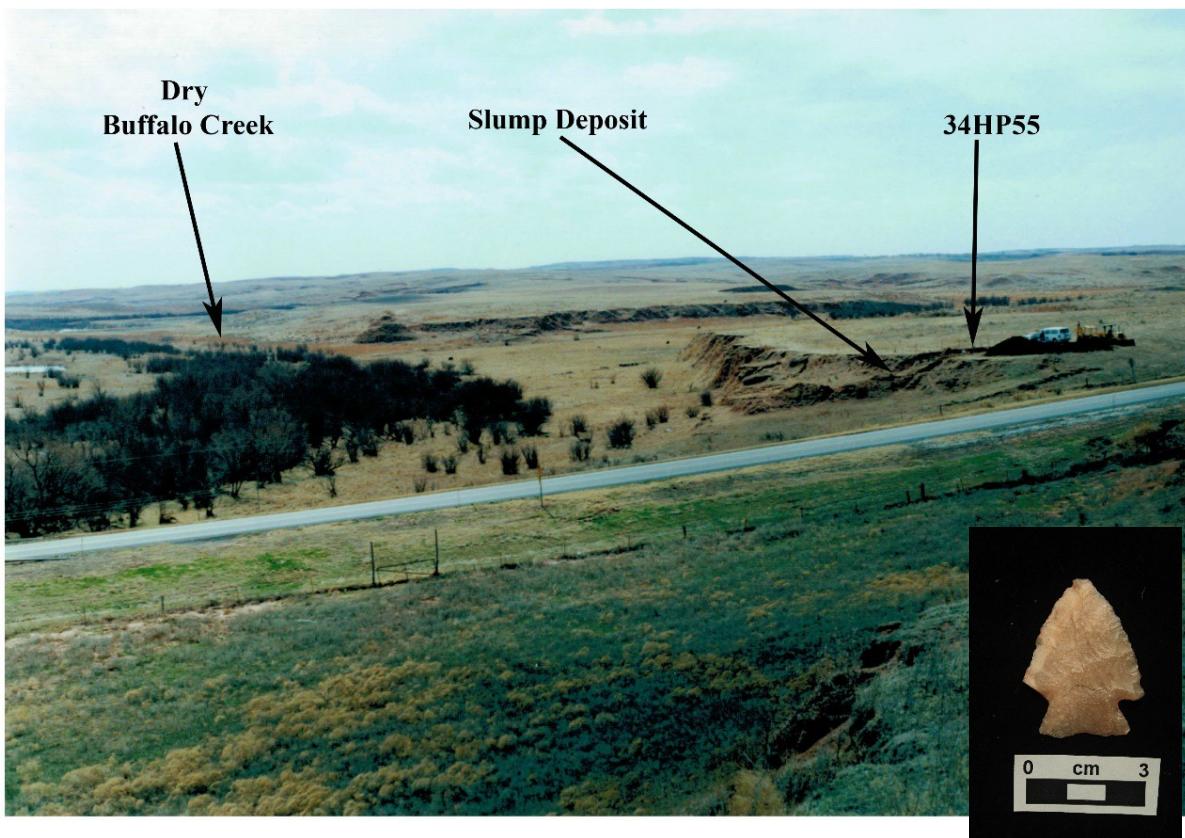


**ARCHEOLOGICAL INVESTIGATIONS AT 34HP55:
A LATE ARCHAIC KNAPPING STATION ALONG
DRY BUFFALO CREEK
IN
HARPER COUNTY OKLAHOMA**
by
Mike McKay and Robert Bartlett



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Environmental Programs Division
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200 NE 21st Street
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Reports in Highway Archeology, Number 20
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Introduction

This report describes archaeological test excavations carried out at 34HP55, a prehistoric site on the western terrace of Dry Buffalo Creek in Harper County, Oklahoma. The site was found during an archeological survey conducted as part of a bridge replacement project [JP 17109; Project # BRF-130B (018)] on U.S. 64 over Dry Buffalo Creek just south and west of Buffalo, Oklahoma (Figure 1). The project proposed a new bridge to be built on a realignment to the south of the existing bridge to soften a horizontal a vertical curve just west of the site location.

Site testing was conducted by the Oklahoma Department of Transportation (ODOT) Cultural Resources Program in an effort to assess the site's potential to contain significant information relating to prehistoric habitations in the region and its prospective National Register of Historic Places (NRHP) eligibility under Criterion D. All subsurface investigations took place in the new right-of-way south of the existing (Pre 2003) highway alignment.

Figure 1. Location of 34HP55, Section 16, T27N, R23W, U.S.G.S Buffalo Quad, 1970.

Project survey and initial recording of the site occurred on April 21, 1998. At that time several flakes of Day Creek chert were observed draped upon the surface of an eroded bench/slump deposit on the east facing scarp of a distinct stream terrace west of the stream. The terrace rises about 10 m above the flood plain and presents a steep, eroded, east facing scarp (Figure 2). The slump deposit located just below the site contained a moderate scatter of maroon colored Day Creek chert flakes upon its surface. The surface of the terrace was devoid of prehistoric artifacts and shovel probes excavated on the surface of the terrace to a depth of 50 cm below the surface (cmbs) produced no cultural materials. Based on this preliminary examination of 34HP55, subsurface investigations were recommended to explore the potential that the flakes observed on the terrace slump derive from a cultural deposit buried in the terrace formation somewhere below 50 cmbs.

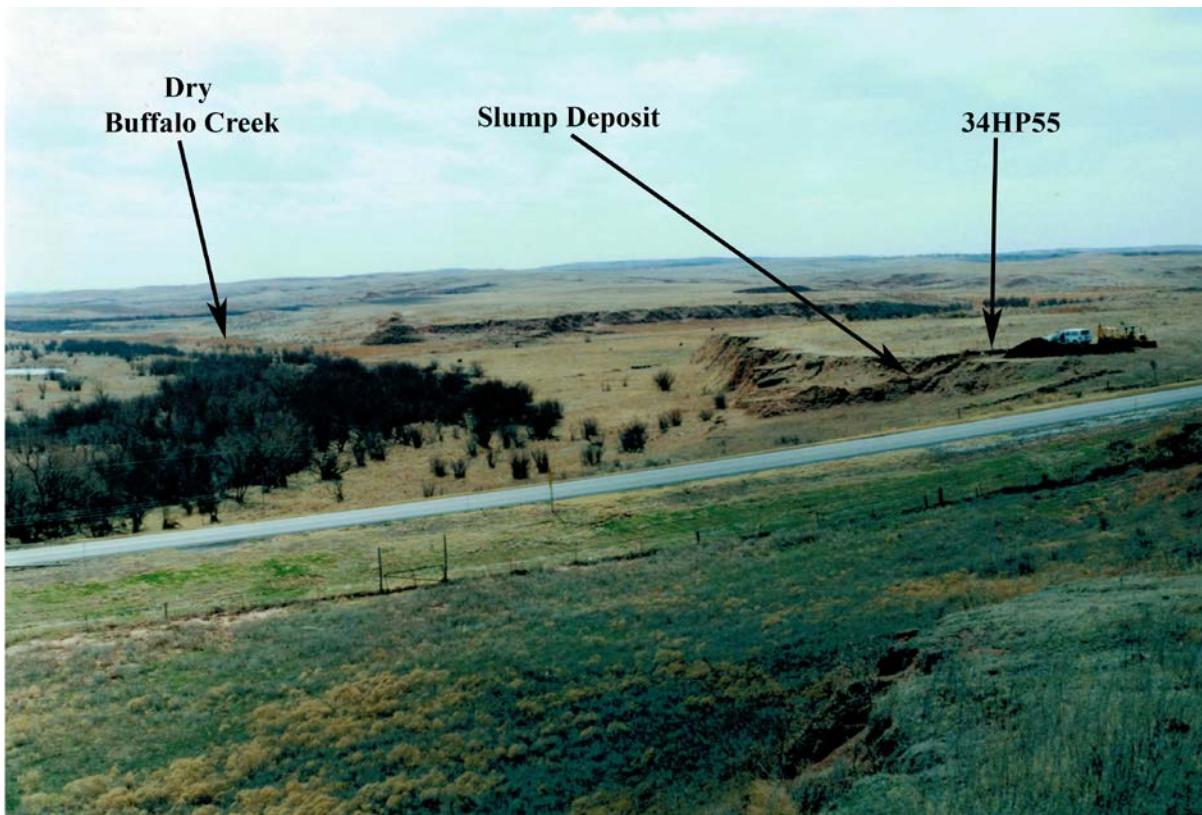


Figure 2. View of 34HP55 and east facing terrace scarp. View is looking south.

Preliminary testing of 34HP55 was conducted on November 11 and 12, 1999 and included excavation of two 50 x 50 cm test units and examination of visible soil profiles along the edge of the terrace scarp. Two 50 x 50 test units were excavated along a north/south line established from a centerline stake at Station # 10 + 848. This line was near the east edge of the terrace scarp. Both units, initiated from the surface were excavated in 10 cm levels. Unit N5W0 was excavated to 70 cmbs. Other than a piece of rubber in level 2, no cultural materials were recovered. Unit N10W0 recovered 2 flakes of Day Creek chert at 62 cm BSL and one flake of Day Creek chert between 70 and 80 cmbs. Excavation of this unit ceased at 90 cm BSL. Both units contained similar soils, a reddish brown (Munsell 7.5YR3/4) sandy loam which became darker (5YR3/2) and siltier at 60-70 cmbs. Small nodules of caliche up

to 1 cm were present beginning about 60 cmbs. At 15m north of the centerline stake, the edge of the terrace scarp above the slump on which the flakes occur was examined by shovel cleaning and troweling 1 m of vertical profile. During cleaning, six flakes of Day Creek chert were encountered from 80-100 cmbs in the profile. The flakes were coated with caliche as were the flakes on the slump. The cleaned profile on the terrace scarp exhibited similar soil color and textures as that exposed in the 50 x 50 cm test units. Based on the findings of this portion of the investigation it was determined that a prehistoric archeological component is buried in the terrace formation 60-100 cmbs.

During this November, 1999 visit to the site, a possible Paleo-Indian/Early Archaic point stem of Alibates agatized dolomite was found on the surface of a slump bench below the terrace edge about 65 m south of the site area subject to the investigations (Figure 3). The stem is rectangular with heavily ground edges and base and parallel collateral flaking. A hinge fracture evidences the loss of the blade and reveals the stem to be lenticular in cross section, with one face much more convex than the other. The stem bears similarities to those of Eden type points (Perino 1971:30). Several flakes of Day Creek chert were also present in this area. While well south of the area being investigated, this find spurred thoughts that the site as a whole might represent a buried and relatively intact late Paleo-Indian/Early Archaic occupation, a rare occurrence in this part of the Southern Plains. Further subsurface investigations were warranted.

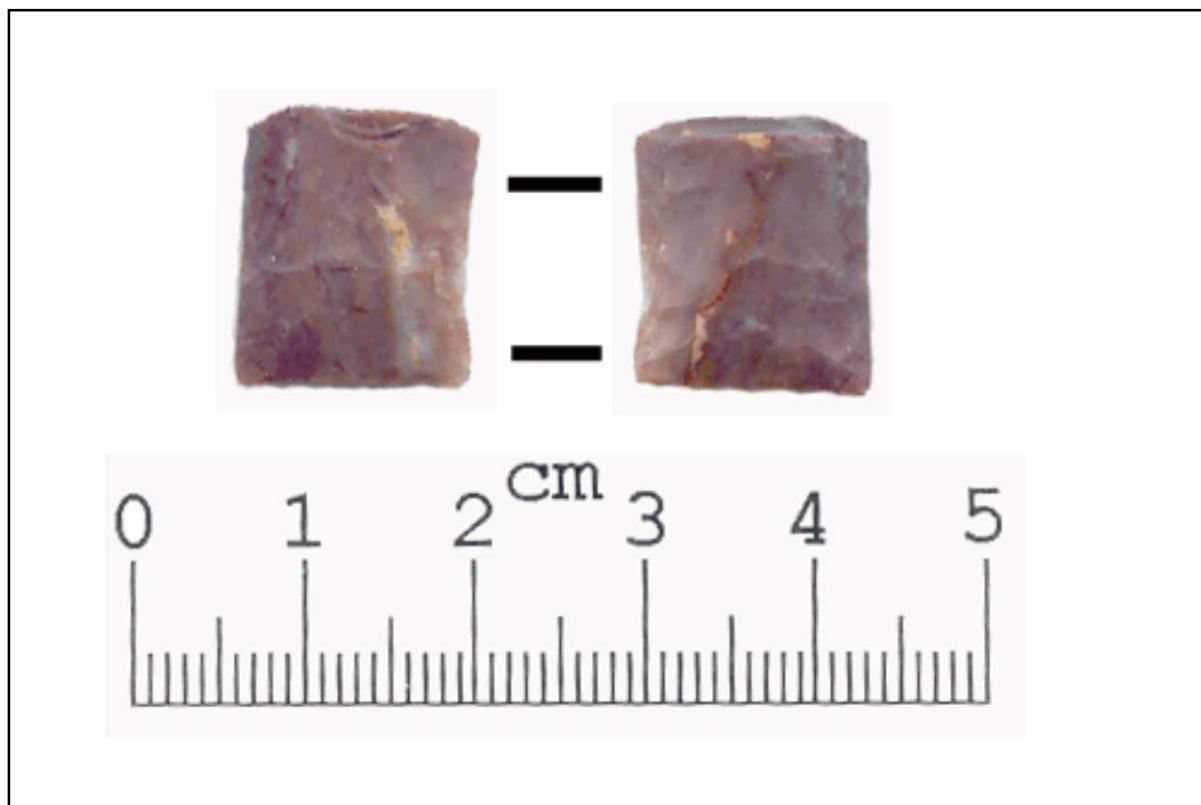


Figure 3. Eden like biface stem from 34HP55.

Further site evaluations took place March 14th to March 17th, 2000. This stage of investigations was designed to explore the cultural deposits 60-100 cmbs and included the use of a backhoe and hand excavation to uncover a sizeable portion of the site area. In addition an east/west backhoe trench was dug in order to better examine soil profiles and interpret the depositional sequence of the portion of the terrace in which the archeological materials occur.

Results of secondary evaluations are discussed in detail in this report and indicate that the site was a Late Archaic knapping activity zone confined within a small geographic area. The site's cultural deposit had been rapidly buried allowing for good integrity of site deposits, however, the area investigated held minimal content. In addition, much of the site at the terrace edge has eroded and slumped into the arroyo of Dry Buffalo Creek. Aside from the cultural material recovered during terrace profiling and excavation, little site content remains. Following completion of the field investigations, no further archaeological work was recommended for the site within the Area of Potential Effect (APE) and bridge and roadway construction continued through the project area as planned.

Environmental Setting

Physiography

The project is centered within Harper County, a region located in northwestern Oklahoma adjacent to the eastern end of the panhandle (Figure 1). The general topography of the region is gently rolling or hilly dissected uplands covered by prairies. This region straddles the divide between the High Plains and the Central Red-Bed Plains (Curtis et al 2008:8). The divide between these two geomorphic provinces is comprised of three other distinct geomorphic provinces which trend northwest/southeast through northwest Oklahoma. These include the Western Sand Dune Belts along the North Canadian River, the Western Sandstone Hills and the Cimarron Gypsum Hills (*ibid*).

Site 34HP55 occurs on Dry Buffalo Creek which merges with Buffalo Creek 4.5 km northeast of the site. Buffalo Creek is a tributary of the Cimarron River and confluences with the River 38.5 km east of 34HP55. At this juncture of the streams, a large salt flat occurs which is known as the Big Salt Plain (Johnson and Luza 2008:12). This valuable source of salt was noted by early explorers during the early 19th century. Several Prehistoric archeological sites have been recorded adjacent to this salt plain (Ferring et al 1976:51-83), a likely testament to the value of this resource to prehistoric inhabitants of the region.

On a broad scale, the Cimarron's watercourse, which headwaters in eastern New Mexico, lies primarily within the boundaries of the State of Oklahoma. Flowing south and eastward from the panhandle region and southwest Kansas, the Cimarron River arrives at its confluence with the Arkansas River in the northeastern portion of the state. Harper County contributes nearly three quarters of its topography as watershed inventory for the Cimarron.

Geology

The underlying geology of the area is the Permian-age Whitehorse Group (Miser 1954; Myers 1959:Plate 1). The Whitehorse Group is composed of fine-grained, reddish sandstone, shales and a few beds of gypsum as much as 175-200 feet (53-61m) thick (Myers 1959:37).

In the vicinity of 34HP55, the Rush Springs Sandstone and Marlow Sandstone members of the Whitehorse Group occur. Rush Springs Sandstone is an orange-brown, fine-grained sandstone cross-bedded with red-brown shale and gypsum. Often, the Rush Springs Sandstone is between 90 and 190 feet thick. The Marlow Formation is an orange-brown, fine-grained sandstone and siltstone inter-bedded with red-brown shale and silty shale as well as pink to maroon gypsum beds of less than 1 ft. in thickness. In northwestern Oklahoma, the Marlow Formation is comprised of the Doe Creek Member, a lentil of coarse-grained, calcareous sandstone with algal clumps and invertebrate fossils. Reaching thicknesses of between 70 and 120 ft., the Doe Creek Member occupies the high hills that strike northeast across the region.

On higher elevations to the north and south of 34HP55, at a distance of 4-5 miles (6.5-8 km) occur lower portions of the Cloud Chief formations which contains the Day Creek Dolomite member (Myers 1959:Plate 1). This dolomite formation contains chert nodules which were exploited by prehistoric knappers for the production of stone tools. Day Creek chert will be discussed in the Lithic Resources section of this chapter.

Soils

The Whitehorse Group is parent material for the Woodward-Quinlan association of loamy soils (Nance et al. 1960) in which 34HP55 occurs. These soils are moderately deep and moderately to strongly sloping (3-8 percent). The Woodward-Quinlan A-horizon generally rests upon limey loams or soft sandstone. Woodward-Quinlan soils have a limited capacity for water storage and are unsuitable for growing any crops except wheat and sorghum. Because of their low to medium propensity for wind erosion and medium to high propensity for water erosion, these soils are most often used as native grass pasture. Due to high evapotranspiration rates and limited rainfall, little leaching of soils in the area occurs. However, more permeable soils may have water penetration and soil development to considerable depths. Often, levels of permeability can be discerned by distinct lime zones in the soil profile (Nance et al. 1960). The soil mapped on the site area is Woodward-Quinlan loam 3-8 percent slopes. A more detailed description of the soil on the site is presented in the Site Investigations section.

Climate

Harper County's geographic position limits the moisture it receives as precipitation. The mean precipitation it receives is 24-28 inches per year (Johnson 2008:18). The somewhat xeric continental conditions existing in the site locality are the result of Pacific air masses which ride the Jet Stream being wrung of their maritime tropical moisture as they elevate over the Sierra and Rocky Mountains leaving little moisture to be deposited on the central Southern Plains. In addition, the Jet Stream often blocks the large, moist, warm air masses moving north out of the Gulf of Mexico, preventing these frontal systems from driving far enough north to deposit moisture in the region.

Spring is the primary season when solar heating is capable of generating enough monsoon energy within Gulf Air masses that they are capable of penetrating far enough north and west to deposit precipitation in Harper County. This moisture is usually delivered by intense thunderstorms that release heavy rainfall of short duration. Nearly 62 percent of the yearly

precipitation in Harper County is delivered between May and September (Nance et al. 1960). The mean annual precipitation is between 24-28 inches (Johnson 2008:18).

The same solar energy that brings Gulf Air into the region also generates high southwesterly winds throughout the warm season. The high winds produce rapid, excessive temperature changes and extreme evaporation of a region that is already precipitation limited. Average summer temperatures are 80 F with highs that reach into the 100's F. Winter temperatures average 37 F with extremes as low as -17 F (Johnson 2008:18, Nance et al. 1960).

Vegetation

In response to the climatic vagaries of the region, the vegetation has adapted to be either diminutive in size, adhere to the wetter lowlands within canyons and gullies, or grow prodigious root bases in order to increase surface area for absorption of moisture. Just as with the physiographic provinces, the site locality straddles two environmental regions, the short-grass and mixed-grass prairies (Hoagland 2008:17; Morris et al. 1976). The boundaries of the two environmental biota are regulated adaptively by differences in moisture availability, allowing them to expand or contract relative to the region's climatic cycles.

