The Peopling of the Americas:

A Brief Synopsis on the Status of the Current Debate

With A Focus On North America

Wilson W. Crook, III

Houston Archeological Society
Report No. 34

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Front cover: Illustration of a Paleoindian hunter (hubpages.com).

Editor's Foreword

The ***Houston Archeological Society Report No. 34*** is a publication of the Society. Our Mission is to foster enthusiastic interest and active participation in the discovery, documentation, and preservation of cultural resources (prehistoric and historic properties) of the city of Houston, the Houston metropolitan area, and the Upper Texas Gulf Coast Region.

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Introduction

In January 2020, I gave a presentation on the current status of the issue of the Peopling of the Americas at a monthly meeting of the Houston Archeological Society (HAS). A number of the members of the society asked for copies of my presentation deck which, while I was more than willing to share, was so large that it was unfeasible to email via my server. Placing the presentation on flash drives and handing them out was also not very cost effective for me. As a result, it was suggested that I condense my comments into a brief summary and publish it as a special HAS Report for distribution to the membership. This brief synopsis thus serves to fulfill that request.

In this regard, I will proceed along the lines of my oral presentation which began with the discovery and recognition of the Clovis culture and its rise to the status of being the oldest recognized human occupation in North America. This ultimately led to the belief that the Clovis people were indeed the first settlers in North America, which became known as the "Clovis First" theory. Somewhat concurrent with the development of the Clovis First theory, a number of sites were discovered that produced geologic and/or radiometric evidence for occupations potentially preceding Clovis. While some of these have since been discredited, others stubbornly persisted through scientific debate and continued to put forth claims for an older-than-Clovis culture across North America. I will discuss some of these early older-than-Clovis claims and how it led to a discussion of what a Pre-Clovis lithic assemblage might look like. I was fortunate to be sitting at a table in the Gault Project lab in 2007 with a number of recognized experts on the issue who were debating the claims of these Pre-Clovis sites. After several hours of intense discussion, Michael Collins, head of the Gault Project, stopped the talk and simply stated that before we start guessing what a Pre-Clovis tool kit might look like, we need to first definitively establish the Clovis tool assemblage. Then we can clearly recognize when artifacts are Clovis or something completely different.

Over the last 35 years, I have participated in excavations at a number of Clovis sites – two in Virginia and another five in Texas. Moreover, I have participated in a year-long study aimed at analyzing the trace element geochemistry of chert artifacts from over 40 Clovis sites in Texas. This study included some 453 Clovis tools covering the entire range of the known Clovis assemblage (projectile points, preforms, bifaces, macro and micro-blades, blade cores, adzes, scrapers, gravers, and worked flakes). So in the second part of this paper, again following the outline of my January 2020 presentation, I will discuss what it means to be Clovis.

Lastly, I will briefly discuss 20 of the best documented older-than-Clovis sites in North America which will include all the data up to the time of this writing. While there are many intriguing Pre-Clovis sites in South America, for the purposes of brevity I am only focusing on the sites in this continent.

The scientific discourse over the Peopling of the Americas has historically been a subject of intense debate and one that was not always conducted in a civil manner. When my father published his anomalous age date of "greater than 37,000 B.P." for the Lewisville, Texas site in 1957 and 1962, his work was met with acrimonious vitriol including frequent death threats that made him physically ill for a number of years. I remember him receiving a phone call during dinner in the 1960s and when the call ended, he retired to his study unable to continue to eat. Robert Heizer of California Berkley in particular both published papers and gave presentations at conferences that not only challenged the validity of the Lewisville site, but further accused my father of planting the artifacts recovered and faking all the stratigraphic,

Figure 1. Wilson W. "Bill" Crook, Jr. and R. King Harris excavating Hearth #1 at the Lewisville, Texas site (41DN72).

paleontological, and radiocarbon data (Heizer and Brooks 1965). My father eventually offered to fly Dr. Heizer (at Dad's expense) from California to Dallas to at least visit and see the Lewisville site and the hearths for himself. Heizer refused saying "he had all the information he needed to make a judgement on the validity of the site". In the late 1970s, Dennis Stanford of the Smithsonian Institution relooked at the Lewisville site and confirmed that the site was indeed real, the hearths were indeed man-produced and not "lightning struck packrat nests" as Heizer had claimed, and that the archeology conducted by my father and King Harris was solid scientific work (Stanford 1982). It is unfortunate that Heizer died several years before this study was published and did not live to see the vindication of my father's work and the destruction of his own theories on the site (Figure 1).

I was born literally into the middle of this scientific debate on the age of the Peopling of the Americas, witnessing first hand both sides of the issue. For example, my geomorphology professor at S.M.U. was Vance Haynes, one the earliest and most ardent supporters of the Clovis First theory. Over my lifetime I have seen the rise and subsequent fall of the "Clovis First" theory and the discovery of a large number of early sites that with each new discovery are rewriting our understanding of who the first Americans were. As such, I believe I am in a unique position to provide this commentary on the subject, bearing in mind that what I write here is based on the knowledge that we have today which will undoubtedly be changed and modified in the future with even newer discoveries.

Early Discoveries

During the first quarter of the 20th century, a bitter debate raged in the archeological and anthropological communities about the age when the first human beings came to the North American continent. In particular, Ales Hrdlicka, then curator of the U.S. National Museum (now known as the Smithsonian National Museum of Natural History) was adamant in his belief that humans could not have arrived in America until about 3,000 years ago (Hrdlicka 1923; Wormington 1957) (Figure 2). Findings of stone tools associated with Pleistocene animal remains were summarily dismissed as mixing due to erosion or burrowing animals or worse, as amateur excavation techniques or even fraudulent "salting" of artifacts among the bones. Any archeologist bold enough to challenge Hrdlicka's view risked damage to his professional reputation and career without absolute indisputable proof (Wormington 1957). That proof came in 1926 with a discovery in Wild Horse Arroyo near the town of Folsom, New Mexico.

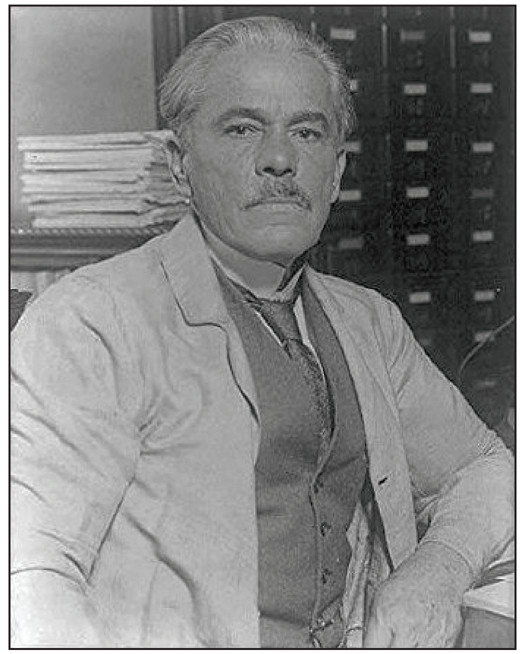


Figure 2. Ales Hrdlicka, curator of the U. S. National Museum (now the Smithsonian) who was adamant that humans could not have arrived in North America prior to 3,000 years ago. (Source: Wikipedia)

That year, Jesse Figgins of the Colorado Museum of Natural History (now the Denver Museum of Nature and Science) was informed of the discovery of a number of skeletons of an extinct species of bison eroding out of Wild Horse Arroyo near the New Mexico-Colorado border (Figure 3). While excavating the bison remains, several fragments of chert projectile points were found, one of which appeared to be in situ near the rib cage of one animal (Figgins 1927). The entire block containing both the bison rib bones and the projectile point was removed intact and can be seen today in the Denver Museum. While Hrdlicka predictably scoffed at the find, other scientists began to take notice of the presence of human beings in association with late Pleistocene mammals. In a second field season, Figgins found even more compelling associations of projectile points with bison remains which he kept intact at the site. Figgins wired a large number of scientists from all the major institutions including the Smithsonian to come out and see the discovery in situ. The projectile point with its long, characteristic channel flake called a "flute", was named "Folsom" for the type locality in northern New Mexico. This led to the beginning of the end for Hrdlicka's long held theory of 3,000 year old Americans.

In 1929, similar finds of man-made projectile points in association with Pleistocene mammals were found 350 km south of Folsom near the small town of Clovis in eastern New Mexico (Figure 4). At Blackwater Draw, Folsom points were again found with extinct species of bison but more importantly, a longer projectile point type was found stratigraphically lower and in association with mammoth remains (Cotter 1937; Warnica 1966; Hester 1972) (Figure 5). Similar projectile points were found in 1933 near Dent, Colorado, also in direct association with a large

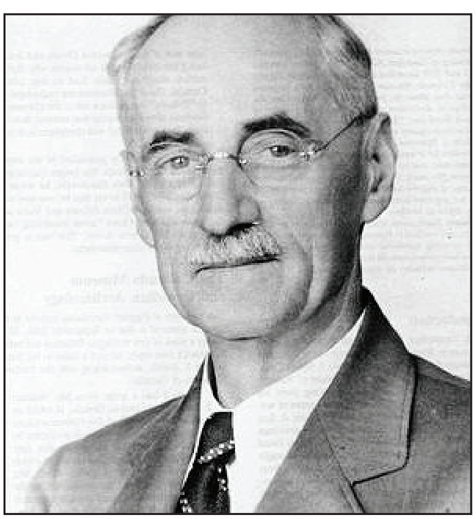


Figure 3. Jesse Figgins of the Denver Museum of Natural History (now Denver Museum of Nature and Science) who excavated both the first Folsom discovery and the Clovis site at Dent, Colorado. (Source: Denver Museum of Nature and Science)

number of mammoths (Figgins 1933; Brunswig 2007; Saunders 1999; 2007) (Figures 6-8). The projectile point type was called "Clovis", after the original New Mexico discovery. However, if the researchers at Dent had been just a little faster on the publication of their paper, we might be talking about the "Dent" point today!

Figure 4. (left) Blackwater Draw, New Mexico where the first Clovis projectile points were recovered.
Figure 5. (right) A Clovis point from Blackwater Draw (Clovis), New Mexico. (Source: Simon Frazier University Museum)

Figure 6. (left) Father Conrad Bilgery (left) and a team of students and other helpers from Regis College excavating the mammoth kill site at Dent, Colorado. (Source: Sangres.com)

Figure 7. (right) Two of the Clovis points found in association with mammoths at the Dent, Colorado site. (Source: ResearchGate.net)

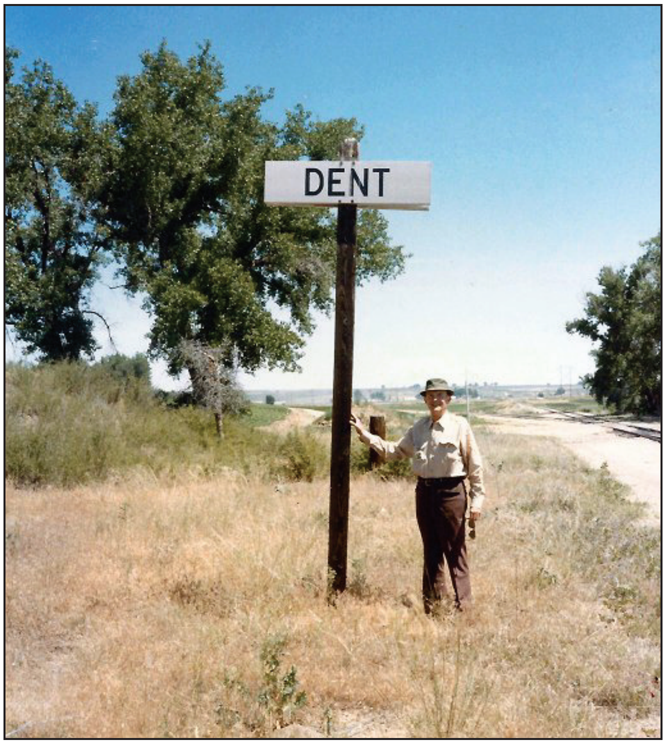


Figure 8. My late father, Wilson W. "Bill" Crook, Jr., at the small train stop at Dent, Colorado. The site is immediately to the left of the sign.

Since the initial discoveries of Clovis points at Blackwater Draw (Clovis), New Mexico and Dent, Colorado, Clovis points have now been found in all 49 continental states including Alaska (Figure 9). As the projectile point was found across the country, it became apparent that the people using the Clovis projectile point were the first, wide-spread colonizers of the continent. Over time, the name of the projectile point, rightly or wrongly, became linked to a culture. Moreover, as it is obvious looking at any map of the closeness between eastern Siberia and Alaska, it was assumed that the Clovis people migrated from Asia to North America during the end of the Pleistocene using a land bridge between the two continents which has since become submerged with the melting of the Pleistocene glacial ice cap. As Clovis was the oldest established technology present in North America, a theory emerged that the people bringing these tools into the continent were its first inhabitants. The theory, typically termed "Clovis First", almost became a scientific law over the 1930s to 1950s, replacing Hrdlicka's 3,000 year old dictum with a new boundary at 12,000 to 13,000 calendar years ago. And as Hrdlicka had done before, the defenders of the Clovis First theory used their considerable influence and power to discredit and often deride anyone bold enough to suggest that the first inhabitants might have entered the continent ***before*** Clovis.

Despite the stigma of being labeled a heretic or worse by the scientific community, a number of discoveries began to surface between the 1950s and the 1970s which challenged the idea that the Clovis culture represented the first Americans. Some of these such as Texas Street near San Diego (a purported discovery of 48,000 year old skeletal remains) (Carter 1957) and Calico, a site in the desert of southeastern California that was claimed to be in excess of 200,000 years old (Leakey et al. 1968; Leakey et al. 1972; Simpson 1960; 1999), were summarily dismissed by later researchers who discovered either misinterpretations in the geology or the fact that the "artifacts" were not the product of humans but had been flaked by natural geologic processes ("geofacts") (Warren 1967; Payen 1982; Hardaker 2009).

Other early claimants were initially dismissed by the scientific community but later research has either shown that the dismissal of their early age was incorrect or there are conflicting arguments leaving the question of great age uncertain. Of the former, certainly the Monte Verde site in southern Chile has withstood a virtual hailstorm of criticism by supporters of the Clovis First theory and its age of 14,800 B.P. has been vindicated by high quality scientific excavation (Dillehay 1989; 1997). Moreover, recent work at the site indicates an even older occupation closer to 20,000 B.P. or older will be reported on in the future (Thomas D. Dillehay, personal communication, 2013).

Still other early sites that remain uncertain include the Burnham site in northwestern Oklahoma (26,000-40,000 B.P.) (Wyckoff et al. 2003), the Lewisville and Hickory Creek sites near Dallas (Crook and Harris 1957, 1958; 1962; Slaughter et al. 1962; Slaughter and Ritchie 1963; Stanford 1982; Crook 2013, 2014, 2015a), and the enigmatic Manix Lake Industry in southeastern California (Simpson 1958, 1964; Bamforth and Dorn 1988; Crook 2020). In the case of the Burnham and Lewisville sites, high quality excavation has unequivocally shown the association of definitive man-made artifacts with Pleistocene mammals. Multiple age dates either on the bones, charcoal, or vegetal matter directly associated with the artifacts has produced anomalous results that cannot be readily explained. With regard to the Manix Lake Lithic Industry, large quantities of large bifacial tools have been recovered above the highest stand of the former Pleistocene Lake Manix in the Mohave Desert between Barstow and Baker, California. No datable materials have been found and attempts to date the desert varnish on the artifacts have proven unreliable (Bamforth and Dorn 1988). The author spent considerable time in the early 1980s at Lake

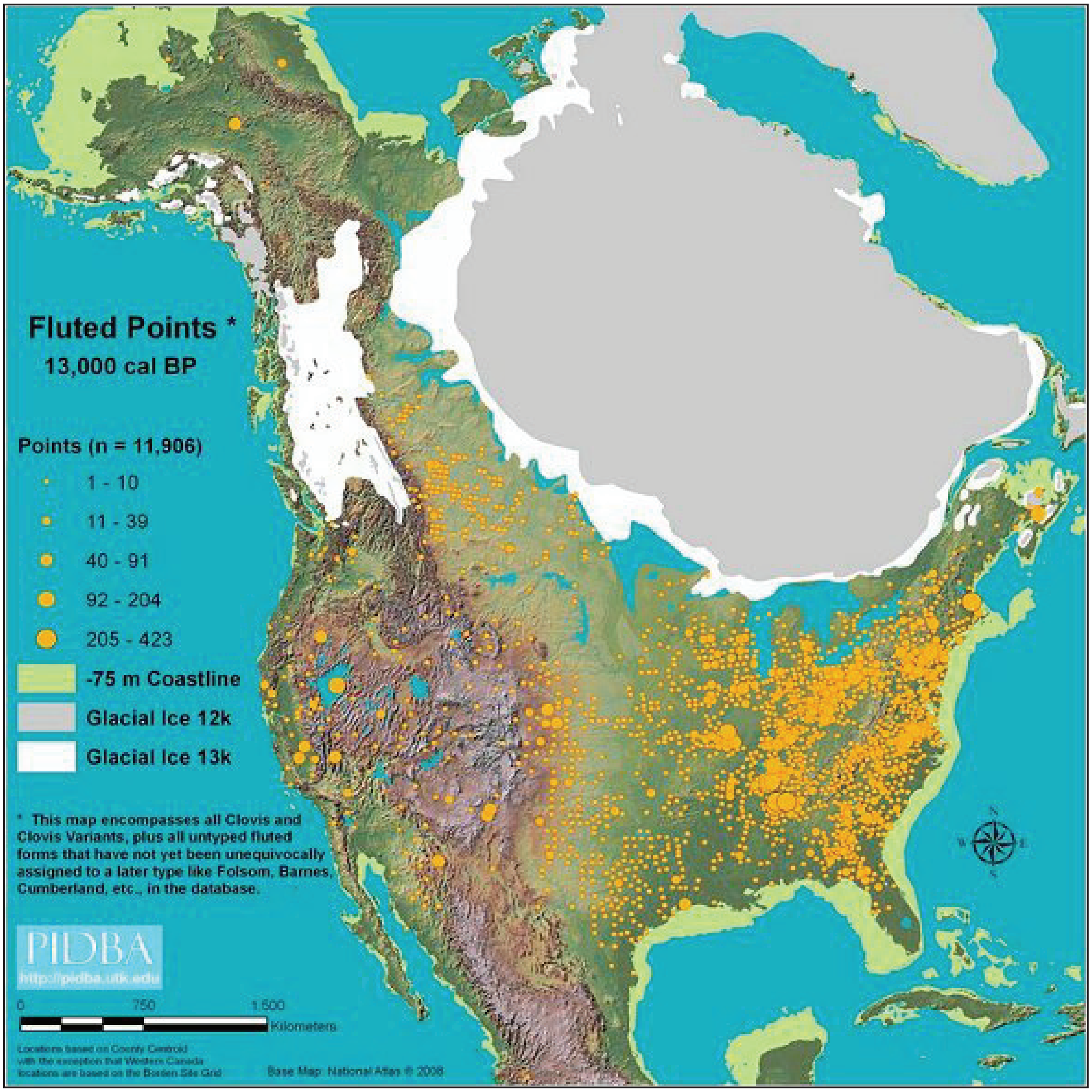


Figure 9. Map showing the current location (in yellow) of all reported Clovis projectile points in North America. (Source: Paleoindian Database of the America ("PIBDA"), Department of Anthropology, University of Tennessee; https://pidba.utk.edu/main.htm)

Manix and collected a large number of the artifacts (Figure 10). If the association between the artifacts and the Pleistocene lake high water mark is correct, then the artifacts are in excess of 18,000-20,000 years B.P. (Crook 2020). One of the many problematic questions associated with the Manix Lake Lithic Industry is that of the literally tens of thousands of artifacts that have been found around the lake, there is not a single projectile point of any type, either preform, broken, or complete. The artifacts, which are clearly man-made and not geofacts, consist mostly of large choppers, hammerstones, scrapers, and tear-dropped shaped hand axes. If the industry is as old as 20,000+ years B.P., then it is the only culture yet found in North America which has no projectile points and/or the projectile points were made of wood and bone which have since been lost to erosion.

