22 Poaceae seed fragments in the sample from Feature 6 also probably represent portions of barley seeds. Because of the condition of the three fragments, it is uncertain whether they represent foxtail barley (*H. jubatum*) or little barley (*H. pusillum*). However, the two complete carbonized specimens (from 60–70 cm bs of Unit 12 and Feature 6) are tentatively identified as foxtail barley, based on their sizes. Minimally, they exhibit the characteristic sulcus (a groove) and embryonic area of a barley grain. However, they are not little barley. One from 60–70 cm bs of Unit 12 measures 3.6 x 1.2 mm, whereas the one from Feature 6 measures 3.7 x 1.1 mm. Carbonized archeological specimens of little barley are almost invariably shorter and mostly wider (see Hunter 1992:Appendix E). There is no evidence for exploitation, much less cultivation, of foxtail barley. However, the seeds are edible, and the species is abundantly distributed in the central and northern Plains (Great Plains Flora Association 1977:497).

Asteraceae and Sunflower. Seeds identified to the Asteraceae family occur in five samples. The total SNE of only five is represented by one whole achene and 32 pericarp fragments. The whole achene from a Feature 18 sample is identifiable as sunflower (*Helianthus* sp.). It measures 4.8 x 1.9 mm. Applying Richard A. Yarnell's (1978:296) shrinkage adjustments of 11 percent for length and 27 percent for width, the measurements of the original uncarbonized achene are estimated at 5.3 x 2.4 mm. Such measurements are well below the length and width ranges for domesticated populations from late prehistoric sites elsewhere in the midcontinent (see Yarnell 1978:Table 1). Instead, the measurements are within those for wild or ruderal populations. The 32 pericarp fragments also compare favorably with those produced by sunflower, including the whole sunflower achene from Feature 18, but such identifications cannot be certain.

Other Carbonized Seeds. The array of remaining carbonized seeds may represent an assortment of uses, although many might have been introduced nonculturally followed by fortuitous carbonization. Of the nine taxa discussed here, seeds of only two occur in more than two samples. These consist of bedstraw (*Galium* sp.), represented by 7 seed fragments (SNE = 4) in 4 samples, and grama grass (*Bouteloua* sp.), represented by 31 seed fragments (SNE = 9) in 3 samples. The majority of the latter (28 fragments [SNE = 6]) occur in the sample from Feature 5, which is one of the possible cultural features located above 70–80 cm bs. Two bedstraw seed fragments occur in this sample as well, and there also are bedstraw seed fragments in the samples from Features 4 and 13. These two features were situated above 80–90 cm bs, and the samples from both contain relatively abundant grass seed fragments. It can be surmised that they might have been introduced by rodents as part of chamber linings or by humans as part of bison chips used for fuel. In any regard the distribution of such materials does call into question the cultural versus noncultural origin of all identified features that occurred above about 70 cm bs at 14HO308.

Other identified taxa consist of pigweed (*Amaranthus* sp.), spurge (*Euphorbia* sp.), pokeweed (*Phytolacca americana*), knotweed (Polygonum sp., biconvex), and vervain (*Verbena* sp.). Less certain identifications of singular specimens are sage or saltbush (*Atriplex* sp.) and buttercup (*Ranunculus* sp.). Interestingly, all of these occur in "good" features, but their SNEs (mostly 1) do not implicate them as economically or ritually useful plants.

Discussion and Summary

The assemblage of plant remains from 14HO308 is relatively unusual, at least in comparison to that from other late prehistoric sites farther to the east in the Central Plains. The remains of maize, squash, and several other cultivated plants are noticeably absent, and there is no evidence whatsoever for any local cultivation, even of native plants, such as chenopod and little barley. Maize was present in the Central Plains by at least ca. A.D. 700–750 (Adair 2006:Table 15.1), and it had achieved paramount dietary status in other parts of the midcontinent by A.D. 1150–1225. For example, maize remains had the highest ubiquity index for flotation-recovered plant remains from House 4 at 25FT22, an Upper Republican site in the Medicine Creek valley (Puseman 1996). Bevitt (1999:36, 61, 92) also reported on the common to abundant presence of maize remains at the Lundeen, Booth, and Bell sites, located about 80 km to the south, and 115 and 120 km to the southeast, respectively. However, these three sites might have been occupied a little later, and the Horsethief site seems to represent a functionally distinct site akin to other Upper Republican sites on the High Plains. The Upper Republican occupants of the Horsethief site appear to have depended entirely on gathered plants in addition to animal products.

Sampling error could account for its absence, but most likely maize and other crops were not cultivated in the vicinity of 14HO308 or they were extremely minor resources during the period(s) of site occupation. If the site served as an overwintering encampment for maize-growing cultivators living elsewhere during the warmer months of the year, at least some charred remains of maize and/or other domesticated plants would be expected, because such sites almost certainly would have been provisioned with stored or surplus foods from the primary agricultural village. In any regard the presence of seeds from fleshy fruits, such as plum and chokecherry, are suggestive of a warm weather or growing season occupation, minimally during the middle summer through early fall.

The evidence points to an intensive occupation by a group engaged solely in hunting and gathering. Apparently a great amount of burning occurred at the site, particularly of locally abundant hackberry wood. The site likely was located in the midst of a hackberry grove. This was the source not only for fuelwood, but also for the ubiquitous hackberry seeds and seed fragments that occur throughout the cultural and noncultural deposits. Fleshy fruits of elderberry, plum, chokecherry, and grape might have been consumed, and wild chenopod seeds were gathered. Edible underground tuberous roots, possibly those from the prairie turnip, probably were gathered, too. Such a nonagricultural subsistence strategy is not unlike that which prevailed during early historic times (e.g., among the Plains Apache) in western Kansas, other parts of contiguous eastern Colorado, and the Oklahoma and Texas panhandles.

FAUNAL ASSEMBLAGE

By David A. Byers

Excavations at the Horsethief site recovered an extensive assemblage of 3,725 faunal specimens that include the remains of a range of bird, mammal, reptile, and mollusk species. This report begins with a discussion of methods and continues with an overview of the various species identified within the assemblage. Bison (*Bison bison*) remains appear to represent the most important food animal within the assemblage, and special attention is given to those remains.

Methods

Identification to species and element was made in reference to comparative specimens included in the CAR faunal collection. Bone was coded using the faunal coding system developed by Lawrence C. Todd (1983, 1987, 1991) to document all specimens identifiable to skeletal element. In addition specimen size, rodent damage, carnivore gnawing, breakage, butchery, burning, and weathering stage (Behrensmeyer 1978; Todd 1987) were recorded for specimens 30 mm and larger. Specimens were identified conservatively to the most specific taxonomic category allowed by specimen completeness and available comparative specimens. Fragmentary bone too incomplete to identify to element was coded as body size Class III (medium artiodactyl), body size Class IV (large artiodactyls), mixed body size Class III/IV (Brain 1981), or an unidentified small mammal category. Specimens too fragmentary to place in any of the above categories were simply tallied as unidentified. Finally, data were quantified by number of identified specimens (NISP), minimum number of individuals (MNI), minimum number of elements (MNE), and minimum animal units (MAU) for analytical purposes.

Given the aggregation issues inherent in quantifying faunal assemblages (Grayson 1984), determining analytical units is an important first step in any faunal analysis. In this instance an understanding of the vertical distribution of materials was required before the construction of derived measures, such as MNI, MNE, or MAU. Two datasets were evaluated to accomplish this task. First, point provenience data collected by total station on bone specimens, plant material, and ceramic and flaked stone artifacts were employed to reconstruct the vertical distribution of cultural material. Figures 39 and 40 display the elevation data arrayed against easting and northing. As these plots illustrate, the vast majority of the cultural material occurs between 99.3 m and 99.0 m elevation, and the materials within this layer lack any obvious stratigraphic breaks. Second, a bilevel plot of body size Classes III and IV specimen counts displays a similar pattern (Figure 41). This plot demonstrates that the vast majority of the faunal assemblage lies between 99.4 m and 99.0 m elevation, and the trend displays a unimodal distribution centered on 99.1–99.2 m elevation (70–90 cm bs). Although all three plots indicate that a limited amount of cultural materials were found both above and below the obvious cultural layer, these remains are most parsimoniously explained as displaced by rodent activity, as prairie dog (*Cynomys* sp.) remains are a common component of the faunal assemblage (see below). Given the discrete vertical distribution of the faunal remains, the following analysis proceeds by assuming that all of the faunal material belongs to a single component.

Assemblage Composition

The Horsethief site produced an extensive assemblage, containing 3,725 faunal specimens (Table 19). In total the assemblage contains 3,648 vertebrate specimens. Of these, 2,840 (77.8 percent) were identifiable to the taxonomic orders Aves, Mammalia, or Reptilia. The remaining 77 specimens represent the invertebrate classes Bivalvia and Gastropoda. This section details these remains.

Twenty-nine specimens represent the order Aves. These include one goose (family Anitidae) based on a single left humerus. This individual likely represents either a snow goose (*Chen caerulescens*) or Canada goose (*Branta canadensis*). A single right tibiotarsus represents at least one prairie chicken (*Tympanuchus cupido*), and one left tibiotarsus and one right femur document at least one grouse-sized tetraonid. One right and one left carpometacarpus represent at least one bird from the family Corvidae, most likely a crow (*Corvus* sp.). In addition to the specimens identifiable to at least the family level, 22 more were identified simply as Aves.

With the exception of the single cut-marked goose humerus and three scored-and-snapped longbone specimens (see also Bone Modifications below), none of the other bird remains displays clear evidence of cultural modification. As a result their depositional history remains unclear. This is not to say that the unmodified bird remains do not document cultural activities. In fact, bird remains are relatively common components of zooarchaeological assemblages in many contexts (Reitz and Wing 1999).

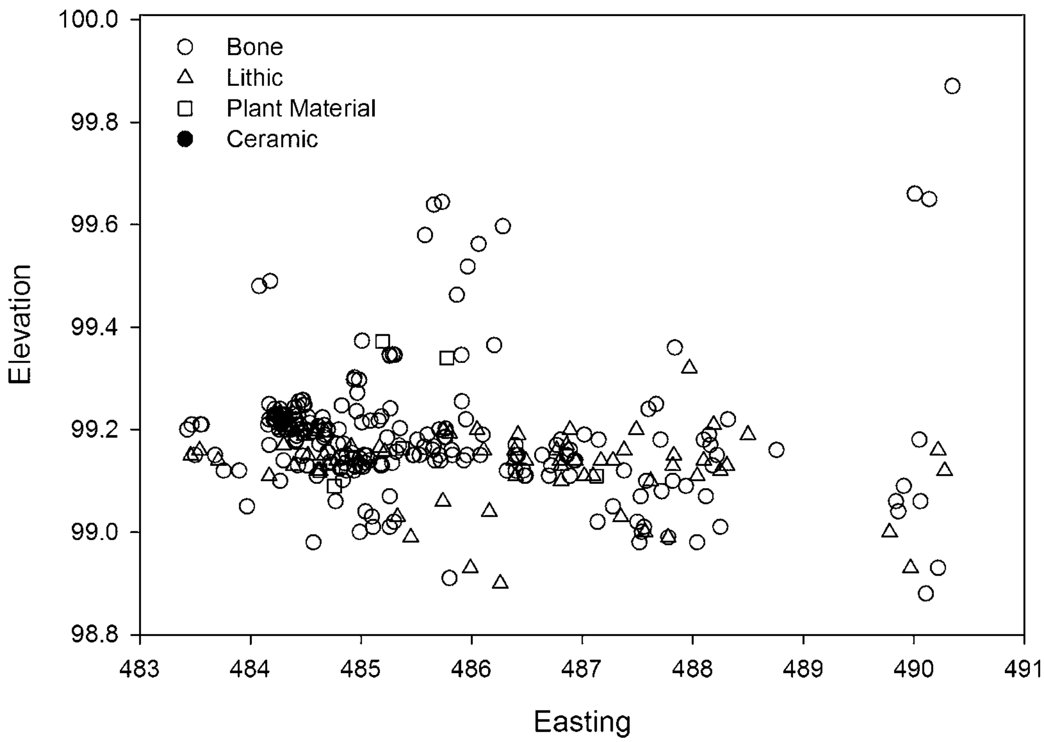


Figure 39. Cultural material by easting and elevation (98.8-100 m bs).