Grasses in the area range in size from the short grass species blue gamma (*Bouteloua gracilis*) to the tall grass species little blue stem (*Andropogon scoparius*). Interspersed within the grass savannahs are copses of skunkbush sumac (*Rhus trilobata*), occasional stands of yucca (*Yucca glauca*), and rare hummocks of Western prickly pear (*Opuntia humifusa*), tree (*Opuntia arborescens*), and ball cacti (*Neomammillaria vivipara*). Though most of the upland settings are pastoral, Chenopodia, Helianthus, thistle, and amaranth are presently found in areas that were historically cultivated (McKay et al. 2004; Nance et al. 1960).

Most of the native trees grow in sandy soils occupying the bottom lands along streams as well as along valley margins where runoff irrigation is heavier. However, these riparian corridors are never densely wooded. Principle native trees in the site locality are cottonwood (*Populus deltoides*), slippery elm (*Ulmus rubra*), hackberry (*Celtis occidentalis*), and eastern red cedar (*Juniperus virginiana*). Willows (*Salix* sp.) and tamarix (*Tamarix gallica*) can be found within wet zones along the bottoms. Shrubby plants in the site locality include Chickasaw plums (*Prunus angustifolia*), skunkbush sumac (*Rhus trilobata*), white prickly poppy (*Argemone intermedia*), Russian thistle (*Salsola kali*), tumbleweed (*Amaranthus graecizans*), sensitive briar (*Schranksia nuttallii*), and sand sagebrush (*Artemisia filifolia*) (Nance et al. 1960; Weaver and Albertson 1956).

Fauna

The High Plains/Gypsum Hills region supported a wide variety of fauna prior to the late 19th and 20th Century settlement and agriculture practices took the region. Throughout prehistory and into the historic period, mammals provided an important resource for humans in the region both as food items and for clothing and shelter needs.

Though they were not the sole faunal resource available to Plains inhabitants, mammals served as primary game and the most plentiful protein resource available to humans in

northwestern Oklahoma. Important large mammals inhabiting the prairies included elephant (*Mammuthus columbi*), bison (*Bison antiquus* through *Bison bison*), deer (*Odocoileus virginianus*, *Odocoileus hemionus*, and *Cervus elaphus*), pronghorns (*Antilocapra americana*), and bear (*Ursus americanus* and *Ursus arctos*). Other mammals of importance to early occupants of the region included cats (*Felis concolor* and *Lynx rufus*), dogs (*Canis latrans*, *Canis lupus*, *Vulpes vulpes*, *Vulpes velox*, and *Urocyon cinereoargenteus*), raccoons (*Procyon lotor*) and ringtails (*Bassariscus astutus*), porcupines (*Erethizon dorsatum*), beaver (*Castor canadensis*), weasels (*Mustela* sp., *Mephitis* sp., *Taxidea Taxus*, and *Lutra canadensis*), hares and rabbits (*Sylvilagus* sp. and *Lepus* sp.), opossums (*Didelphis virginiana*), squirrels (*Marmota monax*, *Spermophilus* sp., and *Cynomys ludovicianus*), gophers (*Geomys bursarius* and *Pappogeomys castanops*), as well as rats and mice (*Perognathus* sp., *Reithrodontomys* sp., *Peromyscus* sp., *Neotoma* sp., *Microtus* sp., *Sigmodon hispidus*, and *Neotoma micropus*) (Bee et al. 1981; Jones et al. 1985).

Avian resources exploited by early human occupants of the region included native and seasonally available birds such as turkey (*Meleagris gallopavo*), pheasant (*Phasianus colchicus*), quail (*Colinus virginianus* and *Calipepla squamata*), grouse (*Tympanuchus* sp.), diurnal birds of prey such as hawks, kites, eagles, falcons, and vultures, nocturnal birds of prey such as owls and nighthawks, waterfowl like ducks, geese, swan, and pelicans, shorebirds including gulls and terns, waders such as stork, crane, ibis, spoonbill, bittern, herons, and egrets in addition to cuckoos and roadrunners, crows and ravens, dove and pigeon including the now extinct passenger pigeon (*Ectopistes migratorius*), and a multitude of perching songbirds (Baumgartner and Baumgartner 1992).

Other animals available to early human occupants of the region included reptiles (snakes, turtles, and lizards), amphibians (frogs and salamanders), molluscs (bivalves and snails), and numerous species of fish. Smaller game was used not only to supplement diets but also to provide people with material for producing accessories such as clothing or tool decoration like bird bone, mollusk shell, or fish scale beads or for producing gaming pieces such as dice, tops, or gaming tubes (Culin 1975). Unique skins were also used as grips for small tools or ceremonial items such as drums, rattles, or staffs.

Lithic Resources

Harper County Oklahoma contains several outcrops of Day Creek Dolomite (Myers 1959:41). The Day Creek is part of the Cloud Chief Formations and the Day Creek Dolomite is exposed on several hill and butte tops in Harper County and extends into Clark County Kansas north of Harper County Oklahoma (Suffel 1930:81-100). The Day Creek Dolomite often contains chert nodules just beneath the dolomite. There are many varieties ranging from blueish, gray, whitish and maroon. These nodules have been harvested and used as a source of stone tools throughout much of prehistory (Bailey 2000). Large prehistoric quarry sites are located 15 km north (34HP40) and 25 km southeast (34HP37) of 34HP55. Here, prehistoric knappers sought the un-weathered nodules of Day Creek chert by removing and/or digging under the dolomite ledge (Bailey 2000:103-104). Baily's (2000) study goes on to ascertain that the Day Creek chert nodules close to the surface, or exposed to weathering processes are often fractured and undesirable for knapping into stone tools (Bailey 2000:51). Site 34HP37 contains some varieties very similar in appearance to

Alibates agatized dolomite, bedrock sources of which occur in the Texas panhandle (Banks 1990:91). Bailey's (2000) study of Day Creek chert outcrops indicates that while exploitation of this lithic material occurred throughout much of the prehistoric period, there seems to be an increasing intensity in its use during the Archaic period.

In addition to the Day Creek chert outcrops in Harper County, gravels derived from the Ogallala Formation are present as lag deposits on some hill tops, high terraces and streams (Bailey 2000:55-56). The gravels contain a variety of knappable materials including quartzite, chert and petrified wood (Banks 1990:94).

Archaeological/Cultural Setting

Increasing numbers of identified sites in the Harper County area suggest that humans have occupied northwestern Oklahoma for at least the past 13,000 years. However, it is possible that there was antecedent occupation of the region by groups that left no relict cultural remains. This may have been due to poor preservation or the inability to recognize associated artifacts because of deep burial or plain lack of serendipity in locating intact sites. In this section cultural developments associated with or circumferential to northwestern Oklahoma will be briefly discussed.

Pre-Clovis

Prehistoric occupations in North America are known to extend back to the Late Pleistocene between 11,000 and 13,000 years ago. During this time distinctive fluted bifaces known as Clovis points are the hallmarks of a wide spread cultural complex. Occupations prior to this time are a matter of debate among archaeologists. The recent acceptance of radiometric dates from the Monte Verde site in southern Chile confirming occupation of the site around 14,800 years ago (Dillehay et al. 1997) certainly raises the question of pre-Clovis occupations in North America.

About 28 km east of site 34HP55, work at the Burnham site (34WO73) has resulted in intriguing finds concerning Pleistocene occupations on the Southern Plains (Wyckoff et al. 2003). The recovery of lithic artifacts in association with an extinct form of large horned bison within a deposit radiometrically dated to 35,000-36,000 ago (Wyckoff et al. 2003:249-260) has provided tantalizing evidence of potential early human occupations in the area. Further indications of Pre-Clovis cultural manifestations on the Southern Plains of Oklahoma comes from the Cooperton site (34KI26) in Southwest Oklahoma where evidence suggests human processing activity in association with mammoth remains dated to about 16,000 years ago (Anderson 1975).

Paleo-Indian Period (ca. 12,000 - 8,000 B.C.)

Evidence of people occupying the Southern Plains beginning about 12,500 year ago is apparent from several sites in the region. This time frame witnessed the onset of the Holocene and the accompanying changes in environmental changes and faunal extinctions. It is thought that highly mobile groups were engaged in hunting and gathering throughout much of the plains till about 9000 years ago. The Clovis and Folsom complexes are two of the earlier manifestations of these groups identified by archaeologists. Based on the findings

at sites in western Oklahoma such as Domebo, Waugh, Jake Bluff and Cooper, the hunting of large mammals, including late Pleistocene fauna such as mammoth and bison, is one documented facet of their adaptation (Leonhardy 1966; Hofman and Carter 1991; Bement 1999). Distinctive lanceolate, fluted bifaces are the hallmark of both the Clovis and Folsom traditions. Scrapers, choppers, knives, and gravers complete the lithic tool assemblage used by Clovis and Folsom groups (Hofman and Wyckoff 1991).

One of the earliest Clovis Period archaeological sites in Oklahoma is the Domebo site located near Anadarko in Caddo County, approximately 190 km southeast of 34HP55. At Domebo, Clovis bifaces and flake debitage were recovered in association with mammoth remains (Leonhardy 1966a). A more recent analysis of Clovis occupations in Oklahoma is being carried out at the Jake Bluff site in Harper County. At Jake Bluff, Clovis-style points have been found in association with an orchestrated bison kill where bison were driven into an arroyo and lanced from the arroyo rim (Bement 2005).

As the Late Pleistocene environment of Oklahoma transitioned into that of the warmer, dryer Early Holocene (Antevs 1955), Paleo-Indian survival strategies also underwent significant changes. As evidenced by the Waugh and Cooper sites in Harper County, groups using the distinctive Folsom point in northwestern Oklahoma maintained a focus on bison hunting (Bement 1997; Hill and Hofman 1997). The Waugh and Cooper sites attest to Folsom hunters trapping bison in gullies and dispatching them with darts or spears tipped with the distinctive fluted Folsom points (Bement 1997; Hill and Hofman 1997). The Cooper site (34HP45), located near the Clovis aged Jake Bluff site, produced evidence of multiple kill episodes as well as a bison skull with a painted design (Bement 1999). The site produced radiometric dates of around 10,200 BP. The Waugh (34HP42) site has also been radiometric dated to around 10,200 years BP (Hofman and Carter 1991). Hofman's (1993) study of the distribution of documented Folsom points in Oklahoma documents only one point in north central Oklahoma and that being found in Kay County, east of 34GT47. Most occurrences are in western Oklahoma.

Late Paleo-Indian manifestations in Oklahoma are poorly understood. Several lanceolate styles of Paleo-Indian bifaces, such as Plainview, are common throughout the region, but sites producing *in situ* assemblages are rare. Many lanceolate bifaces are found in canyon settings (Hofman 1993) and sites producing similar bifaces are known on the Dempsey Divide in Roger Mills County (Thurmond 1990). The Perry Ranch (34JK81) site in southwest Oklahoma has produced Late Paleo-Indian style lanceolate bifaces similar to those from the Plainview site in association with at least two bison (Saunders and Penman 1979; Hofman and Todd 1997). It appears that bison and the hunting of large mammals remained an important aspect of adaptation throughout the Paleo-Indian period. While in the early stages of investigations, several sites in the Beaver River drainage in the Oklahoma panhandle manifest Late Paleo-Indian occupations including campsites and kill sites (Bement et. al. 2007). Further work on such sites will broaden our view of the Late Paleo-Indian period.

Archaic Period (8,000 B.C. - 200 A.D.)

Archaic adaptations in western Oklahoma are obscure and poorly understood. Generally, knowledge gaps concerning cultural traditions of the Archaic Period are attributed to the hot, dry environmental conditions of the Altithermal (Antevs 1955). Early models of Archaic adaptations during the Altithermal suggest that between 8,000 and 2,000 B.C., people inhabiting Oklahoma became more mobile, possibly even vacating much of the state during the harshest periods.

Recent geoarchaeological analysis of organic soils related to the Southern Plains Archaic Period (Artz, Joe Alan 1976; Cranford et al 2009; Ferring 2000; Hofman and Drass 1990; Hofman et al. 1989; Holliday, 1989; Mandel 1994a, 1994b, 2000, 2003), along with a serendipitous find of an Archaic Calf Creek point imbedded in the frontal bone of a bison (Bement et al. 2005), indicate that Oklahoma may actually have been inhabitable during much of the Altithermal. It has become more apparent that instead of a continual period of drought during the Altithermal, the Southern Plains may instead have experienced cyclical periods lacking in effective moisture or that moisture which is delivered during portions of the season most optimal for plant growth. Poor effective moisture resulted in the loss of plant life anchoring soils. Not only did this reduce the faunal, and subsequently human, inventory of the region during these cycles, but loss of plant life also subjected soils to heavy erosion when the delivery of moisture did finally occur. Upland sites during the Archaic Period were taphonomically altered or destroyed through erosive wasting while sites lower on the landscape were deeply buried by the overburden of rapidly eroding upland soils (Bement et al. 2002; Wendland 1978; Wyckoff 1995).

Few sites in Oklahoma have been recorded in relation to the Archaic Period and those few that have been studied provide only ephemeral data on Archaic lifeways. The Archaic period is divided into three significant periods, the Early (8,000 - 4,000 B.C.), the Middle (4,000 - 2,000 B.C.), and the Late (2,000 B.C. - 200 A.D.). Withering environmental conditions may have forced extinction upon the megafauna hunted by Paleo-Indian groups (Haynes 1991), compelling Archaic peoples to diversify their subsistence regimes by depending more on local, seasonally available resources rather than adhering to previously nomadic traditions. This has resulted in the recording of a few, intensively occupied or continually re-occupied sites in Oklahoma which have produced a lithic inventory that displays an increasing dependency on local raw material (Hammatt 1976; Hofman 1989).

No radiometric dated Early or Middle Archaic sites are noted in northwestern Oklahoma, and in fact, the only Early Archaic site in southwestern Oklahoma is the deeply buried Gore Pit site along the terrace of East Cache Creek, a tributary of the Red River in southwestern Oklahoma (Hammatt 1976). The artifact inventory for Gore Pit includes several burned rock features, several corner-notched bifaces not associated with these features, and a wide variety of subsistence resources to include mussels, plant remains, and small mammal remains. Radiometrically dated soils from Gore Pit suggest a burial date of 5,150 B.C. for the site.

Talisman of the Middle Archaic tradition on the Southern Plains are the large, thin, leafolate-shaped, basally-notched bifaces subsumed under the Calf Creek cultural horizon (Wyckoff 2005). Unlike the Gore Pit campsite, Middle Archaic sites are generally small

bison kills, small base camps located on topographical promontories, and/or caches of bifaces and flake preforms. Calf Creek “cachement” techniques indicate intensive reuse, and therefore permanent occupation of the landscape across the Southern Plains (Bement et al. 2002; Johnson 1987, 1997; Duncan 1996; Wyckoff 1995).

The most prevalent sites of the Archaic Period are from the Late Archaic. Numerous camps, shelters, bison kill sites and lithic quarries or workshops, such as Certain, Twilla (Bement and Buehler 1994; Buehler 1997; Thurmond 1991), Duncan-Wilson (Lawton 1968), Little Sunday (Hughes 1955), Lubbock Lake (Johnson and Holliday 1986), and Summers (Leonhardy 1966b) have been identified across the panhandle of Texas and western Oklahoma. Increasing numbers of large bison kill sites during the Late Archaic is attributable to a reversal in climatic conditions away from the xeric Altithermal to more mesic conditions similar to present day. Flourishing plant communities resulted in an increase in bison availability, allowing human populations in the region to flourish as well (Buehler 1997; Dillehay 1974; Hughes 1955). Artifacts representative of the Late Archaic hunters include large, corner-notched projectile points, triangular knives, large end-scrappers, choppers, hammer stones, retouched flakes, and thin grinding slabs. Lithic artifacts were generally produced from locally obtainable, poor to moderate quality resources such as Day Creek dolomite and Ogallala quartzite (Bement et al. 2002; Drass and Turner 1989; Hughes 1984; Thurmond 1991).

Plains Woodland Period (A.D. 200 - 1000)

Evidence for the Woodland Period on the prairies of the High Plains is scanty and obscure. Unfortunately, many Woodland sites lack clear stratigraphy, diagnostic artifacts, or dateable sediments (Johnson and Johnson 1998:214-215). A significant feature of the Plains Woodland Period is the introduction of the bow and arrow, inferred by a prevalence of small corner- and side-notched chipped stone points, and the onset of ceramic production—a hallmark of increasing sedentism. However, ceramics of the Woodland Period were often rudimentary in design and style, and did not preserve as well as the ceramics of later traditions on the Southern Plains. Additional implications that Plains Woodland groups became increasingly sedentary can be gleaned from sites such as those along the Dempsey Divide, Swift Horse, Beaver Dam, Lake Creek, Von Elm, and Brewer where the presence of structural postholes is coupled with storage and basin pits and large amounts of difficult to transport ground stone implements (Briscoe 1987; Drass 1988; Johnson and Johnson 1998; Thurmond 1991; Thurmond et al. 1998; Vehik 1984; Vehik and Pailes 1979; Wyckoff and Brooks 1983).

Unfortunately, without radiometric dates or the presence of pottery and arrow points, Woodland sites on the Southern Plains are poorly distinguishable from many Late Archaic occupations. Hunting and gathering maintain preeminence in the subsistence patterns, though game choices begin to diversify. Interregional contact began to increase during the Woodland Period substantiated by the occasional presence of items such as obsidian and Southwest designed ceramics in site assemblages (Wyckoff and Brooks 1983). At sites such as Patsy’s Island (34HP70) in Harper County, there is evidence that Plains Woodland groups are also becoming increasingly dependent upon horticulture, particularly corn (*Zea mays*) (Bement et al. 2002; Carmichael 2004; McKay et al. 2004). In this regard, it appears that the

Plains Woodland Period in western Oklahoma was a transitional, *in-situ* phenomenon whereby human groups who were becoming less mobile hunters and gatherers begin exhibiting the precursory techniques of horticultural dependence that become synonymous with the Plains Village groups of the Late Prehistoric Period.

Late Prehistoric Period (A.D. 1000 - 1500)

Plains Village societies are the first in western Oklahoma to exhibit widespread construction of permanent structures. In addition, numerous in-ground storage structures and burials are associated with Plains Village houses. Horticulture becomes more widespread and with it are bone and stone implements for cultivation. The spread of prehistoric farmers may have coincided with a period when a horticulturally favorable climate dominated the region (Baerreis and Bryson 1965). Assuming a major role in the subsistence regime of Plains Village groups, horticulture included not only the Mesoamerican domesticates, but such local plants as marshelder or sumpweed (*Iva annua* var. *macrocarpa*), maygrass (*Phalaris caroliniana*), little barley (*Hordeum pusillum*), sunflower (*Helianthus annuus* var. *macrocarpus*), pigweed (*Amaranthus* sp.), and lambsquarter or goosefoot (*Chenopodia berlandieri* sp. *jonesianum*) (Minnis and Elisens 2000).

Availability of large game such as bison and deer, along with a generalized diet that was heavily dependent upon horticulture allowed populations of the Late Prehistoric to fluoresce. Sedentism that was centered on cultivation meant that Plains Village sites were intensively used for long periods. In general, Plains Village sites consist of hunting camps, resource procurement and specialized activity locations, one- to five-house farming hamlets, and large, multi-structure villages. Artifacts generated by Plains Village groups included a prevalence of un-notched and side-notched arrow points, plain and cordmark-decorated globular pots, and a vast array of chipped and ground stone tools. Along with this broadened artifact inventory is the expansion of trade. Communication with the Southeast, Southwest, and North-central portions of the United States introduced unique materials into Late Prehistoric inventories in Oklahoma to include unusual pottery designs and manufacturing techniques, non-local lithic resources, and preciousities such as turquoise, galena, catlinite, and other pipestone.

Because of increased artifact and site availability from the Late Prehistoric, and due to the expanded and extensive artifact inventories at these numerous sites, archaeologists have been able to develop many temporally and spatially distinct cultural traditions for the Plains Village Period on the central Southern Plains. However, none of these traditions or complexes have been attributed to sites in Harper County. Three major Plains Village sites noted along the southern terrace of the Cimarron—Rogers, Lonker, and Fred Loomis—are as yet undefined as to cultural phase, complex or variant (Drass and Turner 1989).

