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Buffalo Chips in the Mammoth Patch:

Investigating Clovis Bison Hunting at the Jake Bluff Site, NW Oklahoma

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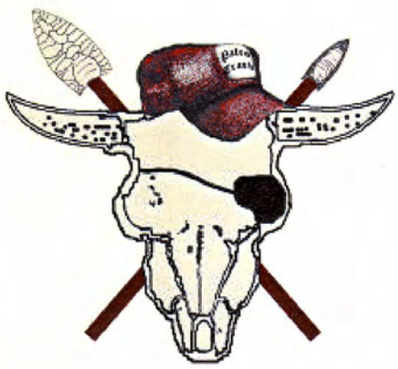

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Abstract

Recently, Gary Haynes characterized Clovis subsistence organization as opportunistically specialized megafaunal hunting. Clovis hunters following mammoth trails into the mammoth patch targeted elephants first, but also dispatched other large animals. Clovis hunting pressure facilitated the extinction of species inhabiting the patch, leaving only the migratory bison to survive. With the extinction or extirpation of "patch animals" those herd animals adapted to life outside the patch where Clovis hunting was minimal became the target of Clovis hunters. This project examines Clovis bison hunting practices from the perspective of the Jake Bluff site (34HP60) in NW Oklahoma. Topics considered include the development of hunting techniques that continued to be employed by post-Clovis bison hunters. Inter- and multi-disciplinary avenues contributing to this research include animal behavior modeling, geomorphology and soils reconstruction, chronometric analysis, palynology, and archaeological investigation.

Keywords: Clovis, Southern Plains, Folsom, Bison

Introduction

On the southern Plains of North America the period between 12,000 and 10,000 rybp is generally considered the Pleistocene/Holocene transition. Rapidly changing climatic conditions, shifting flora and faunal associations, and cultural adaptation mark this period (Holliday 1997; Ruddiman and Wright 1987; Graham and Mead 1987). The cultural shift is from Clovis mammoth hunters to Folsom bison hunters (Bonnichsen, Stanford and Fastook 1987). The shift from mammoth hunting to bison hunting is a result of the extinction of the mammoth. Whether the extinction of the mammoth and other megafauna species was due to changing environments (Grayson 1989; Graham and Lundelius 1984), overkill by human predation (Martin 1984), or a combination of both (Stanford 1999), the result was that hunters on the southern Plains of North America had to adapt to hunting the remaining mammal species--principally bison. In general, adaptive systems incorporate established components with innovations to evolve new strategies (Jochim 1996:360). Hence, on the southern Plains, the adaptive responses of big game hunters should incorporate aspects of Clovis hunters with a new emphasis on developing the bison hunting techniques seen in later Folsom times. Our best or most studied aspect of Clovis hunters is directed toward mammoth hunting with only a secondary, cursory understanding of Clovis bison hunting.

Recently, Gary Haynes proposed that the Clovis people subsisted by "opportunistically specialized megafaunal hunting" (G. Haynes 2002:252). He proposes that

> "Earlier (proto-Clovis) foragers who had passed through the northern and central Plains left nearly no known signs of their initial passing, but by the time of the Clovis florescence after 11,200 rcybp, all the features of Clovis-era behavior were in place across

> much of the continent. By then the people were paying especially close attention to the mammoths and mastodonts in the continent, the animals which created the clearest and most complete trail networks linking the best foraging patches (and other species of large mammals using those patches). The human exploration along megamammal trails led foragers to refugia patches, to water sources, and to pockets of highest biotic richness. Each perturbation of climate in the period 11,500-10,500 rcybp increased the stresses on megafaunal taxa, leading to better and better foraging conditions for human groups. Within a few hundred years the entire continent was occupied or in the process of being "settled." Soon the largest ungulates were dead and gone, along with many carnivores and scavengers that had fed on them. Only in the widest grasslands, where fewer taxa of large mammals lived together, and fewer Clovis groups spent time, did any relatively large animals survive, specifically migratory grazers – bison." (G. Haynes 2002:253-254).

This statement provides the basis for investigation of bison/Clovis interaction. Clovis hunters were specialized mammoth hunters following the mammoth trails to their refugia. Other animals encountered in or en route to a mammoth patch were "opportunistically" harvested. This would account for the presence of bison, horse, and camel remains at mammoth sites such as Blackwater Draw Locality 1, Murray Springs, Aubrey, Gault, and Lubbock Lake. According to Haynes, animals inhabiting the mammoth patches would succumb to extinction due to hunting pressure. Only those animals with substantial ranges outside the mammoth patches would escape the intense hunting pressure of Clovis hunters and thus, survive extinction (Figure 1). With Clovis hunters targeting

mammoth patches, areas of lessened hunting pressure included the vast grasslands inhabited by few taxa including bison.

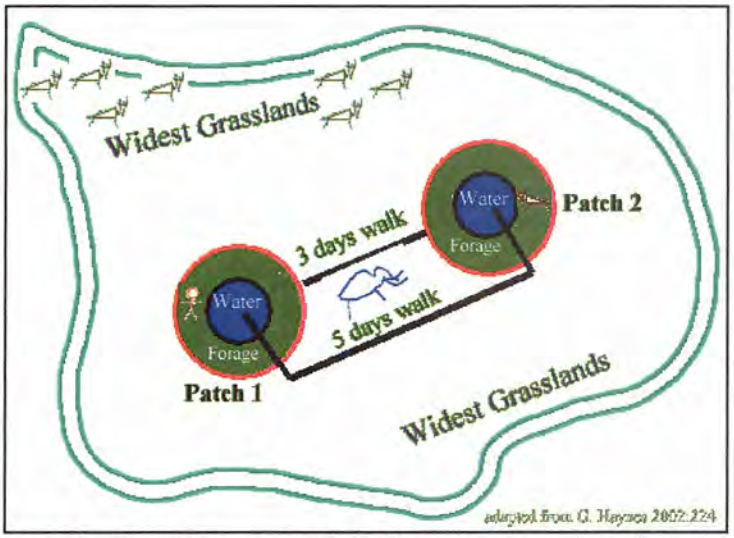


Figure 1. Gary Haynes model of megamammal exploitation by Clovis hunters.