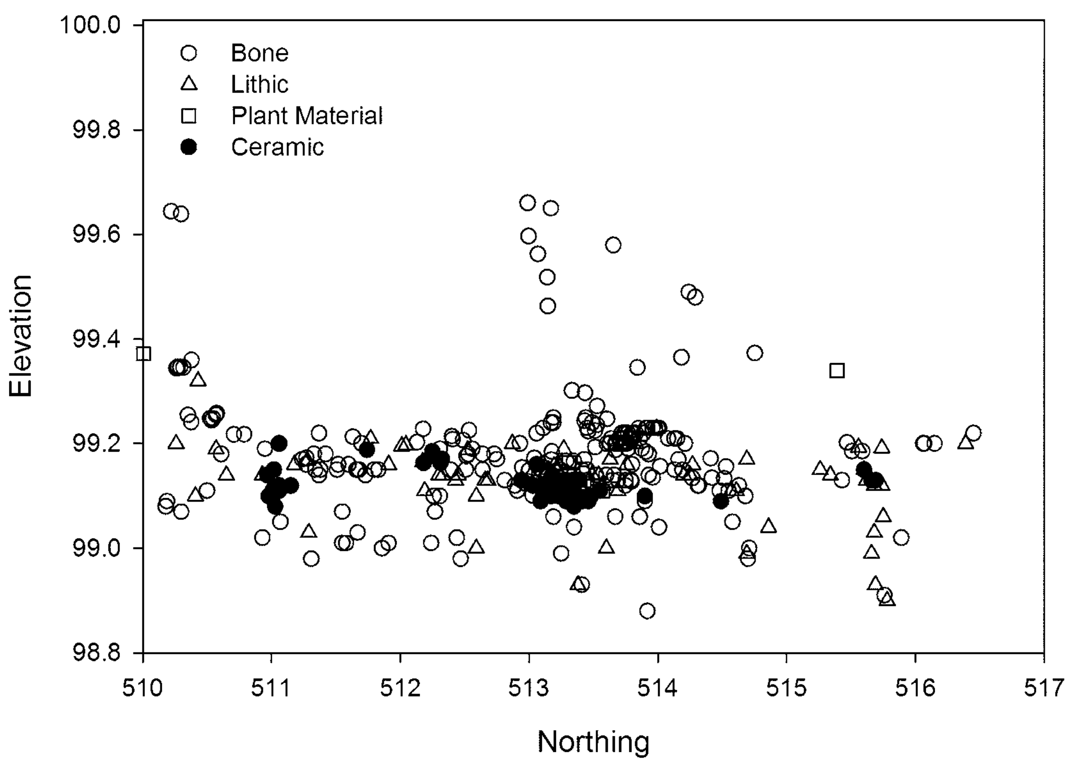


Figure 40. Cultural material by northing and elevation (98.8-100 m bs).

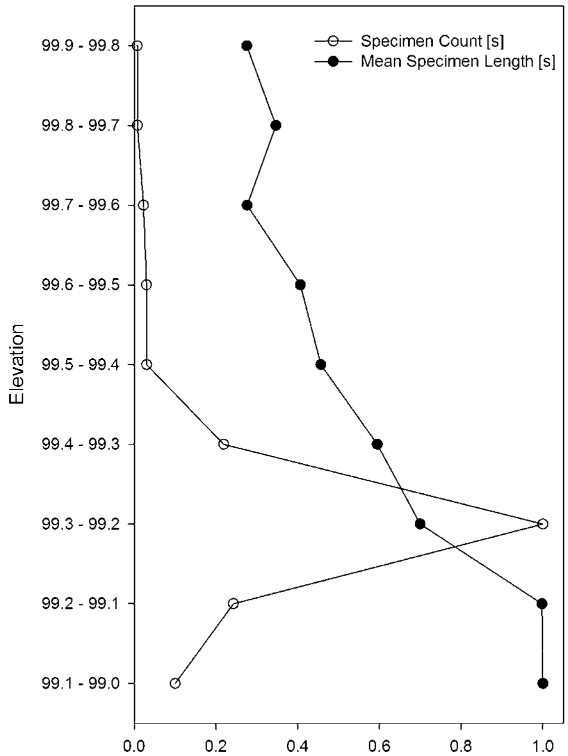


Figure 41. NISP and mean size by level for Class III and Class IV specimens.

However, given the lack of cultural modifications to the majority of the bird remains, any cultural interpretations of this part of the assemblage should be done with caution.

Within the order Mammalia, bison (*Bison bison*) and body size Class IV mammal remains represent 17.0 percent (N = 620) of the total vertebrate NISP and document at least three individuals based on right proximal ulnae. Fragments of unfused proximal humeral and tibial epiphyses and portions of an unfused distal femoral epiphysis indicate the presence of at least one subadult individual. A single heavily weathered bison/cow (*Bos taurus*) size radius was recovered from the first 20 cm of the deposit. This element likely represents a fourth large ungulate. However, given its location in the stratigraphic profile, it is unlikely that it is associated with the main bone accumulation. Instead, it may represent a recently deposited cow bone, so it is not included in any further analysis. The 14HO308 excavations failed to recover any complete bison teeth. Consequently, more precise age estimates and seasonality data cannot be derived from the bison remains. Body size Class III artiodactyls are also present in the assemblage (1.2 percent of total; NISP = 44). These specimens represent at least one pronghorn (*Antilocapra americana*), based on the identification of a single first phalanx. In addition 1,760 (48 percent of the total vertebrate NISP) large mammal specimens too fragmentary to identify to an artiodactyl taxon were tallied in a mixed Class III/IV category. Given the highly fragmentary nature of the artiodactyl bone in combination with the presence of cut marks and evidence for burning to a number of the specimens, the artiodactyl remains clearly represent the outcomes of ancient hunting and butchering episodes.

The Horsethief site assemblage also contains the remains of several smaller mammals. These include paired left and right mandibles of a single wolf (*Canis lupis*), as well as 25 loose teeth, vertebrae, and metapodial fragments identified more conservatively as *Canis* sp. Proximal portions of one left and one right humeri document at least one skunk (*Mephitis mephitis*) and a single right mandible represents one beaver (*Castor canadensis*). Based on left mandibles, 28 specimens in the assemblage account for at least 5 prairie dogs (*Cynomys* sp.), and a right mandible documents a lone unidentified vole (family Cricetidae). In addition to the specimens identified to at least the family level, 102 specimens were classified as unidentified small mammal.

With the exception of the single beaver mandible, which displays cut marks to its ascending ramus, none of the other small mammal remains displays evidence of cultural modification. As a result their context in the deposits remains unclear. Skunk, prairie dog, and vole all exploit fossorial behaviors (i.e., they are adapted for burrowing or digging), and their presence at 14HO308 simply may represent animals that died in their burrows. For this reason the presence of these animals is most parsimoniously explained as intrusive. The wolf mandibles display extremely worn teeth, most likely belonging to an old individual. The wolf remains may document an animal that died while scavenging after humans abandoned the site, although two culturally modified canid metapodials indicate that people interacted with the remains of at least one canid at the site.

Table 19. Summary of Represented Faunal Taxa.

	Class	Order	Family	Genus	Species	NISP	MNI
			Vertebrates				
	Aves	Anseriforms	Anatidae	Unideintified		1	1
		Galliformes	Tetraonidae	*Tympanuchus*	cf. *cupido*	1	1
			cf. Tetraonidae	grouse size		2	
		Passeriformes	Corvidae	cf. *Corvus*	sp.	2	1
			Corvidae	Unideintified		1	
		Unidentified Aves				22	
	Mammalia	Artiodactyla	Bovidae	*Bison*	*bison*	416	3
			Bovidae	*Bos/Bison*		1	1
			Antilocapridae	*Antilocapra*	*americana*	1	1
		Class IV (bison size)				202	
		Class III/IV				1760	
		Class III (pronghorn size)				43	
		Carnivora	Canidae	*Canis*	*lupis*	2	1
			Canidae	*Canis*	sp.	23	
			Mephitidae	*Mephitis*	*mephitis*	2	1
		Rodentia	Castoridae	*Castor*	*canadensis*	1	1
			Cricetidae	Unidentified		1	1
			Sciuridae	*Cynomys*	sp.	28	5
		Unidentified Small				102	
	Reptilia	Tustudines	Emydidae	*Terrapene*	sp.	18	3
			Unidentified			211	1
	Unidentified					808	
				Total NISP Vertebrates		3648	
			Invertebrates				
Bivalvia	Unionoida	Unionoidea	Unidentified		51	2	
		Veneroida	Sphaeriidae	Unidentified		23	14
	Gastropoda	Basommatophora	Planorbidae	Unidentified		3	3
				Total NISP Invertebrates		77	

Turtle remains are relatively common in the assemblage (NISP = 229) and represent at least four individuals. These include at least three box turtles (*Terrapene* sp.), based on left scapulae. Fragmentary post-cranial elements suggest that at least one additional individual is represented in the assemblage. The turtle remains, however, lack any clear evidence of cultural modification and their depositional history remains unclear. Much like the bird bone, this is not to say that these animals do not represent human activities. Archeological contexts often produce turtle remains, and these reptiles likely were used as food items by ancient peoples wherever they were found (Olsen 1968; Reitz and Wing 1999). Nevertheless, box turtles also exploit fossorial behaviors, and their presence in the deposit simply may represent animals that died while aestivating (remaining dormant during the hot, dry summer) or hibernating. Consequently, any interpretations of these specimens as food remains also should be offered with caution.

The Horsethief site faunal assemblage also contains the remains of at least three invertebrate taxa. The most common are freshwater mollusks. These consist of 51 shell fragments, representing at least 2 mussels (family Unionidae), and 23 complete or fragmentary specimens of fingernail clam (family Sphaeriidae). Finally, the assemblage also contained the remains of three gastropods from the family Planorbidae. These species all reflect the nearby presence of Buckner Creek.

Seasonality of Occupation

None of the taxa identified for 14HO308 provide unambiguous evidence for season of occupation. For example, the presence of migratory birds in an archeological assemblage can inform on seasonality if the timing of contemporary populations presents a reasonable proxy for those in the past. Identified migratory bird remains from the Horsethief site are limited to a single goose (family Anitidae), based on one left humerus. Unfortunately, this specimen may belong to one of two species, one migratory and one not, whose ranges overlap in Kansas. If the goose humerus belongs to a snow goose, and given that 14HO308 lies within this species' contemporary winter range, then this specimen indicates at least a winter occupation. Conversely, this specimen does not inform on seasonality if it derives from a Canada goose, as this species inhabits central Kansas year-round (Mowbray et al. 2002).

The turtle remains provide another potential avenue for deriving seasonality data. Since box turtles aestivate during the cooler months, often entering an existing burrow or digging a new one sometime in October and remaining underground until the middle of spring (Pope 1971; Smith 1950), then their remains might signal a warm season occupation, especially if these specimens are viewed as food items. Conversely, the turtle remains simply may document individuals that died in burrows that penetrated the stratigraphic unit containing the cultural layer. Unfortunately, the depositional history of the turtle remains is currently uncertain and a clear picture of seasonality is lacking.

Bone Artifacts

The Horsethief site faunal assemblage contains eight pieces of culturally modified bone, representing tools or non-utilitarian items. These include two bone awls (Figure 42). Specimen 235-PP 135, derived from a piece of rib blade, measures 83.7 mm and displays one polished, needle-like end. Specimen 214-PP 187, derived from a long bone shaft fragment, measures 104.6 mm and displays a fine polish across its entire surface. This artifact also exhibits four inscribed lines across its nonworking end and was sharpened to a fine point at one time. Specimen 169-PP 159 represents a fragment of an unidentified item, likely an ornament, fashioned

Figure 42. Bone awls.

Figure 43. Bone pendant and exhausted bead blanks.

from a broad, thin piece of bone (Figure 43). This specimen measures 32.6 mm (incomplete dimension) in length and 24.7 mm in width, exhibits two drilled holes along one margin, and displays five longitudinal inscribed lines across one surface.

Five cut-and-snapped long bone ends were also identified within the faunal assemblage (Figure 43). These likely represent element portions discarded during bead manufacture. Specimen 370.2-PP 97 derives from the proximal humerus of an unidentified bird. It measures 16.6 mm and displays a cut groove around approximately one-fifth of the circumference of the fragment's distal end. Specimen 340-PP 161 derives from a proximal ulna from an unidentified bird, measures 14.6 mm, and displays a cut groove around approximately one-fourth of the circumference of the fragment's distal end. Specimen 345-PP 99, derived from the distal humerus of an unidentified bird, measures 15.7 mm and displays a cut groove around approximately one-third of the circumference of the fragment's proximal end. Specimen 345-PP 100, derived from the proximal metapodial of an unidentified canid, measures 21.8 mm and displays the remnants of a cut groove around the entire circumference of the fragment's distal end. Specimen 345-PP 97 derives from the proximal metapodial of an unidentified canid, measures 16.0 mm, and also displays a cut groove around the entire circumference of the fragment's distal end.

Bison Skeletal Element Frequencies

Inspection of the bison skeletal element frequencies indicates that appendicular elements dominate the assemblage (Table 20, Figure 44). Scapulae are poorly represented and proximal ulnae are most common (for the remainder of this discussion, proximal and distal refer to halves of elements), whereas distal ulnae and distal radii are least common and, with the exception of humeri, proximal portions are better represented than distal portions. Carpals and metacarpals are completely absent from the assemblage, suggesting that lower forelimbs were culled at the procurement locale and not transported back to camp. Elements of the hindlimb display a pattern similar to those of the forelimb. The assemblage lacks innominate bones, whereas distal femora are better represented than proximal femora, and proximal tibiae are better represented than distal tibiae. Tarsals, including astragali and calcanii, and metacarpals are once again absent, indicating that lower hindlimbs also were not selected for transport back to camp. Moreover, the assemblage lacks any evidence for phalanges, further highlighting the lack of lower limb bones in the assemblage. Finally, elements of the axial skeleton are relatively rare. In fact, this analysis failed to identify any specimens of bison crania, mandibles, and vertebrae, although the fragmentary state of much of the assemblage may obscure a few of these bones.

The apparent over-representation of upper forelimbs begs the question: Why does the assemblage contain differentially represented skeletal elements? Do the skeletal element frequencies result from human subsistence choice, or does this pattern result from selective deletion by non-human taphonomic agents? Further, if noncultural taphonomic processes had little impact on the assemblage, do the identified skeletal part summaries reflect the nutritional requirements of Late Prehistoric hunter-gatherers in west-central Kansas? Here the analysis continues by comparing the skeletal element frequencies with Lee A. Kreutzer's (1992) bone density values, Todd's (2003) settling velocity values, and Alice M. Emerson's (1990, 1993) bison utility indices.