Redbed Plains Variant

The earliest Late Prehistoric cultural complexes of west-central Oklahoma are defined by Drass (1997) as a local Plains Village development known as the Redbed Plains variant. The Redbed Plains variant occupies regions along the Washita River and the northern tributaries of the Red River in west-central Oklahoma. Thought to be an *in-situ* development from existing Woodland groups, the Redbed Plains variant is subdivided temporally into two time

periods, both spatially divided between eastern and western phases. The earliest period (800-1250 A.D.) included the western-most Custer phase and eastern-most Paoli phase. The later period (1250-1450 A.D.), suggested by changes in settlement patterns, architecture, and subsistence regime, is divided between the western-most Turkey Creek phase and the eastern-most Washita phase (Hofman 1978; Moore 1987).

Upper Canark Variant

West of Harper County is the Late Prehistoric complex known as the Upper Canark variant (1100-1500 A.D.) which, until recently (see Brosowske 2005) included much of northwestern Oklahoma. The Upper Canark variant as defined by Lintz (1984) included Krieger's (1946) Panhandle Aspect and Antelope Creek phase of sites "...occurring along and between the upper portions of the Canadian River and the southern tributaries of the Upper Arkansas River..."(Lintz 1986:25) in the north-central portion of the Texas panhandle as well as the panhandle and northwestern corner of Oklahoma. Lintz (1986) also included Campbell's (1976) series of Apishapa focus sites along major Arkansas River tributaries of the Chiquaqua Plateau in southeastern Colorado and northeastern New Mexico. The most distinct feature of the Upper Canark variant tradition was the use of flat stone slabs and adobe in the construction of foundations for single or multi-room semi-subterranean structures or pit-houses found in extended villages. However, open camps, bison kills, and rock shelters have been attributed to the Upper Canark variant as well (Hughes 1991; Lintz 1984).

Odessa Phase

Recent work by Brosowske (2005) has characterized a number of sites across the panhandle of northwestern Oklahoma and in the region of the Buried City Complex of the Texas panhandle as distinct from the Upper Canark variant. Coined the Odessa phase (1250-1475 A.D.), this cultural manifestation is quite similar to sites of the Antelope Creek phase, but are differentiated from the Antelope Creek phase primarily by the lack of stone foundations in pit-house construction, differences in the use of lithic raw materials, and differences in decoration elements and surface treatment of pottery.

Decoration and surface treatment of Odessa phase pottery is highly variable but its uniqueness, compared to Antelope Creek phase ceramics, concerns the production of primarily smoothed-over cordmarked vessels that are rim and neck decorated. As for chipped stone material, the use of Alibates agatized dolomite from bedrock sources along the Canadian River in the Texas panhandle is significantly lower at Odessa phase sites (50 percent) than at Antelope Creek phase sites (80-100 percent). Odessa phase sites also have a high frequency of Smoky Hill and Niobrara jasper present in the chipped stone inventory. The nearest source for these lithic materials is northwest Kansas.

In general, culture complexes west of Harper County are differentiated not only by differences in geography, but variations in architecture, ceramic design or importation, differences in exchange goods, specialized chipped stone tool production, and in subsistence, a change of focus from broadly foraging generalists to hunters who produced the majority of their domestic toolkit from bison processing.

Zimms Complex

Immediately west of Harper County is a series of unique sites that have failed to be characterized as part of the Turkey Creek phase of the Redbed Plains variant, the Antelope Creek phase of the Upper Canark variant or the Odessa phase of the Oklahoma panhandle. Settlements consist of farming hamlets on ridges or high terraces above streams. Structures include possible arbors and square houses with central channels, wall posts, and daub. Because of poor association with other contemporaneous cultural traditions in the area, sites such as Zimms, New Smith, Lamb-Miller, Blackketter-Pyeatts, and Wickham #3 in Roger Mills County and Hedding in Woodward County have been lumped into an indistinct Late Prehistoric unit known as the Zimms complex (Brooks et al. 1992; Brosowske 2002; Drass 1998; Drass and Turner 1989). However, more recent analysis of site assemblages by Drass (1989:4) and Brosowske (2002) concur that the only Zimms complex site in Woodward County (Hedding: 34WD2) has enough significant differences in its ceramic inventory and subsistence economy to prevent its inclusion in the complex.

Flynn (1984) suggests that the sites of the Zimms complex are affiliated with Antelope Creek groups based upon structural remains at the type-site. However, no other structures found at Zimms complex sites corroborate that notion and an additional argument is made that a sure sign of Antelope Creek affiliation, the predominance of Alibates agatized dolomite in the chipped stone inventory, is not found at Zimms complex sites (Brosowske 2002). In contrast, Zimms complex lithics are primarily local resources or Flint Hills chert imported from Kay County in north-central Oklahoma.

Drass (1998) and Drass and Turner (1989) suggest a dissimilarity between Zimms complex and Antelope Creek ceramic assemblages. In turn, they suggest an affiliation of the Zimms complex with Turkey Creek groups of the Redbed Plains variant, particularly when compared with the McLemore site. Unfortunately, the prevalence of Kay County chert in the Zimms complex inventories is not duplicated in the chipped stone assemblages of Turkey Creek sites. Assumption of affiliation with Washita River groups is based upon a higher degree of agreement in ceramic styles. Brosowske (2002:36) goes on to note, however, that decorated ware is rare in Zimms complex inventories while plentiful at Turkey Creek sites.

In essence, understanding of the Zimms complex will only be refined through more extensive study of Late Prehistoric sites in the area and with more explicit definitions of cultural variability in areas such as the Zimms complex region that are peripheral to more homogenous taxonomic units. For the time being, the Zimms complex remains a unique adaptation to the Late Prehistoric environment of western Oklahoma that was locally derived from groups of the Plains Woodland Period.

Bluff Creek Complex

The final Late Prehistoric Period cultural complexes discussed in close geographic relation to Harper County is the Wilmore, Pratt, Bluff Creek, and Great Bend traditions of south-central Kansas. The earliest of these, (unreliably) radiocarbon dated between 1,000 and 1,500 A.D., is the Bluff Creek complex (Drass 1998). The Bluff Creek complex, found along the Chikaskia River west of the Arkansas River at the border of Kansas and Oklahoma, is a series of small villages composed of oval, square, or rectangular, daub-plastered houses that

have both internal and external, cylindrical in-ground storage features. Bison bone tools are abundant at Bluff Creek sites and pottery is both plain and cordmarked.

Pratt Complex

Located north and slightly west of the Bluff Creek complex, along the Arkansas River and its tributaries at the western end of the Great Bend, is the Pratt complex. The Pratt complex is thought to have developed from the Bluff Creek complex due to similarities in artifact assemblages with the addition of Southwest design ceramics. Original dates for the Pratt complex were based upon seriation of the Southwest ceramics, resulting in a chronological range of between A.D. 1,400 and 1,500 for the complex. More recent radiocarbon dates from 14PT304 suggests that the Pratt complex may have, in fact, been a contemporary of the Bluff Creek complex (Drass 1998).

Pratt complex structures were oval with a central hearth. Some structures had central posts and in-ground storage features while others did not, an adaptation thought to reflect differences in site usage. The primary difference between Bluff Creek and Pratt complex sites was in the number of trade materials present. Pratt complex sites possessed turquoise, ceramics with Southwest designs, obsidian, *Olivella* and Gulf marine shell, and a predominance of Alibates agatized dolomite imported from the Texas and Oklahoma panhandles.

Great Bend Aspect

Based upon the stratigraphically distinct occupation of the Lewis and Larned sites, the Pratt complex is thought to have been precursory or ancestral to the Great Bend aspect and therefore the early Wichita tribe (O'Brien 1984). Wedel (1959) defined the Great Bend aspect as a series of sites occupying tributaries of the Little and the Lower Walnut Rivers, both of which are tributaries of the Arkansas River. According to Drass (1998), Southwestern ceramic styles and the presence of European goods such as iron, copper and brass beads, and chain mail, have been used to date the Great Bend aspect between A.D. 1,450 and 1,700.

Great Bend sites are large villages situated on terraces alongside streams. Houses may be surface or semi-subterranean and are round to oval in shape. Numerous large, bell-shaped pit features occupy Great Bend sites. Artifact assemblages are typical of the Late Prehistoric Period comprised of end and side scrapers, unnotched triangular arrow points and drills, elbow pipes, some ground stone tools, ovate and beveled chipped stone knives, ceramics, and large amounts of bone implements indicating a focus on horticulture as well as bison hunting.

Wilmore Complex

Though it is known primarily from the Bell and Booth sites, the Wilmore complex includes a number of sites along tributaries of the Cimarron River (Bevitt 1999; Drass 1998). Radiocarbon dates and artifact assemblages suggest that the Wilmore complex may have had its origin in the Bluff Creek traditions. However, the Wilmore complex also shares some trait similarities, particularly in ceramic styles and surface treatment, with the Zimms complex immediately to the south (Rowlison 1985:125-126). The Wilmore complex is unique, in that much of the artifact assemblage resembles those of the Woodland Period.

Points recovered from Wilmore complex sites are small side-notched and medium-sized corner notched made predominantly from non-local lithic material such as Niobrara jasper, Alibates agatized dolomite, and Kay County chert. Grinding slabs and manos are present but evidence suggesting the inclusion of plants in the subsistence inventory ends there.

Proto-historic Period (A.D. 1,500 - 1,700)

A proto-historic taxonomic unit has been synthesized for the west-central and southwestern portion of Oklahoma. Termed the Wheeler phase, Baugh and Drass (1997) consider this proto-historic tradition to have been an indigenous manifestation of the Plains Caddoan. Geographic associations and similarities in ceramic types define cultural continuity of Wheeler Phase traditions with preexisting Late Prehistoric groups (Baugh 1986; Swenson 1986). The Wheeler phase is a compilation of the Wheeler complex defined by Bell and Bastien (1967) for west-central Oklahoma and the Edwards complex defined by Hofman (1984) for southwestern Oklahoma. Based upon similarities in cultural assemblages, the two complexes are thought to represent one entity or tradition with slight variations in the types and locations of sites occupied and in their trade relations.

Wheeler phase sites have produced an extensive array of artifacts to include predominantly Edwards Plain sand/grit tempered pottery, unnotched and notched triangular arrow points, expanding-base drills, end- and side-scrappers, knives, ensiform pipe reamers, bone artifacts, and extensive quantities of non-local artifacts such as lithics, ground stone, shell, and minerals from the Southwest, Southeast, and High Plains/Central Plains of the United States. However, bone implements are fewer at Wheeler phase sites than at sites of the preceding Late Prehistoric, suggesting that horticulture may not have been as important to the subsistence economy of proto-historic Oklahomans. A radiocarbon date of A.D. 1678 to 1772 for the Little Deer site demonstrates a chronological range for site occupation during a period when European contact may have been transforming economic systems throughout the region.

Surplus production of bison products in exchange for French trade goods may have been taking precedence over the horticultural efforts during the Late Prehistoric and competition over European trade may also account for the construction of fortification ditches at sites such as Duncan, Edwards I, and Bryson-Paddock during the Proto-historic (Baugh 1982, 1986; Drass 2005; Drass and Baugh 1997). It is also likely, based upon less evidence for horticulture and greater evidence of bison hunting coupled with the manufacture of fortified villages, that Proto-historic groups were reverting to a semi-sedentary existence, possibly organized around seasonally determined communal gatherings for trade and renewal celebrations (Baugh 1982). Drass and Baugh (1997) consider the Wheeler phase to be antecedent to the Plains Wichita, though they do recognize, as pointed out by Hofman (1984), that the influx of Apachean groups into southwestern Oklahoma skews our understanding of the relationship of Proto-historic people to Historic tribal ethnicities.

Historic Period (A.D. 1,700 to Present)

Though the first *sallé* by Europeans into the area of Harper County was discussed in the Entradas of Coronado and Oñate in the early 1500's, little else was written during the early Historic Period to describe the nature of the region and its indigenous occupants. It wasn't

until the early 1800's when the region was integrated into the United States through the Louisiana Purchase of 1803 that more extensive written history concerning western Oklahoma actually appears.

During the intervening 200 years following the arrival of the Conquistadors, historic Plains Indians such as the Apache, Comanche, and Kiowa, were influenced significantly by the transmission of European culture. Some were transformed from sedentary and semi-sedentary hunters and gatherers into equestrian nomads utilizing a grassland foraging economy. Other Plains groups, such as the Wichita, retained their sedentary nature continuing to practice extensive farming and foraging.

The introduction of the horse was one of the most important features of change affecting Plains Indian traditions. However, each group integrated European attributes differently. The Kiowa and Kiowa-Apache, both recent arrivals to the Southern Plains during the Historic Period, continued with preexisting traditions of fissioning into smaller units over the winter months and congregating into large groups for hunting during the spring and summer months (Baugh 1982; Mooney 1898). In contrast, the Comanche maintained large, segregated bands throughout the year. The Southern Plains Comanche did not practice communal ceremonies or integrated hunting, preferring instead to hunt bison from horseback year round to fulfill subsistence and trade needs as they were encountered (Baugh 1982; Wallace and Hoebel 1952)

The Wichita adopted a different economy from both the Kiowa and the Comanche. According to the historical accounts of the 1834 Dragoon Expedition out of Fort Towson, the Wichita employed a mixed economy, constructing large, permanent summer villages of multiple (500-600), beehive-shaped, grass-thatched houses surrounded by extensive gardens that grew squash, melon, corn, pumpkin, and beans (Allen 1877; Catlin 1973). During the Winter, after the bison had again moved south with the cooler temperatures, the Wichita prepared and stored the Summer and Fall harvest, brought tipis out of storage, then abandoned the Summer villages for the purpose of hunting.

The Historic Period encapsulates a period when the natal United States government, pressured by white settlers wishing to obtain access to native lands east of the Mississippi River, establishes Oklahoma as Indian Territory—tracts of land to which Native Americans could be forcibly relocated. In 1828, the Cherokee would be the first tribe relocated to what is now Oklahoma by the United States. Cherokee lands in western Oklahoma were known as the Cherokee Outlet. The Outlet was never used by the Cherokee but rather for illicit farming and ranching by white settlers and Livestock Associations (Drass and Turner 1989).

After the Civil War, the growing enmity between Anglo-American settlers and the indigenous groups being supplanted to Oklahoma led to the Medicine Lodge Treaty of 1867 (Gibson 1965). Under the auspices of the Treaty, the Kiowa, Kiowa-Apache, Comanche, and Cheyenne-Arapaho were restricted to established Indian Territory reservations (Bement et al. 2002; Carriker 1990). For many of these groups, reservation confinement was short-lived, erupting into renewed hostilities against encroaching white settlers. These hostilities disrupted commerce in the region, forcing the United States Army to interdict. A forward

base known as Camp Supply was established in northwestern Indian Territory during the winter campaigns of 1868, near the confluence of the Beaver River and Wolf Creek just south of present-day Harper County (and site 34HP55). Camp Supply, later renamed Fort Supply, was the premier military facility in the region, acting as advocate for Indian and white settlers alike until its absorption into the Department of the Interior in 1895 (Carriker 1990).

The Land Run of 1893, overseen by the command at Fort Supply, opened the Cherokee Outlet to white settlement. Outlet lands were distributed by the quarter section, and it was after the land run that the region saw its highest population density. The majority of these early settlers survived in dugout cabins. Unfortunately, conditions on the Southern Plains were harsh and populations dwindled drastically and rapidly as settlers struggled to make ends meet while farming the open prairies. As claim after claim was vacated, cattlemen again began to move back into the region and established large market herds there until 1902, at which time Indian Territory and the Cherokee Outlet were reorganized as part of the Oklahoma Territory. By 1907, northwestern Oklahoma had become part of the State of Oklahoma (Gibson 1965).

Since statehood and after the advent of industrialized agriculture, farming was again attempted in the Harper County region. Even using modern technology, however, it has proven taxing to consistently raise crops on broken, loamy soils with undependable moisture. Farmers have again relinquished to the environment, becoming cattle ranchers that utilize the expansive tracts of native grasses for grazing. Presently, ranching is the primary economy of Harper County with only minor irrigation agriculture occurring in upland locations. Most recently, hunting tourism and large-scale agribusiness, such as feedlots and swine factories, have become the industries well-suited to the region.

Site Investigations

The subsurface investigations of March 2000 consisted of the removal of 60 cm of overburden by machine excavation over an approximate 10 x 10 m area. This depth corresponded to the depth just above the cultural deposit noted in the terrace profile and in the two initial test units. A 4 x 8 m grid was established near the northeast corner of the cleared area, above where it appeared most of the flakes on the slump deposit were originating. The 8m length of the grid was east/west while the 4m width was north/south. The grid was then designated in 2 x 2m squares.

The Test Units were labeled according to the placement of their southeastern corners relative to the grid (and site) datum. The unit furthest north was South 2 m / West 0 m (S2/W0). This Unit was excavated as were Units S4/W0 and two meters west of it Test Unit S2/W2. The last and furthest west of the units excavated was S4/W6. Hand excavation of these units was conducted to a depth of 100 centimeters below surface (cmbs) by arbitrary 10 cm increments (levels). During excavation of the grid units, excavation levels were labeled one through four relative to the machine-exposed (vs. topographic) surface of the grid. Therefore, even though Level 1 of each unit was excavated to a depth of 10 cm below the exposed surface, the actual depth at the base of Level 1 was 70 cm below the grass-covered

topographic surface of the site. To prevent confusion relative to these differing depth measurements, all depths for the site have been converted during analysis to reflect depth from the actual topographic surface. Soil from all excavated units was dry-screened through ¼" mesh hardware cloth. All artifacts were recovered for further laboratory examination. During excavation of the 2 x 2 m units, it was noted that cultural deposits diminished significantly in those units furthest south and west.

To better understand the terrace formation process on which 34HP55 occurs, an exploratory east/west backhoe trench was placed along the southern edge of the exposed grid. Examination of the trench walls was conducted by soil scientists Dr. Brian Carter and Kelly Ponte of Oklahoma State University. Their analysis provides valuable information relating to the context of the cultural deposits at the site.

Dry Buffalo Creek Terrace Formation and Soil Description

The study area falls within the Western Sandstone Hills Geomorphic Province near its western margin with the High Plains (Curtis and Ham 2008). The area contains gently rolling hills cut by steep canyons with vegetation consisting of mixed and short grass prairie and few trees. Site 34PH55 was identified as a buried archaeological deposit within an alluvial terrace west of Dry Buffalo Creek during initial investigations conducted as part of a Harper County bridge replacement project. Dry Buffalo Creek is a northward flowing stream that drains a portion of the upland divide between the Cimarron and Beaver River drainages and is a major tributary of Buffalo Creek which empties into the Cimarron River 30 km east of 34HP55. The stream's confluence with Buffalo Creek is about 3 km northeast of the site. Approximately 8 km south of the area investigated, several tributaries of Dry Buffalo Creek head in the upland divide forming several deep canyons incised into Permian bedrock. A canyon immediately west of one of the tributaries contains the Folsom age Waugh Site where evidence was found indicating the canyons have been subject to several cut and fill episodes since the Late Pleistocene (Hofman and Carter 1991:28). The valley fill throughout the drainage is composed of sediment mostly derived from the unconsolidated Quaternary and Tertiary sands and silts which lie over Permian sandstones and shales on the upland divide (Hofman and Carter 1991:28). The Dry Buffalo Creek watershed above the site drains approximately 28 square km of upland.