Haynes' model does not account for the extinction of the horse and camel—species also inhabiting the widest grasslands. The dynamics of the late Pleistocene extinction events are far more complex than any model proposed.

The specialized Clovis hunters geared up for mammoth encounters before entering patches. The mammoth gear, however, was used on any animals taken. Thus, bison taken in a mammoth patch were dispatched and processed with the typical mammoth tool kit. A comparison between lithic assemblages at bison and mammoth kills within mammoth patches should find little or no difference between the two. This is seen at Murray Springs, Blackwater Draw Locality 1, Lubbock Lake, and possibly at the Aubrey site.

Holen (2001) predicted that Clovis hunters would turn to bison hunting after the extinction of mammoths and other megafauna (Figure 2). Following analysis of the Murray Springs materials, Hemmings (1970) presented a similar hypothesis and its possible effect on projectile point size. Hemmings predicted that as Clovis hunters turned to pursuit of bison, the Clovis projectile would undergo a concomitant reduction in size. Hemmings' (1970) subsequent analysis comparing point size from mammoth and bison contexts, however, did not support this hypothesis as some of the smallest points were associated with mammoth and some larger points with bison.

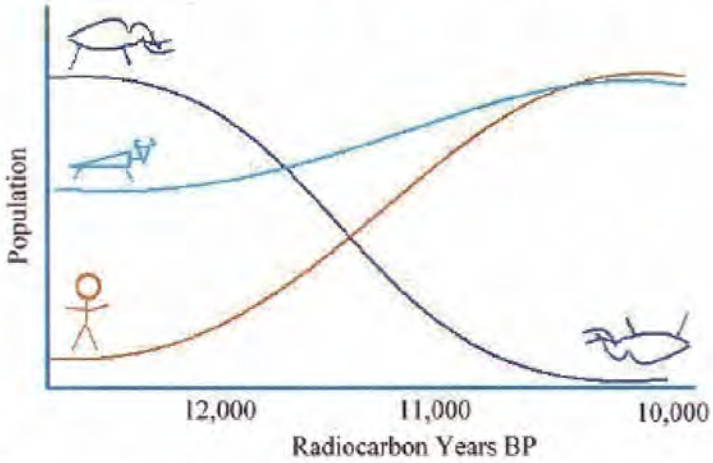


Figure 2. Model of human-megafauna association at the extinction event.

Projectile points with characteristics intermediate between Clovis and Folsom types in the Mockingbird Gap site assemblage may be evidence of this shift (Stanford 1999:296, Weber and Agogino 1997). However, without the recovery of datable materials, this site cannot be positively placed in an intermediate time frame between Clovis and Folsom. Perhaps the post-mammoth adaptation

is seen first in the techniques of bison hunting and later in stone use.

The identification of mammoth patches on the southern High Plains is problematic. Major rivers flow through many areas (Figure 3). Oklahoma has the Arkansas, Cimarron, North Canadian, Canadian, Washita, and the various branches of the Red. The projected higher precipitation levels given for the Late Pleistocene suggests water was not a limiting or tethering factor in the movement of large mammals in many areas of the southern Plains. Periods of drought however, may have limited these resources (C.V. Haynes 1995). So rather than being limited by the number of watered areas, the hunters are faced with the problem of identifying which of the many areas are being used by the limited (diminishing, dwindling) number of mega-mammals, mammoths.

Identifying the grasslands is another matter. The modern flora on the upland divides approximate the widest grasslands envisioned by Haynes. An east to west transect across northern Oklahoma today crosses tall grass prairie, mixed grass prairie, sand sage prairie, and short grass prairie. If the increased water regimes predicted for the late Pleistocene/early Holocene by global circulation models are correct, we would expect to see tall grass prairies across most of western Oklahoma during the Pleistocene/Holocene transition.

Recent results of pollen studies from western Beaver County in the Oklahoma panhandle suggest grasslands are in place by at least 11,000 radiocarbon years BP (Figure 4). This is further supported by stable carbon isotope data from bison bone in the three Folsom kills at the Cooper site in Harper County where up to 75% of their diet was C4 grasses which would include tall grass species (Bement 1999).