Following Lyman's (1984, 1985) recognition that bone density can influence the survivorship of skeletal parts in an archeological deposit, Kreutzer's (1992) volume bone mineral densities for bison

Table 20. Summary of Bone Counts and Analytical Indices.

Element	%MAU	DENSITY[1]	SCAN SITE	STD Vs[3]	[S]MAVGTP[2]	[S]MAVGSKF[2]	[S]MAVGMAR[2]
Cranium		0.71	PET SV		14.20		
Mandible		0.49	DN5	78.7	14.20		
Atlas		0.91	AT2	57.1	6.40	1.60	
Axis		0.97	AX3		7.80	1.10	
Cervical		0.62	CE2		56.60	3.30	
Thoracic		0.42	TH1	44.6	84.70	16.80	
Lumbar		0.39	LU3	52.3	82.90	18.30	
Rib	0.39	0.57	RI3	33.5	100.00	38.70	
Scapula	0.20	0.50	SP1	46.8	31.60	53.70	36.90
Humerus PR	0.20	0.25	HU2		31.60	95.60	71.50
Humerus DS	0.20	0.48	HU4	72.3	25.10	77.20	69.20
Radius PR	0.20	0.48	RA1	64.6	16.50	67.40	68.00
Radius PR		0.35	RA5	64.6	12.10	59.10	50.30
Ulna PR	1.00	0.69	UL2	68.0	20.80	72.30	68.60
Ulna DS		0.35	RA5	68.0	12.10	59.10	50.30
Carpal		0.43	MEAN		6.60	39.20	36.20
Metacarpal PR		0.59	MC1	80.9	3.90	29.20	29.20
Metacarpal DS		0.53	MC6		2.60	24.20	18.20
Innominate		0.53	AC1		54.70	70.60	6.70
Femur PR	0.40	0.34	FE3	65.9	69.40	100.00	97.20
Femur DS	0.80	0.26	FE5	65.9	69.40	100.00	98.20
Tibia PR	0.80	0.41	TI2	80.6	40.80	97.10	100.00
Tibia DS	0.40	0.41	TI5	80.6	25.50	78.00	84.50
Astragalus		0.72	AS1	94.0	13.60	51.60	55.20
Calcaneus		0.80	CA2	84.6	13.60	51.60	55.20
Tarsal		0.65	MEAN		13.60	51.60	55.20
Metatarsal PR		0.52	MR1	100.0	7.50	37.50	40.60
Metatarsal DS		0.48	MR6	100.0	4.50	30.50	25.20
First Phalange		0.48	P11	74.5	2.40	23.50	12.85
Second Phalange		0.41	P21		2.40	23.50	12.85
Third Phalange		0.32	P31	57.9	2.40	23.50	12.85

[1]Volume Density (VD) values for Kreutzer (1992).

[2]Settling Velocities (STD Vs) from Todd (2002).

[3]Utility Indices ([S]MAVGTP, [S]MAVGSKF, and [S]MAVGMAR) from Emerson (1990).

skeletal parts are used to evaluate differential survivorship within the assemblage. Density values employed here represent the most common scan site for each skeletal part, using separate values for proximal and distal halves where applicable (Table 20). A scatterplot comparing %MAU values with volume bone mineral densities indicates that there is no correlation between skeletal part survivorship and density values (Figure 45). In fact, there is a weak negative correlation between %MAU and density ($r_s = -.298$, $p = .103$). Throughout the assemblage, elements with some of the highest densities, and therefore those most likely to survive density-mediated attrition, are completely absent. For example, no astragali, calcanii, atlas vertebrae, or axis vertebrae—all elements with some of the

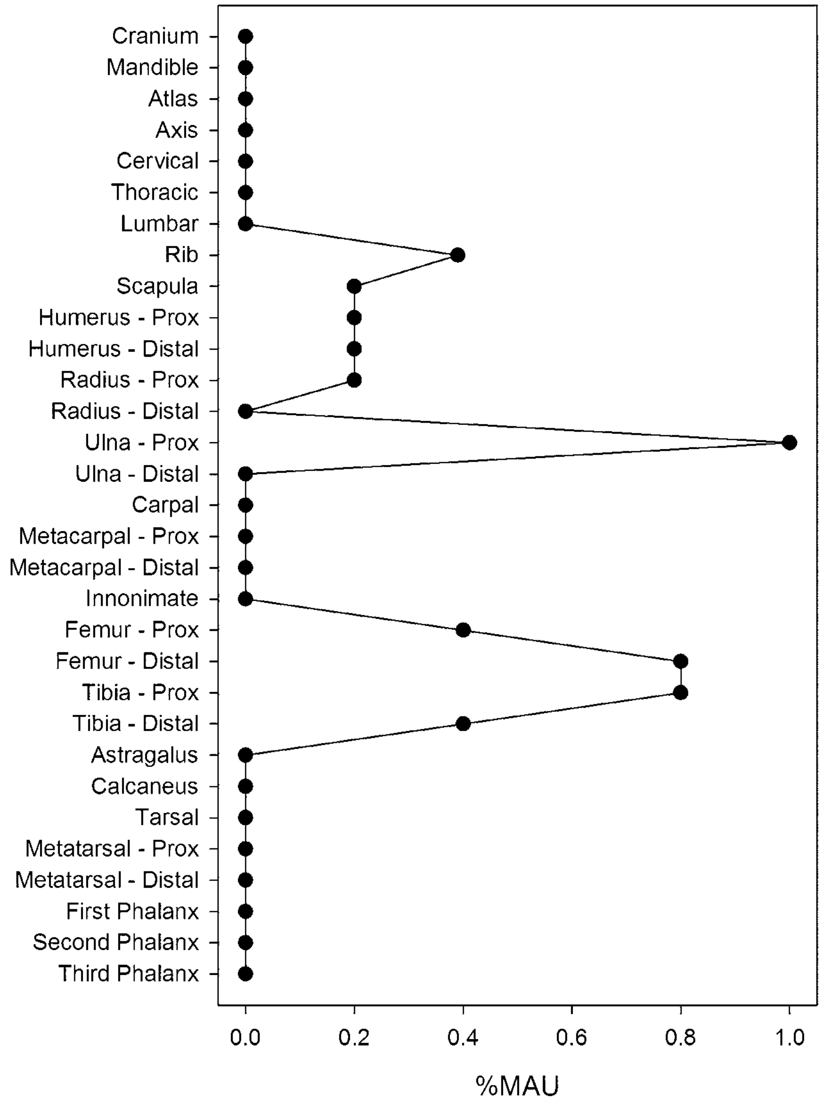


Figure 44. Skeletal element frequencies by %MAU.

highest density values—exist in the assemblage. Because of the lack of positive correlation between %MAU and survivorship, volume bone mineral density does not by itself account for the differential representation of skeletal parts within the 14HO308 assemblage.

Because this site lies in an alluvial setting, fluvial transport also may condition the relative frequencies of skeletal parts recovered. To evaluate this model, skeletal part frequencies are compared with a set of experimentally derived bone settling velocities that document, based on morphology and bone structure, the velocity at which a particular skeletal element will sink when submerged in water (Todd 2003). The results of this analysis failed to document any relationship between settling velocity and element abundance (rs = -.151, p = .505; Figure 46), indicating that this does not by itself account for the differential representation of skeletal parts within the assemblage.

To understand how economic variables might have conditioned the transport decisions behind the introduction of bison parts into the Horsethief site, %MAU values are next compared with a number of nutritional utility indices for bison (Table 21). This analysis employs a series of utility indices, developed by Emerson (1990, 1993) to measure the nutritional utility of bison. The Total Products Model ([S]MAVGTP) measures the general utility of the combined caloric yield of skeletal fat, muscle

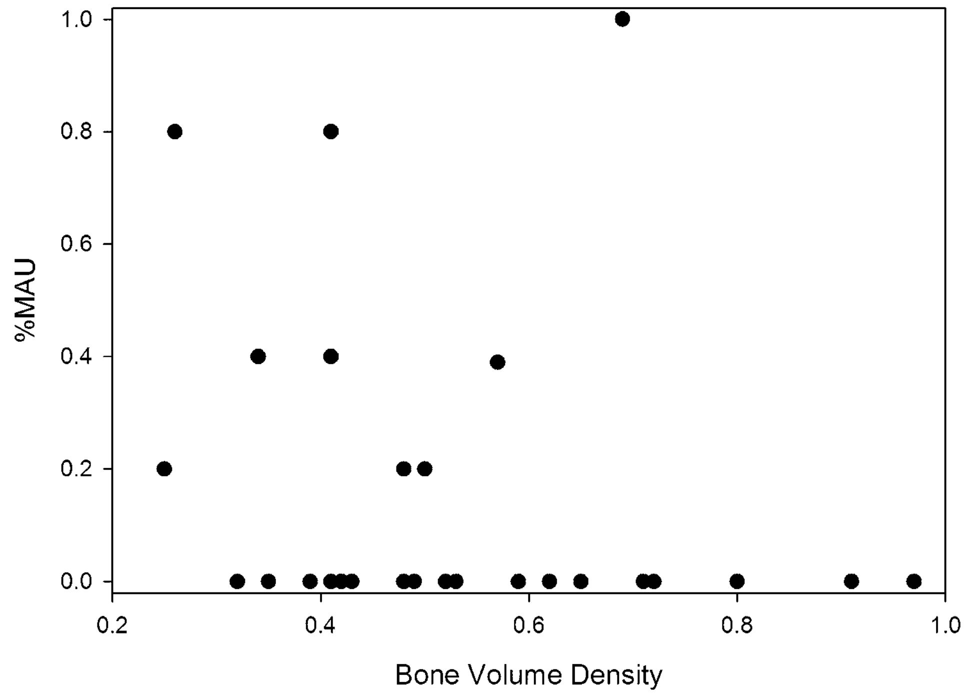


Figure 45. Biplot of %MAU by bone volume density.

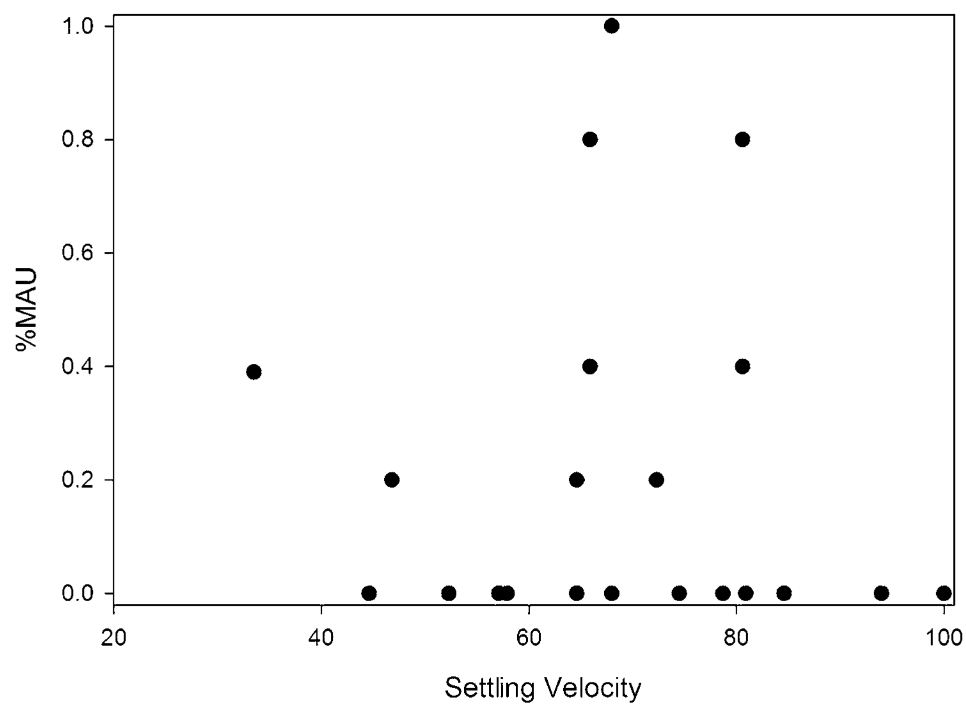


Figure 46. %MAU versus settling velocities.

protein, and intramuscular and other dissectible fat. The Skeletal Fat Model ([S]MAVGSKF) measures the caloric yields of the combined marrow and grease within bone fat content. Finally, the Marrow Fat Model ([S]MAVGMAR) assesses the relative caloric yields of skeletal elements based on marrow alone (Emerson 1990). All of the indices employed during this analysis are standardized on a scale from 0 to 100 and are modified to account for riders.

Skeletal part abundances correlate positively and significantly with the Total Products Model (r_s = .496, p = .043; Figure 47). Surprisingly, however,

Table 21. Summary of Bison Specimens Identified to Element.