The terrace containing site 34HP55 is approximately 75 m west of Dry Buffalo Creek at approximately 1860 feet amsl. This portion of the Dry Buffalo Creek can be described as consisting of a flood plain approximately 300 to 650 m wide with a terrace approximately 3 m above the flood plain east of the stream and a second, higher terrace, containing 34HP55, west of the stream. This second terrace has apparently been eroded away east of the stream by lateral stream migration. The terrace is composed of alluvial deposits and stream incision as well subsequent erosional processes have resulted in its present appearance as a steep, almost vertical slope face rising 8-10 m above the flood plain. However, much of the slope face is obscured by slumping. The terrace is approximately 45 m wide east to west where it rises slightly to the west against a small hill formed of Permian material. The terrace and floodplain are presently covered in mixed prairie grasses with some yucca. Several willow and tamarisk trees line the stream channel. The area investigated and discussed here occurs at the northern edge of the terrace which continues south about 200 m. It is level throughout

most of this length with a slight slope at the southern end. The two major tributaries forming Dry Buffalo Creek merge about 120 m south of this point with the main channel basically flowing from due south for approximately 5.6 km. From approximately 1.6 km (1 mile) south (upstream) of 34HP55 the stream gradient is 5.48m/km (18'/mile) and approximately 4.5m/km (15ft/mile) north or downstream of the site.

An east/west backhoe trench was excavated along the south edge of the stripped area and about 4 m south of the south grid line. The trench was dug 2 m deep on the east end for approximately 2.5 m after which it was excavated to a depth of 1 m for another 4.5 m (Figure 4). A melanized buried soil (2Ab2) was revealed approximately 1.5 m deep in the east end of the trench (Table 1). This soil was subsequently buried by 1.15 m of alluvium in which another well-developed buried soil (2Ab1) formed. This soil was subsequently capped with 30 to 50 cm of aeolian deposits.

As noted in Table 1, the deeper buried soil (2Ab2) exhibits an 18 cm thick A horizon of dark reddish brown, silty clay loam. A bulk soil sample collected from the upper 5 cm of this soil produced a radiocarbon date of 3730 +/- 60 B.P. (Beta 142715). Calibration of this date indicates an age of 4,085 B.P (Stuiver, M. et al, 1998). Although only the upper 50 cm of this soil was observed, the soil is well developed and exhibits an A and Bt horizon (Figure 4;Table 1). Excavation ceased at 200 cm preventing further horizon description. However, the paleosol appears to be represent a stable surface.

The 2Ab2 soil was buried by over bank alluvium. The first 20 cm of this alluvium is mostly clay and contains a few gravels composed of quartzite, sandstone and caliche fragments.

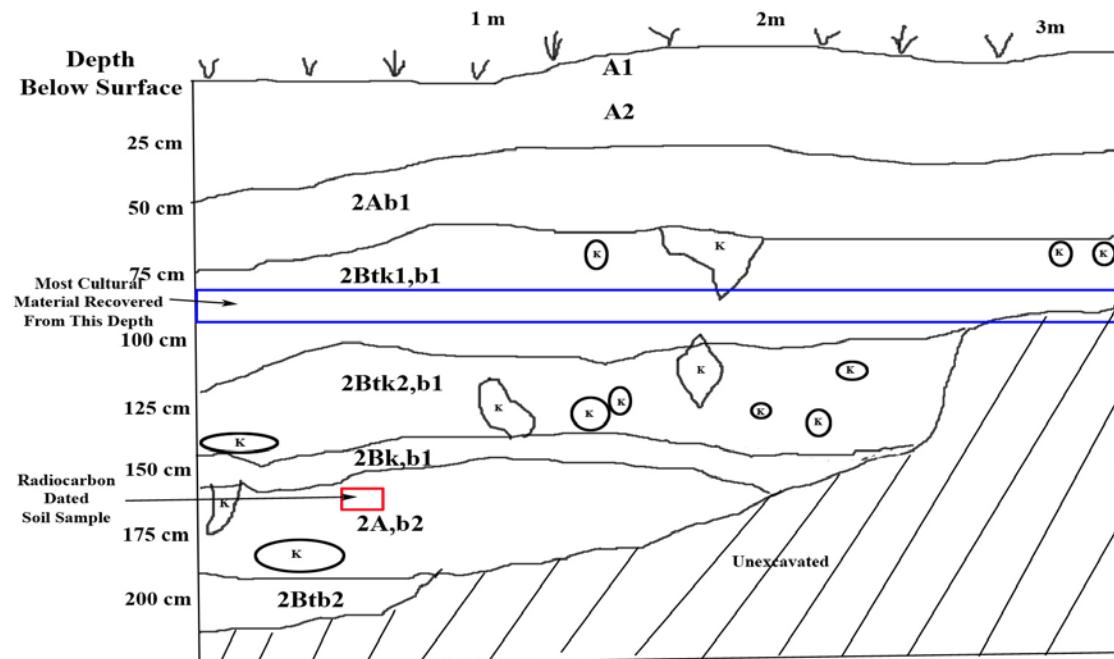


Figure 4. Soil Profile from the south wall of 34HP55 trench located 4m south of Test Unit S4/W0. K= Krotovina

Table 1. Soil profile description, 34HP55 south trench.

| Horizon | Depth (cm) | Color (moist) | Structure | Texture | Consistency | Boundary | Reaction | Special Features |
|-----------|------------|---------------|-----------|---------|-------------|----------|----------|--|
| A1 | 0-9 | 7.5YR3/4 | 1mGr | FSL | vfr | g,s | sle | My f+m roots |
| A2 | 9-35 | 5YR4/3 | 1mSBK | FSL | vfr | cl,s | ve | My f roots |
| 2A, b1 | 35-61 | 5YR3/3 | 2mSBK | Sil | fr | g,s | ve | My f roots. Fw ft CaCO ₃ soft bodies on ped faces |
| 2Btk, B1 | 61-97 | 7.5YR4/4 | 2mPR | SiCL | fr | g,s | ve | Cm f roots. Cm dt clay coatings on ped faces. My dt CaCO ₃ soft bodies on ped faces |
| 2Btk2, b1 | 97-129 | 7.5YR4/6 | 2mPR | SiCL | fr | g,s | ve | Cm f roots. Cm dt clay coatings on ped faces. My dt CaCO ₃ soft bodies on ped faces |
| 2Bk, b1 | 129-150 | 7.5YR4/4 | 2mSBK | CL | fr | a,s | ve | Fw f roots. Cm dt CaCO ₃ soft bodies on ped faces. Fw gravels (quartzite, sandstone, caliche frags.). |
| 2A, b2 | 150-178 | 5YR3/4 | 1cSBK | SiCL | fr | g,s | ve | Fw f roots |
| 2Bt, b2 | 178-200 | 5YR4/6 | 2mSBK | Sic | fr | - | ve | Fw f roots. My pt clay coatings on ped faces |

color: Munsell color notations; structure: 1 = weak, 2 = moderate, m = medium, c = coarse, Gr = granular, SBK = subangular blocky, PR = prismatic; texture: FSL = fine sandy loam, Sil = silt loam, SiCL = silty clay loam, CL = clay loam, SiC = silty clay; consistency: vfr = very friable, fr = friable; boundary: s = smooth, cl = clear, a = abrupt, g = gradual; reaction (with 10 percent HCl): sle = slight effervescence; special features: Fw = few, Cm = common, My = many, f = fine, m = medium, dt = distinct, pt = prominent; soil profile description follows Soil Survey Staff 1993. Soil Survey Manual. USDA Handbook No. 18, US Government Printing Office, Washington DC

Gravel above this horizon is sparse to absent indicating that the initial burial of this soil was by a flood event or events of moderate energy followed by relatively low energy alluviation. The rate of aggradation of the alluvial deposit is difficult to assess without bracketing radiocarbon dates. However, a reasonable assumption can be made that the upper buried soil (2Ab1) likely formed between 2,800 and 1,000 years B.P., a period of widespread soil formation in stream valleys throughout the region (Hall 1977, 1982, Johnson and Martin 1987, Mandel 1994, Thurmond and Wyckoff 1995, Thurmond et al 2000). The 2Ab1 soil exhibits a Btk horizon indicating a significant period of flood plain stability and soil formation associated with this soil. Many of the studies cited above also document widespread stream channel incision beginning approximately 1,000 years ago which likely marks the time the 2Ab1 soil was isolated as a terrace surface and since that time was capped with aeolian deposits (Table 1).

Test Units

The 8 x 12 m excavation grid established at 60 cmbs was divided into 2 x 2 m Test Units for hand excavations (Figure 5). The east end of the grid was set as close to the terrace edge as possible and designated the South 0 line. The north edge of the grid was designated the West 0 line. The grid was centered on and above the eroded slump on which several flakes were present. The Test Units were assigned South/West numbers by the southeast grid stake of each 2 x 2 m unit. A total of four of the 2 x 2 m units were excavated (Figure 6). The units were excavated in 10 cm levels and screened through ¼ mesh. All units were excavated to 100 cmbs. A few of the artifacts as well as some debitage concentrations were horizontally and vertically plotted.



Figure 5. Establishing the 8 x 12 m grid on area of 34HP55 stripped of overburden. View is looking northeast. Backhoe is excavating trench to examine soil profile.

All the test units produced cultural materials, however, the material was sparse except in Test Unit S2/W0, the northeastern most unit situated along the terrace edge (Figure 6; Left). This test unit accounted for the majority of the recovered assemblage including 85 percent of the recovereddebitage, three of the four recovered platform cores, a bifacial core/preform refit from two pieces and four concentrations of flakes (N=367). The vast majority of these items, including the flake concentrations, cores, and refit biface were found in the northwest quarter of this test unit and occurred between 88-92cmbs (Figure 6). There was a notable decrease in the density of materials in the units south and west of S2/W0. Most of the recovered cultural material occurred between 85-95 cmbs.

Test Unit S2/W0 produced the bulk of the cultural material recovered by the investigation and merits further description (Figure 6; Right). The lithicdebitage recovered from this unit accounts for 84.5 percent (N=1596) of the total recovered by the investigation. In addition three of the five cores were recovered from this unit as well as one of two bifacial core/preforms. A total of 93.9 percent (N=1499) of thedebitage was recovered from Levels 3 and 4 (between 80-100 cmbs) The lower portion of Level 3 and the upper portion of level 4 contained a distinct concentration of material including the two fragments of the bifacial core/preform which refit. The two refit pieces were 50 cm apart and both occurred 91 cmbs. Most of the biface core/preforms, core fragments and flake concentrations were located in the northwest quadrant of the 2 x 2 m Test Unit (Figure 6). The piece plotted cores, bifacial core/preform fragments, and fourdebitage concentrations in Test Unit S2/W0 all occurred between 88-94 cmbs. The flake concentrations occurred in four “piles” along the east edge of the northwest quadrant of Test Unit 2S/W0. One core fragment occurred within one of thedebitage concentrations.

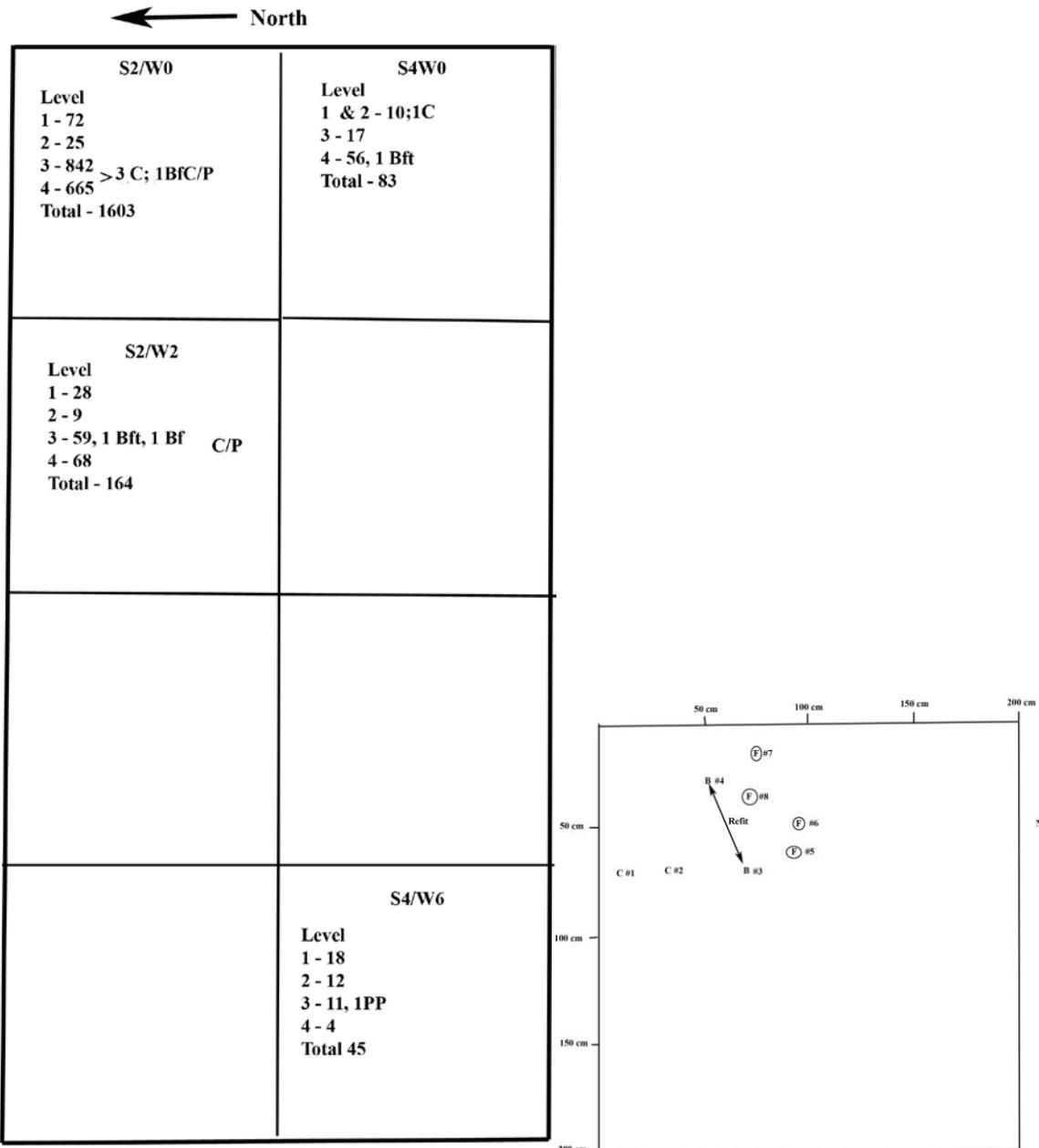


Figure 6. Left: 34HP55 excavation grid with 2 x 2 m test units with the number of pieces of debitage and artifacts recovered per level (Bft = bifacial tool; PP = projectile point; BfC/P = bifacial core/preform). Unlabeled units were not excavated. Right: Test Unit S2/W0 showing plotted cores, bifaces and flake concentrations at 88-92 cmbs. (B = biface; C= core; F = flake concentration).

Laboratory Analysis

All recovered materials were cleaned and processed in the laboratory at the Oklahoma Archaeological Survey at the University of Oklahoma in Norman. Items were washed, catalogued, and boxed according to provenience and date recovered. Many of the site artifacts were richly coated in calcium carbonate as a result of their depth of deposition and the presence of ground water seep dissolving and carrying those carbonates into the soil

horizon containing the cultural materials. During analysis, carbonates were removed only from those lithic artifacts requiring closer scrutiny or clearer imaging.

Lithic Analysis

The lithic assemblage comprises the bulk of the material recovered. For analytical purposes, the assemblage is divided into tool anddebitage categories as well as raw material types. The art of tool making is basically a reductive process focusing on the removal of flakes from an initially larger objective piece. For this analysis the reduction level of each item in the assemblage has been defined. This also includes the determination of tools fromdebitage.

The analyzed categories include bifacial stone tools, bifacial core/preforms (tools that may have served as cores but have two surfaces or faces that meet to form a single edge that circumscribes the tool) anddebitage. Tool types are determined by morphology, inferred function, edge modification, flake scar patterns, and degree of flaking. These stone tool “types” can then be considered cultural “traits” with temporal or chronological connotations. Therefore, the inferred function of tool types can be used to describe activities taking place on a site (Andrefsky 1998).

Debitage is considered to be those flakes that are detached and discarded during the reduction process. Debitage may occur in any morphology, however, controlled production of various tools can produce distinctive types or forms of debitage. All flakes removed in a controlled manner have morphological characteristics that indicate the type of objective piece used and how that objective piece was being reduced by the tool maker. In this regard,debitage is a fossil indicator of prehistoric culture and can often be used as a functional or behavioral indicator of these cultures (Andrefsky 1998).

In order to define the cultural “traits” exhibited in the assemblage,debitage is often classed or categorized according to attributes such as the size and shape of the flake, ventral flake curvature, type of platform present, characteristics of both the dorsal and ventral faces, as well as types of terminations present. Mostdebitage analyses rely on the amount of cortex covering the dorsal flake surface to indicate primary reduction flakes or the point when material is initially being removed from the objective piece (Turner and Hester 1985). In general, however, objective pieces with greater amounts of cortex relative to surface area tend to produce greater amounts ofdebitage with dorsal cortex. Therefore, to better refine the determination of reduction stage, this analysis also observes the amount of cortex found throughout the flake, determining how much of the flake in total is comprised of cortical material (i.e. how much cortex descends into the undersurface (ventral face) of the flake) rather than merely relying on the amount of cortical coverage of the dorsal surface alone to determine reduction stage.

This analysis also differentiates the percentage of cortex found along flake edges from that covering the dorsal face. Based upon the amount of cortex present on the dorsal face or on the flake edge, cortical flakes are tentatively classed as primary and secondary flakes. Primary flakes are often, but not always, large flakes relative to the objective piece and type of raw material being reduced. Primary flakes tend to have large amounts of retained cortex (≥ 40 percent), poorly prepared platforms, and no more than one flake scar apparent on the

dorsal surface. Secondary flakes are often large to medium-sized flakes relative to the objective piece. Secondary flakes may have some retained cortex but generally are identified based upon size, preparation of the platform, and the presence of two or more flake scars on the dorsal face. Non-cortical flakes are classed as secondary, tertiary or bifacial thinning flakes (also called trimming flakes) depending upon the size of the flake and assumptions concerning methods of flake removal (hard/soft percussion; pressure flaking). Though characteristics of percussion technique is not always observable (Patterson 1982; Patterson and Sollberger 1978) these characteristics are often apparent enough to discriminate processes of manufacture (Amick et al. 1988; Dibble and Whittaker 1981).

Flakes removed from a biface are essentially, but tentatively, identified by their small size as well as platform attributes that include lipping, acute angles, and faceting. Bifacial thinning flakes often include microdebitage or in the case of this study, those flakes less than 0.5 cm in all dimensions.

Finally, those flakes that are incomplete or lacking such attributes as platforms, terminations, and sometimes edges are considered broken flakes, termed blocky debris and flake shatter. Blocky debris consists of angular fragments that do not retain flake characteristics; they no longer bear either a definable dorsal or ventral face. Flake shatter is that artifact population that has been broken post-impact and does not retain all of the flake characteristics, primarily the bulb of percussion or terminations. This analysis also evaluates split flakes or those flakes that were broken longitudinally down the flake centerline. Often these flakes lack the characteristics used to determine reduction stage and must be considered shatter, however, some still retain vestigial markers (such as half of the bulb of percussion or part of the platform) allowing the stage of flake reduction to be determined.

Additional debitage analysis included flake morphology—whether the flake was complete, or a proximal, medial, or distal fragment, or whether the flake was a non-orientable fragment (see Sullivan and Rosen 1985; Austin 1999). Proximal fragments are those fragments closest to the point of impact, often retaining such indicators as the platform and bulb of percussion. Medial flakes are those flakes lacking both a proximal end and a complete termination. Morphological traits such as these, particularly in proximal flakes, aid in determining how a flake was removed. Flake morphology assists in making assumptions about methods of percussion and the force applied to the objective piece during flake removal. Intentional production of flake fragments has also been known to occur where microlithic industries were employed in the production of composite tools such as serrated harpoons or sickles.

Other traits pertinent to this analysis were platform characteristics and terminations. Platform attributes are suggestive of applied forces used for flake removal and the propensities (or “traits”) of the tool maker during the knapping process. Types of platforms recorded for the 34HP55 sample include flat, ground, unprepared, and crushed or missing. Flat platforms, may have been prepared through flake removal or may merely be the fortuitous result of the natural objective piece topography, as with the average Day Creek chert tabular cores. Analyzed tendencies from other studies suggest that the preparation and use of flat striking platforms often indicates unidirectional core technology (Andrefsky 1998:94). Ground platforms are prepared platforms produced by rubbing the surface of the

objective piece with an abrasive material to change the topography of the platform to enhance grip or purchase for the percussor.