Over the 1980s to the early 2000s, a relatively large number of new sites began to be reported which purported to be greater in age than Clovis. At the laboratory of the Gault School of Archeological Research, I was fortunate to attend a meeting of a number of notable scholars debating the issue of what a Pre-Clovis artifact assemblage would look like. After several hours of various suggestions being put forward, Dr. Michael ("Mike") Collins

Figure 10. Large chopper made of chalcedony from a site above the highest shoreline of Pleistocene Lake Manix, California.

stopped the discussion and said that we were putting the cart before the horse as before a Pre-Clovis artifact assemblage could be determined, we first needed to establish once and for all what the complete Clovis tool kit looked like. He was, of course, correct; without first knowing what constituted the Clovis tool kit we could not know for sure if the Pre-Clovis finds were similar or completely different. This launched a new investigation into defining what it means to be Clovis.

What Does It Mean To Be "Clovis"

Prior to the 1960s, what was termed as "classic Clovis" was initially known largely from kill and butchering sites, particularly of mammoth, and mainly from western North America (Cotter 1937; Haury 1953; Haury et al. 1959). These sites yielded a fairly limited assemblage of stone tools, largely dominated by the exquisitely made, lanceolate-shaped projectile points thinned near the base by short channel flakes or "flutes", and frequently made from high-quality lithic material. Based on this limited tool kit, it was proposed that the Clovis people were highly skilled and highly specialized big game hunters, concentrating most of their efforts on the biggest of Late Pleistocene mammals, mainly mammoth and mastodon.

By the 1960s, a cache of curved blades at the type Clovis site at Blackwater Draw (Locality No. 1) (Green 1963) coupled with organic tools such as a shaft wrench from a Clovis site in Arizona (Haynes and Hemmings 1966) began to suggest that the Clovis tool kit was much more complex than had originally been proposed. Moreover, it began to be noted that at many Clovis kill sites, the chert artifacts recovered were often made from lithic material that originated great distances from the location of the kill. This strengthened the idea that Clovis hunters were highly mobile bands which covered great distances in search of big game animals.

In the 1960s and 1970s additional Clovis kill sites were discovered (Haynes 1964; Leohardy 1966; Frison 1976, 1989) but also some small associated campsites (Hester 1972; Haynes 1973) which yielded further bifacial and flake tools. In addition, several caches were found, many of which contained bifaces associated abundant red ochre. One such cache near Anzick, Montana was also found to be associated with the burial of a juvenile, suggesting such caches have the potential to reveal something about the spiritual aspect of Clovis people (Lauren and Bonnichsen 1976). Beyond the large Clovis bifacial tools, bone foreshafts were also recovered from these caches which yielded information about how the Clovis weapon system functioned.

Between 1980 and 2010, a number of new Clovis campsites were discovered, many of which were in Texas. These included classic Clovis artifacts associated with mammoth kills (Crook 2011, 2015b) but also larger campsites such as the Gault (41BL323) site north of Austin (Collins 2002), Wilson-Leonard (41WM235) also north of Austin (Collins 1998), Pavo Real (41BX52) near San Antonio (Collins et al. 2003), Aubrey (41DN79) near Denton (Ferring 2001), Bushy Creek (41HU74) northeast of Dallas (Crook and Hughston 2008; Crook et al. 2009a), Timber Fawn (41HR1165) near Houston (Crook et al. 2016), and Wood Springs (41LB15) near Liberty (Crook 2017a, 2017b, 2017c). These sites, especially those that occurred near the Edwards Plateau in Central Texas (Gault, Wilson-Leonard, Pavo Real) yielded a much larger tool kit than had previously been realized for the Clovis people. Satellites sites, such as Brushy Creek, Timber Fawn, and Wood Springs helped demonstrate what parts of the tool kit that were taken on long-distance hunting forays away from sources of high quality chert as well as how the Clovis folk rejuvenated their tool kit after use so as to prolong tool life.

A part of the study on the distances covered by Clovis people from their base camps was conducted by Dr. Tom Williams in conjunction with the author in trying to source Edwards chert found in Clovis artifacts across Texas (Williams and Crook 2013; Crook and Williams 2013). This study demonstrated the presence of Edwards chert, and in particular chert from the eastern side of the Edwards Plateau from the area in and around the Gault site, was present at sites along the eastern boundary of the Edwards Plateau, and as far north as Denton and Hunt county in North Central Texas, and as far east and south as Harris, Liberty, Polk, and Jefferson counties in southeast Texas.

Another significant part of these new Clovis discoveries was the recovery of caches some of which contained mostly bifaces but others contained largely blades (Gramley 1980, 1993; Frison and Bradley 1999; Kilby 2008; Jennings 2012; Collins 1999). The material recovered from both the larger campsites plus the caches led to major insights into Clovis lithic technology. Notable was the characterization of what constitutes a Clovis blade, the types of cores that were constructed and rejuvenated to produce the blades, and what the blades were used for (Montgomery and Dickinson 1992; Collins 1999; Collins and Lohse 2004; Boldurain and Hoffman 2009; Dickens 2005, 2008; Shoberg 2010; Williams 2014, 2016).

In addition to better understanding the overall Clovis tool kit, a number of incised artifacts were recovered in definite Clovis contexts, especially from the Gault site where over 142 incised rocks, mainly of limestone and chert (cortex), have now been recorded from provenienced excavations, surface collections, and collections in private hands (Collins et al. 1991, 1992; Lemke et al. 2015). The oldest provenienced examples are reliably dated to the earliest Paleoindian cultures making them representative of the oldest art in the Americas (Lemke et al. 2015). Designs on the stones include straight lines, cross-hatched lines, patterns of “X”s, and even lines with diamond-shaped tops that look like wheat sheaves (Lemke et al. 2015). The latter may indeed represent plants however, similar designs have been found at Polesini, Italy and in Parpallo Cave, Spain where they are believed to represented fletched atlatl darts (Stanford and Bradley 2012). An engraved *Inoceramus sp*. shell with multiple rows of “X”s on both sides was also recovered from the Brushy Creek Clovis site in Hunt County, Texas (Crook et al. 2009b). Examination of the incised artifacts typically reveals that the incisions have been made by a very fine edged tool as they leave thin “V”-shaped not broader “U”-shaped incisions. It is believed that only something as fine as the edge of a Clovis blade could have been used for making the art work (Michael B. Collins, personal communication, 2009). Examples of Clovis paleo art are shown in Figures 11-14.

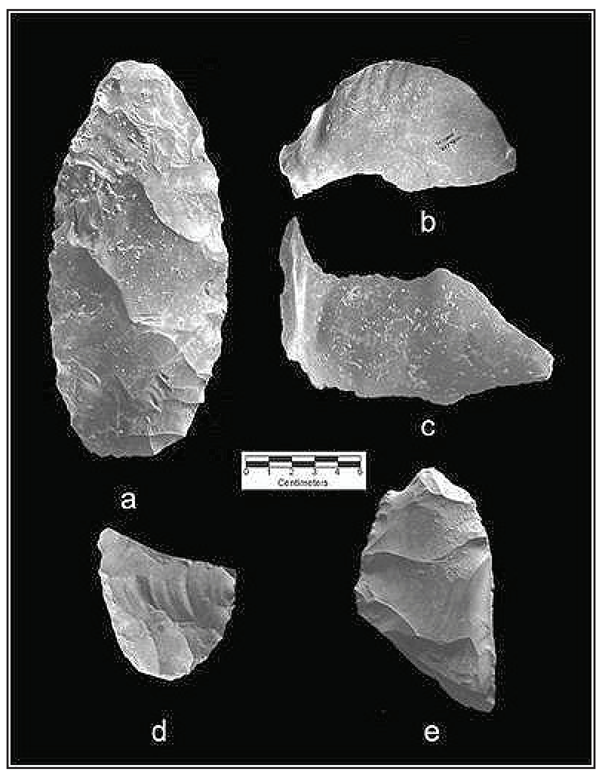
Figure 11. Cross-hatched engraved stone from the Gault site (41BL323), Bell County, Texas. (Source: Gault School of Archeological Research).

Figure 12. Cross-hatched engraved stone from the Gault site (41BL323), Bell County, Texas. (Source: Gault School of Archeological Research).

Figure 13. What sheave-like pattern engraved stone from the Gault site (41BL323), Bell County, Texas. (Source: Gault School of Archeological Research).

Figure 14. (left) Engraved Inoceramus sp. shell from the Brushy Creek site (41HU74), Hunt County, Texas. Note the multiple series of "X" patterns on both the obverse and reverse faces.

Figure 15. (below) Overshot flakes and Clovis biface from the Gault site (41BL323), Bell County, Texas. (Source: Gault School of Archeological Research)



The end result of all of this research led to a much more complete understanding of what it means to be Clovis. We now know that the Clovis tool kit was considerably more complex that originally believed and included both a biface and a deliberate blade mode (Collins 1990; Bradley et al. 2010; Waters et al. 2011; Ellis 2013; Smallwood and Jennings 2015; Jennings and Smallwood 2019). With regard to the biface mode, Clovis knappers preferentially used a technique which removed large flakes that traveled across the face of the biface to uniformly thin the objective piece with the minimum amount of flake removals (Bradley et al. 2010; Smallwood 2015". Known as "*outre-passe*" or overshot and across-the-face flaking, this method is the single most efficient way to thin a biface with the minimum amount of strikes but it is also the most risky because of the high potential of catastrophic failure (Ellis 2013). Use of controlled overshot flaking leaves very diagnostic flake scars which characterize Clovis bifaces including Clovis projectile points. In a quarry workshop site such as the Gault site, overshot flakes and their resultant scars on biface blanks are common (Figures 15-19).

Figure 16. Examples of overshot flakes from the Gault site (41BL323), Bell County, Texas. Note the curvature which is the result of the removal of the flake from one side of the biface, across the face, and over the opposing side. (Source: Gault School of Archeological Research)

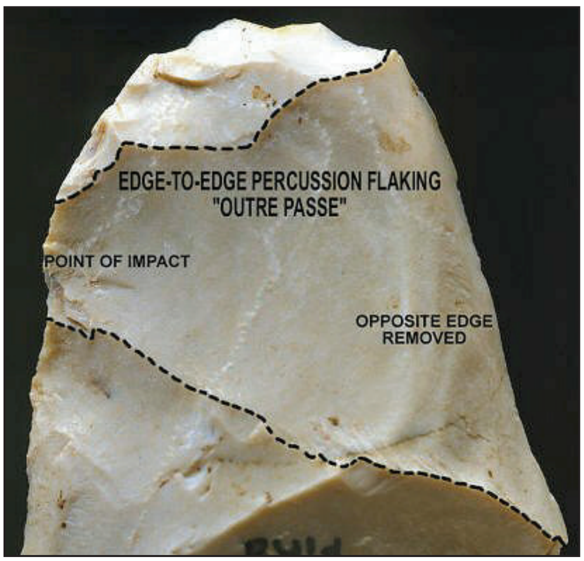


Figure 17. Close-up showing the point of impact and edge-to-edge path of an overshot flake from the McKinnis Clovis Cache, St. Louis County, Missouri. (Source: Lithics Casting Lab, Troy, Illinois; www.lithiccastinglab.com)

Figure 18. Large Clovis biface from the McKinnis Clovis Cache, St. Louis County, Missouri clearly showing overshot, across-the-face flake scars. (Source: Lithics Casting Lab, Troy, Illinois; www.lithiccastinglab.com)

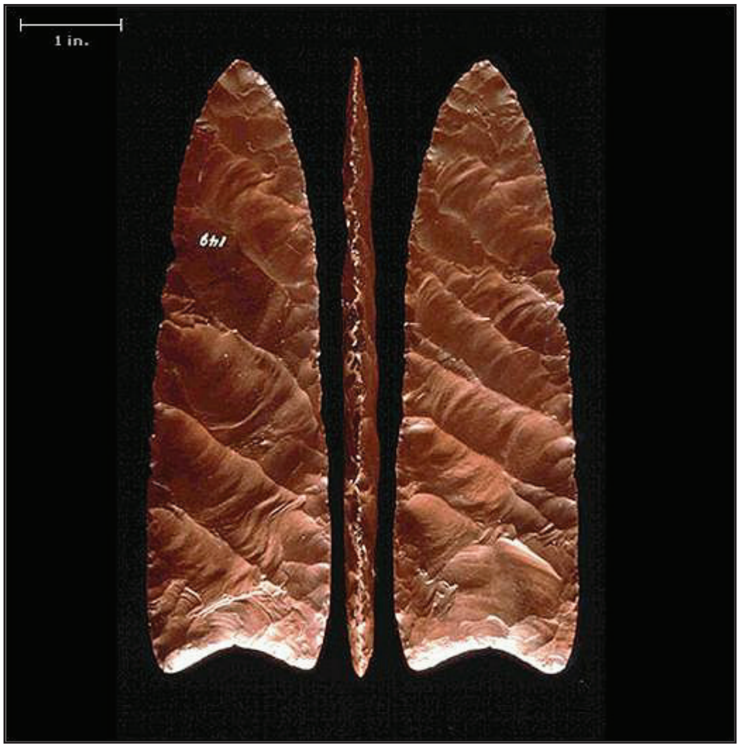


Figure 19. Large Clovis biface from the Fenn Cache, Wyoming-Utah-Idaho border showing prominent overshot, across-the-face flake scars. (Source: Lithics Casting Lab, Troy, Illinois; www.lithiccastinglab.com)

Overshot flakes can also be found in Clovis camps located considerable distances from chert sources indicating that this flake removal technique was used to re-sharpen and/or repair bifaces in the field (Figure 20). Use-wear analysis of Clovis projectile points indicates that they were used both as projectile points and as knives in the butchering of animals (Ellis 2012). Studies by Beaver and Meltzer (2007) across Texas indicate that Clovis points were continually used and re-sharpened before final discard. In this regard, several of the Clovis points recovered from Brushy Creek in Hunt County, Texas and Wood Springs in Liberty County show that they have been re-tipped and/or re-based in order to prolong useful tool life. While not universal, the majority of discarded Clovis points are in the range of 50-60 mm in length, probably about half their original size (Michael B. Collins, personal communication 2008). Clovis points recovered from Brushy Creek (41HU74), Timber Fawn (41HR1165), and Wood Springs (41LB15), all of which contain Edwards chert and are long distances from the Edwards Plateau, fall into this discarded point size range. The larger original size of the Clovis bifaces is demonstrated by examples from caches such as the Hogeye cache located about 70 km east of the Edwards Plateau (Jennings 2012; Waters and Jennings 2015). Large unfinished bifaces were also part of the traveling Clovis tool kit as they could be finished into a projectile point or knife as required with the ensuing flakes then finished as expedient cutting tools (Figures 21-22).

Figure 20. Overshot flake of Edwards chert from the Wood Springs site (41LB15), Liberty County, Texas which is located nearly 250 miles from the Edwards Plateau in Central Texas.

Figure 21. Large, unfinished biface recovered from the Timber Fawn site (41HR1165), Harris County, Texas.

Figure 22. Ultra-thin biface recovered from the Brushy Creek Clovis site (41HU74), Hunt County, Texas. Note the presence of red ochre on the biface.

The other primary lithic mode of the Clovis tool kit is the production of large blades. In fact, Clovis is often as much of a blade industry as a biface industry (Ellis 2013). Clovis blades are defined by a number of characteristics including a length-to-width ratio typically greater than 2:1, a relatively small striking platform, and a thickness of less than 10 mm (Collins 1999). A further defining characteristic of Clovis blades is their high index of curvature, defined as the maximum degree of curvature relative to the overall length of the blade (Collins 1999; Collins and Lohse 2004; Bouldurian and Hoffman 2009; Dickens 2005, 2008) (Figures 23-25). At the Gault site, of the 228 Clovis blades which have been recovered to date, 70 (31 percent) were measured as straight having an index of curvature close to zero, 24 (10 percent) had an index of curvature between zero and five (slightly curved) and 134 (59 percent) had an index of curvature of five or greater (Williams 2016).

Figure 23. Curved Clovis blade from the Gault site (41BL323), Bell County, Texas. (Source: Gault School of Archeological Research)

Figure 24. Curved Clovis blade from the Gault site (41BL323), Bell County, Texas. Note the high degree of curvature. (Source: Gault School of Archeological Research)

Figure 25. Clovis blade from the Brushy Creek site (41HU74), Hunt County, Texas.Note the ratio of length to width of the blade.

High resolution microscopy of the edges of Clovis blades shows that they were the “Swiss Army Knife” of the Clovis world, being used for a myriad of functions. Use-wear analysis coupled with experimental replication has shown that some Clovis blades were used in cutting meat (Figure 26). Others have a high degree of polish on the edges, indicative of having been used to cut silica-rich grass, possibly for thatch for housing (Figure 27) (Shoberg 2007, 2009, 2010). Many Clovis blades were purposed into end scrapers with some of these probably being hafted as evidenced by notches cut into the edge of the blades (Figures 28-29).

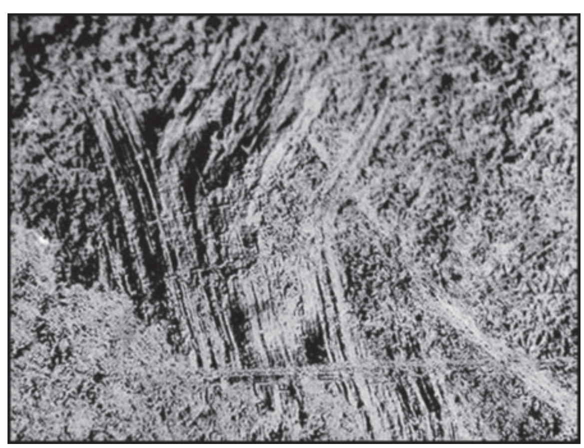


Figure 26. High resolution photomicrograph of the edge of a Clovis blade from the Gault Creek site (41BL323), Bell County, Texas. The striations perpendicular to the blade edge are indicative of it having been used to cut meat.(Source: Gault School of Archeological Research)

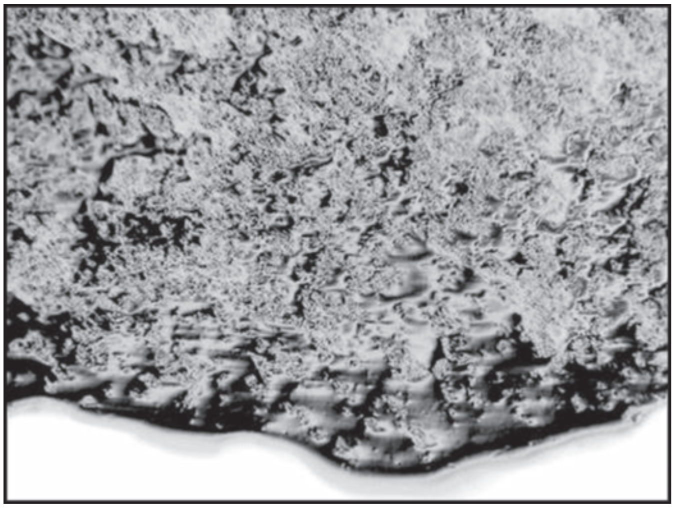


Figure 27. High resolution photomicrograph of the edge of a Clovis blade from the Gault Creek site (41BL323), Bell County, Texas. The bright polish on the edge of the blade is indicative of it having been used to cut silica-rich material such as grass. (Source: Gault School of Archeological Research)

Figure 28. Clovis blade made from exotic Edwards chert from the Timber Fawn site (41HR1165), Harris County, Texas. Note both the distal end and the left lateral edge have been re-worked into scrapers.

Figure 29. Clovis blades recovered from the Timber Fawn site (41HR1165), Harris County, Texas. Note both blades #2 and #3 have prominent notches cut into the blade edge probably for its use as a hafted end-scraper.