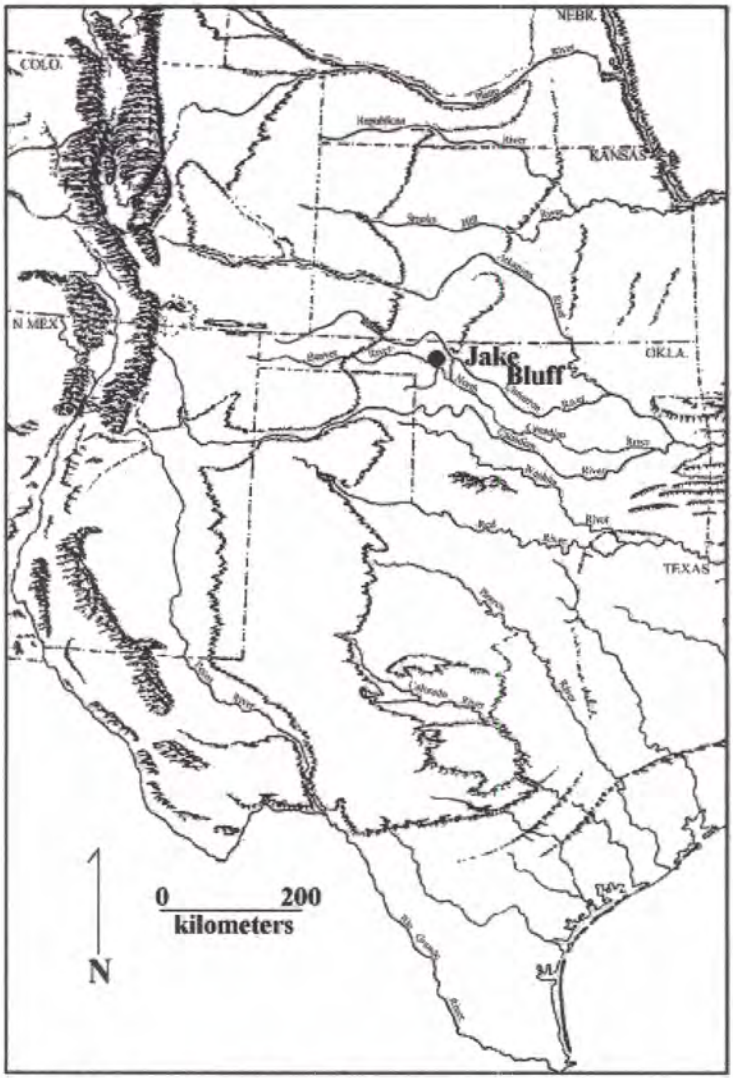


Figure 3. Rivers on the southern Plains.

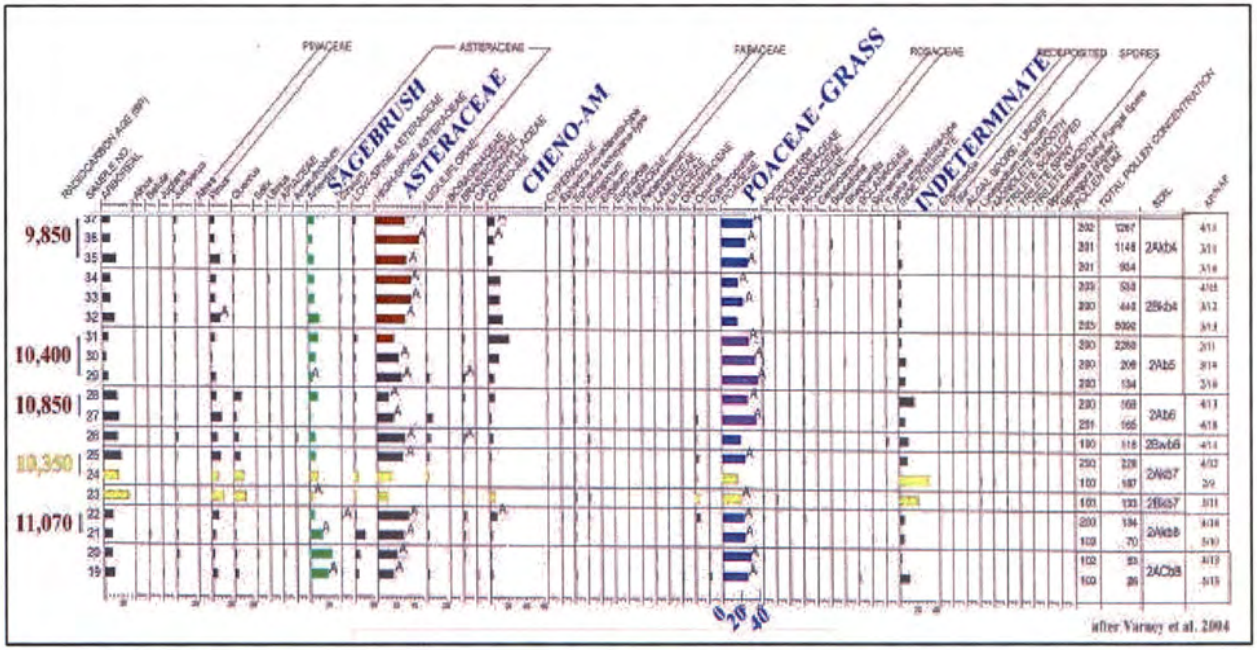


Figure 4. Pollen diagram from the Oklahoma panhandle.

Clovis Subsistence Organization and the Archaeological Record

The debate continues as to whether Clovis hunters were generalists or specialists in their subsistence organization. Sites such as Aubrey fuel the side of generalists with the wide array of apparent animal resources including bison, mammoth, tortoise etc. (Ferring 1995, 2001). The mammoth kill sites (Domebo, Lehner, Dent, Miami, etc.) suggest Clovis technology was developed for megamammal hunting (Frison 1978; Waguespack and Surovell 2003). The model proposed by Gary Haynes identifies Clovis hunters as mammoth and mastodont specialists (G. Haynes 2002).

This is not to say that Clovis hunters did not pursue bison prior to the extinction of mammoths. The archeological record contains numerous examples of Clovis points associated with bison remains, including two bison at Sheaman, Wyoming (Frison 1982) and three bison at the Aubrey site (Ferring 1995, 2001; Yates and Lundelius 2001). Southern Plains bison remains are found in Clovis-age deposits at Lubbock Lake (Johnson 1995), Gault (Collins 1999a,b; Waguespack and Surovell 2003), and the Wilson-Leonard site (Collins 1998). Three Clovis bison kill sites--Murray Springs, MNI (minimum number of individuals) =6 (Hemmings 1970) and two kills at Blackwater Draw Locality 1, MNI=7 (Hester 1972), and Blackwater Draw Locality 1, MNI=4 (Johnson and Holliday 1997)--are found near mammoth kills and are assumed to be the result of opportunistic situations where hunters dispatched small herds using techniques similar to that employed to kill mammoths (G. Haynes 2002). Most of the Clovis sites are found adjacent to ponded water (Ferring 2001; Holliday 1997; Stanford 1999). Many Folsom sites are also near ponded water although the larger kills are found in arroyos (Bement 1999; Hofman *et al.* 1992). Recent investigation at the Jake Bluff site, NW