Element	NISP	MNE Left	MNE Right	MNE Unisided	MNE Total	MAU	%MAU
Cranium							
Mandible							
Hyoid							
Atlas							
Axis							
Cervical							
Thoracic							
Rib	273	10	12	5	27	1.0	0.39
Costal Cartilage	8			5	5	0.2	0.07
Sternum							
Lumbar							
Sacrum							
Caudal							
Scapula	4	1			1	0.5	0.20
Humerus PR	3		1		1	0.5	0.20
Humerus SH	2		1		1	0.5	0.20
Humerus DS	1	1			1	0.5	0.20
Radius PR	1		1		1	0.5	0.20
Radius SH	1			1	1	0.5	0.20
Radius DS							
Ulna PR	6	2	3		5	2.5	1.00
Ulna SH	3	1	1		2	1.0	0.40
Ulna DS							
Carpal							
Metacarpal PR							
Metacarpal SH							
Metacarpal DS							
Innominate							
Femur PR	2	2			2	1.0	0.40
Femur SH	8	1	1		2	1.0	0.40
Femur DS	2	2	2		4	2.0	0.80
Patella	1	1			1	0.5	0.20
Tibia PR	8	1	3		4	2.0	0.80
Tibia SH	19	2	2		4	2.0	0.80
Tibia DS	3		2		2	1.0	0.40
Lateral Malleolus	2		2		2	1.0	0.40
Astragalus							
Calcaneus							
Tarsal							
Metatarsal PR							
Metatarsal SH							
Metatarsal DS							
First Phalanx							
Second Phalanx							
Third Phalanx							
Sesimoid							
Unidentified	69						

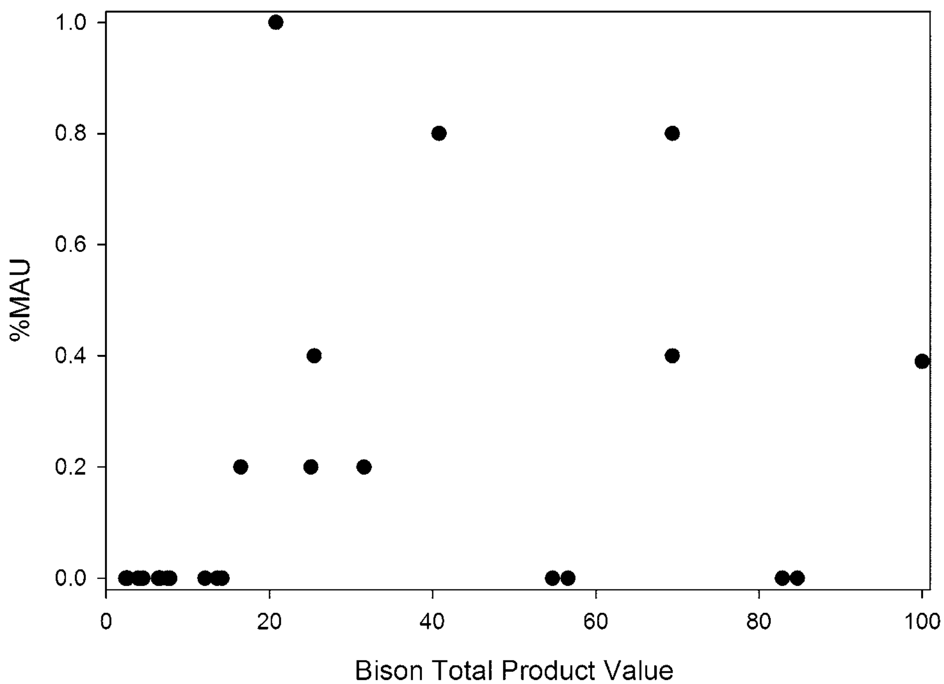


Figure 47. %MAU versus Total Product Model.

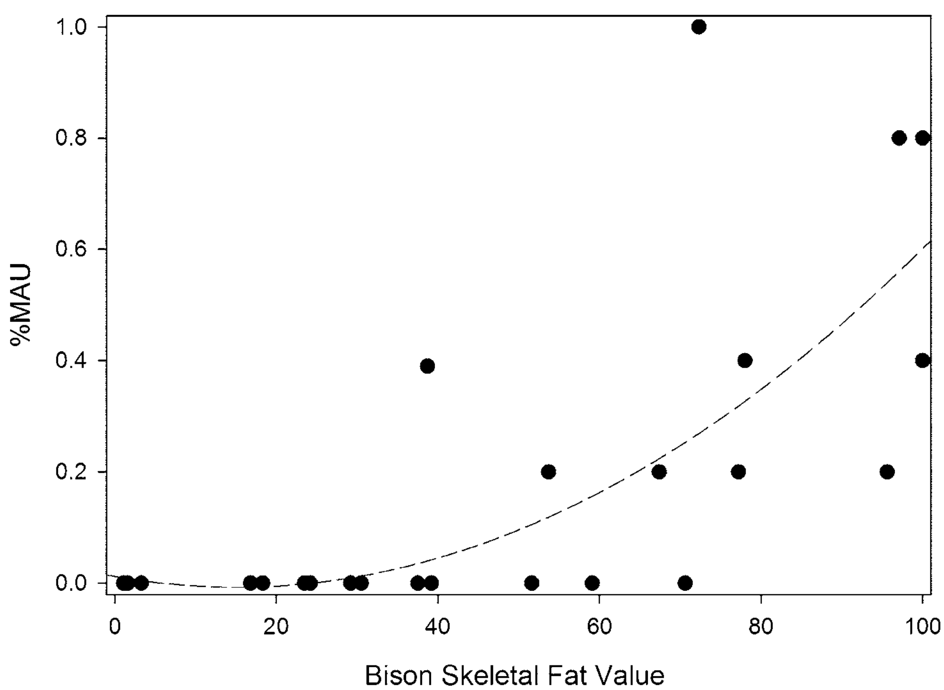


Figure 48. %MAU versus Skeletal Fat Model.

elements representing some of the highest overall utilities are either under-represented (ribs) relative to upper limbs or completely absent from the assemblage (vertebrae and innominate bones). Such a pattern suggests that something beyond bulk meat protein might have been driving the transport decisions behind the bison assemblage.

Comparison of element frequencies with the Skeletal Fat Model suggests that within-bone fat utility might have conditioned transport decisions that lead to the bone accumulation encountered at 14HO308 ($r_s = .739$, $p<.000$; Figure 48). The relationship between skeletal fat and element frequency describes a loose gourmet utility strategy (Binford

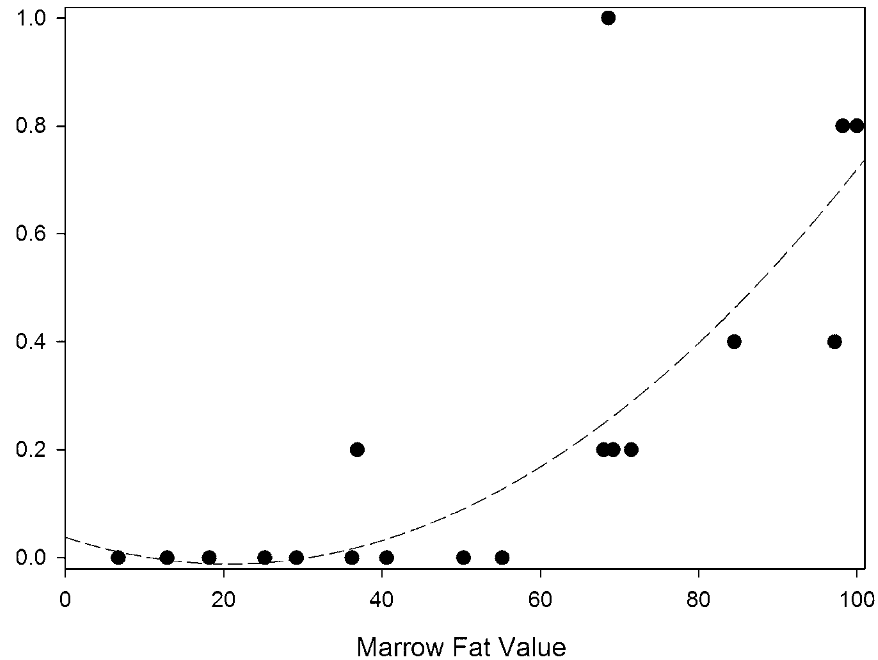


Figure 49. %MAU versus Marrow Fat Model.

1978). In general only those skeletal parts with the highest skeletal fat values appear to have been introduced into the deposit.

Comparison of %MAU with the Marrow Fat Model provides the highest rank order correlation between element abundances and utility as measured on any scale (rs = .792, p<.000; Figure 49), although the difference between this result and the one identified for the Skeletal Fat Model is likely negligible. Much like the patterning identified between %MAU and the Skeletal Fat Model, the relationship between marrow utility and element frequency describes a gourmet utility strategy. In this instance only those skeletal parts with the highest marrow fat values were introduced into the deposit, suggesting that marrow utility might have influenced the transport of food packages from kill sites to the residential base.

Given the significant statistical relationships between skeletal part abundances and utility indices evaluated here, a stepwise regression was run using %MAU as the dependant variable and all of the potential taphonomic indices (density and settling velocity, as well as the various utility indices) as potential predictor variables. (Note that up to this point all analyses have employed non-parametric statistics because they make no assumptions about the underlying distributions of the data. While informative, this use of a parametric method should be viewed with caution.) The results of this test support those generated by the index-specific analyses presented above. In this case all variables were removed with the exception of the Skeletal Fat Model, which alone accounts for over 56 percent of the variability in %MAU (rs = .750; F = 19.326, p = .001). This result also supports the earlier observation that non-human taphonomic processes played a limited role in the formation of the bison assemblage. Conversely, element frequencies are best explained by transport decisions designed to maximize the amount of skeletal fat within any load of transported bison body parts.

Bone Modifications

Bone modifications can also aid in understanding the taphonomic history of the Horsethief site bison remains. These include bone surface weathering, rodent gnawing, and carnivore ravaging, as well as burning and butchery related modifications resulting from human subsistence behaviors.

Bone Surface Weathering

Todd's (1987) modification of Anna K. Behrensmeyer's (1978) system for recording weathering stages was employed to record surface weathering

Table 22. Bone Surface Weathering Stages.

Stage[1]	Compact Bone	Cortical Bone
1	Unweathered, articular surfaces intact with no surface cracking	Unweathered
2	Articular surfaces intact with some surface cracking	Limited surface weathering some longitudinal cracking
3	Articular surfaces exhibit some deterioration, but more than 50% of the surface remains intact	Light surface flaking, deeper cracking
4	Intact articular surfaces restricted to "islands," less than 50% of the articular surface remains intact	Patches of fibrous bone with moderate flaking and cracking
5	No articular surface area remains intact	Deep cracking and extensive surface flaking
6	Bone severely deteriorated, large areas of fibrous bone exposed	Bone falling apart in situ
7	Fragment, inapplicable fragment, inapplicable	
8	Chemically altered, or original surface no longer visible	Chemically altered, or original surface no longer visible

[1]Todd's (1987) weathering stages, modified from Behrensmeyer (1978).

to the 14HO308 bison remains (Table 22). In general the bison bone displays low weathering stages, with 70.3 percent (N = 230) of the specimens with bone surfaces displaying Stage 1 weathering, 17.4 percent (N = 57) displaying Stage 2 weathering, 8.0 percent (N = 26) displaying Stage 3 weathering, and the remainder displaying Stage 4 or greater weathering. This pattern mirrors the one when all artiodactyl-size specimens (body size Classes III, IV, and III/IV, as well as bison) are evaluated for degree of weathering. A little more than 82.1 percent (N = 804) of the specimens with bone surface display Stage 1 weathering, 10.4 percent (N = 102) display Stage 2 weathering, 4.8 percent (N = 47) display Stage 3 weathering, and the remainder display Stage 4 weathering or greater. Further, the two sets of weathering data display a significant correlation ($r_s = .986$, $p<.000$), indicating that insofar as bone surface weathering has modified the faunal materials, all of these various subsets of the assemblage share similar taphonomic histories. Finally, the low weathering stages suggest that sediments aggraded relatively quickly and covered the occupational surface occupied by the foragers responsible for the creation of the Horsethief site soon after their departure.

Rodent Modification

Faunal analysts recognize rodents and carnivores for their ability to condition a faunal assemblage (Binford 1981; Blumenschine 1986, 1988; Blumenschine and Marean 1993; Dixon 1988;

Table 23. Modified Bison Bone.

Element	NISP	Rodent Gnawed	% Rodent Gnawed	Tooth Marked	% Tooth Marked	Cutmark	% Cutmark	Impact Fracture	% Impact Fractures
Rib	273			25	9.2	18	6.6		
Scapula	4			2	50.0				
Humerus	6			2	33.3	2	33.3		
Radius	2								
Ulna	9	1	11.1	1	11.1			1	11.1
Femur	12			7	58.3				
Tibia	30	1	3.3	5	16.7			2	6.7
Shaft Frag	30	1	3.3	5	16.7	4	13.3	1	3.3
Totals	416	3	0.7	47	11.3	24	5.8	4	1.0

Haynes 1980, 1983; Hudson 1993; Maguire et al. 1980). Rodents, especially porcupines, are known to gnaw on bone, often leaving a readily identifiable configuration of multiple grooves that are "relatively broad, flat-bottomed or slightly rounded in cross section, and parallel or nearly parallel to each other" (Fisher 1995). Less than 1 percent of the bison bone specimens show evidence of rodent modification, and such modifications are absent from the remainder of the assemblage (Table 23). Consequently, rodent gnawing is unlikely to have obscured or deleted many cultural bone surface modifications and unlikely to have altered the survivorship of the skeletal parts at 14HO308.

Carnivore Ravaging

A number of specimens display evidence for carnivore modification. These include 11 percent (N = 47) of the specimens identified as bison, 14 percent (N = 28) of those identified as body size Class IV, 3 percent (N = 49) of those identified as body size Class III/IV, and 7 percent (N = 3) of the body size Class III specimens (Table 23). These include fragments of ribs, scapulae, humeri, ulnae, femora, tibiae, and unidentified longbone shaft fragments. In addition to the specimens showing tooth marks, several others display a pattern of selective deletion highly suggestive of canid ravaging (Binford 1981; Haynes 1980). Although several fragments of articular ends are present in the assemblage, more often proximal and distal portions were documented by shaft fragments and not the associated articular surfaces. Articular surfaces are often targets for carnivores due to the bone grease trapped within their cancellous tissues (Binford 1981; Haynes 1980). Therefore, long bone ends will often suffer the greatest relative attrition in a carnivore-ravaged assemblage. As the Horsethief site faunal remains display patterning consistent with carnivore raveng-ing, such activity has likely conditioned the skeletal part frequencies to some extent.