Two types of blade cores were utilized by the Clovis people to produce their long, curved blades. Based on profile morphology, these are known as conical and wedge or flat-backed cores (Collins 1999; Collins and Lohse 2004; Bradley et al. 2010). Conical blade cores have roughly circular platforms with blades removed around the entire circumference of the core from near right-angle platforms (Williams 2014, 2016). Blade removals are unidirectional from the larger upper platform toward the distal end (point) of the cone (Figures 30 and 31). The core platform surface typically shows the presence of core tablet flake scars which were struck in order to rejuvenate the platform of the core so additional blades could be produced. This process was continued until the core was exhausted and no further useful blades could be removed.

Figure 30. Large conical blade core found near Victoria, Texas. Blades were removed from the core platform surface at the top toward the distal pointed end of the core. (Source: Gault School of Archeological Research)

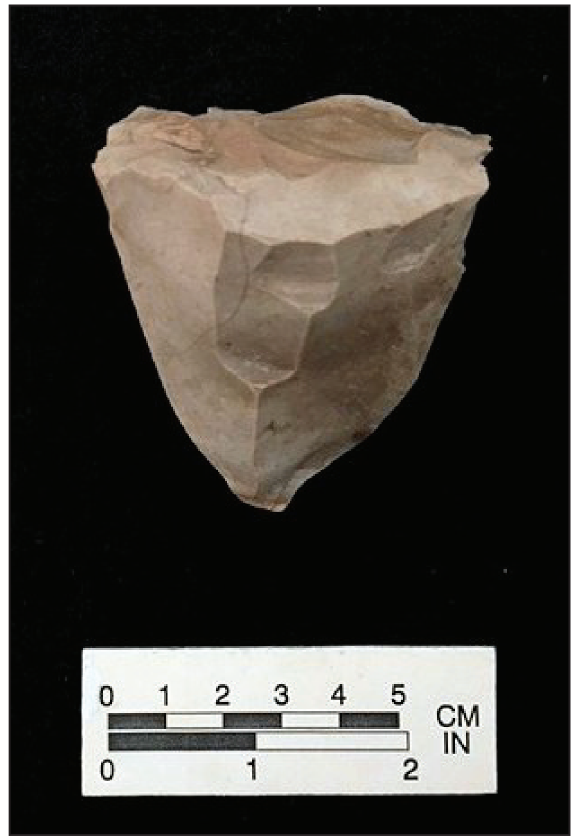


Figure 31. Exhausted conical blade core from the Wood Springs site (41LB15), Liberty County, Texas.

Wedge-shaped or flat-backed cores have blade removals which are restricted to the front face of the core periphery and have more acute platform angles (typically around 45°). While conical blade cores are the most common in Clovis sites across most of North America, wedge-shaped or flat-back cores are the most common core type seen at the Gault site in Central Texas (Bradley et al. 2010; Collins 1999; Collins and Lohse 2004; Williams 2016; Jennings and Smallwood 2019). The name "flat-back" or "wedge-shaped" is derived from the acute angle (usually less than 80°) between the platform and the core face. Blades can be removed unidirectionally but are more commonly seen to be bidirectional to more fully utilize the core (Williams 2016). The back of the core was specifically created by the removal of flakes but no blades were produced across the back face (Figure 32). Eventual loss of platform angle was seen as a major reason for the discard of flat-backed blade cores at the Gault site (Williams 2016).

The morphology of a blade core is important to understanding blade production. Experiments have shown a strong relationship between core morphology and platform thickness as well as blade length and thickness (Pelcin 1997). More recent work by Williams (2016) at the Gault site has also shown that platform depth and angle are also important factors to understanding blade cores. Based on the work done by Collins (1999), an index of

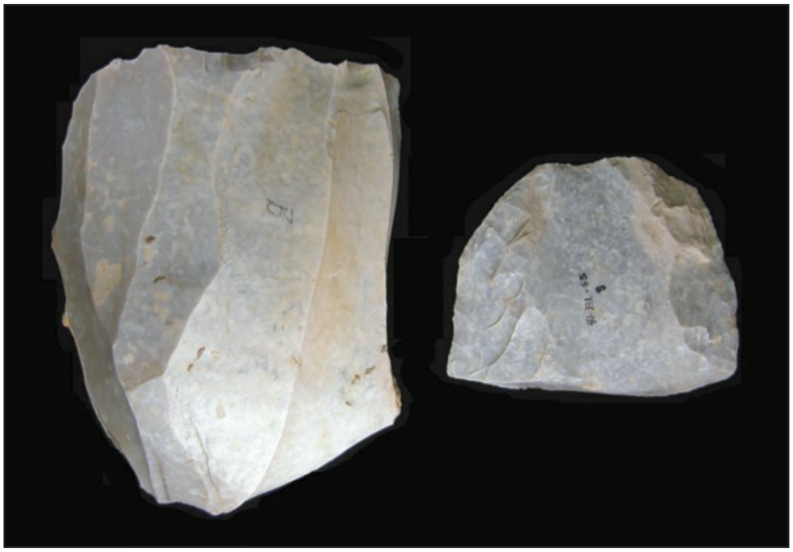


Figure 32. Flat-back or wedge shaped blade core (left) found at site 41BL55 in Bell County, Texas. (Source: Texas Archeological Research Laboratory)

curvature can be measured for all the blade scars on a Clovis core. The index of curvature is a ratio of two linear measurements expressed by the formula of:

$$\text{Index of Core Curvature} = b/a \times 100$$

where a is the straight-line distance between the proximal and distal point of contact of the curve of the blade scar and b is the maximum perpendicular distance the straight line and the curved surface of the blade scar. Collins and Lohse (2004), Bradley et al. (2010), and Williams (2016) all noted that flat-back cores have a significantly greater degree of curvature than conical blade cores. Bradley et al. (2010) reported a mean index of curvature for conical blade cores of 4.1 compared to 11.9 for flat-back blade cores. Williams (2016) measured the 120 blade cores recovered from the Gault site and found a similar relationship with conical blade cores having an average index of curvature of 4.25 and flat-back cores having an average curvature of 11.17.

Lesser-known components of the Clovis tool kit include side-scrapers made from flakes, end-scrapers made from blades, gravers made on both blades and flakes (Figures 33-34), saw-like blades, and adzes (Figures 35-36) (Collins and Hemmings 2005). In addition to lithic tools, a small number of bone and wood artifacts have been recovered in association with Clovis contexts, mainly from caches. These tools include single beveled points, wrench-like shaft straighteners, atlatl foreshafts, bone and wood rods, awls, needles, and the like (Hemmings 2004; LeBlanc 2009; Bradley et al. 2010).

Figure 33. (left) Graver point on a blade from the Gault site (41BL323), Bell County, Texas. (Source: Gault School of Archeological Research)

Figure 34. (right) Gravers made on flakes from the Brushy Creek site (41HY74), Hunt County, Texas.

Figure 35. Clovis adze (left) recovered from the Brushy Creek site (41HU74) in Hunt County, Texas.

Figure 36. Broken bit end of a Clovis adze recovered from the Timber Fawn site (41HR1165) in Harris County, Texas.

Lastly, the range of Clovis occupation has now been definitively dated. Waters and Stafford (2007) based on the majority of Clovis dates, proposed a narrow age span of the culture from 13,200-12,900 years ago. If the ages of other Clovis sites, such as Aubrey near Denton, Texas (Ferring 2001) and some of the eastern Clovis sites are included, the age span for the Clovis period can be placed starting around 13,500 years ago and lasting to about 12,700 B.P. (800 years).

Research over the last three decades has now provided a greater understanding of the Clovis lifestyle. Over the span of roughly 800 years, the Clovis technology spread to almost every environment present across North America. While the people would obviously take advantage of large mammals such as mammoth and mastodon if the opportunity presented itself, they clearly did not exclusively depend on such a diet. Smaller mammals and especially turtle were mainstays of the Clovis diet (Lemke and Timperley 2008; Collins 2007). We also now know that they had a selective preference for exotic toolstone, particularly high quality chert and/or unusual material like crystal quartz. Not all of the cache behavior was designed for future use. Some, such as that deposited with the Anzick juvenile (Lauren and Bonnichsen 1976), clearly had a spiritual or ceremonial significance. In this regard, the use of red ochre associated with some tools and caches probably indicates a special meaning. Lastly, despite the differences in form and possible meaning, the Clovis art artifacts (incised stone) represent a long human tradition of symbolic expression.

The Clovis occupation across North America occurred toward the end of the Pleistocene during the Bølling-Allerød glacial oscillations which were generally warm and moist periods lasting from ca. 14,700-12,700 B.P. (Amick 2017; Waters and Stafford 2007). This was followed by the Younger Dryas Chronozone during which time temperatures dropped back to near Last Glacial Maximums between ca. 12,700 and 11,500 B.P. (Waters and Stafford 2007). During both these time intervals, the fresh water springs at Gault, Brushy Creek, Wood Springs, and other Clovis campsite locations would have been a very attractive location for both humans and animals. Clovis settlement contains a mixture of forager and collector strategies (Haynes 2002). Moreover, the Paleoindian Data Base of the Americas (PIBDA) has demonstrated that Clovis peoples favored temperate deciduous forests and the foothills of the Rocky Mountains (Amick 2017) (see Figure 9). Clovis point concentrations reflect mega-patches of concentrated resources such as food, wood for fuel and shelter, water, and high quality toolstone (Haynes 2002, 2013).

It is thought by some researchers that Clovis represents not a particular people but more of a cultural revitalization movement almost like a cult that spread among the existing low density Pre-Clovis population in North America (Bradley and Collins 2013); Collins et al. 2013). As such, Clovis should probably be thought of as a “techno-complex” that spread to groups of peoples already settled across North America rather than a single "culture" (Shott 2013). According to Bradley et al. (2010), Clovis technology exhibits "a bold, confident and almost flamboyant strategy executed with consummate skill" coupled with "inklings of great and detailed geographic knowledge over vast areas" indicative of it not being a founding population.

The Clovis lithic technology involved direct percussion with minimal pressure flaking. It was highly planned and exhibits exceptional and distinctive platform preparation techniques including basal thinning (fluting), controlled overshot flaking, basal margin abrasion, and extensive reworking (Bradley et al. 2010). A number of these techniques regularly employed by Clovis knappers appear to be driven as much by an ideology as by technological need (Cannon 2011). This observation is supported by a review of global hunter-gatherer technology which readily demonstrates that you do need such an elaborate and diversified tool kit to be a successful, mobile big-game hunter or even survive in extreme climate conditions (Goodchild 1984; Bettinger 1991; Speth et al. 2013).

While Clovis people preferentially sought out high quality toolstone for their artifacts, they were not tethered to lithic sources but exercised substantial planning prior to long-distance forays. Bement and Carter (2010) suggest Clovis groups may have spent more time at larger campsites associated with high quality toolstone outcrops such as the Gault site, and then seasonally traveled some distance to areas away from the source of toolstone in search of big game. Lithic tool kit "gearing up" for long-distance excursions routinely took place among Clovis groups in the Great Lakes and Northeastern U.S. in anticipation of movements of 100-500 km, presumably for the purpose of hunting big game (Amick 2017; Ellis 2011; Ellis et al. 2011). Transportation of toolstone long distances has been demonstrated at a large number of Clovis sites (Bradley et al. 2010). The long distances between the Edwards Plateau chert outcrops and Clovis sites across Texas such as Brushy Creek (320 km), Timber Fawn (325 km), and Wood Springs (370 km) is representative of such a long-distance travel and/or potentially down-the-line trade for lithic materials with other Clovis foraging groups.

The Search For A Clovis Antecedent In Siberia

Archeologists and anthropologists have long looked to Siberia for the origins of the First Americans. Having a Clovis antecedent in Siberia fit the long-held “Clovis First” theory so it was generally accepted that the origins of Clovis would be found somewhere in Siberia and/or the Kamchatka Peninsula (Haynes 1982; Goebel 2004). The problem for North American researchers is that prior to the fall of the Soviet Union, access to archeological sites in Siberia was virtually impossible and what work was done by Soviet archeologists was published in relatively obscure (at least to most western scientists) Soviet journals and exclusively in Russian. Even if the articles could be obtained, few archeologists had the language skills or resources to have them translated.

Finally, after the fall of the Soviet Union in December of 1991, the possibility of western scientists being able to see eastern Siberian archeological sites and their collections slowly began to become a reality. However, instead of finding lanceolate projectile points and large blade cores and curved blades, the researchers found that the Siberian cultures at the time or slightly before the appearance of Clovis in North America (ca. 13,500 B.P.) were characterized by small, stemmed projectile points and microblades (Dikov 1990) (Figures 37 and 38). The latter are typically well under 5 cm in length and are straight with virtually no curvature – nothing akin to what is found in Clovis sites.

Figure 37. (above) Stemmed projectile point from the Ushki 1 site, Kamchatka Peninsula, Russia. (Source: Lithics Casting Lab, Troy, Illinois; www.lithiccastinglab.com)

Figure 38. (right) Small microblades from the Ushki 1 site, Kamchatka Peninsula, Russia (Source: ResearchGate.net)

Initially, the sites in far eastern Siberia were believed to have pre-dated Clovis by about 4,000 years (Goebel et al. 2003). However, more recently, new radiocarbon dates have been obtained from the sites in and around Ushki Lake, notably the Ushki 1 site on the Kamchatka peninsula. Calibration of the radiocarbon dates produced calendar year ages between 13,130 to 12,953 years B.P., or essentially coeval with Clovis (Goebel et al. 2003). Moreover, clearly the lithic tradition across Siberia does not look anything like Clovis. Thus the Siberian lithic tradition cannot by itself be the long-sought after Clovis antecedent. Therefore we are still left with the question of where did Clovis technology originate? Perhaps the Clovis lanceolate biface and large core-and-blade technology evolved from what we see in Siberia; but if it did, it would have had to have undergone a rather radical evolution in a very short time. Or perhaps Clovis truly originated in North America for unknown reasons, or it derived from an earlier, as yet unknown migration from Siberia that might have occurred significantly before the end of the Last Glacial Maximum (ca. 18,000 B.P.) (Ellis 2008). Only additional research in northeast Asia and North America may one day resolve this issue.

Significant Pre-Clovis Sites In North America

What follows is a brief description of 20 of the more significant Pre-Clovis sites thus far discovered in North America. I use the term "significant" to signify that the sites have had exhaustive, high quality scientific research conducted on them and their age of being older than 13,500 B.P. is well-established. While there may still be some detractors with regard to these sites' claim to be older-than-Clovis, the overwhelming majority of North American archeologists concur with the conclusion that they pre-date Clovis. It should be noted that this listing is not exhaustive, nor are the descriptions contained herein a thorough review of all the work that has been conducted at each site. I have selected these sites to demonstrate both the geographic spread of peoples in North America prior to the advent of Clovis lithic technology as well as for their quality of scientific work. In many cases, I have discussed the sites with their primary investigator(s) and thus my descriptions will also reflect some of their comments.

I will begin along the Atlantic Seaboard from Chesapeake Bay and Pennsylvania to Florida, then move to the Mid-Continent in Wisconsin, then north to the Arctic, then down the Pacific Coast to Baja California, and finally wind up in Texas. Lastly, I will briefly discuss the Cerutti Mastodon site and the implications of the discovery if proven to be true.

The Cinmar Biface

In 1970, the scallop dredge "Cin-Mar" was operating about 100 km off the coast of the Virginia Cape at a depth of approximately 75 meters (Figure 39). The dredge hit a large "bump" or obstruction along the bottom. Because of the size of this bump, the ship's Captain, Thurston Shawn, dutifully noted the exact location in his log. Scallop dredgers routinely share this type of information because a major obstacle on the sea floor can destroy the dredge which is, of course, the livelihood of the fishermen.

When the dredge was lifted back onto the ship, its contents included parts of a mastodon tusk, a number of skull bones and teeth from the same animal, and a large bi-pointed biface. Captain Shawn distributed pieces of the mastodon to the crew members but gave the biface and the larger pieces of the tusk to the local Gwynn's Island Museum (Gwynn Island Museum 2014).

In 2008, while conducting an archeological survey of the Chesapeake Bay area, Darrin Lowery of the University of Delaware (now with the Smithsonian Institution), visited the Gwynn's Island Museum and noticed the bi-pointed

Figure 39. The scallop dredge vessel Cin-Mar. (Source: Gwynn's Island Museum)

biface which strongly resembled similar bifaces from the Solutrean period (ca. 22,000-17,000 B.P.) in southern France and northern Spain. Lowery asked the museum if he could borrow both the biface and mammoth tusk for additional study which they agreed to do (Gwynn Island Museum 2014; Darrin Lowery, personal communication, 2013).

Captain Shawn's bathometric data indicated that the remains came from the Last Glacial Maximum shoreline of the James Peninsula adjacent to the south lagoon of ice age Chesapeake Bay. At that time, this area was a sheltered lagoonal habitat which would have been perfect for mastodons to congregate and feed. The small diameter of the tusk indicated that it came from a female of about 30 years in age. A radiocarbon assay of collagen extracted from the tusk yielded a date of 22,760 ± 90 radiocarbon years before present, or 27,440 ± 394 calendar years B.P. (Stanford and Bradley 2012).

The biface is bi-pointed and laurel leaf-shaped, 188 mm in length, 55 mm in width, and 6 mm in thickness (Stanford and Bradley 2012) (Figure 40). It exhibits percussion thinning on both faces through large, across-the-face flaking. Use-wear studies indicate that the artifact had been used as a hafted knife which had been dulled from use and then subsequently re-sharpened prior to it being lost (Figure 41). This wear is consistent with that seen on bifaces at prehistoric mammoth and mastodon butchering sites as well as that seen on modern replicative experiments.

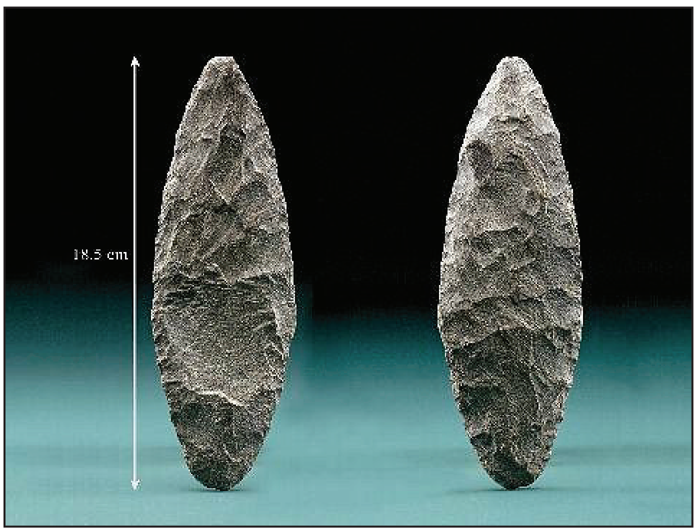


Figure 40. Obverse and reverse views of the Cinmar biface. (Source: Occoquan Paleotechnics, LLC; www.occpaleo.com)

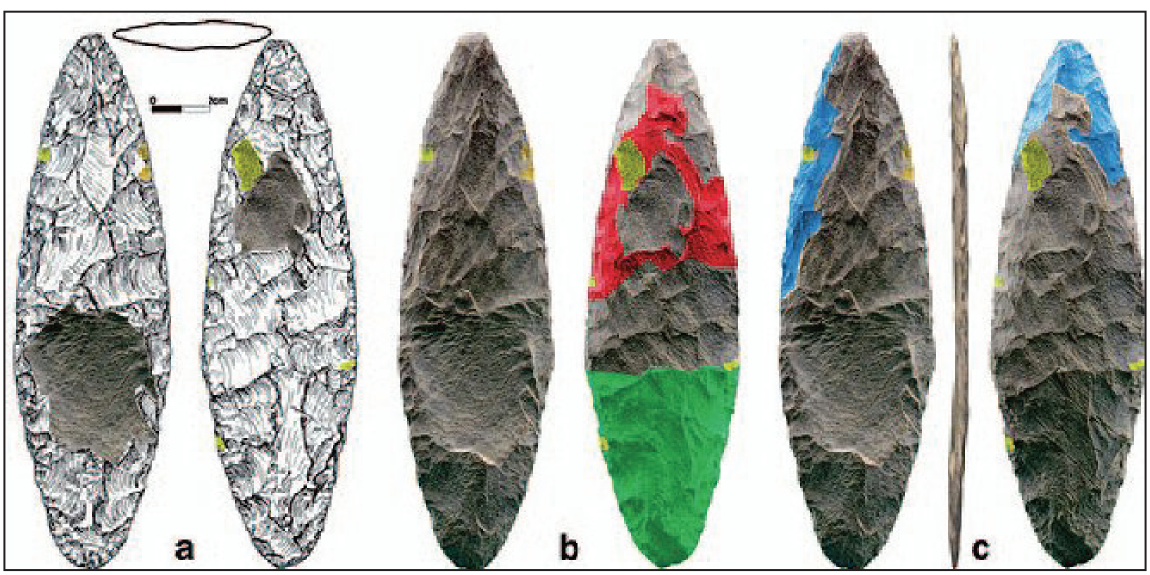


Figure 41. Use history diagram for the Cinmar biface. Yellow represents recent damage cause by the scallop dredge; Green indicates use-wear from hafting; Red is due to blade element wear from cutting; Blue indicates areas that were re-sharpened. (Source: ResearchGate.net).