Oklahoma, has uncovered evidence that Clovis hunters employed the arroyo trap technique to trap and kill at least 14 bison. It is proposed here that the method of taking bison changes from the opportunistic harvesting of one to several animals around water holes to include the deliberate trapping of larger numbers of animals allowing harvesting of 10+ animals at a time. The arroyo trap technique (Figure 5) would be a logical outcome that allows maximum numbers of animals killed with a minimum chance of risk either in the failure of the overall hunt or bodily harm to the hunters, themselves (Meltzer 1993:301). The arroyo trap would not replace the small pond-side kills but rather would be added as an alternative for situations when large numbers of animals and the required arroyos were available to the appropriate number of hunters. The post-mammoth-

Figure 5. Modern arroyo in northwestern Oklahoma.

extinction Clovis bison kills could include both small kills, possibly around watering areas, and larger kills in arroyos. A similar dichotomy in bison kill size has been postulated

for Folsom times where small numbers (≤6) of animals are taken near water sources while larger kills (>10) are found in arroyo traps (Bement 1999). Concomitant with the dichotomy in kill size during the Folsom Period is a seasonal dichotomy where the large arroyo traps occur only during the late summer/early fall season while small kills transpire throughout the year. Interestingly, the bison (MNI=14) killed in the Jake Bluff arroyo indicate a late summer/early fall season of death--the same as that seen at the three Cooper kills only 400 meters away and 250 years later. Is Jake Bluff a Clovis precursor of Folsom practices? Did reduced risk techniques of bison hunting develop during Clovis times as a consequence of the extinction of the mammoth? Did the Clovis groups' need to obtain quantities of animal products comparable to that provided by mammoth kills provide the impetus for the development of techniques capable of procuring larger numbers of bison? Once developed, did these techniques lead to the development of specialized bison hunter groups such as the Folsom and then, later, Late Paleoindian groups?

History of Investigations at Jake Bluff

In 1994, during the second season of excavation of the Folsom-age Cooper site (Bement 1999), a pedestrian survey targeted areas along the distinctive landform containing the Cooper site (Figure 6). Bison bones were found eroding from the side of a modern arroyo only 400 meters upstream from the Cooper site. Initial assessment found only a handful of bison bones under a drape of late Holocene dune sand. No cultural material was found at that time. Four years later, testing of bison bone exposures along this stretch of the North Canadian River included a 1.5 x 0.5 m section of the bone deposit (Bement and Brosowske 1999). The large size of the long bones suggested they belonged to Bison antiquus, a late Pleistocene/early Holocene bison species. This testing program determined the bones lay on bedrock. Coring in

the area identified a 3-meter-deep arroyo on the east side of the bone exposure. The core brought up a piece of bison bone from deep within this arroyo fill. A chert flake found in the bison bone pile on the bedrock bench provided evidence of human association and the site was recorded as 34HP60, the Jake Bluff site. Subsequent monitoring of the exposure yielded two additional flakes and a unifacial flake knife--all of local lithic material.

In 2001, a 2 x 1.5 meter area of the bone deposit and three 1 x 4 meter trenches were excavated across the suspected long axis of the arroyo. The block excavation on the bone deposit revealed the butchered legs of at least three bison. Although dominated by leg elements, the pile also contained a pair of mandibles from a 3.3-year-old bison bull. Tooth eruption and wear pattern identified the season of death as late summer/early fall--identical to that of the nearby Folsom-age kills at the Cooper site. The three trenches confirmed the existence of the paleogully and found bison bone at the bottom, including the mandible

Figure 6. The Jake Bluff site.

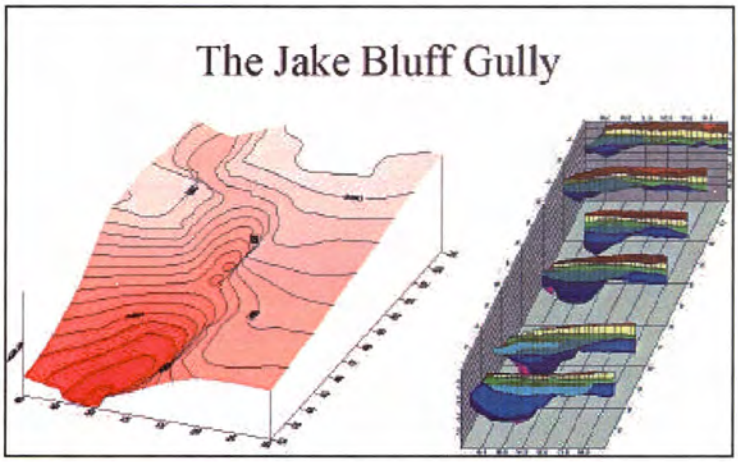
from a 4.3 year old bison cow. Based on this work, the Jake Bluff site was interpreted as a possible arroyo trap bison kill with butchering taking place on the bedrock rim of the arroyo. A radiocarbon assay of 10,750 +/- 40 rybp (CAMS 79940) on a tooth from the bottom of the central trench indicated an early Folsom or late Clovis age for this site.

In 2002, 6 more weeks of excavation further uncovered the arroyo floor, explored the eastern bedrock rim of the arroyo, and obtained datable materials and diagnostic projectile points (Figure 7a, b).

Three wide trenches (2x6m) extended across the arroyo and onto the eastern bedrock rim. Lateral extensions of these trenches brought the total excavated area to 40 square meters including 8 meters along the gully floor. The arroyo was found to extend for at least 20 meters and was surprisingly narrow, only 2 meters wide, appearing more like an eroded/incised animal trail. The bison remains in the bottom of the arroyo suggest the herd consisted of cows, calves, and juveniles (Figure 8).