Cultural Bone Modifications

The bison/large mammal assemblage contains significant evidence for butchery and the acquisition of within-bone nutrients. These modifications include burning, green bone breakage, fragment size, cut marks, and impact scars. Burned (carbonized or calcined) specimens were relatively common within the assemblage. These include 17 percent (N = 65) of the specimens identified as bison, 17 percent (N = 35) of those identified as body size Class IV, 31 percent (N = 547) of those identified as body size Class III/IV, and 5 percent (N = 2) of the body size Class III specimens. Of the bison-size specimens, 19 percent (N = 77) display green bone fractures, whereas 51 percent (N = 105) of the body size Class IV, 9 percent (N = 157) of the body size Class III/IV, and 26 percent (N = 11) of the body size Class III are similarly modified. The assemblage also is highly fragmented. Bison bone averages 83 mm in length; body size Class IV specimens average 35 mm in length; body size Class III/IV specimens average 21 mm in length; and body size Class III specimens average 37 mm in length. Note that for those specimens belonging to or potentially belonging to bison, the more general the taxon identification, the smaller the average fragment size.

Several specimens also display direct evidence of butchery in the form of cut marks and/or impact scars. Six percent (N = 24) of the bison remains, 1 percent (N = 2) of the body size Class IV specimens, less than 1 percent (N = 6) of the body size Class III/IV specimens, and none of the body size Class III specimens display cut marks. Within the bison assemblage, cut-marked elements consist of 18 rib fragments, 2 humerus shaft fragments, and 4 unidentified long bone shaft specimens. One percent (N = 4) of the bison remains, less than 1 percent (N = 1) of the body size Class IV specimens, less than 1 percent (N = 2) of the body size Class III/IV specimens, and 2 percent (N = 1) of the body size Class III specimens display impact scars. Within the bison assemblage, elements displaying impact scars consist of one fragment of an ulna, two tibia fragments, and a single unidentified longbone shaft fragment.

Spatial Distribution

The overall distribution of bone forms an interesting pattern and appears differentially distributed across the site as a function of specimen size. Figure 50 shows the point provenience locations for piece-plotted specimens measuring greater than 5 cm in length, superimposed over a density contour map based on the frequency of all bone specimens per square meter. Larger specimens were recovered from across the excavation block but display a notable concentration associated with Features 14 and 15.

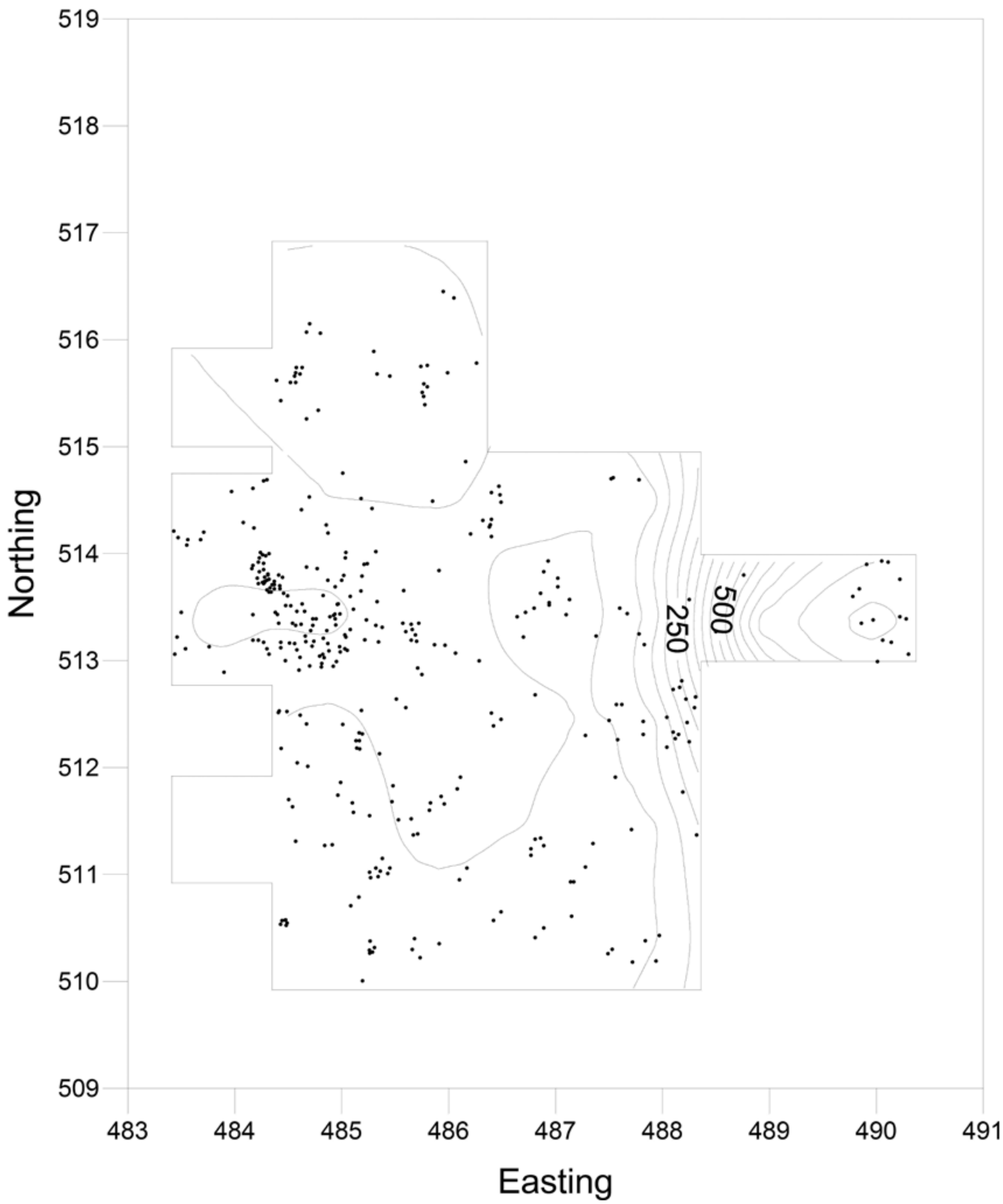


Figure 50. Point provenience locations for specimens >5 cm in length.

In contrast the overall assemblage concentrates in Unit 13 and appears to center on Feature 17/18, interpreted as a small pithouse. In fact, over 1,600 bone specimens, many burned, were recovered from this area of the excavation. When viewed together, this size-mediated spatial pattern suggests that the excavation block captured some recognizable site structure. In this case it appears that some initial processing, including marrow extraction, occurred within the western portions of the excavation block, while more intensive bone processing, perhaps for bone grease, occurred in association with or sometime after the construction of the small pithouse identified in Unit 13.

Discussion

Upper Republican sites are well known from the Central Plains, and diverse faunal assemblages (Scheiber 2007), much like the one from 14HO308, often characterize these assemblages. In fact, if the Horsethief site faunal materials all represent food items—a suggestion made with all due caution—then this assemblage documents a very diverse subsistence base that included not only bison, but also pronghorn and perhaps other artiodactyls, as well as birds, rodents, and turtles. Moreover, at first glance the proportion of bison remains within the 14HO308 assemblage appears fully consistent with those calculated for other Upper Republican sites, where bison often represent less than 16 percent of assemblages by NISP (Scheiber 2007). This is not to suggest, however, that bison did not play an important role in the subsistence behaviors of the Horsethief site residents. The amount of food products represented by the bison remains easily would have provided the bulk of the food, by both weight and calories, introduced into the site. Bone identified to either *Bison bison* or body size Class IV category represents only 17 percent of the total assemblage; however, if the majority of the 48 percent of the assemblage identified to body size Class III/IV category likewise represents bison (another assumption made with all due caution), then bison clearly dominates the site materials.

The 14HO308 bison skeletal element frequencies also appear largely consistent with those from other Upper Republican sites. Appendicular elements often dominate Upper Republican faunas, whereas bones of the axial skeleton, including vertebrae and ribs, are often rare (Scheiber 2007). Similarly, bones of the fore and hind limbs above the metapodial dominate the Horsethief site assemblage, whereas vertebrae and cranial elements are almost entirely absent. In contrast, however, ribs are also relatively common, suggesting that in this case not only were meat- and marrow-rich limb portions targeted by the occupants, but ribs were transported to the site as well.

Finally, Upper Republican sites are well known for highly fragmentary and heavily processed bison assemblages, although these data are highly variable with NISP to MNI ratios varying from 428 to 13 fragments per animal (Scheiber 2007; Scheiber and Reher 2007). The 14HO308 bison remains fall in the more heavily fragmented and highly processed end of this range of variation. If only those specimens identified as bison or body size Class IV are considered, then the assemblage displays a fragmentation ratio of 206 fragments per individual bison. If the body size Class III/IV specimens are also included, then the fragmentation ratio jumps to 793 fragments per individual bison. This level of fragmentation likely documents a focus on maximizing nutrient extraction from those portions of bison carcasses transported to the Horsethief site.

Summary

The 14HO308 faunal assemblage contains 3,725 specimens. The remains of large game animals, such as bison and pronghorn, dominate, but the assemblage also contains the remains of several smaller taxa. These include goose, prairie chicken, wolf, beaver, skunk, prairie dog, box turtles, and three varieties of mollusk. However, the context of most of the small animals remains unclear. Ribs and upper limb bones dominate the bison remains, while crania, vertebrae, and lower limb bones appear generally absent. When arrayed against relevant actualistic data, the bison skeletal part profile suggests that non-human taxonomic factors, such as density-mediated attrition or fluvial transport, have not conditioned the assemblage to any appreciable extent. Instead, the relative abundances of bison skeletal parts appear most consistent with the transport of only the highest fat utility carcass portions to the site. A number of the large mammal remains, bison and otherwise, display cultural modifications, such as burning, green bone breakage, cut marks, and/or impact fractures. Moreover, none of the large mammal skeletal elements remain complete; instead, the entire assemblage appears highly fragmented, suggesting a focus on extracting all possible nutrients from the transported carcass portions. The context of the smaller taxa is unclear. However, assuming that many of the smaller prey represent human subsistence choice, then the assemblage may represent a broad-spectrum strategy that included a wide range of animals that were exploited for both subsistence and non-utilitarian purposes.

CONCLUSIONS

By Neal H. Lopinot, Jack H. Ray, and A. Holly Jones

The primary questions guiding data recovery at the Horsethief site involved chronological placement and cultural affiliation, spatial uses of the site by the prehistoric inhabitants, site function, seasonality, and economy and subsistence. The following conclusions are based on the field results and the specialized analyses presented in previous sections.

Chronology and Cultural Affiliation

Some evidence exists for very brief and intermittent use of 14HO308 sometime between ca. A.D. 900 and 1000. Three hearths (Features 8–10) were clustered along the southern edge of the main block excavation area. Found at depths of 88–90.5 cm bs, this was about 10 cm deeper than those cultural features resulting from the most intensive occupation. At least two radiocarbon ages, one standard and one AMS, also suggest an earlier occupation dating to very late or terminal Early Ceramic times. Thus, the earliest use of the Horsethief site was perhaps by mobile hunters or foragers who portended subsequent use of the site for more intensive purposes. Other than the three hearths, the occupants left no diagnostic artifactual evidence of their presence.

The principal occupation of 14HO308 dates to the Middle Ceramic period. The presence of numerous features and artifacts at 71–85 cm bs (within Levels 8 and 9), as well as a cluster of five of the eight radiocarbon ages, indicate a period of relatively intensive occupation sometime between ca. A.D. 1150 and 1225. The possibility for an even more refined dating of the primary occupation can be inferred from the fact that the intercepts for four of the five later dates cluster around A.D. 1160–1170.

The surfaces of most manmade features relating to this occupation occurred at depths of 71–78 cm bs (i.e., within Level 8), whereas most artifacts occurred in the lower part of Level 8 and the upper part of Level 9. For example, all 20 piece-plotted ceramics were found at 77–87 cm bs, with 17 or 85 percent occurring at 79–85 cm bs. Nearly 89 percent of all recovered lithic artifacts (N = 2,217) also were obtained from Levels 8 and 9, with well over half (N = 1,241) from 70–80 cm bs (Level 8). Similar concentrations of archaeobotanical and zooarchaeological materials highlight the artifact-bearing deposits at 71–85 cm bs as representing a relatively intensive, essentially single-component occupation. Diagnostic ceramic and lithic artifacts and the series of five radiocarbon assays suggest a tentative assignment of the principal occupation to the Upper Republican phase. Traits consistent with this placement include triangular arrow points, bone bead blanks, and Upper Republican globular cordmarked pottery, among others. The early dating and absence of evidence for food production, of Southwestern trade items, and of Alibates chert suggest that the Horsethief site is not assignable to the Plains Border variant.

At least two later components (Zones A and B) were conjectured as the result of test excavations (Bevitt and Bauer 2003:26). Although two possible cultural features (Features 4 and 5) were identified at 27 cm bs and 57 cm bs during the mitigative excavations, and a few small pieces of pottery were recovered from the upper deposits, there is little evidence to reconstruct the nature of these potentially later activities. These likewise may (or may not) represent very brief episodes of site use by transient hunters and/or foragers who left few artifacts.