Trace element geochemical studies conducted using X-ray fluorescence (XRF) indicated that the Cinmar biface (as it is now called after the scallop dredge that found it) is made of a meta-rhyolite that crops out near South Mountain at the headwaters of Chesapeake Bay along the Maryland-Pennsylvania border. This material is of marginal flaking quality and the fact that the Cinmar biface is so thin and well-made testifies to the high knapping skill of its maker (Dennis Stanford, personal communication 2013).

Detractors to the find point out that there is no definitive proof of the association between the biface and the mastodon remains. However, the fact that they were brought up from the ocean floor in the same bucket, the mastodon had been butchered, and the biface shows signs from having been used to butcher an animal, makes the likelihood of co-association high. The survival of micro traces of use-wear on the artifact indicates that it was not stream-rolled, tumbled, and abraded but deposited in association with the mastodon and quickly buried in a pond or bog. Mastodons were apparently highly attracted to ponds and bogs as the Cinmar find would tend to indicate (Owsley and Hunt 2001).

Parsons Island, Maryland

Over the last decade, Darrin Lowery of the Smithsonian Institution has used a kayak to inspect the eroding shorelines within Chesapeake Bay and its islands (Figure 42). During his research, Darrin has discovered a number of archeological sites which have stratigraphic sections exposed by the sea containing an intact record from the Archaic to early Paleoindian to Clovis to occupations which pre-date Clovis (Lowery 2009). Ancient soils in the Delmarva Peninsula consist mainly of loess, a fine-grain sediment that was formed through glacial and then later aeolian action. As the weight of glacial ice moved over the countryside, rocks carried by the glacier slowly grind and crush exposed bedrock to a fine powder (20-50 microns). Later, when the glaciers melt and retreat, this fine-grain sediment is picked up by winds and then deposited in loosely cemented layers which geologists term as "loess". In the Delmarva Peninsula, below the topsoil lies a series of loess deposits collectively known as the PawPaw Loess, which dates to the period of the Younger Dryas cooling event from ca. 12,700-11,500 B.P. (after Clovis) (Lowery et al. 2010). Beneath this layer is a major unconformity which contains the Clovis horizon (12,700-13,500 B.P.) (Lowery et al. 2010; Wah et al. 2014). The Clovis horizon lies on top of a dark black paleosol known as the Tilghman Paleosol which has been radiometrically dated between approximately 18,000 and 25,000 B.P. (18,858 ± 205 to 25,613 ± 385 B.P.) (Wah et al. 2014). Below the Tighlaman Paleosol is another thick unit of loess which corresponds to a period within the Last Glacial Maximum (LGM).

Figure 42. Delamarva Peninsula archeologist Darrin Lowery of the Smithsonian Institution. (Source: ResearchGate.net)

Figure 43. Aerial view of Parsons Island, Chesapeake Bay, Maryland. The white exposed beach cliff on the left side of the island is where the archeological site is exposed. (Source: ResearchGate.net from Darrin Lowery)

At Parsons Island, which is located within the northern part of Chesapeake Bay just south of Annapolis, Maryland, Lowery has found a number of unusual artifacts within and below the Tighlman Paleosol horizon (Figure 43). These include unique single shoulder projectile points, laurel leaf-shaped bi-pointed bifaces, pentagonal-shaped projectile points, blades, end-scrapers and other tools made on flakes and blades (Lowery 2009; Darrin Lowery, personal communication 2013; Lothrop et al. 2016) (Figures 44 and 45).

In addition to the extreme age (>18,000 B.P.), the other notable feature of the Parsons Island artifacts is their strong similarity to Solutrean age artifacts from southern France and Northern Spain. Moreover, none of the artifacts show any similarity to the known Clovis tool kit and thus do not look to be a direct antecedent, although the lanceolate pentagonal point and the blade share some general characteristics. However, it should be noted that the blades from Parsons Island are not produced in the same manner as Clovis blades.

Figure 44. Cast of single-shoulder projectile point from Parsons Island, Chesapeake Bay, Maryland photographed in the Gault laboratory.

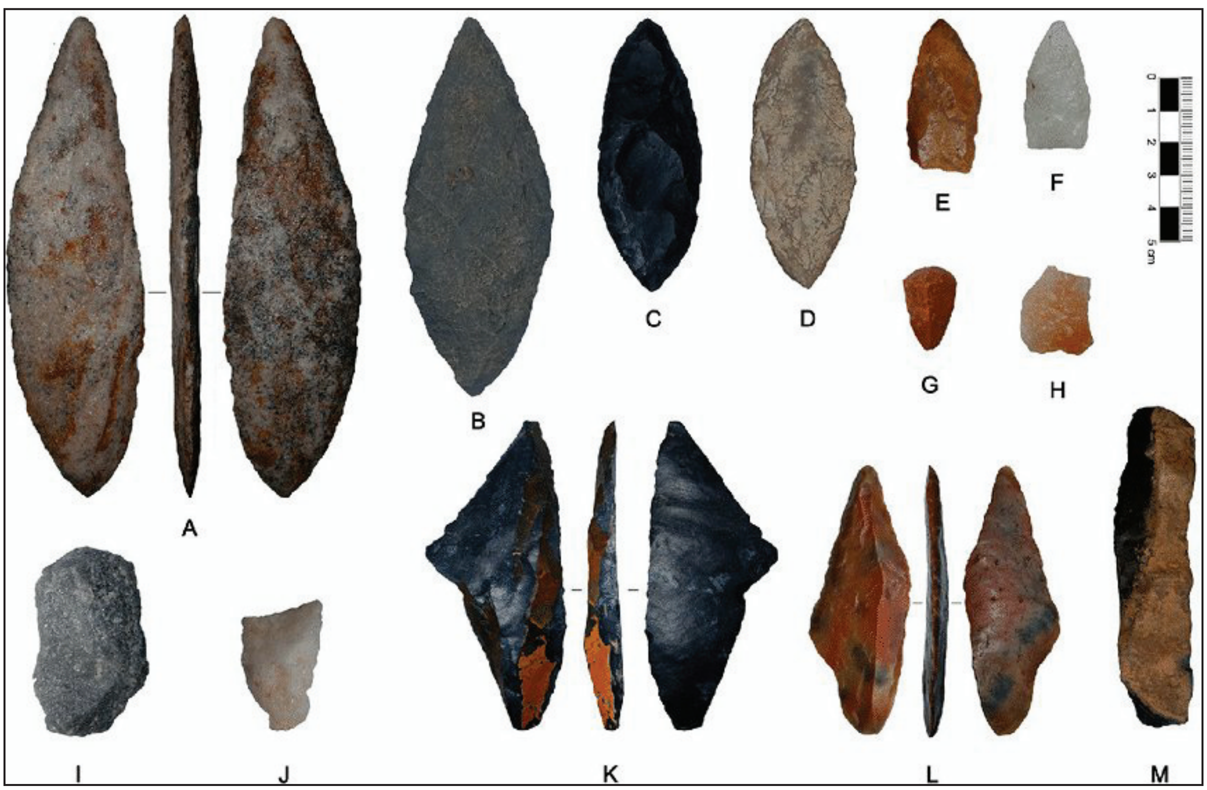


Figure 45. Artifacts recovered from below the Clovis horizon at Parsons Island, Chesapeake Bay, Maryland including laurel-leaf bi-pointed bifaces (top row), pentagonal projectile points (top row, far right), single shoulder points (bottom row, center), and blade (bottom row, far right).
(Source: ResearchGate.net from Darrin Lowery)

Miles Point, Maryland

Another Delmarva Peninsula site discovered by Darrin Lowery is Miles Point which lies on the eastern bank of Chesapeake Bay about two-thirds up its length (Lowery 2007; Lowery and Stanford 2008). Miles Point has a very similar intact stratigraphic profile as Parsons Island with the marker horizon Tilghman Paleosol clearly exposed. A cross-section of the Miles point stratigraphy is shown in Figure 46. Artifacts recovered include a quartzite boulder which had been used as an anvil, two quartzite bladelets, an exhausted bi-polar bladelet core, a polyhedral bladelet core, a flake core, a pentagonal-shaped projectile point, a biface preform, a burinated biface fragment,, a decortication flake, several worked flakes, and a hammerstone (Lowery 2007, 2009; Lowery and Stanford 2008) (Figure 47). All of the artifacts are made from raw materials exposed in local gravel deposits. The cherts found in these sources washed down from bedrock sources in Pennsylvania at the northern end of Chesapeake Bay. As they were tumbled downstream they were worn into fist-sized cobbles which served to limit artifact size (Lowery 2009).

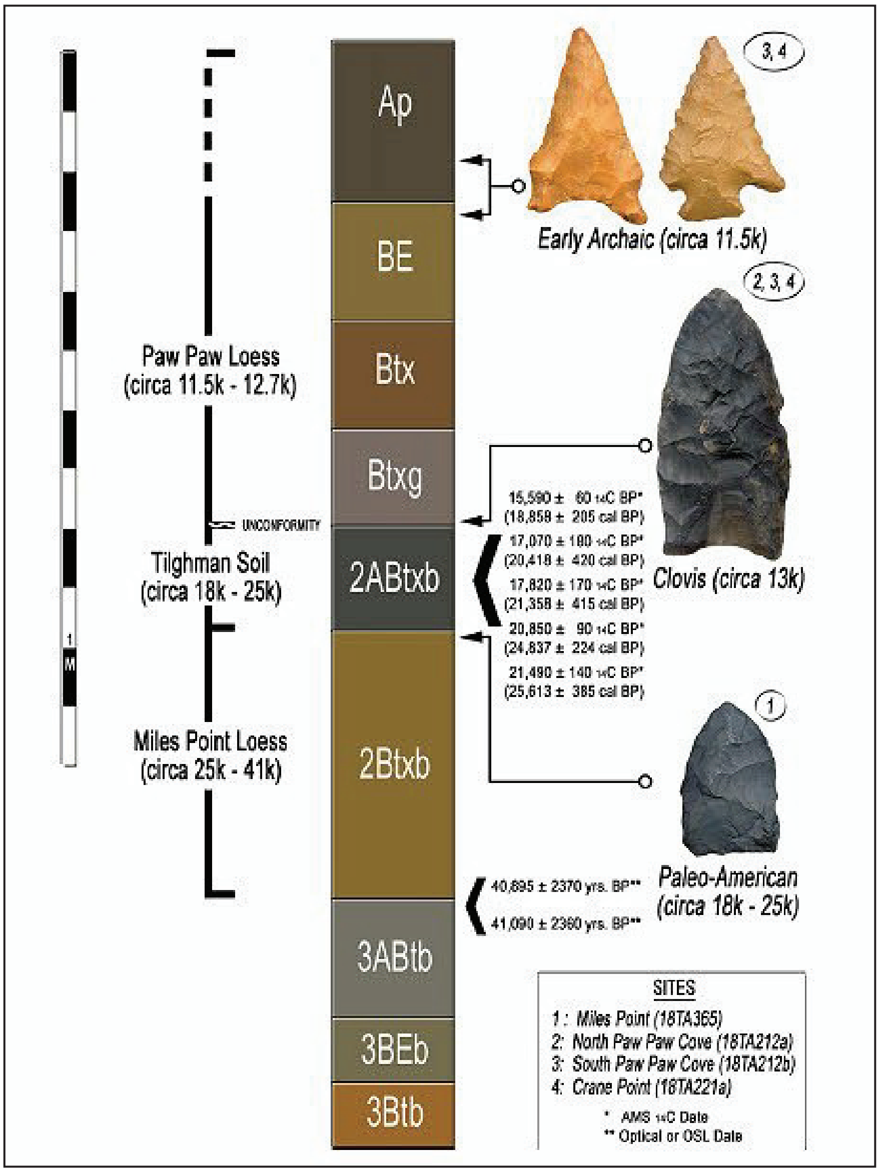


Figure 46. Stratigraphy present at the Miles Point, Maryland site. Note the location of Clovis at the base of the PawPaw loess and the pentagonal-shaped projectile point found below within the Tighlman Paleosol. (Source: ResearchGate.net from Darrin Lowery)

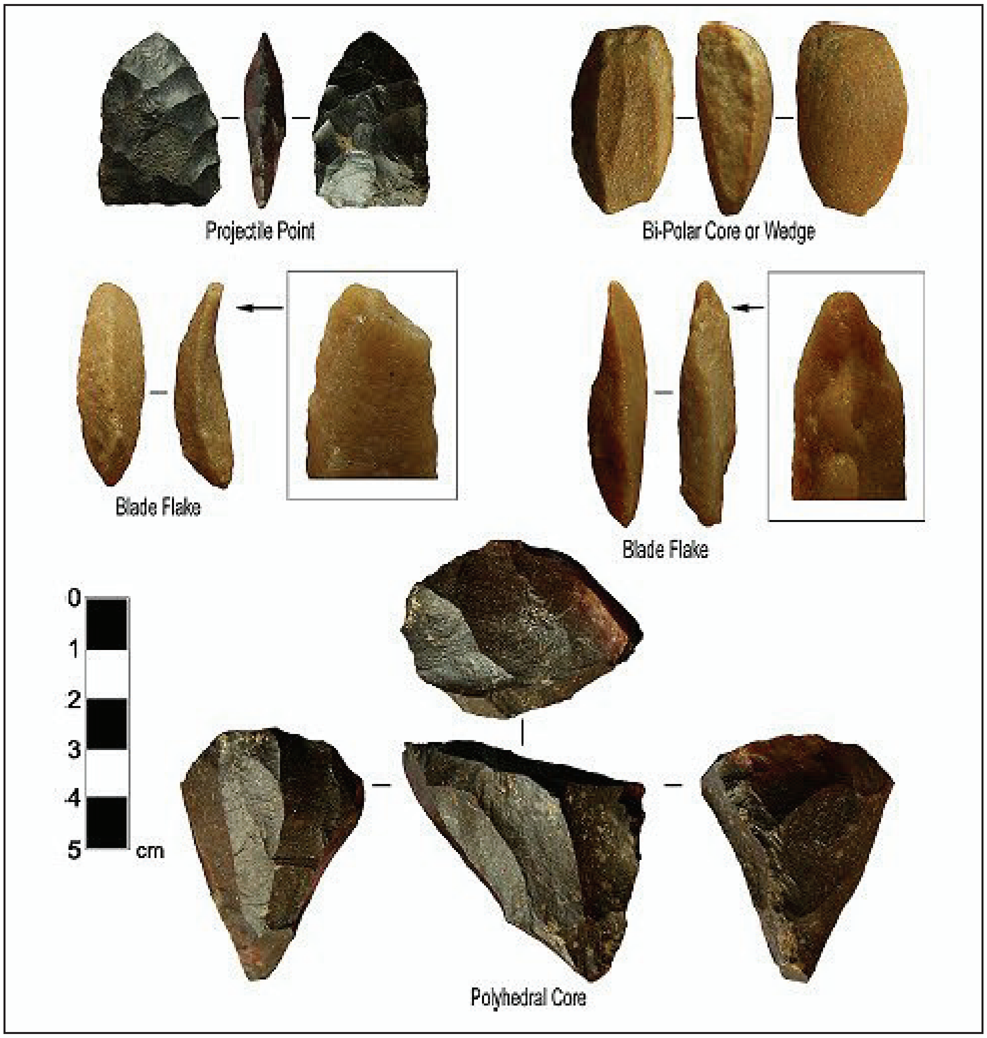


Figure 47. Artifacts recovered from the Miles Point, Maryland site including pentagonal projectile point, quartzite blades, bi-polar bladelet core, and a polyhedral bladelet core. (Source: ResearchGate.net from Darrin Lowery)

The discovery of the Cinmar biface and similar laurel leaf-shaped points in and around Chesapeake Bay served to give rise to the "Solutrean Theory" of Clovis origins (Bradley and Stanford 2004, 2006; Stanford and Bradley 2014; Stanford et al. 2014). As detailed above, the failure to discover an obvious Clovis antecedent in eastern Siberia led to further questions regarding the technological origins of the Clovis lithic industry; more specifically, the use of controlled overshot flaking in the manufacture of bifaces and the production of long, curved blades. The one technological industry known in archeology which shared many of these lithic traditions was the Solutrean culture (ca. 17,000-22,000 B.P.) of southern France and northern Spain. The problem was the approximate 4,000 year "gap" between the end of the Solutrean and the beginning of Clovis in North America. The discovery of Solutrean-like artifacts in the Cinmar biface and at Parsons Island and Miles Point and other sites along the Delmarva Peninsula which dated to 18,000+ B.P., seemed to solve this time gap problem (Stanford and Bradley 2012). Moreover, the location of sites along Chesapeake Bay and the Delmarva Peninsula and its continental shelf are also located just south of the maximum extent of the glaciation during the Last Glacial Maximum providing the optimum location for people fishing and hunting sea mammals (seals) along the ice sheet from Europe to ultimately wind up.

Of course, as would be expected, the postulation of a European (Solutrean) origin for Clovis ran into a storm of opposition with many scientists going to great lengths to "debunk" the theory (O'Brien et al. 2014). One of the most critically asked questions is "where are the boats"? Unfortunately, the key to proving the theory lies 100 km offshore at the edge of the continental shelf. Therefore we may never be able to prove (or for that matter disprove) the Solutrean theory. However, if Solutrean technology is not somehow related to Clovis, then the Clovis people must have invented a similar lithic technology independently.

An intriguing piece of possible evidence in favor of the Solutrean Theory was uncovered during an archeological excavation on Eppes Island, Virginia. During the excavation of a seventeenth century colonial home, a laurel leaf-shaped biface was found below the clay base of the chimney. At the time, it was recognized as possibly being of Solutrean origin and it was thought to possibly have been brought to America from France by one of the colonists as a souvenir. X-ray fluorescence analysis of the biface showed the lithic material to be identical to Grand Pressigny flint from France. Eppes Island is an erosional remnant of an upland terrace at the mouth of the James and Appomattox Rivers and would have been an excellent camp location during the Last Glacial Maximum. The biface's stratigraphic location below the foundation of the house's chimney suggests it probably was not part of the settler's possessions. Thus while it cannot be viewed as a solid piece of Solutrean-to-America evidence, it is an intriguing artifact to consider (Dennis J. Stanford, personal communication, 2013).

Meadowcroft Rockshelter, Pennsylvania

Meadowcroft Rockshelter is located approximately 50 km southwest of Pittsburgh near the Pennsylvania-West Virginia border. The rockshelter (actually a sandstone re-entrant) faces south and overlooks Cross Creek, a minor tributary of the Ohio River. During the Last Glacial Maximum, the site was 84 km south of the Laurentide ice sheet making it one of the northernmost locations for a Pre-Clovis occupation. The shelter appears to have been an ideal location for human occupation. It is situated 15 meters above Cross Creek which would have kept it dry during any flood event. Its southern exposure would have kept it warm and a prevailing west-to-east wind would have kept it largely smoke free (Adovasio and Pedler 2016).