The eastern bedrock rim failed to yield a processing pile such as that seen on the western rim. However, the recovery of broken bones, resharpening flakes, cobble-size hammer stones, and one possible anvil stone indicates that processing activities once were present. The bone deposits in the bottom of the arroyo contained several resharpening flakes, additional cobble-size hammer stones, and two Clovis projectile points.

Both projectile points are made of Alibates agatized dolomite and display a single flute on each face (Figure 9a). One has been reworked from a much larger point (now L=5.2 cm, W=2.6 cm, T=0.74 cm), the other is similar to the Clovis type II defined by Hester (1972) at Blackwater Draw and is rather diminutive (L=4.2 cm, W=1.75 cm, T=0.57 cm) (Figure 9b). Workmanship on both specimens



a.

b.

Figure 7. The gully at Jake Bluff. a. 3D and profile map. b. photograph of gully knick point.

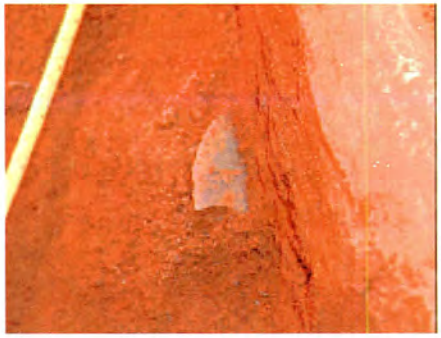
Figure 8. Bone pile on the gully floor in the South Block excavation units.

is similar to other southern Plains Clovis points (Hofman and Wyckoff 1991). Fine pressure retouch on the larger point is reminiscent of the workmanship on the Clovis points from the Domebo mammoth kill in central Oklahoma (Leonhardy 1966) and apparently also resembles specimens from the Mockingbird Gap site in New Mexico (Meltzer pc; Weber and Agogino 1997; Stanford 1999). Basal characteristics place both points in the middle of the range of western Clovis points as discussed by Morrow and Morrow (2002).

More recent excavation in 2004 uncovered an additional Clovis point from the gully floor (Figure 9c). This Clovis point is 7.9 x 3.4 x 1.1 cm and made of gray quartzite—probably Dakota quartzite. Like the other two points, it is fluted on both faces. The large size of this projectile point is more typical of Clovis point size. The presence of large and small points in the same assemblage echoes the results of Hemmings' (1970) study that changes in prey size (mammoth to bison) are not accompanied by changes in point size during Clovis times (Figure 10c-e).

Results of use-wear analysis on the three Clovis points indicate all three had been used as projectile points (Kay 2005). The diminutive point had also been employed as a knife. Sand abrasion apparent on the two Alibates points suggests they had been affected by sediment transport within the arroyo. The coarse-grained quartzite composition of the third point rendered similar conclusions problematic.

A Clovis point refurbished into a drill was also recovered during the 2004 excavation (Figure 10b). This implement was found lying on edge at the rim of the eastern bench adjacent to the gully knick point. This area of the site is believed to have suffered from deflation and



a.

b.

c.

Figure 9. Clovis points from Jake Bluff. a.,b. 2002 season, c. 2004 season.

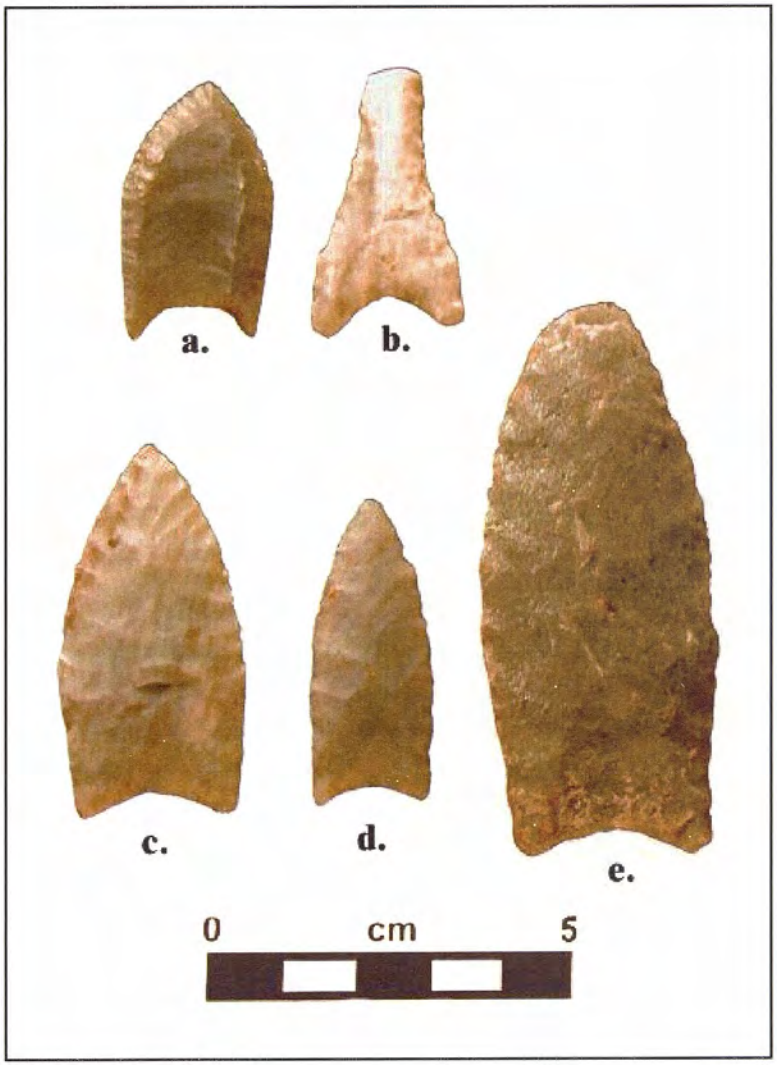


Figure 10. Jake Bluff a. Folsom point, b. Clovis drill, and c-e. Clovis points.

sheet erosion that scoured and dispersed bone and cultural materials along the gully rim. Sand abrasion on this specimen supports this interpretation. The tip of the drill is missing, apparently broken during use. Use-wear analysis identified damage consistent with the tool's use as a drill, including rotational and back and forth movement (Kay 2005). The original size of the projectile point could not be determined. The stone tool material is either Alibates or Day Creek.