Terminations are indicative of the amount and direction of force applied during flake removal. Terminations also provide suggestions about the quality of the lithic resource used for knapping. The terminations sought by the tool maker often relate to the modifications desired in order for the objective piece to approach its final form. Termination types noted in this analysis included feather, hinge, step, and outrepassé or overshot.

Feather terminations are those terminations resulting from the complete transmission of the conchoidal wave front cleanly through the objective piece leaving behind a sharp end on the detached flake. Hinge flakes are produced when the wave front does not transmit completely through the objective piece but instead, turns towards the dorsal flake surface to leave behind a rounded or blunt flake end. Step terminations are similar to hinge terminations, though instead of terminating, the wave front ceases and the flake ultimately snaps or fractures away from the objective piece at a 90° angle to the ventral flake face. Finally, the outrepassé termination is the opposite of a hinge termination. Instead of the conchoidal wave front conducting itself outward towards the dorsal flake surface, the wave front warps inward towards the objective piece and ventral flake surface, producing either a mass of material on the distal end of the flake, or a distinct inward curve of the distal flake end.

Generally, the preeminent termination sought by the knapper was the feather termination where the appropriate level of force was applied at the appropriate angle on the platform to remove the flake from the objective piece without leaving behind any central mass on the objective piece. Step and overshot terminations may at times be sought, however, these terminations generally suggest too great of force was applied to the objective piece during flake removal. In contrast, hinge terminations suggest the force applied was incomplete and the flake was pulled away from the objective piece, causing it to bend during fracture. Many times, each of these terminations is intentionally produced by the toolmaker to prepare the objective piece for later modifications.

Some of the final qualities recorded during analysis of the 34HP55 lithic assemblage included gross dimensions just to note the average size and quality of flakes that were considered refuse by site occupants. Metrics included maximum length, width, and thickness of each flake along with each flake's weight.

Artifacts Recovered

Lithic Material (N =1892)

The entire lithic sample from 34HP55 weighed 3.4 kg and consisted of debitage, a dart point, two bifacial stone tools, cores, and two large bifaces, one of which is refit from two recovered pieces. These latter items appear to be discarded bifacial preforms/cores. The recovered assemblage was dominated by debitage or discarded flake debris. Each of these assemblage elements has been isolated for analysis and discussion.

The lithic material primarily found at 34HP55 was Day Creek chert which made up 99.1 percent of the total assemblage. Outcrops of maroon Day Creek chert, are known to exist on

the ridge line 15 miles (25 km) southeast of 34HP55. The maroon Day Creek chert accessed by the 34HP55 occupants is similarly colored to Alibates and is known to exist in a variety of colors from maroon to crimson to purple to gray and cream. Much of the Day Creek chert has mottled banding or filaments of differing colors throughout. Deep maroon Day Creek chert with streaks and mottles of blue chert was the most common color variant found at 34HP55. In the 34HP55 assemblage, gray-colored Day Creek chert is unique ($N = 85$ flakes; 3.9 percent of total) while bluish-colored Day Creek flakes are rare ($N = 2$ flakes; 0.1 percent of total). A single bifacially flaked tool manufactured from a flake of bluish gray-colored Day Creek chert was defined within the lithic assemblage but flake tools were as much a rarity in the lithic assemblage as the gray- and cream-colored Day Creek material from which it was manufactured. Like coloration, cortex on Day Creek chert also has a wide range of textures from rough, oolitic, and coarse chalk to smooth chalk, and from thick patination to light patination or oxidation of the outer cherty layers

Day Creek chert is cryptocrystalline but possesses a grainy texture that requires great craftsmanship to exploit. Day Creek also has numerous clear, crystalline or bronze-colored vugs or quartz inclusions throughout its matrix. Day Creek is very brittle and if not heat-treated, has a tendency to step fracture when being worked. However, heat-treatment of the Day Creek chert sample from 34HP55 is not discernible. Heat treatment generally causes the material to undergo slight color changes or produce a glossy finish. Even employing heat-treatment, Day Creek chert is still not a high-quality resource for knapping as breakage will often occur along the numerous incipient fracture planes and inclusions. Flake shatter is a prevalent end-product of knapping Day Creek chert. Of the 1882 pieces of debitage recovered from 34HP55, 1187 (62.7 percent of the total) were shattered flakes.

The second most common lithic resource found on-site was a form of chert that was unidentified as to type ($N = 11$; 0.5 percent of total). These pieces of unidentified chert are gold- and cream-banded, some having large, round, beige inclusions resembling sandstone. A few flakes of this unidentified chert also retained a smooth (though not stream-rolled), chalky cortex. The cortex was similar in color and texture to cortex seen on Day Creek chert, though the cortical surface was much smoother and finer than Day Creek cortex.

Stone Tools (N=3)

Projectile Point (N=1)

A complete corner-notched, expanding-stemmed dart point was recovered during excavation of level 3 in Test Unit S4 / W6 (Figure 7). The point measures 4.2 cm in total length, 3.1 cm in width at the shoulders, has a maximum thickness of 0.4 cm, and weighs 6 grams. The blade edge measures 3.5 cm in length and the barbs are 0.6 cm long. The stem measures 0.8 cm in length and between 1.7 and 2.3 cm in width. The stem has a convex base.

The material used to make the dart point was unique to the site's lithic assemblage but may derive from the background gravels of the area. The dart point was manufactured from a yellowish-tan chalcedony that reflected orange under long wave fluorescence and green under short wave fluorescence.

A notable color variation can be identified paralleling the lateral margin of one blade edge. Instead of the predominant yellowish-tan color of the rest of the blade, the entire blade edge is a 4 mm wide band of cream-colored material. The color boundary or transition from yellowish-tan to cream is very distinct. It is possible that the blade edge was originally located near the surface of the objective piece in an area that was adjacent to the cortex and that the color change indicates where the rind of the cortex penetrated and transitioned into the non-oxidized interior of the objective piece. It is notable that the side of the point with a broken barb corresponds to this inclusion. It should also be noted that a flake of chalcedony cortex similar in color to the cream-colored blade edge was discovered in level 4 of S4 / W0, 6 m east of the dart point.



Figure 7. Archaic point recovered from excavation of Level 3 (80-90 cmbs) in Test Unit S4 / W6. The piece is tan to white in color and made of chalcedony.

Bifacial Tools (N=2)

S2 / W2 (N=1)

A biface tool recovered was manufactured from a bluish-gray colored flake of Day Creek chert which may have been heat-treated (Figure 8a). The tool is 3.2 cm long and 3.8 cm in maximum width. The tool is 0.8 cm in maximum thickness and weighs 11.8 gm. At its thickest point the tool exhibits a snap-like fracture. The tool had been systematically thinned by the convergent, centripetal removal of contiguous small flakes from the perimeter of both faces. The tool exhibits heavy wear and polish particularly toward the end with the break. The surface of the break exhibits heavy polish and rounding along its margins as well. The arrises on the flake scars of both faces particularly toward the break end are heavily worn.

This wear pattern suggests the tool may have been hafted or worn through handling with the break serving as a blunt grip surface for the index finger.

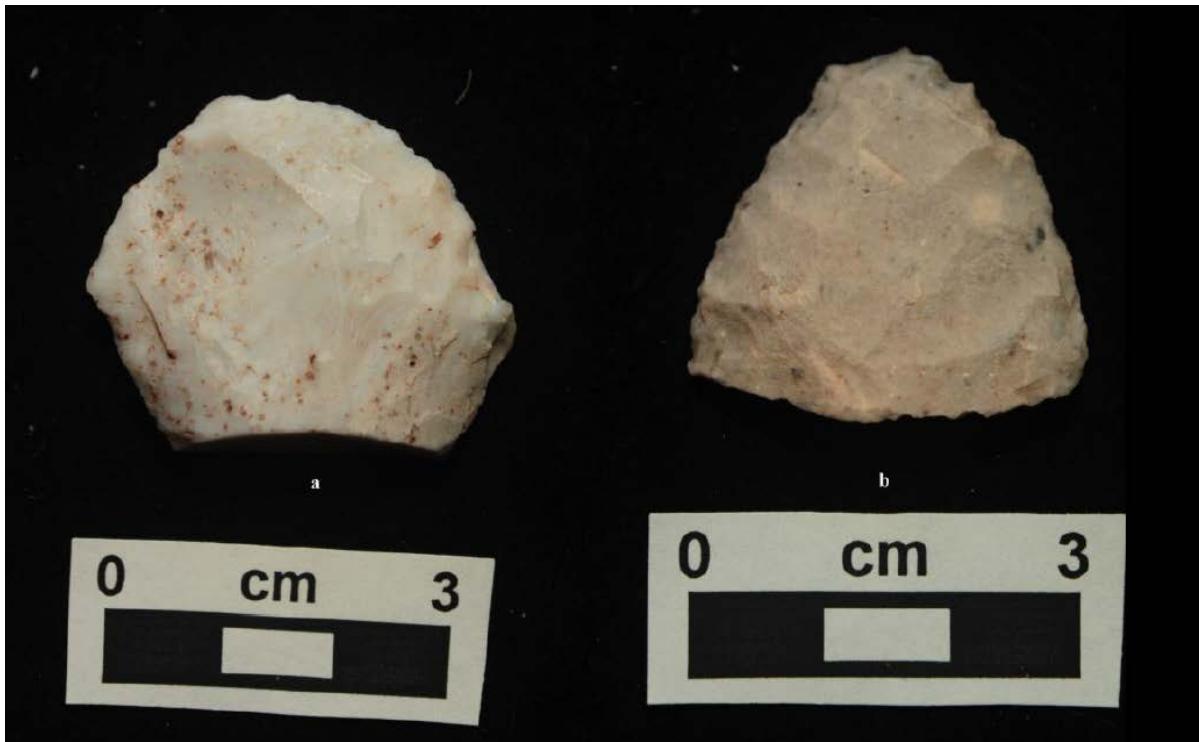


Figure 8. Bifacial stone tools recovered from 34HP55: (a) biface of Day Creek chert from S2/W2 Level 3 (80-90 cmbs); (b) biface of possible Edwards chert from S4/W0 from 85 cmbs.

S4 / W0 (N = 1)

The final biface was recovered during excavation of Level 4 (90-100 cmbs) in S4/W0. The tool is 3 cm long and 3 cm in maximum width. It is 0.6 cm thick and weighs 6.6 gm. It was manufactured from a flake of gray chert that macroscopically compares well with Edwards chert. The tool fragment reflected amber when fluoresced by short wave and a pumpkin/orange color when fluoresced on long wave, all indicative of material from the Edwards plateau of south-central Texas. However, Bailey (2000:67) has documented that some varieties of Day Creek chert appear identical both macroscopically and UV fluorescence so it can't be ruled out that the item could be a variety of Day Creek chert. The biface had been thinned primarily on the dorsal side by the removal of small flakes in a convergent, centripetal pattern from around the tool's perimeter (Figure 8b). A few large, intersecting flake scars are evident on the flake's ventral face, however, much of the ventral face remains visible. Step fractures and serrations on the point of the biface appear to have been the result of inadvertent load application during thinning. Edge wear is evident by rounding and polish along portions of the lateral edges. The tool was broken by a lateral snap (Johnson 1979; Purdy 1975) which was due to bending stresses resulting in a hinge termination at the break. It is unknown what the tool's function may have been to consider if

fracture occurred during use or if breakage was the result of remote or indirect fracture during maintenance.

Cores (N=6)

The majority of the artifact assemblage recovered from 34HP55 is comprised of debitage and cores of Day Creek chert. The Day Creek chert is a maroon colored variety with mottled blue and white streaks. The chert contains several inclusions, vugs and interior fractures. The cores described below are comprised of two types, bifacial preform/cores in which the core exhibits flake removals on two faces and single or multi-platform cores (Table 2). The bifacial preform/cores are cores from which flakes could be struck for use as tools eventually resulting in a bifacial preform which could be shaped into a bifacial tool. The largest category of cores is comprised of items which evidence the production of flakes and while they exhibit a degree of bifacial flaking, they were not intended to result in a bifacial core/preform and were discarded when they could no longer produce useable flakes.

Table 2. Description of Day Creek chert cores recovered from 34HP55.

| Unit | Depth (cmbs) | Field # | Objective piece | Dimensions (cm) | | | | % retained cortex |
|------------------------------|-----------------|---------|------------------------|-----------------|---------------|-------------------|---------------|-------------------------|
| | | | | Max. length | Max. width | Max. thickness | Weight (g) | |
| S2 / W0 | 92 | 01 | core | 7.5+ | 6.7 | 2.5 | 106.1 | 40 |
| S2 / W0 | 94 | 02 | core | 6.4+ | 6.0 | 2.9 | 92 | 30 |
| S2 / W0 (refit to #04) | 91 | 03 | Biface core/preform | 6.0+ | 4.3 | 2.0 | 38.9 | 40 |
| S2 / W0 (refit to #03) | 91 | 04 | Biface core/preform | 7.2+ | 5.1 | 2.7 | 100.2 | 10 |
| S2 / W0 | 90 | 06 | core | 6.5+ | 5.2 | 2.2 | 69.4 | 5 |
| S2 / W2 | 88 | 01 | Biface core/preform | 4.5+ | 5.8 | 1.9 | 56.3 | ---- |
| S2 / W2 | 87 | 02 | core | 6.5+ | 5.2 | 2.15 | 68.0 | ---- |
| S4/W0 | 60-70 | - | core | 7.5 | 5.6 | 3.0 | 109.8 | 60 |

cmbs: centimeters below surface; D.C.: Day Creek chert

Bifacial preforms/cores (N = 2)

Two of the cores exhibit bifacial flaking patterns initiated from the lateral edges toward the central axis of the artifact. The intent of the flaking was to thin and shape the biface. One of the items, from S2/W0 is refit from two pieces recovered at 91 cm below the surface and about 50 cm from each other (Figures 9 and 11e). This test unit also produced the vast majority of recovered items including multiple cores.

S2/W0 The bifacial core/preform from this unit (Figure 9), refit from two pieces, is 10.5 cm in length, 6.7 cm in maximum width and 2.75 cm in maximum thickness. The total weight is 139.1 gm. The biface is somewhat oval in cross-section and retains a very broad platform (4.5 x 2.5 cm) along one edge. The artifact exhibits a transverse break resulting from a lateral flake removal initiated from the approximate center of one lateral edge. The flake removal resulted in a deep hinge termination near the axis of the biface. An interior quarzitic vug along the line of the flake removal is the likely cause of the break. Just prior to fracture, the initial steps had begun for its systematic shaping into a biconvex tool through centripetal, convergent flaking of the perimeter from both faces. The item was then discarded with the

two pieces recovered within 50 cm of each other at the same depth below the surface. A rough bedrock cortex is present on both faces, though more prevalent on one face. This face exhibits fewer flake scars, though platforms had been set up for removal of more thinning flakes from this face. Retained impact scars suggest that flake removal was accomplished using hard hammer percussion. Fracture of the biface was caused by an attempt to further reduce a portion of the central mass using the large edge platform. Impact caused a lateral snap or transverse fracture, "...bisecting the biface in a relatively straight line forming an obtuse angle with the longitudinal axis" (Johnson 1979:25).

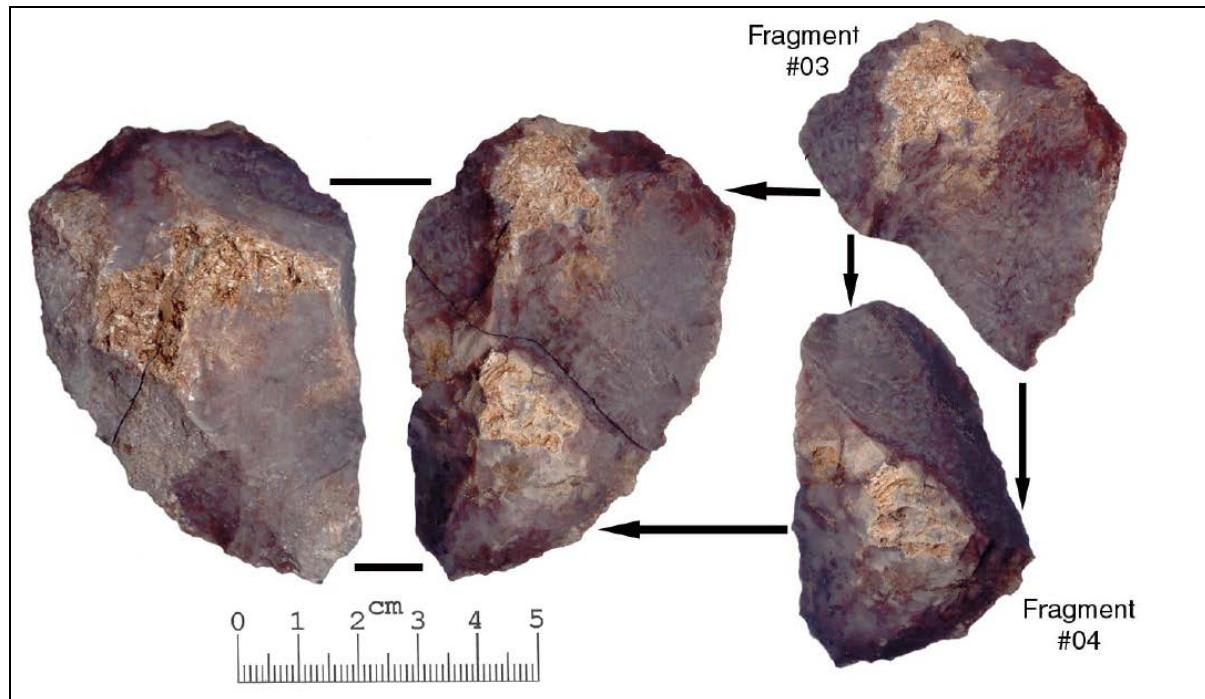


Figure 9. Day Creek chert bifacial core/preform refit from two fragments. The fragments were recovered from two distinct proveniences within excavation unit S2 / W0. The piece is maroon-colored with blue mottling.

S2/W2 A bifacial core/preform was recovered from Test Unit S2/W2 at 88 cm BLS. The biface exhibits a transverse break (Figure 10). A large, interior vug is present throughout most of the length of the break. The biface is in an early stage of reduction and has been completely flaked on both faces. No cortex is present, however there is a rough, vug area on the unbroken end of the biface which is very similar to the cortex observed on much of the recovered assemblage. The biface possesses a systematically produced oval cross-section having been evenly thinned by the removal of large flakes in a convergent, centripetal pattern from around the perimeter of both faces. Bifacial flaking of the perimeter has given the exterior edge of the biface a grossly serrated appearance. There is no evidence of use-wear or grinding along the biface edges. The biface is 4.1 cm in length, 5.5 cm in maximum width and 1.9 cm in maximum thickness and weighs 56.3 gm.



Figure 10. Bifacial core or preform recovered from S2/W2 at 88 cmbs.

Platform Cores N=5

The cores described in this section exhibit flake removal patterns which indicate the goal of the reduction was to obtain flake blanks. While most exhibit flaking on more than one face, the items do not appear to have been reduced along a trajectory which would result in a bifacial preform such as those previously described. Most exhibit a primary platform from which flakes were struck. It is of interest that there is little variance in the length and maximum thickness of the recovered cores.

S2/W2 (N=1)

A core manufactured from a large, thick flake was recovered from Test Unit S2/W2 (Figure 11a). The core is 6.5 cm in maximum length which occurs along the axis of the flake. The maximum width is 5.2 cm and it is 2.15 in maximum thickness. A portion of the distal end of the large flake has broken off. Two flakes have been removed from the ventral face to thin the bulb of percussion. The dorsal face evidences multidirectional flake scars. At least four of the dozen visible flake scars were from flakes removed after the large flake had been detached from its parent material.

S2 / W0 (N = 3)

All of the cores recovered from S2 / W0 were manufactured from nodules of maroon Day Creek chert. All of the cores were found at the depth where excavation level 3 transitioned into excavation level 4 (ca. 88-92 cmbs). Two recovered from the unit (designated field number (FN) # 01 and # 02) were found at the base of level 3 and were located south and west of the flake concentrations (see Figure 6). The third was found associated with flake concentration FN #6.