For all intents and purposes it now seems clear that most, if not all, of the artifacts found above about 70 cm bs were moved upwards as a result of faunalturbation. For that reason the following sections focus entirely on what is considered here an Upper Republican component.

Intrasite Spatial Use and Site Function

During Upper Republican times the Horsethief site served as a late prehistoric homestead at the edge of the High Plains. Evidence was found for one semi-subterranean structure and several smaller exterior roasting and/or smudging pits. The house structure is not fully understood due to bioturbation and incomplete excavation, but it appears to have been a small somewhat rectangular pole structure, measuring less than about 3 x 2 m. Oriented northeast to southwest, it had wattle-and-daub walls, based on the occurrence of wattling daub or plaster fragments in flotation samples. Similar structures have yet to be reported for western Upper Republican sites, but the small house at 14HO308 is somewhat similar to a structure reported by Brosowske and Bevitt (2006:Figure 11.5) at the Lemon Ranch site (14BA401) in Barber County. However, the occupation of that site is assigned to the later, but still poorly defined Pratt complex of south-central Kansas. Based on the size of the main part of the Horsethief site (i.e., the area within the arc of 1 x 2-m units), the site population likely was small.

An array of activities appears to have been undertaken at 14HO308, including cooking and food consumption, bone grease manufacturing, hide scraping, clothing manufacture or maintenance, pottery and bead making, and stone tool manufacture and maintenance. The presence of "nonportable" ceramics, a diverse assortment of lithic materials, a faunal assemblage that reflects the transport of selected parts to the site, bone tools and ornamental items, and an assortment of plant foods (but not cultivated products) indicate that the Horsethief site was not a hunting camp but a site where an assortment of everyday activities occurred. It was a settlement to which a series of logistical hunting and foraging activities were tethered.

Spatial uses of the site are difficult to surmise in the absence of more extensive excavations. Furthermore, the desiccated nature of the soils (despite repeated wetting) and considerable faunalturbation made it difficult to identify features and their boundaries. As Figure 7 shows, the Upper Republican component was characterized by a small pithouse surrounded by a variety of features, largely represented by concentrations of burned earth and charcoal. Within the main block excavation, lithic debitage of Ogallala opalite, Ogallala chert, and Smoky Hill chert were concentrated within three relatively distinct portions of the site. Despite the extent of bioturbation, this reflects some integrity to the deposits and represents at least three episodes of tool manufacture and maintenance. However, piece-plotted bone and tools appear to be randomly distributed throughout the block excavation area.

The lithic assemblage indicates that the occupants spent a good amount of their time manufacturing and maintaining hunting and hide-scraping tools. The unusually high percentage of biface reduction or thinning flakes indicates that the production and maintenance of bifaces was the primary knapping activity. Diagnostic bifacially flaked arrow points and end scrapers are well represented. Four types of arrow points have been identified: Washita, Harrell, Huffaker, and Fresno. However, several lines of evidence support the contention that these simply represent a range of variability within a single macrotype. Less common tools include formal side scrapers and gravers, as well as informal or expedient flake cutting and scraping tools. Recovered ground-stone items include abraders of two types, a hammerstone, and a few pieces of faceted hematite.

Economy and Subsistence

Four pottery wares were identified, two of which represent Upper Republican wares. Micaceous sand was found to be the most frequent temper. The inhabitants of 14HO308 most likely were exploiting locally available clays and sands in pottery production. A third ware, potentially classified as Bluff Creek, is also similar to descriptions provided for the Pratt complex. The fourth ware might have been introduced into the site assemblage via trade, although no chemical confirmation has been obtained.

Debitage of Ogallala opalite from local outcrops of mortar and Ogallala chert from the gravels of Buckner Creek dominate the lithic assemblage. Even so, the majority of arrow points and arrow point preforms are made of nonlocal Smoky Hill chert, the third most common material, and more than half of the end scrapers also were made from nonlocal and exotic cherts. Exotic cherts, including Florence, Alibates, and Edwards, are represented at the site, although by far fewer numbers of artifacts. As there is no evidence for the manufacture of tools of exotic chert at the site and because the distances to source areas are relatively great, most if not all probably were obtained as finished products through trade. For example, all but 1 of the 10 artifacts made from Edwards and Alibates cherts are tools, and the lone piece of Edwards debitage is a small (probable resharpening) biface flake.

The occupants of the Horsethief site relied on a hunting-and-foraging subsistence strategy. They focused primarily on larger ungulates, such as bison and pronghorn. Although the evidence is scant, it appears that the meat diet was supplemented by smaller mammals, birds, and turtles. Based on the selectivity in fat content evident for the faunal assemblage, the occupants were extensively involved in processing for bone grease. This was apparently a common practice at other nonagricultural Upper Republican sites, such as those on the High Plains studied by Scheiber (2001, 2007; Scheiber and Reher 2007). It has been suggested through experimental study that cordmarked pottery permitted easier handling of greasy pots (Lynn and Black 2009), which might provide a functional explanation for the preponderance of cordmarked pottery at sites with evidence for bone grease production.

Similar to other Upper Republican sites west of 100° west longitude, bison scapula hoes and plant remains suggestive of some level of food production were not evident at 14HO308. However, fragments of scapulae were present despite the lack of evidence for food production. Besides hunting, the occupants gathered berries, seeds, and probably underground tubers/roots from wild plants. With respect to the archaeobotanical evidence, it seems clear that the occupants were generalists. Edible plant foods represented include hackberry (perhaps), wild grape, chokecherry, wild plum, elderberry, sumac, chenopodium, wild barley, and sunflower. No maize or other produced foods (e.g., squash and beans) were represented. The site apparently occurred in the midst of a stand of hackberry trees, with other locally occurring trees, such as cottonwood/willow, green ash, plum, chokecherry, and box elder, providing additional fuel and construction materials.

The seemingly great amount of wood charcoal at the site presumably reflects needs beyond that for cooking and bone grease production (i.e., for heating during the colder months of the year). Certainly, the residents also invested more than incidental labor in the construction of one or more plastered houses, albeit small in size. As was commonplace elsewhere on the Plains, the primary reason for abandonment of the Horsethief site might have been tied to local resource depletion, particularly of wood resources. In this regard Wedel (1986:233) notes

> . . . I suggest the consumption of live wood for house construction and the continuing drain on deadwood for fuel probably placed formidable restrictions on the westward expansion of permanent Indian communities in the Republican country in prehistoric days. Probably, too, wood shortages became more critical than the exhaustion of garden lands and eventually encouraged the abandonment of what may well have become horticulturally marginal territory.

Others (Griffin 1977; Lehmer 1970, 1971) also have noted that the availability of wood and other local resources might have played a critical role in site distribution and abandonment elsewhere on the Plains.

Seasonality and Duration of Site Use

The faunal assemblage is somewhat ambiguous with respect to occupational seasonality. The MNI of only three bison and one pronghorn implies that the residents did not remain at 14HO308 for long or else they supplemented their ungulate diet to a large extent with a variety of smaller game and plant foods. This is almost certainly true. However, it is also emphasized here that (1) the excavations encompassed only a small part of the site, (2) much of the recovered bone was highly fractured and could only be identified as bison size (Class IV) or ungulate size (Class III), and (3) the excavations might not have sampled the primary disposal area(s) for bone refuse. Therefore, the documented MNI (particularly for ungulates) probably represents only a fraction of the animals that were killed and consumed by the occupants.

Site seasonality and duration of site use remain largely unanswered based on the faunal assemblage, but the archaeobotanical assemblage is indicative of multiseasonal site use. Fleshy fruits, various seeds, and underground stems/roots, such as prairie turnips, would have been procured during the summer and early fall. No deep below-ground storage facilities were located, but it is conceivable that some of these products were gathered in quantities sufficient for above-ground storage. Furthermore, the preservation of meat and the production of pemmican for overwintering needs seems a good possibility. The considerable amount of evidence for faunalturbation is postdepositional, but it is probably reasonable to assume that vermin (e.g., mice) also were present during the period of occupation and would have been cause for concern with respect to subsurface storage.

As for the duration of site use, one can only speculate. Others (e.g., Wedel 1986; Wood 1969) have done the same for lodges at Upper Republican sites, relying primarily on the ethnographic record. Blakeslee (1999:41–43) suggested using the number of vessels to estimate the duration of house and, depending on the number of houses, site use. The limited number of represented vessels and an apparent lack of superposition of cultural features at 71–85 cm bs could be regarded as evidence that the site was not occupied for many years. However, the relatively small number of vessels also could reflect the relatively limited overall extent of the excavations, one of several variables that Blakeslee (1999:42–43) recognized as problematic. At least for the Horsethief site, it is noted that the residents were engaged in hunting and foraging, as opposed to even low-level food production, so use of a more mobile container technology, composed of fiber baskets and skin bags, might have had precedence over nonportable ceramic vessels. Nevertheless, one cannot ignore the sensitive environmental limitations for long-term intensive site use by Upper Republican populations. Besides potentially limited wood supplies, Carl R. Falk (1969b:51) suggested the possibility that intensive exploitation of local fauna on a year-round basis might have necessitated frequent relocation of settlements.

Based on the plant and animal remains from the Mowry Bluff site, Wood (1969) contended that houses were used for about five years each. Wedel (1986:105) also provided some insight into the possible maximum duration of the 14HO308 occupation, observing that at least ". . . historic Pawnee earthlodges, constructed of much heavier timbers than those used by most Upper Republican peoples, were said (Weltfish 1965) to have been serviceable for 10 to 12 years; Wilson (1934:372) reported 7 to 10 years for the Hidatsa houses." Although comparative data on discard rates would benefit an assessment of site-use duration, and the information provided above based on sites with relatively large, formal structures, it is suspected that the Horsethief site was occupied for less than 10–15 years during the later half of the twelfth century A.D.

Implications and Future Prospects

As with most research endeavors, this study raised more questions than provided answers. The site has yielded much new information about the Upper Republican phase, but more survey and excavation are needed in southwest Kansas. There are, no doubt, other Upper Republican sites along Buckner Creek, along the Pawnee, and elsewhere in the southern part of the Upper Republican phase area.

Recent work by Roper et al. (2007) has demonstrated the importance of NAA for discriminating Central Plains pottery, necessary for evaluating the likely directional movement of pottery and, therefore, the interaction of people living at various sites on both sides of 100^{o} west longitude. Although somewhat problematic, chemical composition studies of available resources should be undertaken for micaceous sand and clay in southwestern Kansas. Obtaining and submitting additional samples for NAA will permit researchers to further identify chemical markers, resulting in more refined compositional results. A residue study of the pottery from both the 2002 and 2008 excavations at 14HO308 also may answer questions regarding vessel function. Residues were noted on both interior and exterior surfaces, but their origins remain unclear to date.

There also needs to be substantially more microanalyses of botanical, lithic, and faunal materials to better understand site formation processes and subsistence pursuits. In the future it is particularly important that considerably greater emphasis be given to the collection of flotation samples and the study of plant remains. In reference to food production versus foraging, Wedel (1986:114, 123) noted that ". . . we have no way of assessing at the moment the relative effort expended by local groups in exploiting effectively the two diverse subsistence economies [food production versus foraging]," and "we have at present no means of evaluating precisely the relative proportion of time and effort devoted to either pursuit." Yet, Wedel (1986:121) also noted that "the staples of daily fare were very likely bison meat and maize." Although not meant to demean the importance of bison, the archaeobotanical assemblage from the Horsethief site indicates that there has been considerable zooarchaeological bias in studying late prehistoric adaptation near and on the High Plains. There is a long tradition of research on faunal remains from Upper Republican sites but very little focus on the study of plant remains.

Historically, the model positing a dichotomy between maize horticultural villages and bison hunting camps has been useful, but it dramatizes a contrast that simply did not exist. It is evident that the term "hunting camp" or "hunting station" has been much abused, and such a concept should not be used in the absence of any systematic studies of plant remains. Many such sites do contain an abundance of bone refuse, projectile points, scrapers, and other lithic artifacts, reflecting the importance of procuring animals and processing their parts. Almost two decades ago, however, Roper (1990) demonstrated that Upper Republican sites on the High Plains were much more than bison hunting camps. She lamented the absence of a better understanding of Upper Republican subsistence, suggesting that the "western Upper Republican people likely were permanent populations on the High Plains, pursuing a wide range of plant and animal foods using some form of residentially mobile foraging strategy." The occupants of such sites were typically generalists, not specialists focused primarily on bison (Roper 1990:16). With respect to understanding Upper Republican human-plant relations, absence of evidence is not evidence of absence. The problem has merely been absence of analysis. Archaeobotanical evidence from 14HO308 provides support for an Upper Republican generalist adaptation; the occupants of the Horsethief site were broad-spectrum foragers.

The archaeobotanical assemblage is characterized by a diverse set of materials, reflecting an array of food-gathering and processing activities. Still, the archaeobotanical record almost certainly presents a distorted and partial representation of human-plant relations. There are likely many consumed items that are missing or poorly represented in the record relative to their importance. What also must be taken into account is the fact that the material culture of plant-food gathering and processing may be little represented in the archeological records of open-air sites in the Central Plains, as that technology could have consisted largely of perishable materials (e.g., wooden digging sticks, baskets, wooden seed beaters, wooden mortars and pestles, skin bags). For example, Strong (1935:61, 67) reported on the recovery of a wooden mortar, wood bowls, a wooden platter, and textile materials from historic Pawnee sites, but he found no such items at earlier protohistoric sites; they presumably perished due to the greater age of such sites.