The site was discovered by the local land owner, Albert Miller, whose family has farmed the area since 1795 (Adovasio and Pedler 2016). Miller resolved to protect the shelter from looters and thus brought it to the attention of Jim Adovasio of Mercyhurst University (Figure 48). Beginning in 1973 and continuing to this day, Adovasio and his teams have excavated a portion of the rockshelter from the surface to its lowest occupation levels four meters below the surface (Adovasio et al. 1978) (Figure 49). Stratum IIa contains the oldest evidence of human inhabitation. The unit is separated from those above and below it by episodes of rock falls from the ceiling. These events clearly establish the in situ location of the artifacts found within it. Stratum IIa has been dated to between 13,200 and 19,200 years B.P. and contains two distinct occupational horizons. The uppermost horizon dates to 13,200 and 15,100 years B.P. with the lower zone dating to 18,300-19,200 B.P. (Adovasio et al. 1990).

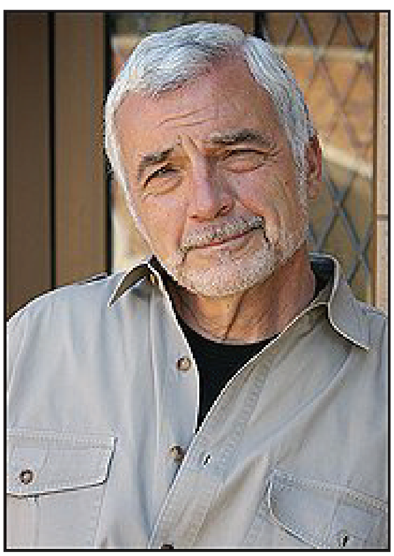


Figure 48. (left) Jim Adovasio, Principal Investigator of the Meadowcroft Rockshelter site in Pennsylvania. (Source: Alchetron: The Free Social Encyclopedia)

Figure 49. (right) Inside Meadowcroft Rockshelter. The white dots represent cultural levels where age dates have been obtained. (Source: Uncovering Pennsylvania)

Both horizons within Stratum IIa contain animal bones, mollusk shells, wood fragments, cordage, bladelets, worked flakes, and a large amount of chipped stone debitage. A single projectile point was recovered from Stratum IIa which is pentagonal-shaped and exhibits both percussion and pressure flake scars. The lateral edges of the point do not show any smoothing (grinding). The point, both in size and shape, is very similar to the pentagonal points found at Miles Point and Parsons Island. Adovasio named the projectile point a "Miller" point, after the site's owner (Adovasio et al. 1998) (Figure 50). All of the lithic material found at Meadowcroft is of general local origin and consists of Flint Ridge chert from eastern Ohio, Kanawha chert from West Virginia, and Onondaga chert from southern New York (Adovasio et al. 1978; Adovasio et al. 1998).

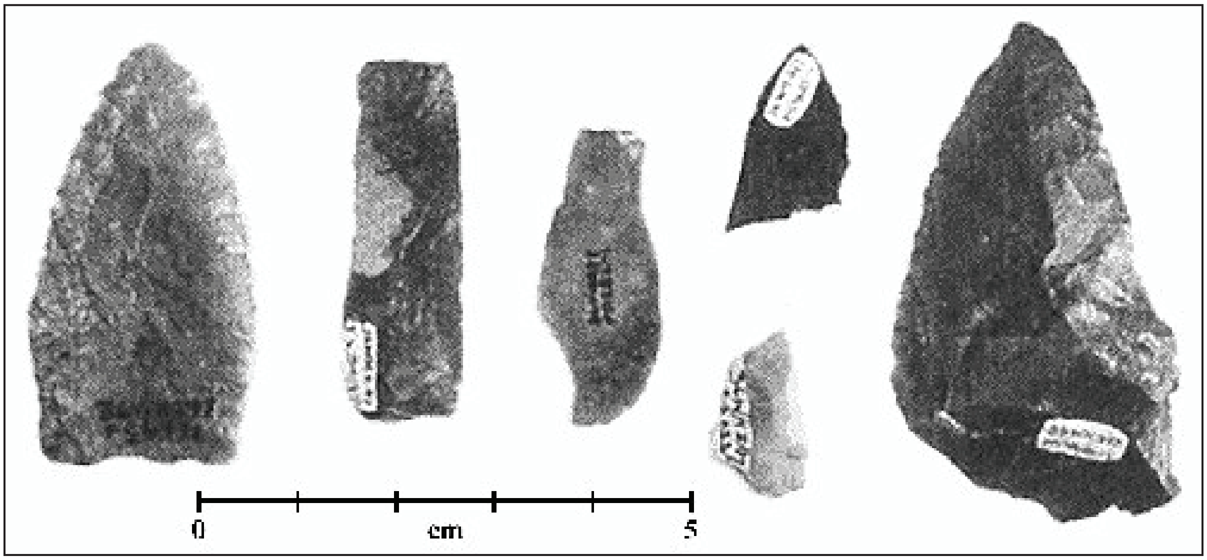


Figure 50. Lithic assemblage from the lowest levels of occupation at Meadowcroft Rockshelter. The pentagonal projectile point on the left is a Miller point, named for the location's land owner, Albert Miller. (Source: Athena Publications)

Meadowcroft is often cited as the type example of a perfectly excavated site with meticulous records, collection of artifacts, mammalian and floral data, and extensive stratigraphic age dating. There is virtually no disagreement that the site was occupied by at least 16,000 years ago and probably as long as 19,000 years B.P.

The excavations at Meadowcroft led to further exploration of the Cross Creek drainage system for similarly aged sites. A site named Krajacic was found close by which contained artifacts similar to those found in Stratum IIa at Meadowcroft including Miller points. The material at Krajacic was found just below the ground surface and may represent a mixed assemblage with later occupational material. However, Miller points and polyhedral/conical bladelet cores were recovered (Boldurain 1985). With the second find, Adovasio named the early occupation the "Miller Complex" (Adovasio and Pedler 2016).

Cactus Hill, Virginia

The Cactus Hill site is located on the east bank of the Nottoway River in southeastern Virginia (Sussex County). The location is 13 miles east of Fall Zone, a major limestone escarpment that defines the eastern margin of the Virginia Piedmont Plateau. A series of sandy wind-blown (aeolian) ridges have formed adjacent to the river. The site gets its name from the abundant prickly pear cacti that have grown over the top of the ridges. Abundant quartzite cobbles and boulders deposited along the edge of the Nottoway River and in alluvial point bars enhanced the attractiveness of the site to early hunter-gatherers.

Beginning sometime about 19,000+ years ago, these sandy ridges began to be occupied by human beings visiting the area. After the appearance of the first settlers to the area, sand ceased to accumulate and a stable surface allowed a soil to develop. Subsequent to this, there was a new round of dune formation followed by deflation. The deflation removed not only the more recently-developed sand but also much of the previous ridge, leaving only a thin zone of the earliest occupation. When Clovis hunters came to the area about 13,000 years ago, only three to six inches of the previous Pre-Clovis ridge was left. After Clovis times, there was a more or less continuous

Figure 51. Wind-blown sandy ridge where much of the Cactus Hill site material has been found. (Source: Virginia Department of Historical Resources)

period of sand ridge formation until the modern topography of the site was established (Wagner and McAvoy 2004) (Figure 51).

Two independent excavations have been carried out at the Cactus Hill site; one by Joe McAvoy and his team from the Nottoway River Survey and the other led by Mike Johnson and volunteers from the Archeological Society of Virginia. Both excavations have yielded identical results with the major site excavation report written by McAvoy and his team (McAvoy and McAvoy 1997; McAvoy et al. 2000). Since only a few inches separate the Clovis material from the older artifacts at the site, a primary concern for the excavators was the possibility of admixing due to bioturbation, either by animals or tree/bush root action. This potential problem appears to have

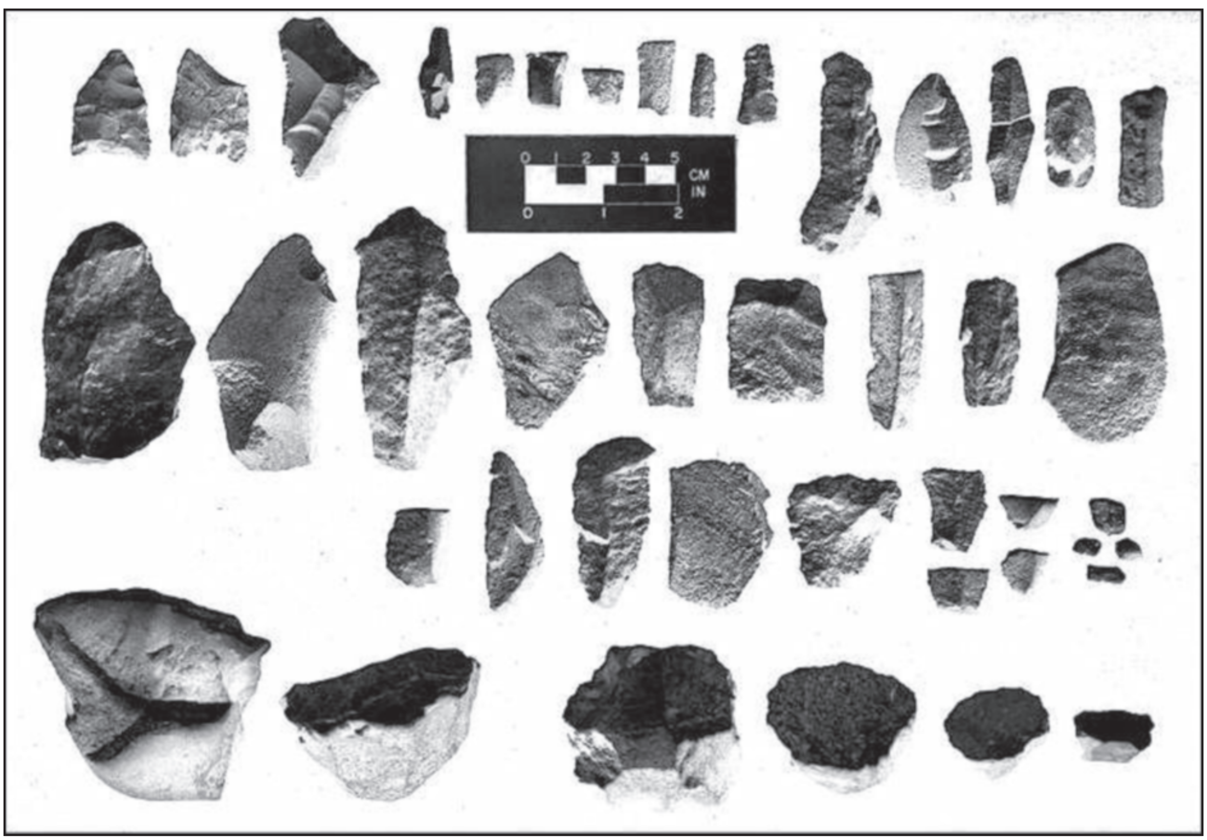


Figure 52. Artifact assemblage from the Pre-Clovis horizon at the Cactus Hill, Virginia site. (Source: Nottoway River Survey Archeological Research)

been eliminated mainly by the observed lithic materials at the site. The older-than-Clovis horizon primarily used the local quartzite whereas the Clovis hunters used cherts, jaspers, and other material that is not indigenous to the site area.

Three clusters of artifacts were found in the lowest level of the sand ridge. Two of these were associated with hearth features represented by small scatters of white pine-derived charcoal. The uppermost hearth yielded a date of 18,450 ± 450 B.P. Three quartzite blades and seven flakes were associated with the hearth (McAvoy et al. 2000). A second hearth feature slightly below the first produced a date of 19,800 ± 730 B.P. A series of Optically Stimulated Luminescence (OSL) dates were run over the entire stratigraphic section of the site which confirmed the dates obtained by radiocarbon analysis (McAvoy et al. 2000; Wagner and McAvoy 2004).

The uppermost cluster of artifacts (slightly above the uppermost hearth feature) contained two pentagonal-shaped projectile points, a retouched biface, and five small bladelets which averaged 29 mm in length, 6 mm in width, and 3.6 mm in thickness (Figure 52). The middle cluster consisted of the quartzite blades associated with the upper hearth feature. These blades average 66 mm in length, 28 mm wide, and 7.8 mm thick. The lowermost cluster six incomplete blades and broken tools made on blades. All the material except the two projectile points were constructed from local Nottoway River quartzite. The two projectile points were made from a meta-rhyolite not present in the region of the Cactus Hill site (Figure 53).

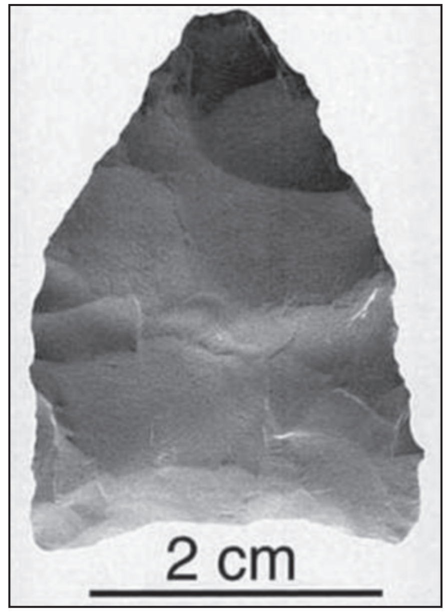


Figure 53. Pentagonal-shaped Miller point recovered from Cactus Hill, Virginia. (Source: Lithics Casting Lab, Troy, Illinois; www.lithiccactinglab.com)

The two projectile points recovered from Cactus Hill exhibit highly controlled percussion flaking and are sub-triangular to pentagonal in shape. They are extremely thin, and have no lateral edge grinding. Both in shape and manufacture they closely resemble the Miller points found at Meadowcroft and Krajacic in Pennsylvania as well as those from the Delmarva Peninsula sites.

Page-Ladson, Florida

The Page-Ladson site is located in northern Florida just at the beginning of the Florida Panhandle. The site is an inundated sinkhole which appears to have been formed from a pond or bog during Pleistocene times. When archeologists first explored the sinkhole (all exploration and excavation has to be conducted underwater), they found abundant "matting" of twigs, bark, and other tree material. It wasn't until later that they realized that all the "mat" material they were observing was the remains of mastodon coprolites (dung). Proboscideans are not very efficient digesters of plant material and much of what they digest passes straight through the gut without significant change. Mastodons, unlike their mammoth cousins, were browsers (not grazers) and tore off great branches of leafy material to eat. The Page-Ladson pond must have been a perfect hideaway with water and abundant leafy material for them to enjoy. The high concentration of dung (archeologists measured 21 square meters in the sinkhole and estimate the original deposit may have been as much as 50 square meters or more) (Halligan et al. 2016) indicates that the animals stayed in the area for a considerable time and/or continually returned to the area on a seasonal basis. Plant species identified within the mastodon coprolites included cypress, bald cypress, pond cypress, buttonbush, willow and others – all species that occur in the general area today.

Several mammoth tusks and other bones have been recovered from the sinkhole which have been radiometrically dated to 14,550 B.P. (Waters 2019). At least one of the tusks has man-made cut marks on it indicating that humans were present at the site and preyed on the mastodons (Figure 54). Several projectile points were found near the site but were displaced from the sinkhole and not in direct association with the mastodons. A team from Texas A&M University under the direction of Mike Waters conducted a large number of dives into the sinkhole, laying out an excavation grid and patiently excavating the area near the mastodon tusk. This work was extremely tedious as any disturbance of the bottom sediment resulted in the immediate decrease in visibility. Excavators could also only work for a few minutes at a time until their air supply got low (Mike Waters, personal communication, 2019). However, their work was rewarded with the discovery of an in situ broken biface. (Figure 55). The biface is made from a chert that sources to the Flint River Basin in Georgia. Interestingly, strontium isotope analysis of the mastodon remains indicates that they too came from Georgia. This coincidence (or not) suggests that the Pre-Clovis hunters may have followed the mastodons to the Page-Ladson site in order to ambush and kill them there.

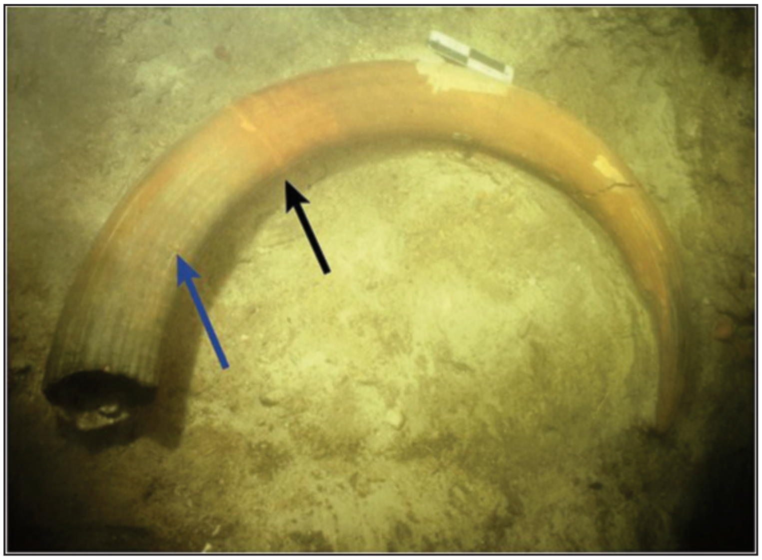


Figure 54. Underwater photograph of a mastodon tusk contained cut marks (see arrows) from the Page-Ladson sinkhole in Florida. (Source: Center for the Study of First Americans, Texas A&M University)

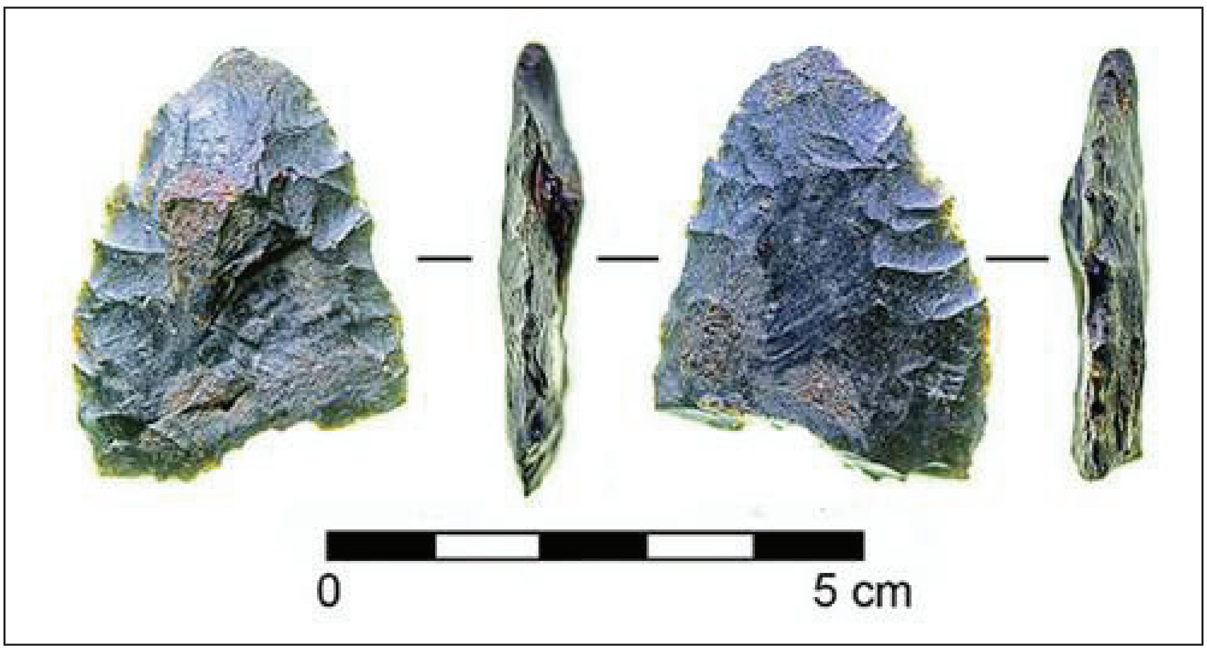


Figure 55. Obverse and reverse views of the broken biface recovered in situ from the Page-Ladson sinkhole in Florida. (Source: Center for the Study of First Americans, Texas A&M University)

Topper, South Carolina

The Topper site is located in Allendale County, South Carolina, about 70 km southeast of Augusta, Georgia and 110 km north of Savannah. The site occupies a terrace on the east bank of the Savannah River. The site is on a high terrace (7 meters) about 130 meters from the river. The archeological deposit is composed of four zones: (1) a lower zone on the terrace, (2) an upper hilltop zone three to four meters above the terrace, (3) a third zone on the gently sloping hillside adjacent to the hilltop, and (4) a large chert quarry at the foot of the steeply sloping hill. The site was discovered in 1981 by Albert Goodyear of the University of South Carolina who was led to the location by forester John Topper, for whom the site was named (Figure 55). Excavation by Goodyear in 1986 identified a well-developed Archaic occupation underlain by a very large Clovis age quarry and workshop

(Goodyear 2003). To obtain an independent assessment of the site's stratigraphy and chronological age, Mike Waters and his team from Texas A&M University were invited to conduct excavations at the site from 1999-2009 (Smallwood 2010; Smallwood et al. 2015). To date, over 600 square meters has been excavated at the site and work continues to this day.