Field specimen # 01 is a multi-platform core (Figure 11b). Approximately 10 percent of its surface still retains rough cortical material, most occurring along two edges of the core. A large vug is also visible on one edge. The core appears to have been discarded after the knapper encountered the vug. It is likely the knapper decided that due to this vug as well as other exposed inclusions, that no flakes of useable dimensions could be obtained from the core and it was discarded. The objective piece had numerous large vugs and quartzite inclusions throughout, one of which caused a major reverse fracture (see Johnson 1979:31), resulting in its discard.

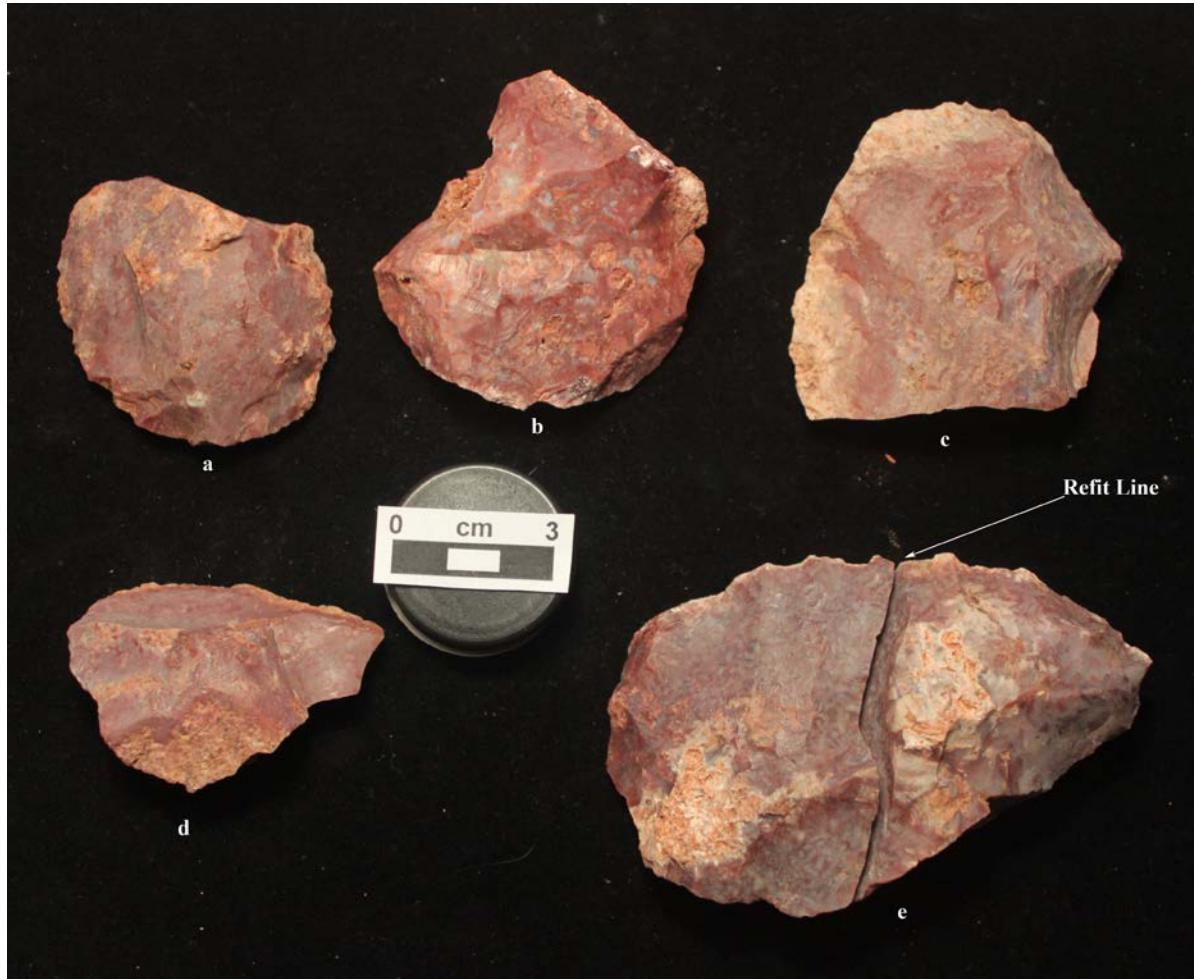


Figure 11. Selected cores from 34HP55: (a) Core from S2/W2; (b) core (Field #1) from S2/W2; (c) core (Field #2) from S2/W2; (d) core fragment (with flake concentration Field #6) from S2/W0; (e) refit bifacial core/preform (Field #'s 3&4) from S2/W0. All items recovered 88-92 cmbs.

Field specimen # 02 is a core retaining a portion of a primary platform along one edge (Figure 11c). Approximately 50 percent of one face is rough, cortical material while the other is covered with multiple flake scars. A series of flakes has been removed along the edge of the cortical face. One edge has been lost via a transverse break in an area weakened by a natural fracture line. The longest flake scar on the fully flaked face is 53 mm in length and was initiated from the primary platform. Two smaller flake scars on each side of this scar

also initiate from this platform. Initial flaking of the piece was accomplished by the removal of flakes from multiple directions across the cherty ventral face, or the face opposite the cortical material. The fact that very little usable chert remained on the biface conditioned its discard. It appears that after a series of flakes were removed bifacially from the perimeter of the preform, a final attempt was made to remove a large flake on the ventral side.

A small fragment of a core was recovered among the flake concentration designated field # 06 for the Test Unit (Figure 11d). Fragmentation occurred when flake removal from the dorsal surface caused the piece to fracture along a line of quartz inclusions. Approximately 10 percent of its dorsal side still retains a rough cortical material. There have been approximately three flakes driven unidirectionally from the core's ventral face.

S4/ W0 (N = 1)

A single core was recovered from between 60 and 70 cmbs during excavation of unit S4 / W0 (Figure 12). The artifact is 75 mm long, 56 mm in maximum width and 30 mm in maximum thickness. The core weighs 190.9 gm.



Figure 12. Core of Day Creek chert recovered from S4/W0 60-70 cmbs.

One face of the core is rough cortical material and heavily patinated chert. Two of the edges exhibit a thinner cortex, or thick patination. It was a tabular cobble of Day Creek chert whose flat surfaces acted as natural platforms for the removal of large flakes via hard hammer percussion. One of these edges was used as the primary platform for the core. The edge opposite the platform has been lost by a hinge type fracture initiated from that edge and an interior flaw. The largest flake scar emanating from the platform is interrupted by the

break, is 43 mm in length and 29 mm in maximum width. Additional smaller flakes were secondarily removed from the core at right angles to the initial reduction. The core was discarded after the break which occurred subsequent to the removal of the large flake revealed by the scar.

Debitage (N = 1882)

Characteristics of the 34HP55 debitage assemblage evaluated during this analysis included raw material type, the level of each flake in the reduction sequence (1° = primary, 2° = secondary, 3° = tertiary) flake morphology, method of percussion used to remove the flake, percentage of cortex retained, the type of striking platform manufactured or available, the type of termination produced during flake removal, and finally the maximum dimensions of each flake. All of these characteristics were carefully evaluated and recorded in an effort to observe trends or stylistic features used by occupants of 34HP55 to produce lithic tools (Table 3).

Table 3. Debitage quantities from excavation of grid units at 34HP55.

| Provenience | | Flake Reduction Level w/ % Comparison to Total Site Debitage | | | | | | | | | | Unit Totals | | | |
|--|---------------|--|-------------|------------|-------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|
| Test Unit | Depth (cmbs) | 1° | % | 2° | % | 3° | % | TF | % | BD | % | S | % | Sum | % |
| S2/W0 | 60-70 | 6 | | 12 | | 6 | | 5 | | 2 | | 41 | | 72 | 3.8 |
| | 70-80 | 3 | | 4 | | 2 | | 1 | | --- | | 15 | | 25 | 1.3 |
| | 80-90 | 73 | | 114 | | 80 | | 55 | | 7 | | 510 | | 839 | 44.6 |
| | 90-100 | 25 | | 91 | | 60 | | 39 | | 12 | | 433 | | 660 | 35.1 |
| | <i>Sum:</i> | 107 | 5.7 | 221 | 11.7 | 148 | 7.8 | 100 | 5.3 | 21 | 1.1 | 999 | 53.1 | 1596 | 84.8 |
| S2/W2 | 60-70 | --- | | 5 | | 4 | | 1 | | --- | | 18 | | 28 | 1.5 |
| | 70-80 | --- | | --- | | 2 | | --- | | --- | | 7 | | 9 | 0.5 |
| | 80-90 | 5 | | 11 | | 5 | | 2 | | --- | | 33 | | 56 | 3.0 |
| | 90-100 | 1 | | 16 | | 2 | | 1 | | --- | | 48 | | 68 | 3.6 |
| | <i>Sum:</i> | 6 | 0.3 | 32 | 1.7 | 13 | 0.7 | 4 | 0.2 | --- | --- | 106 | 5.6 | 161 | 8.6 |
| S4/W0 | 60-80 | 2 | | 1 | | --- | | --- | | --- | | 6 | | 9 | 0.5 |
| | 80-90 | 4 | | 4 | | --- | | --- | | --- | | 9 | | 17 | 0.9 |
| | 90-100 | 6 | | 10 | | 4 | | 1 | | --- | | 34 | | 55 | 2.9 |
| | <i>Sum:</i> | 12 | 0.6 | 15 | 0.8 | 4 | 0.2 | 1 | .05 | --- | --- | 49 | 2.6 | 81 | 4.3 |
| | <i>Totals</i> | 126 | 14.3 | 270 | 14.3 | 168 | 8.9 | 109 | 5.8 | 22 | 1.2 | 1187 | 63.1 | 1882 | 100 |
| TF: trimming flakes; BD: blocky debris; S: shatter; %: percentage of total debitage recovered from grid excavations. | | | | | | | | | | | | | | | |

Of the 1882 flakes recovered during site testing, 126 flakes (6.6 percent of sample) were considered primary reduction flakes having cumulative 35 percent of their dorsal surfaces covered in cortical material. After trimming away the cortex of large Day Creek chert cores, a sizeable quantity of the inner mass remained. Thinning of this portion of the core resulted in the production and discard of a large quantity of secondary flakes. Secondary flakes numbered 270, equaling 14.2 percent of the total flake sample. Tertiary flakes, or those flakes produced near the end of the reduction process, at a point when more precise flake removal is necessary, numbered 168 and comprised 8.9 percent of the debitage total. The final step in the reduction process, when a tool is finished through the application of soft hammer (billet) and pressure percussion, produces small flakes known as bifacial thinning or trimming flakes. Trimming flakes numbered 109 which was 5.8 percent of the total debitage. Many of the trimming flakes were very small and so were considered micro-debitage which, in

general, measured less than 0.3 x 0.3 x 0.1 cm and weighed an average of 0.2 grams at 34HP55.

Often the largest component of the debitage assemblage consists of angular or blocky debris and shatter. There were few examples of blocky debris (N = 22; 1.2 percent of total) within the lithic assemblage. Instead, the largest portion of the debitage sample was shatter (N = 1187; 63 percent of total).

Percussive techniques used in the 34HP55 lithic industry included hard hammer, soft hammer and pressure flaking. Percussion was noted on both debitage and flake tools. The largest portion of the sample was indeterminate as to method of percussion used (N = 1240; 65.8 percent of total). Very few of the flakes were considered to be pressure thinning flakes (N = 111; 5.8 percent of total). The remainder of the sample was evenly split between hard hammer (N = 258; 13.7 percent of total) and soft hammer (N = 273; 14.5 percent of total) reduction.

The number of complete flakes (N = 363; 19.2 percent of total) was relatively small while broken flakes dominated the assemblage. Flake fragments representing both the proximal end (N = 297; 15.8 percent of total) and mediolateral ends of a flake (N = 273; 14.5 percent of total) were very similar in quantity. The largest morphological sample consisted of flake fragments that retained no landmarks by which they could be oriented (N = 955; 50.7 percent of total).

Additionally, many of the flake fragments from 34HP55 had been broken longitudinally near centerline. These flakes are considered split flakes (N = 124; 5.7 percent of total). Many of the split flakes retained enough landmarks to have been recorded in other morphological categories (i.e. proximal, medial, or distal fragments), however, most were impossible to orient morphologically.

According to studies done by Austin (1999:67) based upon the Sullivan-Rozen typology, "...core reduction tend(s) to produce fewer (complete and proximal flakes) and more (non-orientable flakes) than patterned tool reduction." Minor variability in these characteristics may occur due to variation in raw material, knapping skills, and knapping tools, or analytical experience (Amick and Mauldin 1997), yet these flake attributes are consistent enough to enable the 34HP55 flake assemblage to be distinguished as an early-, versus late-stage biface production assemblage.

As would be expected in a sample predominated by shatter and broken flakes, the majority of the platforms are missing (N = 1418; 75.3 percent of total). Some of these missing platforms were attributable to crushing during percussion (N = 380; 17.5 percent of total). Many platforms either showed no preparation prior to percussion (N = 121; 5.6 percent of total) or were very slightly ground (N = 21; 1 percent of total). The predominant type of platform recognized within the flake assemblage was flat (N = 352; 18.7 percent) and usually non-cortical. Remarkably, many of even the smallest flakes (tertiary and BTF) retained flat platforms even though biface fragments recovered from 34HP55 indicate that the technique of bifacial thinning used to produce the large biconvex preforms involved attempts to remove sizeable flakes from a thin tool edge by applying force to points on both faces where the ridge between two flake scars was

available. Since this topography does not provide flat platforms, it is likely that these numerous small flakes with flat platforms, though they have the characteristics of a tertiary or trimming flake, are in fact part of the shatter produced during early thinning of the objective piece. This emphasizes the fact that flake typologies are merely a heuristic for interpreting human activities, not a specific indicator of these activities.

The predominance of broken flakes and shatter in the 34HP55 assemblage was also apparent when analyzing terminations. Since many of the flakes were non-orientable, lacking platforms, edges, hackles, and other landmarks, terminations may have been present but were unidentifiable as well. The number of flakes with unknown types of terminations ($N = 1024$) represents 54.4 percent of the total sample. Terminations that were identified within the flake assemblage included step ($N = 364$; 29.3 percent of total), feather ($N = 332$; 17.0 percent of total), hinge ($N = 149$; 7.9 percent of total), and outrepassé or overshot ($N = 21$; 1 percent of total). It should be noted that step fractures represent flake breakage that can primarily be attributed to the brittle nature of the lithic resource. For the same reason, most of the broken edges of those flakes with unknown terminations were also step fractured.

The richest source of site debitage came from within unit S2 / W0. This unit was located in the northeast corner of the exposed grid adjacent to the site datum and nearest the creek terrace forming the eastern boundary of the site. The unit produced 1604 flakes (85 percent of the total debitage excavated). Debitage from the unit consisted of 1597 flakes of Day Creek chert and seven flakes of unidentified chert with distinctive gold and white banding.

Some of the unit's debitage ($N=367$; 23 percent) came from four flake concentrations (Field #'s 5-8) located in the NW $\frac{1}{4}$ of the unit between 88-92 cmbs the (base of level 3 and the surface of level 4) (Table 4; Figure 6). The flake concentrations containing 367 flakes account for 16.9 percent of recovered debitage. The flake concentrations varied in the number of flakes recovered (Table 4). Concentrations #5 and #6 retained 111 and 15 flakes respectively. An additional 99 flakes were recovered from the immediate vicinity of # 5 and #6 as well. Concentration # 5 also contained 247 pieces of micro debitage (1-5mm in max dimension) weighing about 4 gm. An additional 15 pieces weighing 1 gm were found with concentration # 8. No micro debitage was recovered with concentrations #6 and #7. The occurrence of the micro debitage, particularly the amount in concentration #5 indicates little fluvial disturbance occurred during the process which resulted in the site becoming buried. Strong fluvial action would have displaced these small, light pieces of debitage.

Table 4. Flake concentrations recovered during excavations of unit S2 / W0 at 34HP55.

| Flake Concentrations | | Debitage Morphology | | | | | | Concent. Totals | |
|-----------------------------------|--------------|---------------------|-----------|-----------|-----------|----------|------------|-----------------|-------------|
| Field Number | Depth (cmbs) | 1° | 2° | 3° | TF | BD | S | Total | % |
| 7 | 80-90 | 15 | 14 | 7 | ---- | ---- | 56 | 92 | 4.9 |
| 8 | 88-92 | 1 | 8 | 2 | 2 | ---- | 37 | 50 | 2.7 |
| 5 | 88-92 | 1 | 8 | 3 | 27 | ---- | 72 | 111 | 5.9 |
| 6 | 88-92 | 1 | 4 | ---- | 2 | ---- | 7 | 15 | 0.8 |
| 5 & 6 | 91-92 | 8 | 21 | 4 | ---- | ---- | 66 | 15 | 5.3 |
| Debitage morphology totals | | 26 | 55 | 16 | 31 | 0 | 238 | 367 | 19.5 |

TF: trimming flakes; BD: blocky debris; S: shatter; %: percentage of total debitage recovered from grid excavation.

The two excavated units nearest to S2 / W0 were S2 / W2 on its eastern edge and S4 / W0 on its southern edge. The density of flakes recovered from these two units was greatly

diminished compared to S2 / W0. The western unit (S2 / W2) produced 155 flakes (7.2 percent of total) while the southern unit (S4 / W0) produced 81 flakes (3.7 percent of total). These findings indicate that the portion of the site where the most intensive knapping activity occurred was small, localized, and discreetly bounded, occurring for the most part in the northwest quadrant of Test Unit S2/W0.

Interpretations and Conclusions

The bulk of the cultural debris from the Archaic Period occupation of the Dry Buffalo Creek terrace was recovered from a distinct horizon occurring around 90 cmbs. The horizon of cultural material lies within the B Horizon (2Btk1b1) of a buried soil formed in alluvium and about 60-70 cm above a second buried soil (2Ab2) buried by the alluvial deposits. Organics from a soil sample derived from the lower buried soil (2Ab2) were obtained from the upper portion of the A horizon of the soil and produced a calibrated radiocarbon date of 4085 B.P. The upper buried soil (2Ab1), composed of alluvium was buried by a mantle of aeolian derived material forming the upper 50 cm of soil (A1 & A2) covering this portion of the terrace. Unfortunately, it is unknown how rapidly the terrace soils containing the Archaic Period artifacts were aggrading so all we can say is that the occupation occurred after ca 4,000 B. P. and before the upper, undated buried soil (2Ab1) began to form. However, based on the apparent integrity of the cultural deposit it was likely buried with little in the way of disturbance prior to or while being covered by alluvium. The recovery of small micro flakes with two of the flake concentrations and the close vertical and horizontal proximity of the two refit pieces of the bifacial core/preform, is an indication the cultural deposit was covered with alluvium from low energy stream flow.

While the rate of aggrading of the floodplain is unknown, it appears the site was buried rather quickly without much disturbance. While a few flakes were found above the densest layer of cultural material, the recovered items do not indicate an intense occupation occurred. The evidence for the most intense knapping activity occurred between 88-92 cmbs and appears to have been a brief event and the area may not have been revisited on a regular basis. However, observations of flakes eroding from the terrace 65m and 100m south of 34HP55 indicates that other areas of the terrace were occupied, though the time frame remains unknown.

Variation in horizontal artifact distribution was noted during excavations of the 2 x 2 m units. The highest number of artifacts (N = 1603; 73.4 percent of site total) was recovered from unit S2 / W0, a unit situated near the project centerline at the edge of the modern stream terrace in an area that the investigations determined is the primary activity area of the site. The two excavated units nearest S2/W0 were S2/W2 on its eastern edge and S4/W0 on its southern edge. The density of flakes recovered from these two closely associated units was greatly diminished when compared to S2 / W 0, with S2/W2 producing 164 artifacts (7.5 percent of total) and S4/W0 producing only 83 artifacts (3.8 percent of total). Of the high number of artifacts recovered from the unit with the highest artifact density (S2/W0), many of those were flakes and discarded tool or core fragments found in distinct concentrations located 88-92 cmbs of the NW^{1/4} of the unit.