A Folsom point (Figure 10a,11a) was associated with the bison processing pile on the gully rim (Figure 11b). This specimen is made of translucent brown Edwards Plateau chert from Central Texas. Use-wear analysis of this point found haft wear within the channel flake scars all the way to their termination (Kay 2005). Additional haft wear was found on the margins of the point. Impact damage was also seen along the edges and at the tip. In total, the use-wear suggests the implement functioned solely as a projectile point. Several cycles of resharpening and refurbishing produced its final dimensions. The lack of sand abrasion supports its association with the bone processing pile which contained articulated leg bones.

The discovery of a Folsom projectile point makes Jake Bluff one of only a few sites with stratified Clovis and Folsom cultural deposits (Sellards 1952) (Figure 12). The separation of these two components divides the bison remains into MNI groups of 8 animals for the Folsom processing pile and 14 for the Clovis kill. The location of the Folsom bison kill is unknown and may not be preserved if it was west of the Jake Bluff gully as this area was removed by modern erosion.

An activity area containing butchered bison bones, a hammer stone, and burned Alibates flakes was identified 30

a.

b.

Figure 11. Jake Bluff a. Folsom projectile point and b. Bison processing pile.

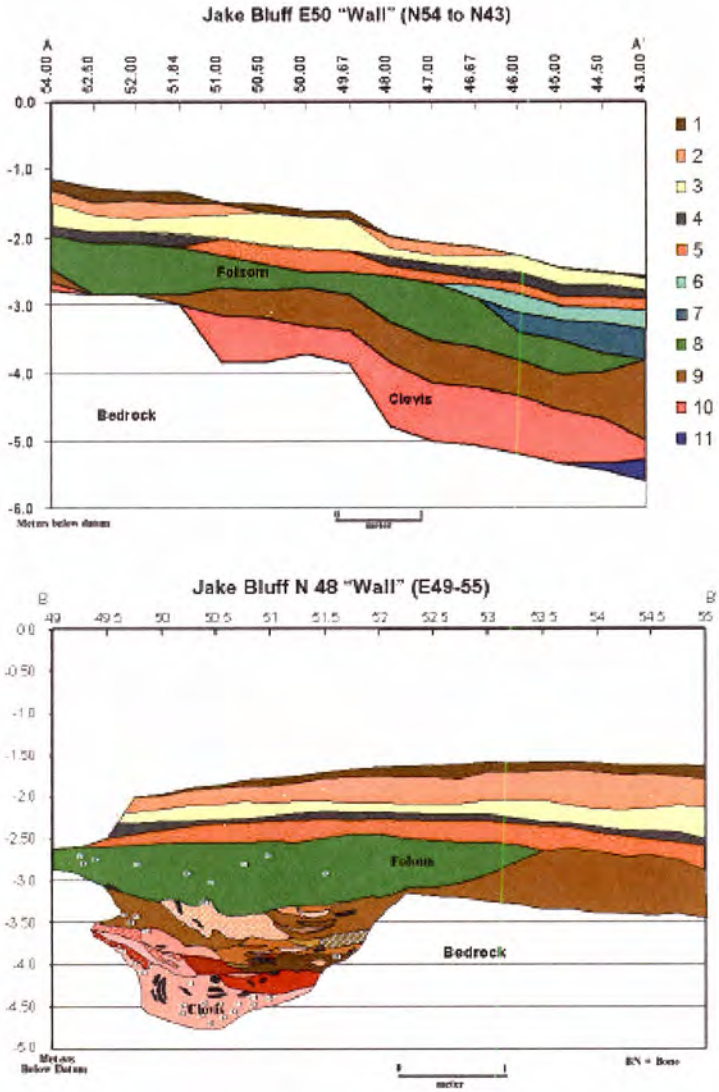


Figure 12. Plan map and profiles along the E50 line along the gully long axis and across the gully at N48 illustrate the stratigraphic position of the Clovis and Folsom components at Jake Bluff.

meters east of the Jake Bluff gully. Cultural attribution for this area cannot yet be assigned because no temporally diagnostic artifacts were found. Initial radiocarbon results of 10,070 +/- 50 rcybp (Beta-194028) obtained from charcoal flecks contained in a paleosol underlying the cultural deposit suggests a late-Folsom or post-Folsom age for this material.

The recovery of Clovis points in direct association with bison remains in the bottom of the arroyo and the apparent Folsom attribution of the gully bench processing pile nearly two meters above the Clovis deposits highlight the need for reliable radiocarbon dates and an understanding of gully cut-and-fill processes. The radiocarbon date of 10,750 +/- 40 rcybp (CAMS 79940) suggests the Clovis deposits may post-date mammoth extinction. The evaluation of the radiocarbon date and additional radiocarbon assays became the priority of the initial weeks of analysis. The age was obtained from XAD purified collagen from an upper molar recovered from the bottom of the arroyo in 2001 and processed by Dr. Thomas Stafford.