Waters and his colleagues from Texas A&M observed three discrete occupational horizons at the site (Waters et al 2009). The uppermost (Stratum 3b) is a 1-1.4 meter thick layer of silty sand that washed down the slope and contains intact stratigraphic sequences dating from the eighteenth century A.D. to Paleoindian times. The Clovis horizon, occurs at the base of this sequence, and was dated using OSL techniques to 13,200 B.P. (OSL dating was used as burned plant and animal remains are rare at the site). Below the Clovis horizon, is a two meter thick layer of Pleistocene alluvial sand (Stratum 2) which in turn is underlain by a two meter thick section of silty clay (Stratum 1). The Pre-Clovis material found at the site occurs mostly in the upper sandy layer but some reported artifacts have been found in the silty clay as well. Waters dated the upper formation with a minimum OSL age date of 14,,800 to 15,200 B.P. (Waters et al. 2009). The lowest horizon at the site has one radiocarbon date taken from a hickory nut shell of 50,470 B.P. (Goodyear 2001, 2005) (Figure 57).

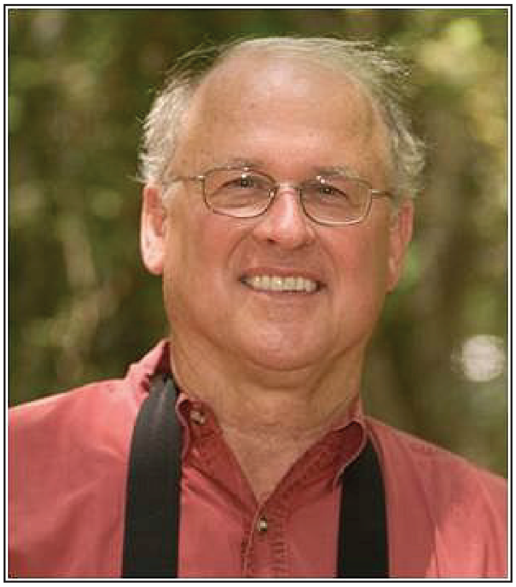


Figure 56. Al Goodyear, Principal Investigator of the Topper site near Allendale, South Carolina. (Source: Alchetron: The Free Social Encyclopedia)

Figure 57. Al Goodyear describing the stratigraphic profile exposed at the Topper, South Carolina site showing the Clovis horizon (1), the upper and lower Pre-Clovis horizons (2 and 3), and the lowest purported occupation zone (4) which has been dated to 50,470 B.P. (Source: people.delphiforums.com)

The most diagnostic artifacts from the Topper site come from the extremely prolific Clovis horizon which essentially surrounds a quarry of Allendale Coastal Plain chert. To date, over 40,000 Clovis artifacts have been recovered including bifaces in all stages of manufacture, fluted point preforms, fluted Clovis projectile points, blades, blade cores, unifacial flake tools, scrapers of many types, gravers, and countless pieces of lithic debitage (Adovasio and Pedler 2016) (Figure 58). In contrast, the 13,000+ artifacts recovered to date from the levels below the Clovis horizon are significantly more primitive and consist of crude blades, scrapers, one possible microblade core, and dozens of burins constructed using an unusual bend-break technique. Examples of some of the Pre-Clovis tools from Topper are shown in Figure 59.

I have personally had the opportunity to observe many of the Pre-Clovis "Topper Assemblage" artifacts at the Paleoamerican Odyssey Conference held in Santa Fe in October, 2013. A number of the artifacts do appear to have been human made, however others appear (at least to me) to be "geofacts" – produced by natural rather than man-made processes. This is certainly true for those artifacts from the lowest 50,000+ B.P. level. I firmly believe that there is Pre-Clovis evidence at the Topper site however, how much there is and of what lithic tradition remains to more fully investigated.

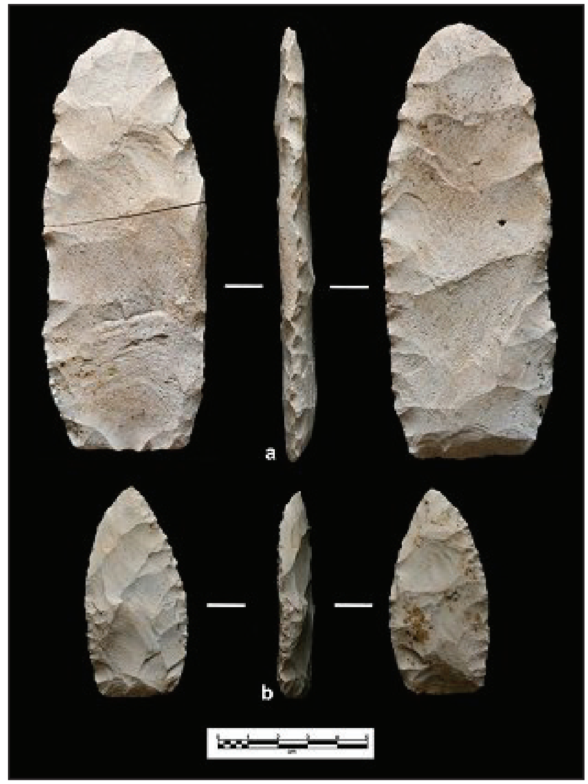


Figure 58. Large Clovis biface from the Topper, South Carolina site. (Source: ResearchGate.net from Al Goodyear)

Figure 59. Tools from the "Topper Assemblage", Pre-Clovis horizon at the Topper, South Carolina site. Top row, A, B, E, bend-break tools; C, D, bend-break spalls; Bottom row, F, G blades; H, possible microblade core; I, scarper; J, blade-like tool. (Source: ResearchGate.net from Al Goodyear).

Wisconsin Mammoth Sites – Schaefer, Hebior and Mud Luke

Four sites have been identified over the past three decades within a 200 square mile area of southeastern Wisconsin. These include the Schaefer, Hebior, Mud Lake, and Fenske sites. Of these, Schaefer and Hebior have received the most amount of work so I will focus mainly on these two sites as examples of the mid-continent Pre-Clovis occupations associated with mammoths.

The Schaefer and Hebior sites are located in Kenosha County, Wisconsin, southwest of Racine, 45 km south of Milwaukee and about 90 km northwest of Chicago. Both sites are about 15 km west of Lake Michigan and straddle the boundary between the Upper Mississippi Valley and Great Lakes drainage systems. The Schaefer and Hebior sites are located within one kilometer of each other on neighboring farms. Both were discovered as a result of agricultural drainage operations (Joyce 2006).

The Schaefer site was discovered in 1964 but it was not until 1992-93 that Dan Joyce of the Kenosha Public Museum in conjunction with the Great Lakes Archeological Research Center in Milwaukee excavated the site (Figures 60 and 61). Both the Schaefer and Hebior mammoths sites contain bone beds which are composed of a single male Jefferson's mammoth (*Mammuthus jeffersoni*). The Schaefer mammoth bones were concentrated in a nine square meter area, completely disarticulated (joints separated) and missing the front forelimbs (apparently carried away by the hunters and deposited else-

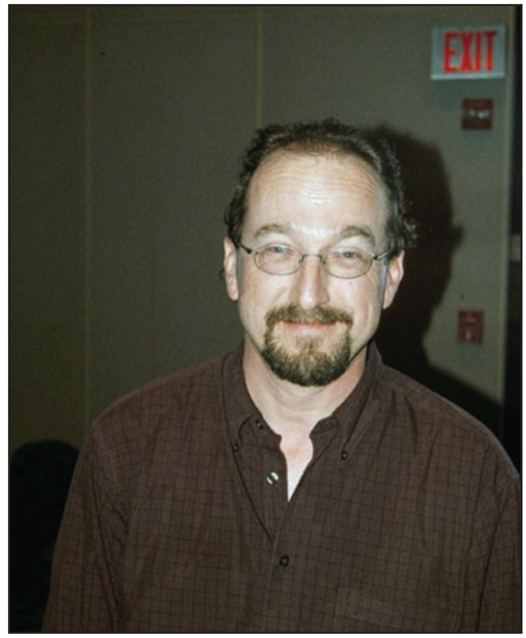


Figure 60. Dan Joyce, Principal Investigator of the Schaefer mammoth site near Racine, Wisconsin. (Source: Department of Anthropology, University of Arizona)

Figure 61. The Schaefer mammoth site during excavation. (Source: Department of Anthropology, University of Arizona)

where as they have yet to be found) (Joyce 2006). Ten of the bones exhibit a total of 30 cut marks as part of the butchering and de-fleshing process (Adovasio and Pedler 2016). After stacking the bones, the Schaefer mammoth appears to have been relatively quickly buried by pond sediments. The bones from the Schaefer mammoth were comprehensively dated using 15 Accelerated Mass Spectroscopy (AMS) radiocarbon dates on purified bone collagen. The dates range in age from as early as 15,150-14,630 B.P. to as late as 14,630-14,030 B.P. with an average around 14,650 ± 150 B.P. (Joyce 2006).

Two artifacts were recovered in direct association with the mammoth bones, both located beneath and in contact with the animal's pelvis. One is a small blade-shaped flake produced from a bifacial core and the second artifact is a larger blade that appears to have been heat-treated. Neither of the artifacts show extensive use-wear and both were made from locally-occurring chert (Joyce 2006).

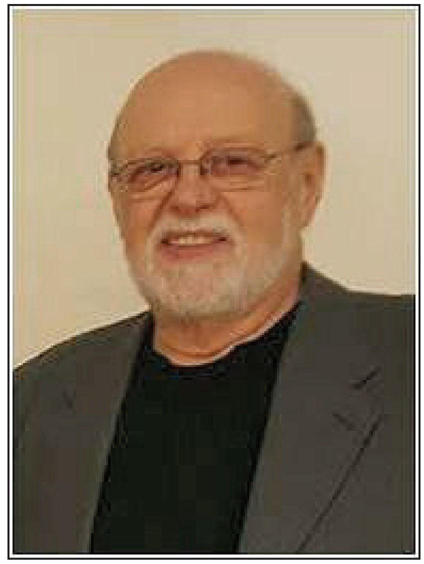


Figure 62. David Overstreet, Principal Investigator of the Hebior mammoth site near Racine, Wisconsin. (Source: Department of Anthropology, University of Arizona)

The Hebior site was excavated by David Overstreet in conjunction with the Great Lakes Archeological Research Center (Figure 62). Unlike the Schaefer mammoth bone bed, the bones at the Hebior site, while concentrated, were not disarticulated except for the frontal leg bones and feet. The Hebior mammoth exhibits nine cut marks, again mostly on the forelimbs and feet. A total of four artifacts were recovered in conjunction with the mammoth including two chert bifaces, a chert flake, and a dolomite chopper (Overstreet 2005) (Figure 63). The bifaces were recovered in association with the vertebra and both show use-wear consistent with the processing of meat. Three AMS dates were taken on purified bone collagen from the Hebior mammoth which range from as early as 15,170-14,670 B.P. to as late as 15,040-14,270 B.P. with an average around 14,850 ± 150 B.P. (Overstreet and Stafford 1997).

The age range for both sites is at least 1,000 years to as much as 2,000 years before Clovis. None of the artifacts recovered from either of the two mammoth sites can be associated with a definitive culture or lithic tradition. Joyce believes the two blades from the Schaefer site suggest the beginnings of a core and blade technology but

Figure 63. Three of the artifacts recovered in association with the Hebior mammoth. (Source: Kenosha Public Museum)

one lacking the sophistication associated with Clovis. Overstreet believes that the tools found in association with the Hebior mammoth belong to the Chesrow Great Lakes tradition (Overstreet 2005). Chesrow points are comparatively thick, basally-thinned projectile points that were ground along the lateral edges near the base. Except for thickness, they are similar to Miller points in overall morphology and manufacturing technique (Stanford and Bradley 2012).

Two additional Wisconsin mammoth sites, Mud Lake and Fenske, produced similar radiocarbon dates on mammoth bone collagen of about 16,050 years B.P. While there is some evidence that both mammoths were butchered, no lithic tools were recovered from either site.

Bluefish Caves, Yukon Territory, Canada

The Bluefish Caves are located above the Arctic Circle in the Yukon Territory of Canada, 54 km southwest of the First Nations community of Old Crow near the Yukon-Alaska border. The location is 770 km northwest of Whitehorse and 800 km northeast of Anchorage. The site was apparently known to the First Nations people but was "discovered" in the mid-1970s by Canadian archeologist Jacques Cinq-Mars while conducting an aerial survey of the region by helicopter. The site is made up of three caves that vary in size from 350 to 1,060 cubic feet. The caves are exposed at the top of a prominent limestone ridge in the Keel Range and provide an excellent view of the Bluefish River valley below (Figure 64).

Cinq-Mars excavated the caves during 1977-87, focusing on the larger Cave I (Figure 65). The caves were filled with aeolian (wind-blown) loess deposits which had blown into the caves during the Late Pleistocene. Buried in the aeolian deposits were the bones of numerous mammals including mammoth (*Mammuthus sp*.), Steppe bison (*Bison priscus*), muskox (*Ovibus moschatus*), Yukon horse (*Equus lambei*), Dall sheep (*Ovis dalli*), caribou (*Rangifer tarandus*), saiga antelope (*Saiga tatarica*), brown bear (*Ursus arctos*), mountain lion (*Felis concolor*), wolf (*Canis lupus*) and many smaller animals as well as birds and fish (Cinq-Mars 1979). No cultural features (ie., hearths) were located in the caves but many of the bones of the larger mammals exhibited butchering cut marks and a few of the larger mammoth bones appeared to have been broken and modified by percussion flaking activity. Also present in the loess were microblades and burins which apparently were the tools used in processing the meat. Unfortunately, none of the tools recovered could be absolutely placed in association with the mammal bones. Radiocarbon dates from the mammal bones in Cave I provided a wide range of ages from 29,170 to 23,000 B.P. (Cinq-Mars and Morlan 1999). Cave II provided a much more stable set of dates with a medium age of 24,070-23,170 B.P. (Cinq-Mars and Morlan 1999) However, the validity of the presence of human activity in Cave II came into question when a reanalysis of the bone assemblage found only two certain cut marks in over 6,000 bones collected.

As sadly had become the norm in North American archeology, Cinq-Mars had dared to challenge the Clovis First "paradigm" and as such, he was treated by the archeological community as a bit of a pariah. Undaunted, he steadfastly continued to make his case for the antiquity of the Bluefish Caves site and that the artifacts he had

Figure 64. Bluefish Caves, Yukon Territory. (Source: Yukon Ministry of Tourism and Culture)

Figure 65. Canadian archeologist Jacques Cinq-Mars mapping the lower bone bed exposed outside Bluefish Cave I, 1977-87. (Source: Smithsonian magazine)

recovered belonged to the burin and microblade technology that has been found in eastern Siberia and the American Paleoarctic.

In 2015-16, Lauriane Bourgeon of the University of Montreal re-examined the bones from Bluefish Caves (Bourgeon 2015) (Figure 66). She and Ariane Burke looked at the 36,000 bones collected from the caves and found 15 that had definite cut marks and another 20 with probable cut marks. The most definitive specimen was of a horse mandible that appeared to have had both the flesh removed from the jaw as well as its tongue cut out (Figures 67 and 68). The bones were sent to Oxford University in the U.K. for radiocarbon dating which yielded an unequivocal age date of 24,000 B.P. vindicating Jacques Cinq-Mars' original work (Bourgeon et al. 2017)

Figure 66. Lauriane Bourgeon. (Source: University of Montreal)

Figure 67. Horse mandible from Bluefish Caves which exhibited prominent cut marks from butchering. (Source: University of Montreal)

Figure 68. Detailed photo of horse mandible from Bluefish Caves showing distinct cut marks from human butchering. (Source: University of Montreal)

Manis Mastodon, Washington

In the mid-1970s, Emanuel Manis decided to construct a small pond on his property in northern Washington State University southwest of Seattle. In digging through six feet of peat he uncovered two large tusks of a mastodon. The site was excavated in 1977 by Carl Gustafson of Washington State University who recovered most of the remaining bones from the mammal. One of the mastodon's ribs near its junction with the spinal column appeared to contain a bone projectile point. Organic material found near the mastodon was dated to approximately 14,000 years B.P. Controversy ensued as the age date did not come directly from the bone material itself. Moreover, many theories were concocted to attempt to explain the alien piece of bone including it coming from as absurd an idea as an antelope attack. How or why an antelope would leap upon a mastodon's back and break off part of a horn wasn't explained. It did not have to be explained; a theory had to be put forward to ensure the Clovis First paradigm remained firmly in place.

Mike Waters of Texas A&M and the Center for the Study of the First Americans re-examined the controversial bone point in 2011 (Figure 69). He was able to obtain purified collagen from the mastodon rib bone which produced an age date of 13,800 B.P. (Waters et al 2011). CT scans and 3D projections of the bone clearly showed that the bone fragment embedded in the rib bone was a projectile point (Figures 70 and 71). The new work both vindicated the original archeology of Gustafson but also showed that there is a considerable amount of information that can be obtained with new, modern technology taking a re-look at promising old sites. Lastly, the discovery of a bone projectile point also shows that some Pre-Clovis peoples were using bone as well as stone (and also probably wood) as an integral part of their hunting tool kit.