It is equally important that Upper Republican researchers do not overemphasize the importance of maize until more thorough and numerous studies of archaeobotanical assemblages in the region are obtained. There has long been a maize bias in studies of late prehistoric populations in eastern and central North America, a reflection of a dependence on historic models of subsistence that in most cases do not apply to late prehistoric times. This bias has been perpetuated by the paucity of analyzed flotation-recovered materials and a continued emphasis on the observations of pre-flotation-era archeologists who had historically based, preconceived notions about the importance of maize relative to other plant foods.

It continues to be readily apparent that the meridian of 100° west longitude has much significance for understanding the presence/absence of evidence for food production in the Central Plains. However, in the absence of more archaeobotanical research, the possibility that other less moisture-dependent plants were being cultivated in some form or that wild grasses and other naturally occurring plant products were intensively gathered cannot be precluded. In the case of the Upper Republican phase, the relative importance of maize to other crops or gathered foods has never been adequately evaluated. Maize cobs and kernels represent conspicuous plant remains and, as such, their importance relative to other smaller and often fragmentary, less recognizable plant remains can be overemphasized easily. This is not meant to demean the importance of maize in some contexts in this portion of the Central Plains, but rather it is to point out that the data are not really adequate to interpret its economic importance in late prehistoric space and time.

In the literature on Upper Republican, it is further noted that terms such as gardening, horticulture, and agriculture are tossed about without definition. Other than the recovery of bison scapula hoes and maize remains, the fact is that nothing is known about the relative importance of food production (i.e., not just maize production). The scapula "hoes" were probably generalized digging implements and food production might have been more limited than most think, despite the identification of conspicuous maize remains at some Upper Republican sites. Given the many poses of subsistence that probably characterized Upper Republican populations, it is delusory to categorize sites simply as agricultural or horticultural villages versus hunting camps. These represent two extremes of a diverse spectrum of subsistence pursuits. It is strongly suspected that all Upper Republican adaptational poses were somewhere between these two extremes.

If 14HO308 and other similar types of Upper Republican sites west of 100° west longitude were occupied multiseasonally, if not year-round, as might have been the case, then the absence of storage pits could be considered somewhat perplexing. Storage is typically an attribute of a greater degree of sedentism. However, if dried meat and pemmican were important commodities and were sometimes designated for storage, they likely were stored above ground, primarily within the interior of structures. The authors have alluded elsewhere to the likelihood for above-ground storage simply to evade infestation from rodents. Wedel (1986:122) noted that Upper Republican sites lacked the large subsurface storage pits characterizing early historic Pawnee and Wichita sites. Indirectly, the absence of such large storage pits is suggestive of substantial differences in the level of food production, as grain would likely be a commodity designated for below-ground storage. However, such storage also might have been a form of caching commodities while engaged in group hunting activities away from the village sites.

Lastly, more direct evidence on seasonality needs to be obtained. The plea for more collection of flotation materials for systematic archaeobotanical research has been made throughout much of this summary. However, the zooarchaeological community needs to step to the plate in teasing out the seasonality of site use, going well beyond simply assessing seasonality based on the presence or absence of migratory waterfowl or assumptions about when animals would be procured based on their habits and historic hunting patterns. Mammal teeth, mussel shell, fish scales, and other animal remains can play a key role in obtaining a better understanding of Upper Republican settlement-subsistence strategies.

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CORRECTION

As a KCAS member who was involved with the work at the Miller site, James E. Roberts has offered a correction to Jeffrey Spencer's article, "Analysis of Pottery Decorations at the Miller Site (14WY8): A Late Kansas City Hopewell Occupation," published in *The Kansas Anthropologist* 28:34–39. A sentence in the abstract reads, "Amateur archeologists conducted unprovenienced excavations in an effort to salvage information from the site in advance of a construction project in the 1930s." This should be "in the 1980s," as indicated by other passages on page 35 of the article.

BOOK REVIEWS

Medicine Creek Journals: Ena and the Plainsmen D. JEAN SMITH. Old Hundred and One Press, North Platte, Nebraska, 2003. 272 pp., illustrations, forward, acknowledgments, preface, introduction, end notes, bibliography. $24.95 (paper). ISBN 0-9721613-6-8. *Reviewed by* Nancy J Arendt.

Born into a privileged family in Spring Hill, Georgia, Annie Eliza Palmer Raymonde Ballantine McClary had no idea that she would end up living in western Nebraska. Sleeping under the stars, in a tent, or a homemade cabin, hunting for food, living miles from other people, and having Indians all around was far from her comfortable plantation life with servants, schooling abroad, and easy access to life's necessities. The Civil War changed the life course of many people, as it did for the Palmer family.

Annie was the second child of Dempsey and Ann (Timmons) Palmer. A brother, William "Herbert" Palmer (later known as Paddy Miles), who was two years older, gave her the nickname of Einna (Annie spelled backwards), which was shortened to Ena. Lying about his age, Herbert joined the Confederate forces during the Civil War. Returning home after the war, he found a ravaged Georgia and knew that home would never be the same. In 1867 he set out to find a new life, traveling to Cuba, Florida, and New York. He did not find what he was looking for and returned home again. Shortly after his return, a former fiancé of Ena's was murdered, and suspicion centered on Herbert. Not seeing any other recourse, "Herbert disappeared, and when his clothes were found on a Georgia riverbank, the assumption was that he had drowned. The naked man who emerged on the other side of the river, dressed in dry clothes, picked up his gun and satchel, slid a bowie knife into his boot-top and headed for a new life in the west as William Herbert Miles." He had promised his mother and sister to find a new home in the west and send for them. He eventually arrived at Fort McPherson, Nebraska, near what is now North Platte, in 1869 with the nickname Paddy. His journals reflect a life of herding, scouting, hunting, Indian skirmishes, and work with Buffalo Bill Cody along the Platte and Loup Rivers, and participation in the Grand Duke of Alexis' buffalo hunt. Paddy had finally found the life he was searching for and set claim to property in the Pleasant Valley along Medicine Creek in July 1871. By February 1872 Frontier County was organized with Stockville as the county seat. Paddy sent for his family.

Arriving in March of 1872, Ena and her parents were oblivious to what was in store for them. As they stepped off the train in their fashionable eastern clothes, a caged yellow canary in tow, all eyes were on them. Ena and her mother were the first white female settlers of Frontier County. Ena was an accomplished writer, a published poet, and spoke Latin and French fluently—with all the refinement of a southern belle. She was also already a first class sharpshooter and horsewoman. These skills and her southern charm would be instrumental in her survival on the plains. Like Paddy, she knew that she had found what was missing in her life when she arrived in Nebraska.

Settling in Pleasant Valley along Medicine Creek, gardening, hunting, trapping, and raising chickens became Ena's new way of life. Nebraska weather was quite different from Georgia's sunny warm climate. Wind and rain-storms, blizzards, floods, grasshoppers, drought and wild fires all had their way in Ena's new world.

Ena had been married briefly in Georgia. Now as the only white single woman for miles around, she was the focus of male attention. W.F. "Doc" Carver, a dentist, asked her to join him in his travels, but she wanted no part of it. Ena did help him improve his marksmanship, and he later became a world famous rifle shot and paired with Buffalo Bill Cody to develop the first wild west show, Cody & Carver's Wild West Show. Ena was drawn to "Texas Jack" Omohundor, a well-known scout, who later joined the Wild West Show, but he too was not for settling down in one location. Frequent visitors through the valley were Major North, General Custer, and Wild Bill Hickok.

Nearby was a temporary reservation known as the Cut-offs of the Oglala Sioux under Chief Whistler.

Frequent encounters with other Plains Indians were common; most came to see Enas' white skin. To learn more about their way of life, Ena lived with the band of Sioux for a month. When Indian uprisings occurred, such as the killing of Chief Whistler, the Battle of the Little Big Horn, and the battle of the Sioux and Pawnee at Massacre Canyon, the valley settlers sought shelter at Fort McPherson until things quieted down. Ena loved the adventure and the feeling of freedom in the wilderness and fulfilled many dreams, including going on buffalo hunts and killing many game animals with single shots. Her competitiveness was fueled by frequent shooting challenges.

Ena's journals rarely mention her parents. Her mother, Ann, died in April 1877, and her father, Dempsy, died in February 1880. There are significant time gaps throughout her journals, one of more than a year, beginning in the fall of 1873. Letters and journal entries from her cousin, Mamie, in Georgia, her brother, Paddy, Doc Carver, Dick Seymour, and others also give glimpses into some of the gaps in time. In February 1875 she resumed her journaling.

August of 1875 introduced David Coulter Ballantine, an established cattleman with a ranch a couple miles from Ena's home. He was the man who finally captured her heart. They married October 5, 1875. Ena loved her life as wife and mother. A son, David Coulter Ballantine, Jr., was born August 21, 1876, and a daughter, Ann Ena Ballantine, was born on February 24, 1881. David Ballantine, Sr., was a very successful cattle rancher, a member of the Chicago Board of Trade, and later a Nebraska senator. The family spent a considerable amount of time in Lincoln, Nebraska, and Ena and children visited her home in Georgia the winter of 1881–1882. However, the life and love Ena had searched for was found along the Medicine Creek in Pleasant Valley but was cut short by the tragic death of her husband at age 39, three days short of their seventh wedding anniversary. While on a cattle shipping trip to Benkelman, Nebraska, he fell under a moving train car while attempting to board. He was buried in Lincoln, Nebraska.

Ena ran the ranch alone for one and a half years before hiring Washington L. (Addie) McClary of Stockville, Nebraska, as ranch manager. Not wanting to winter on the ranch again with two small children, Ena moved into McClary's house in Stockville, and he moved into her home on the ranch. McClary had always been in the background of Ena's life as a suitor and now hoped to help put her life back together. While in town on business or to wash down the dust with whiskey, he would stay in his home in Stockville, even though Ena was living there. Ena became pregnant and had to decide what was next: marry a man whom she did not love but who would fill the emptiness in her life or become the object of controversy associated with her unwed pregnancy. She accepted her fate and, with a sense of relief, married Addie in early July 1884. Fate, however, had one more wicked twist in store. Upon returning from a short honeymoon, Addie gave the horses free rein and cracked his whip. The wagon was virtually a runaway rig. It hit a deep rut in the road, throwing Ena out. She sustained a broken neck, miscarried, and lived only a short time. She died on July 13, 1884, at age 35, and was buried in Sunset Cemetery near Stockville next to her parents.

Ena's children, David Coulter Ballantine, Jr, and Ann Ena Ballantine, were reared by Ballantine relatives. In 1895 David married a girl whom he met at college in Colorado and returned to run the Ballantine ranch. He and his family lived in the sod home that his parents built until 1944. As of 2003, the frame house he built on the Ballantine property continued to be a residence. He died in 1959. He and his wife were buried at Sunset Cemetery. Ann married, spent her adult life in Missouri, and died in 1976. Ena's brother Paddy was married twice, widowed then divorced by the 1900s. He wintered in Florida and California. He died in 1901 and was buried in Long Beach, California. A monument was erected for him at Sunset Cemetery. Third husband Addie McClary married two more times before moving to Canada.

More than 40 years of research by many people who were interested and involved in their regional history made this book possible. Primary source material (journals and letters), news articles, and cooperation from the Nebraska State Historical Society and the Frontier County Historical Society, were used to tell the story. Some of Ena's journals were found in a trunk at the Ballantine residence when it was temporarily abandoned. The author provides historic maps, and photographs, journal pages and drawings by Ena, and also photos of the headstones and Paddy's monument at Sunset Cemetery. A map showing the location of the Sioux reservations, dwellings, and cemetery locations is included.

This book demonstrates the value of a journal in documenting regional history and recognizes a woman's place in settling and meeting the challenges of the frontier.

Arch Lake Woman: Physical Anthropology and Geoarchaeology. DOUGLAS W. OWSLEY, MARGARET A. JODRY, THOMAS W. STAFFORD JR., C. VANCE HAYNES JR., and DENNIS J. STANFORD. Texas A & M University Press, College Station, 2010. xiv + 93 pp., 22 figures (including 9 color plates), 26 tables, references, index. $30.00 (hardcover). ISBN 978-1-60344-208-4. *Reviewed by* Jim D. Feagins, St. Joseph Museum.

Arch Lake woman's skeletal remains are the third oldest found in North America. This burial contains profoundly important information on one of the earliest inhabitants of the continent and how she was buried.

The burial was located a few miles south of the now-dry Arch Lake basin in extreme eastern New Mexico near the Texas border. The site is not far from the Clovis type site at Blackwater Draw; however, the burial is not as old as the Clovis site.

When the burial was found and excavated in 1967, its geological context suggested it was of considerable antiquity—dating to the Paleoamerican period. The remains were found eroding out of a road-cut bank within a late Pleistocene sand dune. The avocational archeological discoverers, Gregg Moore and Cecil Clark, are to be commended, as they made every effort to protect the basic integrity of the burial. Initially they found a portion of a considerably encrusted mandible exposed on the surface. A portion of the burial sands were stained with red ocher. After some excavation, the skeletal remains were left in situ, and Dr. F. Earl Green of Texas Technological College was contacted. Under Dr. Green's supervision the remains were removed as a block unit after notes and photos were taken. The skeletal and cultural remains were curated at Eastern New Mexico University's Blackwater Draw Museum. Partly encased in its surrounding matrix of soil, the burial was on exhibit from 1969 to 1985.