In addition to producing the highest number of debitage, Test Unit S2/W0 also produced three of the five cores recovered by the investigation as well as one of two bifacial core/preforms. A total of 93.9 percent (N=1499) of the debitage was recovered from Levels 3 and 4(between 80-100 cmbs). The lower portion of Level 3 and the upper portion of level 4 (88-92 cmbs) within the northwest quadrant of the Test Unit contained a distinct concentration of material including three cores, four flake concentrations and the two fragments of the bifacial core/preform which refit. All these items were located in the northwest quadrant of the 2 x 2 m Test Unit (Figure 6).

The four flake concentrations (367 artifacts representing 24.4 percent of the unit debitage total and 19.5 percent of the site total), encircle an area of low artifact density as though they were deposited by a toolmaker that had been seated on the ground surface north of the concentrations; a craftsman that would intermittently dump small accumulations of flakes (from a knapping apron or other apparel?) onto the surrounding ground surface. While it is recognized that alluvial energy may have potentially played a part in forming these distinct concentrations of artifacts, the occurrence of numerous small flakes and shatter (1-5mm maximum dimension) among the flake concentrations #5 (N=253; 4gm) and #8 (N= 15; .05gm) suggest these concentrations were buried without dispersal by disturbances such as moving water or rodent activity.

The results of the site testing and artifact analysis indicates that the bulk of the site assemblage represents a discreet knapping episode during the late Archaic Period. The knapper(s) were manufacturing bifacial core/preforms as well as single and multi-platform cores from which flake blanks were struck. All of the cores, bifacial core/preforms and over 99 percent of the debitage is maroon Day Creek chert. The occurrence of two stone tools and a projectile point from the same levels across the investigated area indicates other activities were associated with the site. It is of interest that none of these latter items which represent tools brought to the site in finished form are not manufactured of the maroon Day Creek chert. While the manufacture of cores and early stage bifacial cores/preforms occurred, little evidence for the late stage manufacture of tools was present in the assemblage. Further, no tools manufactured of the maroon Day Creek chert that was being worked on the site were found by the investigation.

Outcrops of Day Creek Dolomite containing nodules of maroon chert are documented 14-17 km southeast of 34HP55 (Bailey 2000:51). These outcrops contain extensive prehistoric workshops evidencing exploitations of the chert from the dolomite deposit. The chert occurs near the base of the dolomite and prehistoric knappers exploited these chert nodules rather than those exposed in residual deposits (Baily 2000:103). The Day Creek Chert present at these locations is of a maroon variety displaying a variety of shades, and degree of inclusions and calcitic vugs. The inclusions are often blue or white and much of the material bears similarity to Alibates silicified dolomite. However, there is no geologic correlation between the formations (Bailey 2000:118). Geologic sources of Day Creek Dolomite containing a bluish-gray variety of chert are documented 14.7 km north of 34HP55 (Baily 2000:103).

The knapper(s) at 34HP55 obtained cobbles/nodules of maroon Day Creek chert from a bedrock source and transported the items to site 34HP55 along Dry Buffalo Creek for further

processing. The cortex lacks weathering which indicates the nodules were obtained directly from association with the Day Creek Dolomite (Baily 2000:94-95). It is evident from the analysis that both single and multi-platform cores were used to produce flakes usable for stone tools. Further it is evident that a bifacial technology was employed to produce bifaces which could serve both as transportable cores and tool preforms.

Only three discarded stone tools were recovered by the investigation, none of which were made from the type of maroon Day Creek chert which comprised the debitage and core assemblage found at the site. The tools are made of quality stone including chalcedony, possibly Edwards chert and good quality Day Creek chert (blueish-gray variety) which suggest that the site inhabitants had access to other sources of stone either directly or indirectly. No expended or broken tools of the maroon Day Creek chert being worked on the site were recovered. The lithic debitage analysis found no evidence that the manufacture of late stage bifaces or formal tools of the maroon Day Creek chert occurred on the area investigated. However, there is substantial evidence for the manufacture of flake blanks and bifacial preforms and cores from maroon Day Creek chert. Further it appears that any tools, non-expended cores, bifacial core/preforms or selected flake blanks were taken from the site when the prehistoric inhabitants left.

Expectations are that the function of bifacial core reduction, such as the scale of production, and transportation costs would be inversely linked to distance from the resource area. However, judging solely by the total number of flakes present and comparing the production system to equivalent sites in the area, it appears that investment in production was controlled by other requirements than transportation costs and production efficiency. According to Sassaman's (1994) study of Savannah River Phase assemblages of South Carolina, numerous groups throughout the course of the early- to mid-Holocene were removing lithic cores from resource quarries and hauling these unprepared objective pieces large distances prior to tool production.

The Sullivan-Rosen Technique (SRT) (1985) as adapted by Prentiss (1998) was lightly applied to the 34HP55 assemblage in an attempt to define distinctive normative behavior in tool production there. As with the SRT, the 34HP55 lithic assemblage has been analyzed as flake morphology (complete flakes; proximal flake fragments; mediolateral flake fragments; non-orientable fragments). The flake debris was also divided into a typology of size elements (very small = $<.64$ cm 2 ; small = .7 - 4.0 cm 2 ; medium = 4.1 - 16 cm 2 ; large = 16.1 - 64 cm 2) and the two characteristic sets (size and morphology) were then compared using Prentiss' (1998) version.

According to the results arrived at by Prentiss (1998:647), edge modification and platform preparation are synonymous with bifacial reduction and should result in large numbers of small, proximal flake fragments. At 34HP55, large numbers of proximal fragments are not evident at all. Those proximal fragments present predominate in the medium-sized flake category which does not substantiate a process of bifacial reduction at 34HP55. However, "...unprepared core reduction also tends to produce relatively higher quantities of large and medium proximal and mediolateral fragments" (Prentiss 1998:647). Neither morphological class is heavily represented in the 34HP55 assemblage, possibly due to the tabular nature of

the Day Creek dolomite providing adequate, flat platforms without necessitating platform preparation.

A second issue noted in the SRT by Prentiss is that core reduction strategies often result in the production of higher numbers of small, non-orientable flakes when compared to bifacial reduction strategies. The 34HP55 assemblage provided a large number of both small and very small non-orientable flakes supporting a process of core reduction versus bifacial reduction on-site.

It was also noted by Prentiss that if a tool production industry is geared towards the production of large flake tools, a predominance of medium-sized mediodistal flake fragments and very few medium-sized proximal and non-orientable fragments will result. At 34HP55, the quantities of these three flake fragment forms are relatively equal. Additionally, high numbers of small and very small complete flakes were present at 34HP55. According to the SRT, these details point to the prevalent use of hard hammers in the reduction process and indicate that flake tool production was not a focus at 34HP55. This is further substantiated by the fact that only one flake tool (made of a non-local chert type) was recovered during site excavations.

In a general sense, an intermediate process of lithic reduction and tool manufacture was occurring at 34HP55. Primarily, large, tabular or blocky objective pieces (cores) were being extracted from a lithic resource area and transported to the site for further reduction. Judging from the reduced number of large flakes, blocky debris, and residual cortex on-site, it is probable that the objective pieces selected from the Day Creek outcrops were either pieces with little cortical material remaining, or were being initially shaped and cleaned at the quarry prior to their transport to 34HP55. Secondary thinning of the objective piece was accomplished on-site with the aid of a hard hammer applied to a preferably flat but unprepared cortical platform. It is unknown what material was used as hard hammer percussor at 34HP55 but the most likely material was the stream-rolled, oval cobbles of quartzite that were readily available as part of the region's background resources.

Flaking of the bifacial core/preforms by the 34HP55 occupants was initially accomplished by removing flakes from multiple directions, striking any convenient, naturally flat platform available until a somewhat biconvex preform began to take shape. Templates for these large biface preforms resemble tools known as chipped stone celts or ovate biface knives identified as part of a number of Middle Ceramic collections from Kansas (O'Brien 1984:107 & 118) or tools described as gouges and wedges from eastern Kansas (Reid 1984). After the preform began to take shape, a soft hammer—probably an antler billet—was then employed for the finer trimming of the preform. After much of the central mass was removed from the objective piece and a biconvex preform was established, flaking began centripetally and bifacially along the perimeter of the piece, working convergently to reduce the center mass of the preform—a difficult task because of the brittle nature of the Day Creek chert. An additional hazard encountered at 34HP55 when knapping Day Creek chert were incipient veins or strings of quartz inclusions that made the biface more prone to fracture. Bailey (2000:95) notes abundant evidence that prehistoric knappers encountered obstacles such as vugs and fault lines in Day Creek chert nodules at quarry sites.

A large amount of Day Creek chert was transported to the Dry Buffalo Creek terrace during the Archaic Period. Based upon the recovery of large, broken bifaces, discarded cores, and a complete assemblage of flake debitage (much of which would have been quite suitable for manufacturing into flake tools but was instead discarded on-site), in addition to the lack of subsurface features like structural foundations, hearths or storage pits, it appears that mobile Archaic groups were using 34HP55 as a facility for producing large bifacial cores/preforms, multi and single platform cores and flake blanks from local lithic raw materials. According to Andrefsky (1994:22), "...mobile groups occupying relatively large areas may find themselves in regions where lithic raw materials are not suitable for use as tools, and thus must have ready-made tools available for the tasks at hand. Portable tools, tools that can be redesigned, or tools that have variable functions are best suited for the situation. Tools that meet these specifications include bifaces, formally prepared cores, and retouched flake tools." Therefore, groups such as those occupying 34HP55 would produce a number of expedient/informal, portable tools such as prepared bifacial cores to carry along on seasonal rounds as insurance against the possibility that campsites might later be established in areas where tool stone was not available (see also Johnson 1989; Parry and Kelly 1987; and Sassaman 1994:111). An additional consideration would be the exchange of large bifaces with groups having no direct access to lithic resources. This could represent a risk-aversion technique or a method of generating social surplus with surrounding groups on the High Plains.

Tomka (Andrefsky 2001:208) proposes that differences in the formality or expediency of tool form has more to do with the type of subsistence resources being exploited by a group rather than their level of mobility. It is agreed that the manufacture of flaked stone tools in the past had to conform to the cultural constraints and perceived needs for which they were made and used, but without knowing in what tasks people occupying 34HP55 were employing their bifaces, and without any evidence of an established, semi-sedentary occupation of 34HP55, mobility must serve as the predominate model in this site interpretation. In this regard, the primary benefit of biface production to mobile groups such as those that occupied 34HP55 is that the production of large biface cores provides an efficient form of cutting-edge storage (see Clark 1987) while simultaneously reducing transportable weight.

Ethnoarchaeological studies of lithic raw material use by groups of aboriginal Australians similar to early North American hunter-gatherers, was conducted by Gould (1980). Gould's analysis suggests that whenever a mobile group finds a usable lithic resource in close proximity to a water source, a base camp will be established and a large percentage of artifacts from the locally obtainable lithic resource will be manufactured, used, and discarded within the confines of the campsite. Often, when locally available lithic raw materials are ubiquitous but of poor quality, like Day Creek chert, this stone resource is not used to produce more formally-created tools. Instead, formal tools are manufactured from higher quality material obtained from greater distances (Andrefsky 1994:29). It is possible that diagnostic artifacts from 34HP55 are representative of this tactic. An Archaic Period projectile point manufactured from a high-quality chalcedony and two bifacial stone tools of high quality chert were recovered from the site. Two of the tools are manufactured from lithic resources (chalcedony and possible Edwards chert) that are less apparent in the geologic background than Day Creek chert. The material from which these tools were made

was not being worked at 34HP55. Instead, the primary site component indicative of the Archaic occupation of 34HP55 was the working of lesser quality, maroon Day Creek chert into single and multiplatform cores from which flake blanks were struck, but apparently not used or further reduced on the site, as well as the manufacture of bifacial core/preforms for transport and later use.

References

- Allen, Joel A.
- 1877 *History of the American Bison, Bison americanus*. United States Geological and Geographical Survey of the Territories, Annual Report No. 9(3), pp. 301-328. Academic Press, New York.
- Amick, Daniel S. and Raymond P. Mauldin
- 1997 Effects of Raw Material on Flake Breakage Patterns. *Lithic Technology* 22(1):18-32.
- Amick, Daniel S., Raymond P. Mauldin, and Steven A. Tomka
- 1988 An Evaluation of Debitage Produced by Experimental Bifacial Core Reduction of a Georgetown Chert Nodule. *Lithic Technology* 17(1):26-36.
- Anderson, Adrian
- 1975 The Cooperton Mammoth. An Early Man Bone Quarry. *Great Plains Journal* 14:130-173
- Andrefsky, William Jr.
- 1994 Raw-material Availability and the Organization of Technology. *American Antiquity* 59(1):21-34.
- 1998 *Lithics: Macroscopic Approaches to Analysis*. Cambridge University Press, Cambridge.
- 2001 *Lithic Debitage: Context, Form, Meaning*. The University of Utah Press, Salt Lake City.
- Antevs, Ernst
- 1955 Geologic-Climate Dating in the West. *American Antiquity* 20:317-355.
- Artz, Joe Alan
- 1976 *The Soils and Geomorphology of the East Branch Walnut Valley: Contexts of Human Adaptation in the Kansas Flint Hills*. Master's Thesis. Department of Anthropology, University of Kansas, Lawrence.
- Austin, Robert J.
- 1999 Technological Characterization of Lithic Waste-Flake Assemblages: Multivariate Analysis of Experimental and Archaeological Data. *Lithic Technology* 24(1):53-68.
- Baerreis, David A. and Reid A. Bryson
- 1965 Historical Climatology and the Southern Plains: A Preliminary Statement. *Bulletin of the Oklahoma Anthropological Society* 13.

- Bailey, Berkley
- 2000 *The Geoarchaeology of Day Creek Chert: Lithostratigraphy, Petrology, and the Indigenous Landscape of Northwest Oklahoma and Southwest Kansas.* Ph.D. dissertation, Department of Anthropology, University of Oklahoma, Norman Oklahoma. University Microfilms, Ann Arbor.
- Banks, Larry D.
- 1984 Lithic Resources and Quarries. In *Prehistory of Oklahoma*. Edited by Robert E. Bell. Academic Press, Inc. New York.
- 1990 *From Mountain Peaks to Alligator Stomachs; A Review of Lithic Resources in the Trans-Mississippi South, the Southern Plains, and Adjacent Southwest.* Oklahoma Anthropological Society, Memoir #4.
- Baugh, Timothy G.
- 1982 *Edwards I (34BK2): Southern Plains Adaptations in the Proto-Historic Period.* Oklahoma Archaeological Survey, Studies in Oklahoma's Past No. 8.
- 1986 Culture History and Proto-historic Societies in the Southern Plains. In Current Trends in Southern Plains Archaeology. Edited by Timothy G. Baugh, pp. 167-187. Memoir 21, *Plains Anthropologist* 31(114, Part 2).
- Baumgartner, Frederick M. and A. Marguerite Baumgartner
- 1992 *Oklahoma Bird Life.* University of Oklahoma Press, Norman.
- Bee, James W., Gregory Glass, Robert S. Hoffman, and Robert R. Patterson
- 1981 *Mammals in Kansas.* The University of Kansas Museum of Natural History Public Education Series No. 7. Lawrence.
- Bell, Robert E. and Tyler Bastien
- 1967 Survey of Potential Wichita Archaeological Remains in Oklahoma. In *A Pilot Study of Wichita Indian Archaeology and Ethnohistory*. Assembled by Robert E. Bell, Edward B. Jelks, and W.W. Newcomb, pp. 54-118. National Science Foundation, Final Report, Grant GS-964. Ms. On file at the Oklahoma Archaeological Survey, The University of Oklahoma, Norman.
- Bement, Leland C.
- 1997 The Cooper Site: A Stratified Folsom Bison Kill in Oklahoma. *Plains Anthropologist* 42(150):85-100.
- 2005 Buffalo Chips in the Mammoth Patch: Investigating Clovis Bison Hunting at the Jake Bluff Site, NW Oklahoma. *Prehistoric People of Oklahoma* No. 5. Oklahoma Archaeological Survey, Norman.

- Bement, Leland C. and Scott D. Brosowske
1998 *Pedestrian Survey of Playa Lake Environments in Beaver and Texas Counties, Oklahoma.* Archaeological Resource Survey Report No. 39. Oklahoma Archaeological Survey, Norman.
- Bement, Leland C. and Kent J. Buehler
1994 Preliminary Results from the Certain Site: A Late Archaic Bison Kill in Western Oklahoma. *Plains Anthropologist* 39:173-183.
- Bement, Leland C., Debra K. Green, and Brian J. Carter
2002 *Pedestrian Survey of Canyons in the Cimarron River Drainage Harper County, Oklahoma.* Archaeological Resource Survey Report No. 45. Oklahoma Archaeological Survey, Norman.
- Bement, Leland C., Ernest L. Lundelius, Jr., and Richard A Ketcham
2005 Hoax or History: A Bison Skull with Embedded Calf Creek Projectile Point. *Plains Anthropologist* 195:221-226.
- Bement, Leland C., Kurt Schuster and Brian J. Carter
2007 *Archeological Survey for Paleo-Indian Sites along the Beaver River, Beaver County, Oklahoma.* Oklahoma Archeological Survey Archeological Resource Survey Report No. 54. University of Oklahoma, Norman.
- Bevitt, C. Todd
1999 *Life on the High Plains Border: Archaeological Investigation of Three Late Prehistoric Habitation Sites in Southwest Kansas.* Unpublished M.A. thesis. Department of Anthropology, Wichita State University, Kansas.
- Briscoe, Jim
1987 *Analysis of Cultural Materials from the Swift Horse Site, An Early Plains Woodland Site on the Black Kettle National Grasslands, Roger Mills County, Oklahoma.* Briscoe Consulting Services. Submitted to the U.S.D.A. Forest Service Cibola National Forest Contract No. 40-83D5-6-468.
- Brooks, Robert L., Michael C. Moore, and Douglas W. Owsley
1992 New Smith, 34RM300: A Plains Village Mortuary Site in Western Oklahoma. *Plains Anthropologist* 37:59-79.
- Brosowske, Scott D.
2002 What Exactly is the Zimms Complex? A Review and Synthesis of Architectural and Assemblage Traits. *Oklahoma Archaeology, Journal of the Oklahoma Anthropological Society* 50(4):20-39.
2005 *The Evolution of Exchange in Small-scale Societies of the Southern High Plains.* Unpublished Ph.D. Dissertation. The University of Oklahoma Graduate College. Norman.

- Brosowske, Scott D. and Leland C. Bement
2001 *Streams in No Man's Land: A Cultural Resource Survey in Beaver and Texas Counties, Oklahoma.* Oklahoma Archaeological Survey Report No. 43. Oklahoma Archaeological Survey, Norman.
- Buehler, Kent J.
1997 Where's the Cliff?: Later Archaic Bison Kills on the Southern Plains. In *Southern Plains Bison Procurement and Utilization from Paleo-Indian to Historic.* Edited by Leland C. Bement and Kent J. Buehler. *Plains Anthropologist Memoir* No. 29:135-143.
- Campbell, Robert G.
1976 *The Panhandle Aspect of the Chaquaque Plateau.* Texas Tech University Graduate Studies No. 11. Lubbock.
- Carmichael, Casey
2004 *Woodland Period Settlement and Subsistence in the Southern High Plains.* Unpublished M.A. Thesis. The University of Oklahoma Anthropological Department, Norman.
- Carriker, Robert C.
1990 *Fort Supply Indian Territory: Frontier Outpost on the Plains.* The University of Oklahoma Press, Norman.
- Catlin, George
1973 *Letters and Notes on the Manners, Customs, and Conditions of North American Indians.* Volume 2. Dover Publications, Inc., New York.
- Clark, John E.
1987 Politics, Prismatic Blades, and Mesoamerican Civilization. In *The Organization of Core Technology.* Edited by Jay K Johnson and Carol A. Morrow, pp. 259-284. Westview Press, Boulder, Colorado.
- Cranford, David J, Elsbeth Dowd and Don G. Wyckoff
2009 *Geoarcheology and the Cross Timbers.* Oklahoma Anthropological Society, Memoir # 13.
- Culin, Stewart
1975 *Games of the North American Indians.* Dover Publication, Inc., New York.
- Curtis, M. Neville Jr, William Ham and Kenneth Johnson
2008 Geomorphic Provinces of Oklahoma. In *Earth Sciences and Mineral resources of Oklahoma.* Kenneth Johnson and Kenneth Luza editors. Oklahoma Geological Survey. University of Oklahoma. Norman Ok.