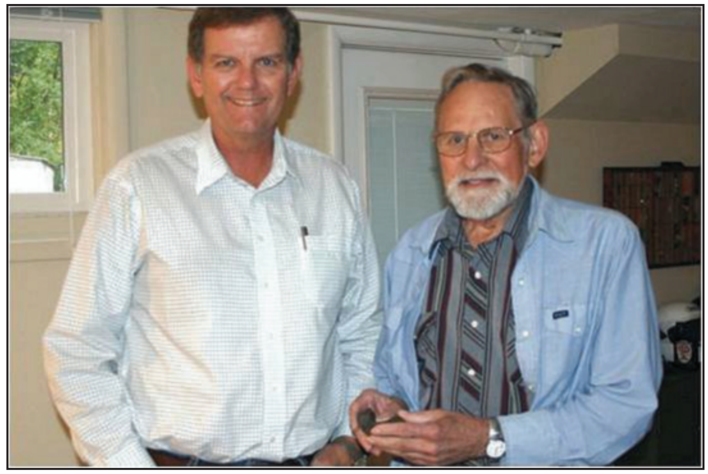


Figure 69. Mike Waters (left) and Carl Gustafson (right). (Source: Center for the Study of the First Americans, Texas A&M University)

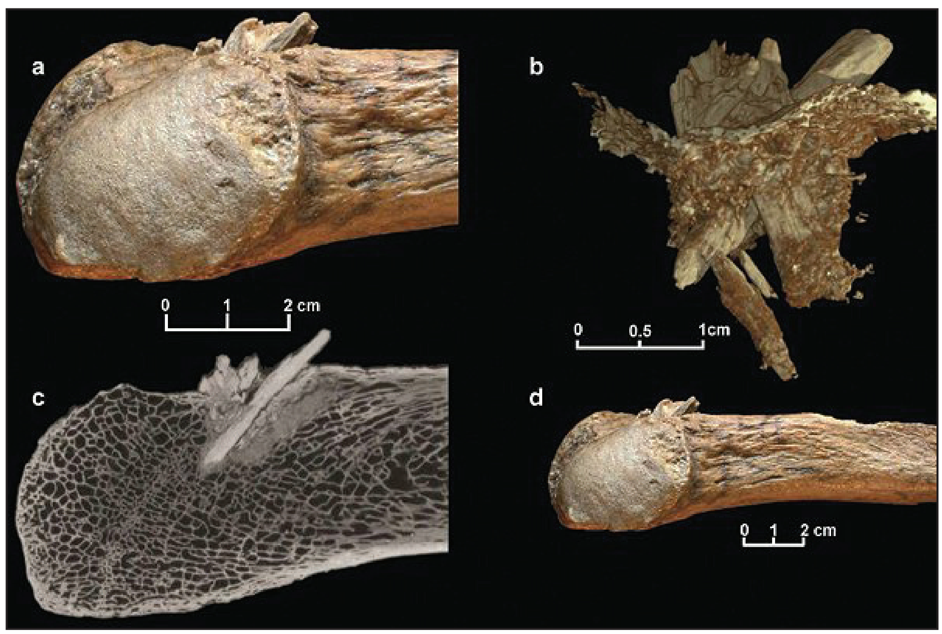


Figure 70. (left) Manis mastodon rib bone; the bone projectile point is near the top of the bone. (Source: Center for the Study of the First Americans, Texas A&M University)

Figure 71. (right) CT and 3D scans of the Manis mastodon rib bone and the emplacement of the bone projectile point. Photo b has had some of the surrounding rib bone removed and clearly shows the pointed nature of the projectile point. (Source: Center for the Study of the First Americans, Texas A&M University)

Paisley Five Mile Point Caves, Oregon

The Paisley Five Mile Point caves are located in the Summer Lake Basin of south-central Oregon, just north of the community of Paisley. The site occupies a basalt ridge of the former shoreline of Late Pleistocene pluvial (rain-fed) Lake Chewaucan (Figure 72) (Jenkins et al. 2013). The site is less than three kilometers away and 50 meters above the ancient lake shoreline. The shelter provided by the caves coupled with the proximity to water would have made it an attractive site for humans to inhabit. Moreover, the rich grasslands between the caves and the lake shore would have provided a prime habitat for grazing herds of mammoth, mastodon, bison, horse, elk, deer, pronghorn antelope, and llama. The lake itself would have provided fish as well as waterfowl (Jenkins et al. 2013).

Figure 72. Remains of Pleistocene Lake Chewaucan as seen from Paisley Caves.(Source: SFgate.com)

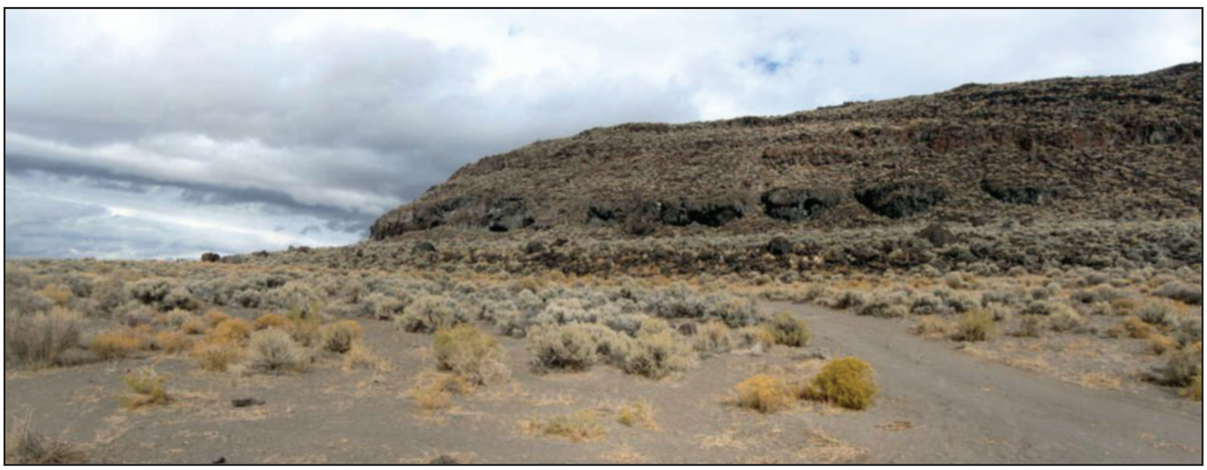


Figure 73. Paisley Five Mile Points caves, Oregon. (Source: SFgate.com)

The site is composed of a series of eight caves and rockshelters, roughly spaced about every 25 meters (Figure 73). They range in size from about 290 square feet to as much as 700 square feet. Since the end of the Pleistocene, the prevailing winds from the southwest have filled in some of the caves with sand and silt. The caves were first investigated between 1938-40 by University of Oregon archeologist Luther Cressman in company with Ernst Antevs whom many consider to be the father of Great Basin geology. Cressman looked at Caves 1, 2 and 3 and determined that there was a complete stratigraphic sequence from the surface down to the Late Pleistocene complete with artifacts in association with extinct mammal remains. Cressman's findings were largely ignored by the archeological community of the day and the caves remained open to looters until 2002 when Dennis Jenkins of the University of Oregon's Museum of Natural and Cultural History set out to test Cressman's findings (Figure 74) (Jenkins et al. 2013). Jenkins and his team have excavated at the site ever since and work is ongoing to this day.

Jenkins began his excavations by re-examining Caves 1, 2, and 3 which Cressman had excavated and then expanded his work to Cave 5. The earliest human evidence has been found at Caves 2 and 5 where over 180 radiocarbon dates have recorded a well-ordered stratigraphy that dates from the early Holocene (Early Archaic) to Clovis and then to Pre-Clovis (Figure 75). Cultural materials recovered from the site include lithic artifacts (mostly morphologically indistinct forms such as cores, biface fragments, and debitage), cordage (twisted rope from sagebrush and other materials), wooden artifacts, butchered animal bone, and other organic material such as hair, animal tissue, and hearth charcoal (Figure 76 and 77).

*Figure 74. Dennis Jenkins of the University of Oregon, Principal Investigator of the excavations at Paisley Caves, Oregon.
(Source: EurekAlert.org)*

Figure 75. Cave 2 stratigraphy, Paisley Caves, Oregon. (Source: ResearchGate.net from Dan Jenkins)

Figure 76. Sagebrush cordage recovered from Cave 5, Paisley Caves, Oregon. (Source: University of Oregon Museum of Natural and Cultural History)

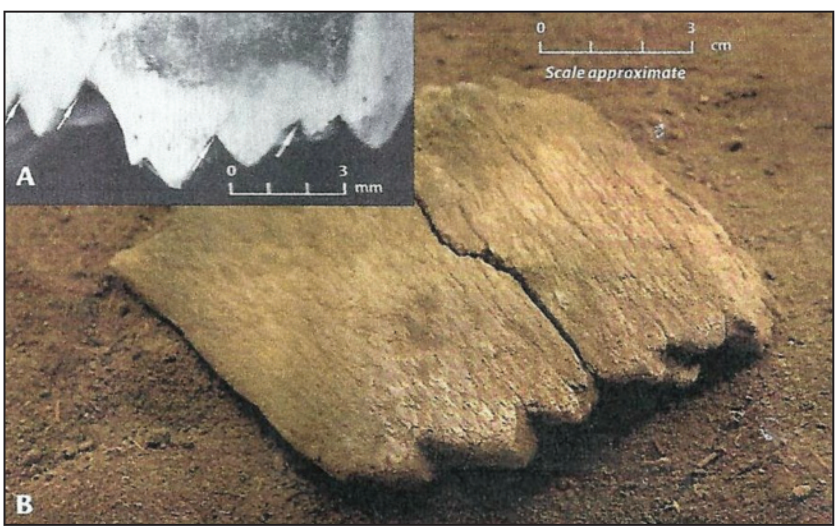


Figure 77. Possible hide-scraper made from bear bone. Paisley Caves, Oregon. (Source: University of Oregon Museum of Natural and Cultural History)

Age dates obtained on bone material from the Pre-Clovis horizon at Cave 5 included a butchered mountain sheep bone (14,850-14,110 B.P.), a modified bear bone flesher (see Figure 77) (14,200-13,980 B.P.), and a horse bone dating as early as 14,710-14,170 B.P. (Jenkins et al. 2013). The most definitive and controversial evidence for human presence at Paisley Caves has been the presence of human coprolites (Figure 78). Thirty-two radiocarbon dates have been obtained from these artifacts ranging from 14,860-14,140 years B.P. (Jenkins et al. 2012). The dates obtained from the human material correlate well with the age dates from the stratigraphy. Moreover, in shape, size, and form the coprolites look identical to human fecal material (Dennis Jenkins, personal communication, 2013). Detractors claim that the fecal material looks more like that from animals, but multiple lines of analytical evidence have confirmed only the presence of human and plant DNA in the coprolites.

Figure 78. Human coprolite from Cave 5, Paisley Caves, Oregon. (Source: University of Oregon Museum of Natural and Cultural History)

More recently, Jenkins' team has recovered fragments of several projectile points made from obsidian from the 14,000+ B.P. horizon that appear to correspond to the general Western Stemmed Tradition (Figure 79) (Jenkins et al. 2012). As we will see in the next section, Western Stemmed points represent a completely different lithic tradition from Clovis and are at least as old and probably older than Clovis.

Figure 79. Fragments of Western Stemmed Tradition (WST) projectile points from Paisley Caves, Oregon. (Source: University of Oregon Museum of Natural and Cultural History)

Western Stemmed Tradition (WST)

The archeological record of the Late Pleistocene in the Intermountain West is dominated by stemmed rather than fluted projectile points known collectedly as the Western Stemmed Tradition (WST). Historically, stemmed projectile points have taken a back seat to the fluted technologies which garnered most of the early scientific attention (Bryan 1980). This, of course, derives from the discovery of fluted points in conjunction with extinct megafauna at Folsom, Clovis, and other localities in the 1920s and 1930s. (Wormington 1957).

The first report of stemmed projectile points from the shores of Pleistocene pluvial lakes was by Elizabeth and William Campbell in the Mohave Desert (Campbell et al. 1937), while the first discovery in a buried context came from Paisley Caves (Cressman 1942). Over the next seven decades many more buried and surface sites have shown that the tradition of ancient stemmed projectile points extended over a vast part of the American west, stretching from California's Mohave Desert to western Canada (Beck and Jones 1997, 2010; Jenkins et al. 2013; Rosencrance 2019). Despite this widespread occurrence, the lack of buried sites with both intact stratigraphy and datable material has hindered the establishment of a solid chronology for western stemmed points as well the interrelationship between individual projectile point types. The principal researchers most involved with trying to unravel the mystery associated with the WST are Charlotte Beck and her husband, George Jones, both of Hamilton University (Figure 80).

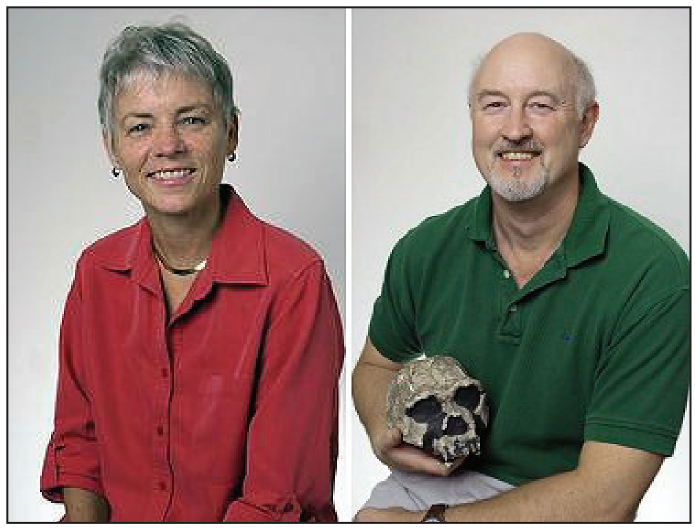


Figure 80. Charlotte Beck (left) and George Jones (right) of Hamilton University. (Source: Hamilton University)

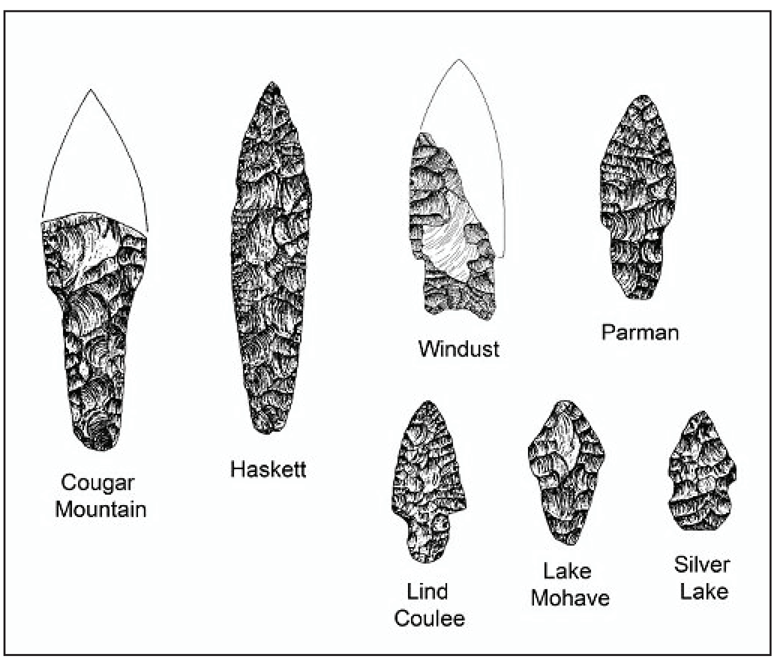
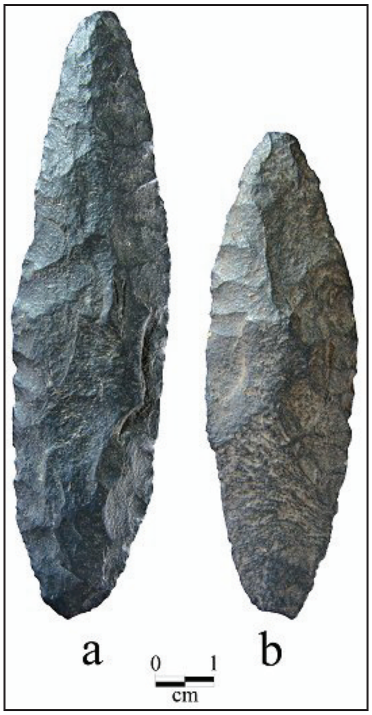


Figure 81. Common Western Stemmed Tradition projectile point types. (Source: ResearchGate.net from Charlotte Beck and George Jones)

A number of projectile point types have generally been assigned to the Western Stemmed Tradition (Willig and Aikens 1988; Beck and Jones 2010). These include Cougar Mountain (Layton 1970), Silver Lake and Lake Mohave (Amsden 1937), Parman (Layton 1970), Lind Coulee (Daugherty 1956), Windust (Scott 2016), and Haskett (Butler 1965; Sargeant 1973). All of these types generally have long, contracting stems; however, the length of the stems can vary with both lithic material and use (Figures 81-84).



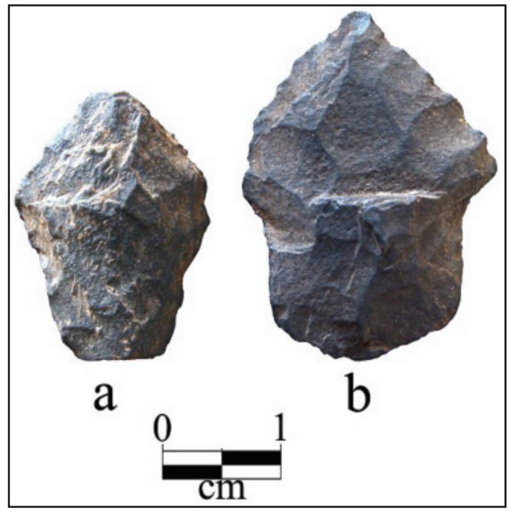


Figure 84. Parman type projectile points excavated by the author from Rock House Springs, Teels Marsh, Nevada.

Figure 82. (left) Large Haskett points excavated by the author from Rock House Springs, Teels Marsh, Nevada.

Figure 83. (center) Silver Lake projectile point excavated by the author from Rock House Springs, Teels Marsh, Nevada.

Western Stemmed Tradition points differ from Clovis and other early Paleoindian points in a number of ways. In particular, side-struck instead of end-struck flake blanks were the preferred method of initial tool construction (Pendleton 1979). Flake blanks were also reduced to a very considerable degree at the lithic source and then carried to occupation sites (Beck et al. 2002). Unlike Clovis and other early Paleoindian point types, Western Stemmed Tradition points are almost exclusively made from either obsidian or other fine-grain volcanics (basalt, dacite, andesite) as opposed to chert (Fagan 1974; Amick 1995; Willig and Aikens 1988; Beck and Jones 2010; Jones et al. 2003). Western Stemmed Tradition points are also typically narrower, lack any type of fluting, and require an altogether different construction method than Clovis points. Beck and Jones (1993) have also shown that many WST points served multiple functions and were not used solely as projectile points.

Historically, the Western Stemmed Tradition was thought to be derived from a fluted point industry in the Intermountain West (Willig and Aikens 1988; Beck and Jones 2012). However, more recently, sites have been found that show Western Stemmed Tradition points are coeval in age or even older than Clovis (Jenkins 2007; Jenkins et al. 2013; Beck and Jones 2012; Davis et al. 2019). Due to the lack of stratigraphic context at many Great Basin sites, age dates for many of the Western Stemmed Tradition points are relatively scarce. Galm and Gough (2007) dated Haskett points from Sentinel Gap, Washington between 10,010 ± 60 to 10,680 ± 190 B.P. Bedwell (1973) dated Haskett points from Connley Cave, Oregon at 11,200 ± 200 B.P. Parman points have been dated at Wildcat Canyon, Oregon at 10,600 ± 200 B.P. (Dumond and Minor 1983). More recently, the discovery of WST points at the lowest levels at Paisley Caves (Jenkins et al. 2012; Jenkins et al. 2013) and at Cooper's Ferry in Idaho (Davis et al. 2019) have shown that these forms extend back to at least 14,000-16,000 B.P. As such, they clearly precede the advent of Clovis and yet extend in usage to beyond Clovis. Neither technology looks like it is an antecedent to the other. Does this imply that there were two separate technologies evolving in North America simultaneously? What are the ages of specific WST point types and how do they relate to one another? Much more research needs to be done in the Intermountain West in the future in order to clear up some of the questions that recent discoveries have now raised.

Cooper's Ferry, Idaho

The Cooper's Ferry site is located within a river terrace at the confluence of Rock Creek and the Lower Salmon River in western Idaho near the Oregon/Washington border. The Salmon River is a tributary of the large Columbia River Basin. At the location of Cooper's Ferry, the Salmon River has cut deep into the Columbia Plateau basalt and the site rests on an elevated alluvial terrace 10 meters above the river. The Nez Perce Tribe refers to the area as an ancient village site which they call "Nipehe". Peoples moving down the Pacific Coast would have found the Columbia River as one of the first major highways into the interior of the continent.

Cooper's Ferry was originally investigated by B. Robert Butler in the early 1960s who uncovered stemmed projectile points in stratigraphic context. Though none of the levels were dated, Butler's work was of significant interest to the sites' current Principal Investigator, Loren Davis of Oregon State University, because it contained both WST points and the stratigraphy was undisturbed (Figure 85). The site has been investigated by Davis and his team for a number of years as a joint development between Oregon State and the Bureau of Land Management. Oregon State even ran its field school at the location. Early work discovered occupational levels down to early Paleoindian (ca 12,000 B.P.). Recently, Davis decided to go deeper and see what lay below the previously believed lowest level of occupation at the site (Figure 86).