Two additional bone samples were submitted to Stafford Labs for similar processing. This time, petrous bones were selected from the 2002 excavations (Figure 13). The petrous was utilized following the results of amino acid analysis on six samples from different elements of the same individual from the Middle Kill of the Cooper Site (Stafford and Bement nd). At Cooper, the petrous was found to contain the least altered amino acid suite of any long bone samples and the resultant radiocarbon date of 10,530 +/- 45 rybp (CAMS 82407) fits well with the known Folsom association with that bone bed. Because the Cooper site is only 400 meters from Jake Bluff and because both sites are in gullies along the same landform remnant of the

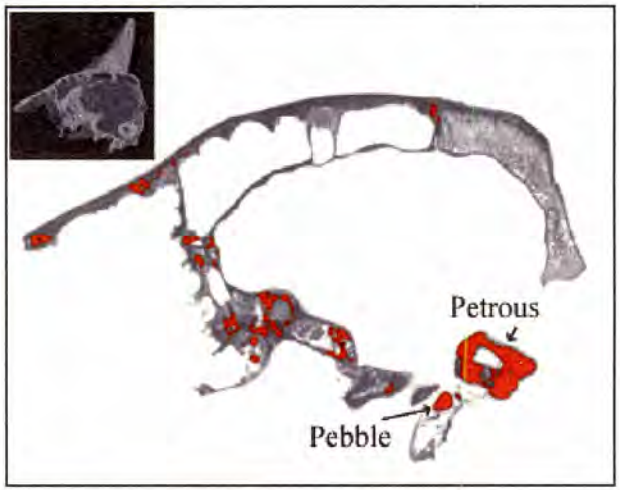


Figure 13. Location of petrous bone in bison skull. Optical density comparison between petrous and cherty pebble in CT scan.

North Canadian River, it was felt that the petrous from Jake Bluff might also be well preserved. Subsequent amino acid analysis of two Jake Bluff petrous bones from the arroyo deposits showed them to be as well preserved as the Cooper petrous. The resultant radiocarbon ages of 10,840 +/- 45 and 10,700 +/- 45 rybp (CAMS 90968 and 90969 respectively) provide confirmation of the late age of this site (Figure 14). Combining these two dates with the previous Jake Bluff date yielded a mean of 10,760 +/- 30 rybp (Long and Rippeteau 1974).

The evidence strongly supports the hypothesis that the Jake Bluff site is a late-Clovis adaptation to bison hunting. Is it a coincidence that the Jake Bluff gully is among a number of paleogullies including the Cooper gully, preserved along this 3 km long landform segment on the north side of the North Canadian River?

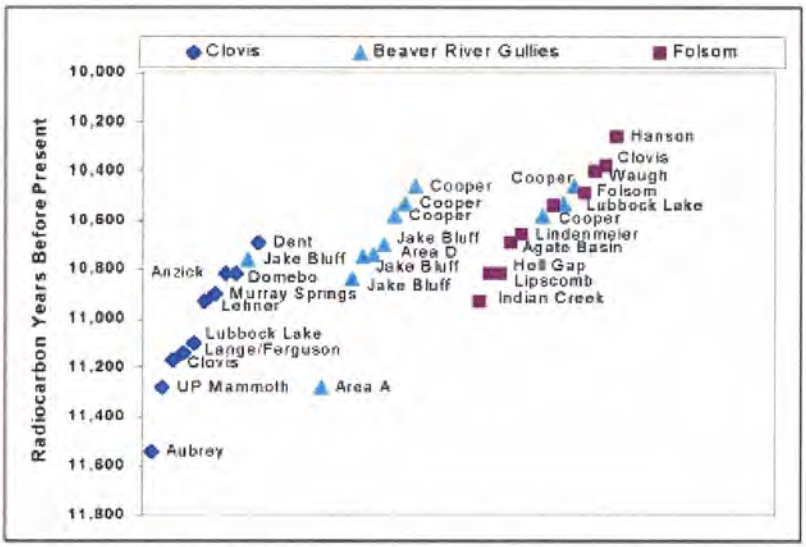


Figure 14. Dated Clovis sites, Folsom sites, and Beaver River gullies.

Gully Formation and Context:

The hills containing the Jake Bluff and Cooper sites retain segments of ancient arroyos buried by gully fill and sand dunes and thus, provide an opportunity to further assess and refine our understanding of Paleoindian use of this landscape (Figure 15). The investigation of gullies sheds light on the processes contributing to the late Pleistocene formation of gullies and then the filling of these same gullies during Clovis and Folsom times. Incision or flushing of the gullies during or proceeding the Clovis period is indicated by the recovery of bones and artifacts on the bedrock contact at the bottom of the arroyo at Jake Bluff. The filling of gullies during Clovis and Folsom times is indicated by the sedimentological sequence at the Clovis-age Jake Bluff site and Folsom-age Cooper site. The formation of these gullies "opened" the landscape features for use as arroyo bison traps. The subsequent filling removed these same gullies from continued use in trapping

bison. Identifying the processes responsible for this sequence of cut-and-fill events and their timing contributes to an understanding of the Paleoindian development of bison kill techniques at the Pleistocene/Holocene transition. After all, gullies of a certain depth, length, and morphology are a prerequisite for the arroyo-trapping of bison.

The geoarchaeological history of the bluff is central to the understanding of Paleoindian cultural activity. Gullies were not only used by Paleoindians as bison traps, but the subsequent filling with sediment preserved the faunal remains.