- Dibble, Harrold L. and John C. Whittaker
 1981 New Experimental Evidence on the Relation between Percussion Flaking and flake Variation. *Journal of Archaeological Science* 8:283-296.
- Dillehay, Tom
 1974 Late Quaternary Bison Population Changes on the Southern Plains. *Plains Anthropologist* 19:180-196.
- 1997 *Monte Verde: a Late Pleistocene Settlement in Chile, Volume 2: The Archaeological Context and Interpretation.* Smithsonian Institution Press, Washington, D.C.
- Drass Richard R.
 1988 A Re-analysis of the Brewer Site: An Early Plains Village Settlement in Central Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 37.
- 1989 Reexamination of the Hedding Site, 34WD2. *Oklahoma Anthropological Society Newsletter* 37(8):2-6.
- 1997 Culture Change on the Eastern Margin of the Southern Plains. *Studies in Oklahoma's Past* 19, *Oklahoma Anthropological Society Memoir* No. 7. Oklahoma Archaeological Survey, Norman.
- 1998 The Southern Plains Villagers. In *Archaeology on the Great Plains.* Edited by W. Raymond Wood. University Press of Kansas, Lawrence.
- Drass, Richard R. and C. L. Turner
 1989 *An Archaeological Reconnaissance of the Wolf Creek Drainage Basin, Ellis County, Oklahoma.* Archaeological Resource Survey Report No. 35. Oklahoma Archaeological Survey, Norman.
- Duncan, Marjorie
 1996 Test Excavations at the Kubik Site, 34KA354. *Oklahoma Archaeological Survey Newsletter* No. 51(1).
- Ferring, C. Reid
 2000 Geoarchaeology in the Southern Osage Plains. In *Geoarchaeology in the Great Plains.* Edited by Rolfe Mandel. University of Oklahoma Press, Norman.
- Ferring, C. Reid, Daniel Crouch and Towana Spivey
 1976 *An Archeological; Reconnaissance of the Salt Plains Areas of Northwest Oklahoma.* Contributions of the Museum of the Great Plains, Number 4. Lawton, Oklahoma.

- Gibson, Arrell M.
- 1965 *Oklahoma: A History of Five Centuries*. Harlow Publishing Corporation, Norman, Oklahoma.
- Gould, Richard A.
- 1980 *Living Archaeology*. Cambridge University Press, Cambridge.
- 1982 Geology of Delaware County. In: *The Late Holocene Prehistory of Delaware Canyon*, edited by C. R. Ferring, pp. 47-63. Contributions in Archaeology No 1. Institute of Applied Sciences, North Texas State University. Denton Texas
- Hall, Stephen A.
- 1977 Geology and Palynology of Archaeological Sites and Associated Sediments. In: *The Prehistory of the Little Caney River*, edited by D. O. Henry, pp13-41. Contributions in Archaeology 1. University of Tulsa, Tulsa Oklahoma.
- Hammatt, Hallett H.
- 1976 The Gore Pit Site: An Archaic Occupation in Southwestern Oklahoma and a Review of the Archaic Stage in the Southern Plains. *Plains Anthropologist* 21:245-277.
- Haynes, C. Vance
- 1991 Geoarchaeological and Paleohydrological Evidence for a Clovis-age Drought in North America and Its Bearing on Extinction. *Quaternary Research* 35:438-451.
- Hill, Matthew H. and Jack L. Hofman
- 1997 The Waugh Site: A Folsom-Age Bonebed in Northwest Oklahoma. *Plains Anthropologist* 42(159):63-84.
- Hofman, Jack L.
- 1978 The Development and Northern Relationships of Two Archaeological Phases in the Southern Plains Sub-area. In *The Central Plains Tradition: Internal Development and External Relationships*. Edited by Donald J. Blakeslee. *University of Iowa Office of the State Archaeologist Report* 11:6-35.
- 1984 The Western Proto-Historic: A Summary of the Edwards and Wheeler Complexes. In *Prehistory of Oklahoma*. Edited by Robert E. Bell, pp. 347-362. Academic Press, Orlando.
- 1989 Hunters and Gatherers. In *From Clovis to Comanchero: Archaeological Overview of the Southern Great Plains*. Arkansas Archaeological Survey Research Series No. 35, Fayetteville.
- 1993 An Initial Survey of the Folsom Complex in Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 39:71-105

Hofman, Jack L., Robert L. Brooks, Joe S. Hays, Douglas W. Owsley, Richard L. Jantz, Murray K. Marks, and Mary H. Manhein

- 1989 *From Clovis to Comanchero: Archaeological Overview of the Southern Great Plains.* Arkansas Archaeological Survey Research Series No. 35, Fayetteville.

Hofman, Jack and Brian Carter

- 1991 The Waugh Site: A Folsom-bison Association in Northwest Oklahoma. In *Guidebook: A Prehistory of the Plains Border region: South Central Friends of the Pleistocene, 9th Annual Meeting, Woodward, Oklahoma.*, Edited by B.J. Carter and P.A. Ward III, pp. 24-37, Oklahoma State University. Stillwater Oklahoma.

Hofman, Jack L. and Richard R. Drass, eds.

- 1990 *A Survey of Archaeological Resources and an Evaluation of Buried Site Potential in Northwestern Oklahoma County, Oklahoma.* The University of Oklahoma, Oklahoma Archaeological Survey, Norman.

Hofman, Jack L. and Lawrence Todd

- 1997 Reinvestigation of the Perry Ranch Plainview Bison Bonebed, Southwestern Oklahoma. *Plains Anthropologist* 42(159):101-119.

Hofman, Jack L. and Don G. Wyckoff

- 1991 Clovis Occupations in Oklahoma. *Current Research in the Pleistocene* 8:29-32.

Hoagland, Bruce

- 2008 Vegetation of Oklahoma. In *Earth Sciences of Oklahoma.* Edited by Kenneth S. Johnson and Kenneth V. Luza. Oklahoma Geological Survey, University of Oklahoma, Norman Ok.

Holliday, Vance T.

- 1989 Middle Holocene Drought on the Southern Plains. *Quaternary Research* 31:74-82.

Hughes, Jack T.

- 1955 Little Sunday: An Archaic Site in the Texas Panhandle. *Texas Archaeological Society Bulletin* 26:55-74.

- 1984 The Foragers: Western Oklahoma. In *Prehistory of Oklahoma.* Pp. 109-117. Edited by Robert E. Bell. Academic Press, Orlando.

- 1991 Prehistoric Cultural Developments on the Texas High Plains. *Bulletin of the Texas Archaeological Society* 60:1-55.

- Johnson, Ann Mary and Alfred E. Johnson
1998 The Plains Woodland. In *Archaeology on the Great Plains*. Edited by W. Raymond Wood. University Press of Kansas, Lawrence.
- Johnson, Eileen
1987 *Lubbock Lake: Late Quaternary Studies on the Southern Plains*. Texas A&M University Press, College Station.
- 1997 Late Quaternary Bison Utilization at Lubbock Lake on the Southern High Plains. In *Southern Plains Bison Procurement and Utilization from Paleo-Indian to Historic*. Edited by Leland C. Bement and Kent J. Buehler. *Plains Anthropologist Memoir* No. 29:45-61.
- Johnson, Eileen and Vance T. Holliday
1986 The Archaic Record at Lubbock Lake. In *Current Trends in Southern Plains Archaeology*. Edited by Timothy G. Baugh. *Plains Anthropologist Memoir* 23(2):31-114.
- Johnson, Jay K.
1979 Archaic Biface Manufacture: Production Failures, A Chronicle of the Misbegotten. *Lithic Technology* 8(2):25-35.
- 1989 The Utility of Production Trajectory Modeling as a Framework for Regional Analysis. In *Alternative Approaches to Lithic Analysis*. Edited by D.O. Henry and G.H. Odell, pp. 119-138. Archaeological Papers of the American Anthropological Association No. 1.
- Johnson, Kenneth and Kenneth Luza
2008 Rivers Streams, and Lakes of Oklahoma. In *Earth Sciences of Oklahoma*. Edited by Kenneth S. Johnson and Kenneth V. Luza. Oklahoma Geological Survey, University of Oklahoma, Norman Ok.
- Johnson, William C. and Charles W. Martin
1987 Holocene Alluvial-Stratigraphic Studies from Kansas and Adjoining States of the East-Central Plains. In: *Quaternary Environments of Kansas*, edited by W.C. Johnson, pp-109-122. Guidebook Series 5. Kansas Geological Survey, Lawrence, Kansas.
- Jones, J. Knox Jr., David M. Armstrong, and Jerry R. Choate
1985 *Guide to Mammals of the Plains States*. University of Nebraska Press, Lincoln.
- Krieger, Alex D.
1946 *Culture Complexes and Chronology in Northern Texas*. University of Texas Publication No. 4640, Austin.

- Lawton, Sherman
- 1968 Duncan-Wilson Bluff Shelter: A Stratified Site of the Southern Plains. *Oklahoma Anthropological Society Bulletin* 16:1-94.
- Leonhardy, Frank C.
- 1966a *Domebo: A Paleo-Indian Mammoth Kill in the Prairie-Plains*. Contributions of the Museum of the Great Plains No. 1. Lawton, Oklahoma.
- 1966b *Test Excavations in the Mangum Reservoir Area of Southwestern Oklahoma*. Contributions of the Museum of the Great Plains 2:1-72. Lawton, Oklahoma.
- Lintz, Christopher R.
- 1984 The Plains Villagers: Antelope Creek. In *Prehistory of Oklahoma*. Edited by Robert E. Bell. Pp. 325-346. Academic Press, New York.
- 1986 *Architecture and Community Variability within the Antelope Creek Phase of the Texas Panhandle*. Oklahoma Archaeological Survey, Studies in Oklahoma's Past No. 14. Norman.
- Lopez, David R. and Kenneth D. Keith
- 1979 *Oklahoma Highway Archaeological Survey Reconnaissance Program 1972-1978*. Oklahoma Highway Archaeological Survey. Norman.
- Mandel, Rolfe
- 1994a Geomorphology and Soil Stratigraphy of 41MU55. In *The Valley Branch Archaeological Project: Excavations at an Archaic Site (41MU55) in the Cross Timbers Uplands, North-central Texas*. Reports of Investigations No. 15:41-50. Edited by A.V. Thomas. Texas A&M University, Archaeological Research Laboratory, College Station
- 1994b *Holocene Landscape Evolution in the Pawnee River Valley, Southwestern Kansas*. Kansas State Historical Society Bulletin No. 236. Kansas Geological Survey, Lawrence
- 2000 The History of Geoarchaeological Research in Kansas and Northern Oklahoma. In *Geoarchaeology in the Great Plains*. Edited by Rolfe Mandel. The University of Oklahoma Press, Norman.
- 2003 Geomorphology and Stratigraphy. In *The Archaic Occupations of the Allen Fan Site (13HA385) in the Iowa Valley of Central Iowa*. *Plains Anthropologist* No. 185(48):11-23.

- McKay, Michael W., Leland C. Bement, and Richard R. Drass
2004 *Testing Results of Four Late Holocene Sites, Harper County, Oklahoma.* Archaeological Resource Survey Report No. 49. The University of Oklahoma, Oklahoma Archaeological Survey, Norman.
- Minnis, Paul E. and Wayne J. Elisens
2000 *Biodiversity and Native America.* University of Oklahoma Press, Norman.
- Miser, Hugh D.
1954 *Geologic Map of Oklahoma.* U.S. Geologic Survey. Denver, CO.
- Mooney, James
1898 Calendar History of the Kiowa Indians. *Bureau of American Ethnology 17th Annual Report, Part I.* Smithsonian Institute, Washington D.C.
- Moore, Michael C.
1987 A Reconnaissance Survey of Quartermaster Creek. In *Archaeology of the Mixed Grass Prairie Phase I: Quartermaster Creek.* Edited by Timothy G. Baugh. Pp. 51-215. *Archaeological Resource Survey Report 20.* Oklahoma Archaeological Survey, Norman.
- Morris, John W., Charles R. Goins, and Edwin C. McReynolds
1976 *Historical Atlas of Oklahoma.* University of Oklahoma Press, Norman.
- Myers, Arthur
1959 *Geology of Harper County.* Oklahoma Geological Survey Bulletin Number 80. Oklahoma Geological Survey, Norman Oklahoma.
- Nance, Earl C., Joe D. Nichols, H.L. Kollmorgen, R.E. Daniell, H.L. Costilow, and K.T. Lofton.
1960 Soil Survey of Harper County, Oklahoma. Soil Conservation Service, United States Department of Agriculture. Washington D.C.
- O'Brien, Patricia
1984 *Archaeology in Kansas.* University of Kansas, Museum of Natural History, Public Education Series No. 9. Lawrence.
- Parry, William J. and Robert L. Kelly
1987 Expedient Core Technology and Sedentism. In *The Organization of Core Technology.* Edited by J.K. Johnson and C.A. Morrow, pp. 285-304. Westview Press, Boulder, Colorado.
- Patterson, Leland W.
1982 Replication and Classification of Large Size Lithic Debitage. *Lithic Technology* 11(3):50-58.

- Patterson, Leland W. and J.B. Sollberger
1978 Replication and Classification of Small Size Lithic Debitage. *Plains Anthropologist* 23(80):103-112.
- Patton, P.L. and Schumm, S.A.
1981 Ephemeral-stream Processes—Implications for studies of Quaternary Valley Fills. *Quaternary Research* 15:24-43.
- Perino, Gregory
1968 Guide to the Identification of Certain American Indian Projectile Points. *Special Bulletin No. 3 of the Oklahoma Anthropological Society*. Oklahoma City, Oklahoma.
- 1971 Guide to the Identification of Certain American Indian Projectile Points. *Special Bulletin No. 4 of the Oklahoma Anthropological Society*. Oklahoma City, Oklahoma.
- Prentiss, William C.
1998 The Reliability and Validity of a Lithic Debitage Typology: Implications for Archaeological Interpretation. *American Antiquity* 63(4):635-650.
- Purdy, Barbara A.
1975 Fractures for the Archaeologist. In *Lithic Technology: Making and Using Stone Tools*. Edited by e. Swanson, pp. 133-141. Mouton Publishers, The Hague.
- Rebnegger, Karin J., Debra Green, Luther Leith, J. Peter Thurmond, and Don G. Wyckoff
2006 34RM507, A Late Archaic Site in Western Oklahoma. Joint Publication of the Oklahoma Anthropological Society, Memoir 10. Sam Noble Oklahoma Museum of Natural History, Department of Archaeology. Norman.
- Reid, Kenneth C.
1984 Nebo Hill and Late Archaic Prehistory on the Southern Prairie Peninsula. *Publications in Anthropology* No. 15. University of Kansas, Lawrence.
- Rondeau, Michael F.
1981 An Additional Failure Type During Biface Manufacture. *Lithic Technology* 8(3):10-11.
- Rowlison, Don
1985 A Preliminary Report on the Bell Site and the 1984 Kansas Archaeology Training Program. *Kansas Anthropological Association Journal* 5:117-128.
- Rye, Owen S.
1981 *Pottery Technology: Principles and Reconstruction*. Manuals on Archaeology No. 4. Australian National University. Teraxacum, Washington.

- Sassaman, Kenneth E.
- 1994 Changing Strategies of Biface Production in the South Carolina Coastal Plain. In *The Organization of North American Prehistoric Chipped Stone Tool Technologies*. Edited by Philip J. Carr, pp. 99-117. International Monographs in Prehistory, Archaeological Series No. 7. Ann Arbor, Michigan.
- Saunders, Roger S. and John T. Penman
- 1979 Perry Ranch: A Plainview Bison Kill on the Southern Plains. *Plains Anthropologist* 24(83):51-65.
- Schiffer, Michael B.
- 1987 *Formation Processes of the Archaeological Record*. University of New Mexico Press, Albuquerque.
- Schumm, Stanley A.
- 1977 *The Fluvial System*. John Wiley & Sons. New York.
- Shepard, Anna O.
- 1956 *Ceramics for the Archaeologist*. Publication 609. Carnegie Institution of Washington, Washington D.C.
- Stuiver, M., Reimer, P. J., and Reimer, R. W.
- 2005 CALIB 5.0 (WWW program and documentation).
- Sullivan, Alan P., III and Kenneth C. Rozen
- 1985 Debitage Analysis and Archaeological Interpretation. *American Antiquity* 50:755-779.
- Swenson, Fern
- 1986 *A Study in Cultural Adaptation to Climatic Shifts on the Southern Plains: Washita River Phase and Edwards Complex Cultural Continuity*. Unpublished Thesis. The University of Oklahoma, Norman.
- Thurmond, J. Peter
- 1990 Late Paleo-Indian Utilization of the Dempsey Divide on the Southern Plains. *Plains Anthropologist* 35(131).
- 1991 Archaeology on the Dempsey Divide, A Later Archaic/Woodland Hotspot on the Southern Plains. *Oklahoma Anthropological Society Bulletin* 34:103-157.
- Thurmond, J. Peter and Don G. Wyckoff
- 1995 A Dated Valley Fill Sequence on Plum Creek in Roger Mills County. *Newsletter of the Oklahoma Anthropological Society* 43(5):7-10.

- Thurmond, J. Peter, Kenneth C. Kraft and Don G Wyckoff
 2000 Calibration of the Radiocarbon Dates from 34RM501, the Swift Horse Site. .
Newsletter of the Oklahoma Anthropological Society 48(1):12-13
- Thurmond, J. Peter, Don G. Wyckoff, and Charles B. Batchelor
 1998 A Rapid Return to Woodland Period Conditions? Or How Site 34RM451
 Returned to Waterfront Property. *Oklahoma Anthropological Society Newsletter* 46(3):5-8.
- Turner, Ellen Sue and Thomas R. Hester
 1985 *A Field Guide to Stone Artifacts of Texas Indians.* Texas Monthly Press.
 Austin.
- Vehik, Susan C.
 1984 The Woodland Occupations. In *Prehistory of Oklahoma.* Edited by Robert E. Bell. Academic Press, New York.
- Vehik, Susan C. and Richard A. Pailes
 1979 *Excavations in the Copan Reservoir of Northeastern Oklahoma and Southeastern Kansas.* The University of Oklahoma, Oklahoma Archaeological Research and Management Center, Research Series No. 4. Norman.
- Wallace, Ernest and E. Adamson Hoebel
 1952 *The Comanches: Lords of the South Plains.* The University of Oklahoma Press, Norman.
- Weaver, John E. and Frederick W. Albertson
 1956 *Grasslands of the Great Plains, Their Nature and Use.* Johnsen Publishing Company. Lincoln, Nebraska.
- Wedel, Waldo R.
 1959 *An Introduction to Kansas Archaeology.* Bureau of American Ethnology Bulletin 174, Washington D.C.
- Wendland, Wayne M.
 1978 Holocene Man in North America: The Ecological Setting and Climatic Background. *Plains Anthropologist* 23:273-287.
- Wormington, Hannah M.
 1957 *Ancient Man in North America, Fourth Edition Revised.* The Denver Museum of Natural History Popular Series No. 4. Denver, Colorado.

Wyckoff, Don G.

- 1988 *An Introductory Study of Alibates Gravel Occurrences along Western Oklahoma's Canadian River*. Oklahoma Archaeology Survey. University of Oklahoma, Norman.
- 1995 A Summary of the Calf Creek Horizon in Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 42:179-210.
- 2005 A Calf Creek Potpourri. *Oklahoma Archaeology, Journal of the Oklahoma Anthropological Society* No. 53(1):22

Wyckoff, Don G. and Robert L. Brooks

- 1983 *Oklahoma Archaeology: A 1981 Perspective of the State's Archaeological Resources, Their Significance, Their Problems and Some Proposed Solutions*. Archaeological Resource Survey Report No. 16. The University of Oklahoma, Oklahoma Archaeological Survey, Norman.

Wyckoff, Don G., James L. Theler and Brian J. Carter

2004. *The Burnham Site in Northwestern Oklahoma: Glimpses beyond Clovis?* Joint publication of the Sam Noble Oklahoma Museum of Natural History, University of Oklahoma and the Oklahoma Anthropological Society, Memoir 9.