In 2000 the Department of Anthropology at the National Museum of Natural History organized an interdisciplinary team to reexamine the burial. The team's research goals were to establish or record the discovery history, geologic context, bone chemistry, AMS radiocarbon age, skeletal and dental features, cultural affiliation, burial practice, and associated artifact assemblage. This study, coming 33 years after the burial's initial discovery, had the advantage of using new and advanced techniques administered by a team of experts in many different scientific fields. *Arch Lake Woman: Physical Anthropology and Geoarchaeology* describes the results of this intensive study.

The burial was lying in an extended, supine position at the bottom of a filled rectangular vertical shaft. The skull was toward the southeast and the feet to the northwest. The skull faced upward but was slightly tipped toward the right (east). The burial was 2.4 m below the present ground surface or at least 1.2 m (42 inches) below the surface at the time of interment. The skeletal remains are that of a female, 17–19 years of age, with an estimated stature of 166.5 cm (5 feet 5.5 inches). The physical proportions of Arch Lake woman are generally similar to those of American whites (p. 51).

The crowns of the teeth are well preserved, although there is extreme root erosion on some of the teeth. Also there is some postmortem enamel etching from the soil chemistry. One third molar is fully erupted, another is not. Only a trace of shoveling, and no double shoveling, is present on the maxillary incisors. Moderate to slight tooth wear offers some evidence that Arch Lake woman might have used her anterior teeth as tools to help perform certain tasks. Perhaps she used them in bison hide processing. Tooth crown traits and measurements were recorded to compare with ancient and recent Native Americans, and the dental traits and metric data are presented in a series of tables. The results are compared to the tooth data from another Paleoamerican burial site, Horn Shelter No. 2, in east

Texas. However, the dental features and tooth metric data indicate that, while the two Paleoamerican burials are similar to each other, they do not show close affinities to any of the groups of recent Native Americans. (For readers interested in additional information on the use of dental traits and metrics in comparative analysis, this reviewer has found Turner [1992] quite useful. Also the subject was presented briefly by Meltzer [1993:87–91].)

The Arch Lake burial also is different from modern Native Americans in having a low face and orbits. The woman's cranium has a short, broad vault that is dissimilar to other early crania. However, it is large and in that aspect similar to other early crania, but again it is quite different from any group of modern Native Americans.

The post-cranial measurements focused on the femur and tibia. Arch Lake woman was compared with remains from Pecos Pueblo, Coalescent Arikara, and American whites. Generally Arch Lake woman's femur and tibia are significantly different from the two Native American samples (Table 17) but are somewhat similar to American whites.

Mitochondrial DNA could not be obtained. However, the skeletal remains contained enough collagen to supply adequate radioactive carbon for dating the burial. Arch Lake woman was dated at 10,020 $\pm$ 50 RCYBP (radiocarbon years before present). This corresponds to a calibrated (1-sigma) age range of 11,260 to 11,640 CALYBP (calendar years before present).

A stable carbon and nitrogen isotope study was conducted on the remains. Clearly the Arch Lake woman's diet had a high proportion of animal protein. Speculatively, bison would be the most likely main source of this protein, as other megafauna are thought to be extinct after 10,800 RCYBP. The stable isotope study of bone collagen also suggested that the C3 and C4 plant species compositions were similar to the Texas panhandle during the early Holocene.

Twenty-two artifacts were found with the Arch Lake burial. They included a unifacial stone tool, apparently pulverized or ground red ocher, 19 drilled beads, and a probable bone tool. None of these artifacts was diagnostic for determining a specific cultural affiliation. However, based on the carbon-14 dating and the site's geological and geographical location, Arch Lake woman possibly could represent a Plainview burial.

The Arch Lake burial contains the oldest known North American beads manufactured from talc. The 19 disc-shaped talc beads were biconically drilled with a tapered-tipped stone drill. They were clearly part of a necklace, as 14 were found in place, forming an arc just above the clavicles. The remaining beads were found when screening the burial fill. Talc is a hydrous magnesium silicate mineral, usually rather soft and is an uncommon material for bead manufacture. The specific source of this talc is not known, but it was indurated (hardened by heat or pressure); therefore, the beads are harder than most talc. They are white to light green in some areas and are opaque to slightly translucent. The diameters of 15 beads available for measurement range from 5.1 to 7.3 mm in diameter, and 13 of them are 1.9 to 2.6 mm in thickness, with two others noticeably thicker—3.1 mm and 3.5 mm. Drilled from both faces, the diameters of the holes are narrowest at the center, ranging from 1.5 to 2.8 mm. The largest bead is faceted.

The pigment with the burial, red ocher, was unconsolidated, possibly as a ground powder once contained in a now-decayed pouch. It was concentrated in an area approximately 65 mm by 75 mm by 55 mm, located along the lateral side of the left humerus. Red pigment is often associated with Paleoamerican burials and lithic caches (Roper 1987) and appears to have a ceremonial significance. An intensively worked Paleoamerican red ocher mine has been discovered in eastern Wyoming (Stafford et al. 2003).

Near the left side of Arch Lake woman's waist, adjacent to the concentration of red ocher, a resharpened flake tool was recovered. This fine-grained cryptocrystalline tool was manufactured from Edwards chert, whose source is western Texas. The striking platform and bulb of force are missing from this tool. The uniface is 51.2 mm long, 25.3 mm wide, and 4.9 mm thick. On the dorsal side the lateral edges have continuous retouch. Use-wear studies, employing a low power microscope, suggest that the flake tool was used for light cutting and scraping, as one might expect for a knife. Even after cleaning, red pigment was observed at the termination of many small flake scars. This flake knife may have been in a pouch with the red ocher. Close-up photos of this artifact, showing more detail, would have been useful.

The last cultural item described was probably a bone tool, one made from a large animal, such as a bison. It was found above the woman's chest. Modified and rounded at one end, the other end was obscured by a heavy carbonate encrustation. This robust bone was displayed with the burial exhibit; however, it is since missing from the collection.

The Arch Lake burial was compared with five other early burials dating in a range from 9500 to 10,020 RCYBP. (Interestingly the well-publicized Kennewick man skeletal remains were not even mentioned in the volume. Of course, they were considerably younger, perhaps as much as 1,600 to 2,000 years younger, than Arch Lake woman.) The five compared burials were from four sites: Horn Shelter No. 2 (Texas), Gordon Creek (Colorado), Wilson-Leonard (Texas), and Buhl (Idaho). A detailed comparison of these burial sites with Arch Lake woman is presented in three useful tables. Along with discussions in the text, two tables succinctly compare sex, age at death, radiocarbon date/age, cultural affiliation, burial practice (including body/head/face/hand placements), tooth modification, associated artifacts and their placement, above ground markers, and ceremonial aspects. The third table compares seven classes of burial assemblages from these ancient sites by functional categories and types of modification. It includes information on number of cultural items, ornaments and/or amulets, emblems of spirit connection, fabricating and processing tools, hunting-related/weaponry tools, unmodified or other raw material, chipped stone, and ground stone.

In general, Arch Lake woman was tall, young, ate considerable meat protein, and often performed numerous tasks, which probably included bison hide working. She was buried with personal items, including a talc necklace, a pouch (probably attached at the waist) that contained powdered red ocher and a chert knife, and a probable bone tool (on her chest). Her cultural affiliation is uncertain, but time and geography suggest that Plainview is a good possibility. She shared many similarities and some differences with other early burials, which continues to support previous analyses concerning the diversity among the early Americans. Arch Lake woman, as with other early burials, was generally quite different from the morphological pattern of modern Native Americans. This intensive study of Arch Lake woman, her burial site, and the artifacts presumably intended to accompany her into the afterlife, adds a considerable amount of new information about the rarely found early humans who occupied North America.

The amount of detail concerning the Arch Lake woman and how she was buried was most informative. The problem-solving approach using standard geological, archeological, and forensic methods along with specialized high tech methods borrowed from other fields provided an interesting, educational read. Some portions of this short volume were rather technical, but even the general reader with an interest in the early people who inhabited North America will find a great deal to enjoy.

Published for the Center for the Study of the First Americans by Texas A&M University Press, *Arch Lake Woman: Physical Anthropology and Geoarchaeology* is the first issue of a proposed series called *Peopling of the Americas Publications*. This reviewer looks forward to seeing the next volume.

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A lifetime resident of Colby, Nancy received her Associates of Nursing degree from Colby Community College in 1977. She is employed as a Licensed Practical Nurse II at Family Center for Healthcare in Colby. She and husband Marlin celebrated their 38th wedding anniversary in November 2011. They have two children, Chris and Kathy. In addition to archeology, Nancy enjoys spending time with her family (particularly her seven-year-old grandson, Caelen), gardening, fishing, camping, and bird watching.

David Byers
[redacted]

David Byers occupies a faculty position at Missouri State University in the Department of Sociology and Anthropology. He earned a Ph.D. in anthropology from the University of Utah, and an M.A. in anthropology from the University of Wyoming. He has been previously employed as adjunct faculty at the University of Utah and as a senior archeologist at several archeological consulting firms. He possesses formal training as a zooarchaeologist but is also knowledgeable in lithic analysis, geoarchaeology, Quaternary paleontology and paleoecology. Current and recent projects include a stable isotope study of human subsistence in the Aleutian Islands, taphonomic investigations of Great Basin faunal assemblages, and research into the role of extinct elephants in the diets of ancient foragers. David has also been investigating the impact of Holocene climate change on large game population histories and the ways that trends in prey availability condition the strategies used by ancient foragers to butchered and process animal prey. Recent fieldwork has focused on a coastal forager site in Jamaica and the upland archeology of the Pryor Mountains in Montana.

Jim D. Feagins
[redacted]

Jim Feagins is a private archeological consultant who also serves as part of the adjunct archeological staff for the St. Joseph Museum and is senior archeologist for Environmental Advisors and Engineers, Inc. He received a B.S. degree from Pittsburg State University and a MNS degree from the University of Oklahoma. After 30 years as a science instructor for Consolidated School District No. 4, Grandview, Missouri, he retired in 1995.

Active in promoting archeological education, he is president emeritus of the Missouri Archaeological Society. He also served as president of the Kansas City Archaeological Society and as a vice-president of the Missouri Association of Professional Archaeologists and the Kansas Anthropological Association (KAA). He is a life member of the KAA.

Marlin F. Hawley
[redacted]

Marlin is an archaeology curator with the Museum Archaeology Program at the Wisconsin Historical Society. Readers of *The Kansas Anthropologist* may recognize the name from his many addenda. He lives with his wife Amy and their two children and some pets in DeForest, Wisconsin.

A. Holly Jones
[redacted]

Holly Jones is the owner/director of Archaeological Field Research in Nixa, Missouri. She served as research archaeologist (2005–2008) and assistant director of the Center for Archaeological Research (2008–2009) at Missouri State University in Springfield, Missouri. She earned a Ph.D. in anthropology from the University of Missouri-Columbia in 1999.

Neal H. Lopinot
[redacted]

Neal has been director of the Center for Archaeological Research (CAR) for more than 18 years. He is also an associate research professor at MSU and secretary of the Missouri Archaeological Society. He earned his Ph.D. in anthropology, specializing in archeology, from Southern Illinois University at Carbondale (1984). Although perhaps best known for his research into changing prehistoric human-plant interrelationships, his interests are very eclectic. They include everything from the early peopling of the Americas to contact-period colonialism to experimental archeology.

Jack H. Ray
[redacted]

Jack received a B.A. degree in anthropology from Western Kentucky University (1978) and an M.A. degree in anthropology from the University of Missouri (1981). Since then he has conducted research and supervised more than 125 large- and small-scale CRM projects in Missouri, Arkansas, Kansas, Oklahoma, Kentucky, Illinois, and Iowa.

His research interests include early prehistoric cultures, geoarchaeology, geomorphology, and lithic technology, but his area of specialization is the identification and analysis of chipped-stone resources located throughout the Ozarks and adjacent regions. In 2007 he published an unprecedented guidebook detailing the availability, identification, distribution, and prehistoric use of Ozarks cherts and other siliceous raw materials.

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OLSON	BILL & BETH	[redacted]	[redacted]	[redacted]	[redacted]
O'TOOLE	JOHN	[redacted]	[redacted]	[redacted]	[redacted]
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PEARSON	GENEVA	[redacted]	[redacted]	[redacted]	[redacted]
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STRICKLIN	HENRY	[redacted]	[redacted]	[redacted]	[redacted]
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SULLIVAN	MELONIE	[redacted]	[redacted]	[redacted]	[redacted]
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Manuscripts are actively solicited for *The Kansas Anthropologist*. Articles should have a relationship to Kansas anthropology (archeology, ethnography, ethnohistory, cultural/social anthropology, physical anthropology, etc.). All manuscripts must be the original, unpublished work of the authors.

The varied readership of the journal should be kept in mind when preparing papers. **Jargon should be avoided**. The style authority is *American Antiquity* (see Volume 57, Number 4, 1992). Professionals are expected to submit their manuscripts in this form; others who are not familiar with the *American Antiquity* style guide will receive editorial assistance.

Illustrations are encouraged; at least two or three should be included if possible. **Digital photography with original resolution less than 300 dpi is not optimal for print publications.** High resolution digital images are acceptable, as are 35-mm black and white or color prints or slides. All illustrations should be designed to fit within 6 x 8.5-inch margins, including caption. If protected by copyright, securing written permission for use is the responsibility of the author.

If IBM-compatible computer technology is available, please submit papers on CD or as an e-mail attachment, **using as little internal formatting as possible**. **Each table and figure should be submitted as a separate file rather than embedded in the text.** A single hard copy also should be provided.

The editorial committee will review manuscripts and judge whether articles are appropriate and what revisions may be necessary for publication. Outside reviewers may be used. The editor welcomes responses to previously published articles. Five reprints will be provided free of charge to the author of each major article.

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