Aggradation of streams and rivers and the rise in base levels during the Holocene produced deposition in gully channels and gully headcut areas; burying and preserving Paleoindian sites. Modern gully formation has fortuitously exposed several buried Paleoindian hunting

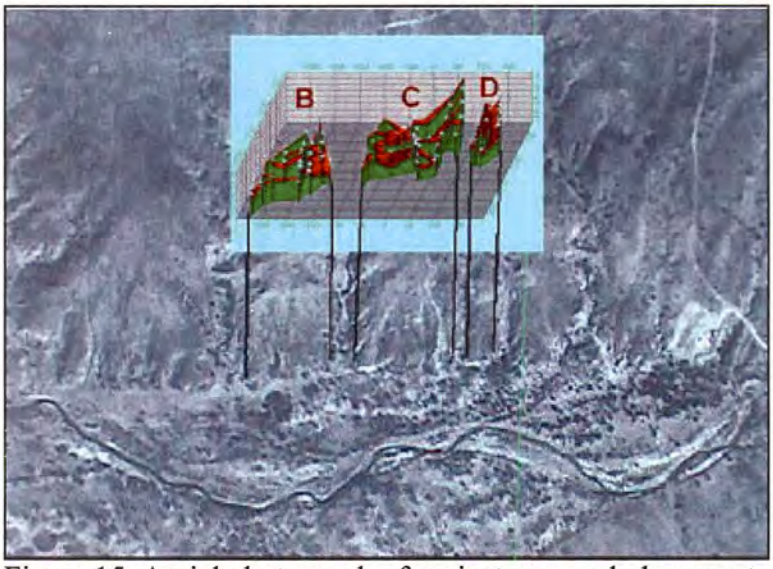


Figure 15. Aerial photograph of project area and placement of cores.

areas along this bluff. Other potential buried Paleoindian occupation sites have been identified through gully prospecting.

A geomorphic prospecting project employing pedestrian survey, systematic coring (2" Bull Probe), and the collection of samples for dating along a 0.5 km section of the 3.0 km long landscape remnant containing the Cooper and Jake Bluff sites provides an estimate of the density of paleogullies, their age and contents, and possible cultural use. In all, 166 cores were distributed over an area 0.5 km long by 0.2 km wide along the long axis of the north border of the North Canadian River floodplain.

The geomorphic study of approximately .5km of the 3km long landform under investigation identified six paleogullies cut into sandstone bedrock, including the Folsom-age Cooper site and Clovis-age Jake Bluff site. Two other gullies contained datable deposits indicating they were open between 10,000 and 12,000 years ago. The final two have yet to be dated. The excavation of the Folsom-age Cooper site, the Clovis-age Jake Bluff site, and coring identified a distinctive Late Pleistocene/Early Holocene-age sediment within the buried gullies (Figure 16). This sediment, termed the Cooper sediment because of its first defined occurrence, is distinct in color and texture from overlying Holocene sediments and underlying sandstone bedrock. Due to its distinctive characteristics, it is easily recognized in cores. Based on the results of the Pilot Study, it is projected that the remaining 2.5 km landform remnant contains an additional 30 paleogullies, of which 24 could date to Late Pleistocene/early Holocene times. Of these 24, it is possible that as many as 12 could contain evidence of Paleoindian bison hunting activity.

On-going Analyses

Analysis of the Jake Bluff site material continues. The analytical techniques of grains size, pollen, and

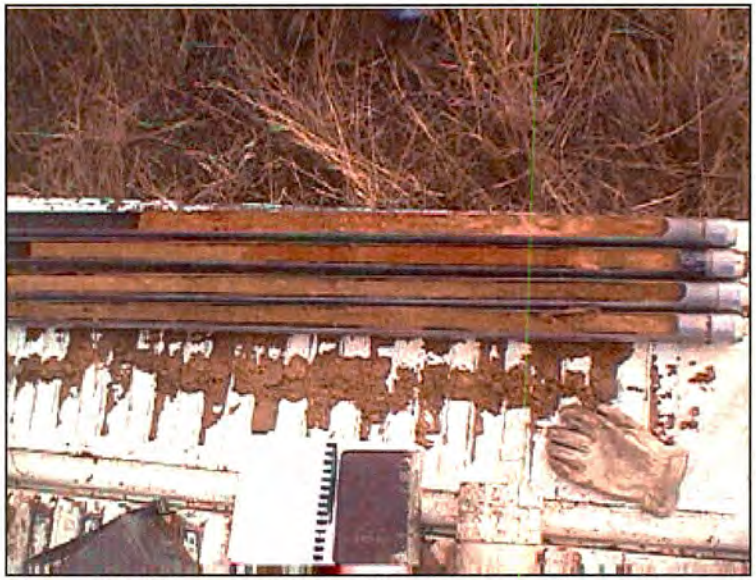


Figure 16. Cores containing the Cooper sediment.

phytoliths are being pursued in an effort to reconstruct the environment during gully formation and filling. These results will be compared with recently derived pollen and particle size data sets at the Bull Creek site in neighboring Beaver County, Oklahoma. Bison remains are currently being analyzed to reconstruct butchering patterns and post-depositional histories. The stone tools and lithic debris related to the killing and butchering of bison are also undergoing descriptive analysis. Additional dating of the site deposits is required to securely set the timing of all events to allow inter- as well as intra-site comparisons of activities.

Conclusions

This project integrates geoarchaeological and archaeological approaches in the assessment of changes in large animal hunting organization at the Pleistocene/Holocene transition on the southern Plains of North America. The Jake Bluff bison kill provides new

avenues for studying aspects of Clovis hunting organization, including adaptations in hunting practices in post-mammoth extinction times and landscape evolution between Clovis and Folsom times. With the extinction of the mammoth and other large animals, Clovis hunters expanded their hunting prowess to areas outside the mammoth patch. The gully at the Clovis-age Jake Bluff site is an early New World instance of an apparent arroyo trap employed to contain and kill bison. As such, it provides an opportunity to study the early development of arroyo-style hunting procedures. Generally, the earliest arroyo trap bison kills in this region are of Folsom age. The presence of a Folsom component above the Clovis kill at Jake Bluff and the close proximity of the Folsom age Cooper site provide avenues for future investigation into the development of arroyo style bison kills and the possible evolution from Clovis to Folsom economies.

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