Figure 85. Loren Davis of Oregon State University, Principal Investigator of the Cooper's Ferry, Idaho site. (Source: Oregon State University)

Figure 86. Excavations at the Cooper's Ferry, Idaho site. (Source: Davis et al. 2019, doi: 10.1126/science.aax9830)

The new work uncovered the butchered remains of a horse, a hearth, and 189 lithic artifacts – 27 of which were tools including broken projectile points, biface fragments, blades, and flake tools (Davis et al. 2019) (Figure 87). The stemmed points from Cooper's Ferry are remarkably thin, most only 4.5-5.3 mm thick. According to Davis, this is due to the fact that they were heavily finished using pressure flaking, not percussion techniques. Charcoal and bone samples from the oldest level associated with human artifacts have yielded a radiocarbon age dates of 16,560 to 15,280 years B.P. (Davis et al. 2019). Other conformational dates from the same level consistently date between 14,000-16,000 B.P. These dates are the oldest thus far found in western North America where man-made tools are in absolute direct association with mammal remains.

Figure 87. Lithic assemblage including projectile points, biface fragments and a blade from the lowest levels (15,000-16,000 B.P.) at the Cooper's Ferry, Idaho site. (Source: Davis et al. 2019, doi: 10.1126/science.aax9830)

The ice-free corridor between Alaska, Canada, and the lower part of North America is believed to have become passable somewhere around 14,800 years B.P. (Adovasio and Pedler 2016). The evidence from Cooper's Ferry now suggests that people migrating into North America did not wait until the glaciers melted but instead moved down the Pacific Coast and into the interior where natural highways, such as the Columbia River, provided access.

Paleocoastal Culture, Channel Islands, California

Although there are a few terminal Pleistocene sites along the coast of Peru (Meltzer 2009; Dycus 2019), and seaweed has been dated to >14,000 B.P. at Monte Verde in Chile (Dillehay 2008; Dycus 2019), little is known about the settlement of the North American Pacific coastline. California's northern Channel Islands are separated from the mainland by a minimum of 7 to 20 km since the end of the Last Glacial Maximum. They have a relatively sparse flora and fauna but a wealth of marine resources including seaweed, marine mammals, shellfish, finfish, and seabirds.

Until 10,000 years ago, the three northern Channel Islands (San Miguel, Santa Rosa, and Santa Cruz) were connected as one large island geologists refer to as "Santarosae" (Erlandson et al. 2011; Erlandson et al. 2016). Since about 13,000 B.P., sea levels have risen by about 70 meters, shrinking the size of the islands and moving the shoreline by as much as 10 km. Terminal Pleistocene shorelines where ancient peoples most likely lived are now completely submerged. However, three large Paleoindian sites have been excavated on the islands. Two of these are surface shell middens on San Miguel and the third is a large buried site on Santa Rosa.

At the large site on Santa Rosa, 52 small Channel Island Barbed projectile points along with 15 crescent tools were recovered (Figure 88). Other tools found in situ include biface preforms, flake tools, abundant debitage, and a piece of red ochre with a prominent incised line across it (see Figure 88). The majority of the tools are made from local chert indigenous to Santarosae (chert was recovered from Cardwell Point on San Miguel Island) but one piece of obsidian was recovered. XRF analysis sourced the obsidian to the Coso Range of southeastern California indicating that the inhabitants of Santa Rosa ranged as far inland as near the California-Nevada border.

More than 5,000 bone fragments were recovered from the site on Santa Rosa. The faunal assemblage is dominated by waterfowl and seabirds such as Canada goose, snow goose, cormorant, and albatross. The Channel

Figure 88. Channel Islands lithic assemblage from Santa Rosa site CA-SRI-512 Channel Island Barbed points (left) and crescents (center). (Source: ResearchGate.net from Jon Erlandson)

Island Barned points were likely used to hunt birds but remains of pinnipeds (seal) and other small mammal bones were also found. Fish species present at the site included rockfish, greenling, sculpin, and members of the herring/sardine family. Shellfish present include red abalone, giant chiton, mussel, black turban snail, and various species of crabs (Erlandson et al 2011).

AMS dates taken on marine shells from the surface middens yielded age dates of 12,250 to 11,200 B.P. with an average of approximately 11,850 Erlandson et al. 2011). However, a twig taken from one of the middens dated to 13,200 years B.P. and may be indicative an older occupation at the site.

A single human skeleton has been excavated from the Arlington Springs site on Santa Rosa Island and dated to 13,200 $\pm$ 200 years B.P., coeval with Clovis (Orr 1962, 1968). Taken with the twig from the site on Santa Rosa Island, this places the Paleocoastal culture at least equal in age to Clovis. The Channel Island barbed points are extremely small, more likely to have been used with a bow than as an atlatl dart. Similar projectile points in both form and size are known from Japan (Dennis Stanford personal communication 2013). The finds described here represent yet another culture present at the same time as Clovis, that clearly is not an antecedent or apparently related.

Paleocoastal Culture, Cedros Island, Baja California

Another part of the Paleocoastal culture is currently being explored by Matthew Des Lauriers, Director of the Anthropological Institute at Cal State Northridge, on Cedros Island off of Baja California (Figures 89 and 90). Since 2008, Des Lauriers and his team have been exploring ancient settlements on the island and uncovering additional evidence of how the ancient paleocoastal peoples lived. Prior to about 14,500 years B.P., Cedros Island may have been connected to the Baja California peninsula by a land bridge, possibly only traversable at low tide. However, by 8,000 B.P., sea levels had risen completely cutting off the island from the mainland.

Des Lauriers in conjunction with Loren Davis from Oregon State are systematically excavating a number of well-stratified sites composed of wind-blown sand and silt. Embedded in the sediments are scattered marine shells, lithic artifacts, and concentrations of charcoal (Des Lauriers et al. 2017). One of the most exciting discoveries was made at the Richard's Ridge site in 2009 when Des Lauriers uncovered the first, incontrovertible fishhook found on Cedros Island (Figure 91). The fishhook is made from mussel shell and shaped into a 180° curve. Des Lauriers postulates that the fishhook was attached to a line of agave fiber which has unusually strong gripping power. The line may have then been cemented to the hook using a binding agent of conifer resin mixed with wood ash, animal feces, or other macerated fibers. Age dates for material directly associated with the fishhook date to 12,600-10,400 years B.P. (Des Lauriers 2017). Even more exciting is that the fishhook did not come from the lowest levels of occupation at the site and there are dozens of similar sites across the island waiting to be excavated.

To date, Des Lauriers has found evidence that the Cedros islanders exploited shellfish, sea lions, elephant seals, sea birds, and fish. Vertebrae found in the sites indicate that some of the fish that were caught were taken from the deeper water ocean and not just from the shoreline. Therefore, the indigenous inhabitants knew how to make and use watercraft. Moreover, some of the fish skeletons are almost human size. Therefore the shell fishhooks they made were strong enough to catch very large marine fish.

Figure 89. Map of Baja, California. Cedros Island lies off the west coast about midway down the peninsula. (Source: WorldMap.com)

Figure 90. Matthew Des Lauriers, Principal Investigator at Cedros Island, Baja, California. (Source: Science, www.sciencemag.org)

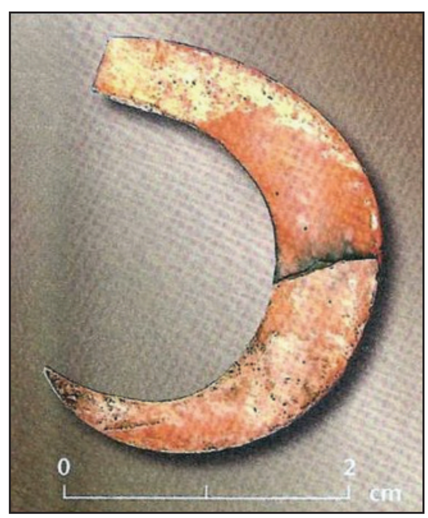


Figure 91. Shell fishhook recovered by Matthew Des Lauriers and his team from Cedros Island, Baja, California. (Source: Mammoth Trumpet, 2019, 34(3):8)

Buttermilk Creek Complex, Debra Friedkin Site, Texas

The Debra Friedkin site (41BL1239) is located in Bell County, central Texas. The site is approximately 250 meters downstream along Buttermilk Creek from the famous Gault site. Excavations at the site began in 2006 under the direction of Mike Waters of Texas A&M University and Director of the Center for the Study of the First Americans (Figure 92). The site is located on an adjacent property to the Gault site and thus was named in honor of the current land owner, Debra L. Friedkin.

Early humans would have been attracted to the area encompassed by Buttermilk Creek for a large number of reasons including its relatively mild climate, a perineal source of fresh water – both from the creek and a series of freshwater springs, a large variety of plant and animal resources (whitetail and turkey frequent the Buttermilk Creek valley today), and an abundant supply of high quality Edwards chert. The latter occurs both as scattered nodules within the valley as well as embedded in the Cretaceous age limestone that forms the valley wall. Edwards chert is considered by modern flint knappers to be among the highest quality chert toolstone in North America. These prime conditions apparently have lasted for thousands of years as excavations have shown an almost continual occupation of the area from the Late Prehistoric near the surface to the deeply buried Pre-Clovis level.

Figure 92. Mike Waters, Director of the Center for the Study of the First Americans at Texas A&M University and Principal Investigator at the Debra Friedkin site, Bell County, Texas. (Source: Texas A&M University)

The excavations at the Debra Friedkin site were focused on two areas, both located in terraces composed of Pleistocene floodplain deposits. Block A, which contains the Pre-Clovis occupation, sits on the second terrace above the creek and Block B on the first terrace. The stratigraphy exposed in Block A consists of a colluvium of sand and clay resting on Cretaceous limestone bedrock, which in turn is buried by 1.2-1.4 meters of clay that was periodically deposited during flood events of Buttermilk Creek.

Excavation of the site took place over two periods, the first from 2006-2009 and a second excavation between 2015-16. Together, a total of 104 square meters of Block A has now been investigated. Nine distinct soil horizons were identified in the excavation of Block A which consisted of over 50 one x one meter squares (Waters et al. 2011) (Figure 93). Together, 104 square meters of Block A has now been investigated.

In the upper 1.1 meters of floodplain sediments at Block A, over 639,000 artifacts were recovered, including 4,600 tools of which 130 were time diagnostic projectile points ranging from the Late Prehistoric to Paleoindian period. Below the Late Paleoindian horizon, a thin (10 cm) layer was found to contain three Folsom points and below this, a horizon that contained numerous diagnostic Clovis artifacts including completed projectile points, pre-

Figure 93. Researchers from Texas A&M excavating Block A at the Debra L. Friedkin site, Bell County, Texas. (Source: Texas A&M University)

forms, bifaces, overshot and channel flakes, and blades. The Pre-Clovis horizon, which Waters termed the "Buttermilk Creek Complex", lies in a 20 cm zone below the Clovis occupation (Waters et al. 2011). Up to 30 cm of archeological sterile sediments lies below the lowest cultural horizon.

Due to the acidic nature of the soils and thus poor preservation of organics at the site, the stratigraphic section at Block A was dated using Optically Stimulated Luminescence (OSL) technology. Samples for OSL dating were taken by hammering copper tubes (10-15 cm in length and 2.6 cm in diameter) into the soil profile. A total of 70 OSL dates were obtained from the site, and along with diagnostic artifacts recovered from each soil horizon, confirmed the undisturbed nature of the site. The 18 OSL dates taken from the Pre-Clovis zone yielded dates from 13,500 B.P. to 17,000 B.P. with the occupational horizon spanning the time frame from 13,500 to 15,500 B.P. (Waters et al. 2011).

About 100,000 total lithic artifacts have been excavated from the Pre-Clovis horizon, the majority of which are macro- and micro-lithic debitage. Three hundred and twenty eight distinct tools were recovered including 12 complete and fragmentary projectile points along with bifaces, blades, bladelets, blade cores, worked flakes, radial bend-break tools, and at least one piece of polished hematite (Waters et al. 2018) (Figure 94). Use-wear analysis on the tools showed evidence of polish and striations characteristic of cutting meat as well as grooving or incising hard material such as bone or wood.

Figure 94. Examples of artifacts recovered from the Pre-Clovis "Buttermilk Creek Assemblage" at the Debra L. Friedkin site, Bell County, Texas. (Source: Center for the Study of the First Americans, Texas A&M University)

The lanceolate projectile points include one complete specimen, one basal fragment, four medial fragments, and five tips (Figures 95 and 96). The one complete point (see Figures 95-96) has been re-sharpened but appears to have retained most of its original size and morphology. The blade is alternatively beveled and both the lower lateral edges and the base have been ground. Age dates taken from near the complete projectile point bracket around ca. 15,000 B.P. with other lanceolate fragments found between 13,550 and 15,500 years B.P, (Waters et al. 2018).

As might be expected, when the original description of the Buttermilk Creek Complex was published in 2011, it was met with

Figure 95. Complete lanceolate projectile point in situ in the Pre-Clovis horizon at the Debra L. Friedkin site, Bell County, Texas. (Source: Center for the Study of the First Americans, Texas A&M University)

Figure 96. The same lanceolate projectile point after its removal from the Pre-Clovis horizon at the Debra L. Friedkin site, Bell County, Texas. (Source: Center for the Study of the First Americans, Texas A&M University)

both acceptance and rejection from the archeological community. One of the harshest areas of criticism came from the fact that the individual occupation horizons at the site are relatively thin and as such, are potentially susceptible to animal burrowing and admixing of units due to the action of vertisols (Morrow et al. 2012).

Vertisols are soils which contain swelling clays such as montmorillonite. They are common in Texas, especially in soils within the Blackland Prairie. As such, they are a constant potential problem that the archeologist needs to be aware of. The vertical provenience of artifacts is of critical importance to the archeologist. When a site is excavated, great care is taken to record data in stratigraphic context. Archeologists base their excavations on the principle of superposition; cultural materials are assumed to have been deposited with the youngest closest to the surface and get progressively older with depth. This relationship is also assumed to have remained constant through time. This basic principle is based on the assumption that the soil is a passive entity in an archeological site. With the presence of vertisols, this assumption is not always correct (Duffield 1970).

A vertisol is defined as any soil with a high enough content of swelling clays (typically >30 percent) to cause a high degree of volume change with variation in moisture content (Dudal and Eswaran 1988). Because they have high clay contents, vertisols have a low hydraulic conductivity and require extended periods of precipitation followed by long periods of aridity to fully swell and shrink. When vertisols contract during dry periods, vertical cracks form in the soil that allows material from the surface to potentially move downward in profile. As the soil moves, slickensides such as those seen in fault movements can develop on the soil surfaces within the cracks (Yalon and Kalmar 1978; Wilding and Tessier 1988; Lynn and Williams 1992; Dudal and Eswaran 1998). Rehydration during rainy periods causes re-expansion of the clays and the closing of the cracks. This action over time has the potential to disrupt and even destroy the stratigraphic context of a site, at least within the zone impacted by vertisol cracking (Lynne and Williams 1992; Keene 2011). The movement of archeological material by vertisols is known as “argilliturbation”.

Vertisols originate from base-rich materials including limestones, dolomite, and calcareous shales. Topographically, such soils are commonly found in lowlands and in areas that are gently rolling. Vertisol soils develop a characteristic microrelief pattern, known as gilgai topography that is associated with the movement of the soils (Wilding and Tessier 1998; Coulomb et al. 2000). In the United States, vertisols are particularly prevalent along the Gulf Coast in Texas, Louisiana, Mississippi, and Alabama (Duffield 1970). Vertisols have major implications not just for archeologists but on plant growth. Due to the high degree of argilliturbation that can damage tree roots, vertisols are not favorable for tree growth. This phenomenon is clearly present in the Pineywoods of Southeast Texas where trees grow most abundantly in well-watered areas such as along major streams and rivers (Kishue’ et al. 2009).

For a soil to be classified as a vertisol, it must meet five criteria: (1) it must have at least 50 cm (20 inches) of sediment before reaching any lithic horizon such as bedrock, (2) it must have a clay content of greater than 30 percent to a depth of 50 cm or greater, (3) the clay minerals making up the soil must be known “swelling clays”, usually the mineral montmorillonite, also known as “smectite”, (4) there must be open cracks at some point in the year that are at least one cm (0.4 inches) wide and extend for at least 50 cm below the surface, and (5) either gilgai relief or slickensides must be evident (Dudal and Eswaran 1988; Wilding and Tessier 1988; Kishue’ et al. 2009).

As a result, Waters and his team conducted exhaustive geologic and stratigraphic studies which concluded that the stratigraphy was largely undisturbed and non-mixed based on several lines of evidence including (1) the lack of artifact sorting by size from the top to the bottom of Block A, (2) pedogenic calcium carbonate present only on artifacts from the Pre-Clovis horizon, and (3) the ordered chronological sequence of the numerous OSL dates (Keene 2009).

The blades, bladelets, and overshot flakes recovered from the Pre-Clovis horizon show similarities with lithic technologies that would later be expressed to a larger degree in Clovis. The lanceolate shape and lateral edge grinding on some of the projectile points recovered during the second major excavation at the site also have similarities with Clovis. However, no examples of fluting are found in the Pre-Clovis level and there are no stemmed points in the Clovis horizon. The presence of certain core reduction strategies present in the Buttermilk Creek Assemblage suggest later Clovis lithic technologies and tool kit might have evolved from such an earlier complex.

The site's pre-Clovis occupation is supported by numerous lines of evidence including undisturbed stratigraphy, an abundant lithic assemblage that does not correspond to Clovis, and numerous OSL dates in association with the lithic artifacts which range from greater than 13,500 to 15,500 years B.P. In this regard, the Debra Friedkin site offers one of the strongest arguments for a Pre-Clovis occupation in North America.

Gault Site, Texas

The Gault site (41BL323) is located 250 meters upstream of the Debra Friedkin site in Bell County, Texas midway between Georgetown and Fort Hood about 40 miles north of Austin. The site has a long history of both uncontrolled artifact digging (pay dig) and controlled archeological investigations. Located in a small wooded valley (Figure 97), the site has the same ideal conditions for human occupation as the Debra Friedkin site including a perennial source of spring-fed water (Figure 98), floral and faunal food materials (the author has frequently seen whitetail deer in the woods surrounding the site as well as wild turkey), and an abundant source of extremely high quality Edwards chert (Barnes 2007). The latter occurs both as nodules in place within the Cretaceous limestone that flanks the valley (Figure 99) as well as loose boulders on the valley floor (Figure 100). In describing the Gault site, Mike Collins, the site's Principal Investigator, has frequently referred to it as "an embarrassment of riches" (Mike Collins, personal communication 2012).

The area where the Gault site is located was originally owned by Henry Gault (for whom the site is named) who put together a small, 250 acre farm in 1904 in Buttermilk Creek valley. Finding stone artifacts littering the valley on his property, Mr. Gault brought the site to the attention of James E. Pierce of the University of Texas. Pierce, one of the first professional archeologists in Texas, was drawn to the site because of its prolific Archaic midden. Excavations took place between 1929-30 but only extended in depth to the base of the Archaic. Over the next 60 years, the site was opened up to collectors as a "pay-to-dig" site. Fortunately, the artifact collectors did not dig below the Archaic midden mainly because the density of marketable artifacts began to thin out at that level.

Figure 97. View of Buttermilk Creek valley that encompasses the Gault site in the foreground.

Figure 98. One of the perennial fresh water springs that feeds Buttermilk Creek adjacent to the Gault archeological site.

Figure 99. Large nodule of Edwards chert (note geologic pick for scale) in place within the Cretaceous limestone adjacent to the Gault site.

Figure 100. Chert boulders which litter the floor of Buttermilk Creek valley next to the Gault site.

In 1990, an artifact collector decided to dig below the Archaic midden and found a Clovis point in conjunction with two incised stones. The discovery was brought to the attention of Michael Collins and Tom Hester of the Texas Archeological Research Laboratory (TARL) who carried out limited testing in 1991 to confirm the collector's story. However, the property owner at the time continued to promote pay-to-dig activities.

Fortunately for the prehistory of North America, the property changed ownership in 1998, all pay-to-dig activities ceased, and controlled scientific excavations were initiated. Over the period of 1998-2002, and 2002-2015, a total of 15 areas of the site have been excavated from the surface to bedrock. The excavations have been led through this entire period by the site's Principal Investigator, Michael Collins (Figure 101). Other noted participants at the site include researchers from Texas A&M, the University of Texas, Brigham Young, Exeter University in the U.K., and numerous other institutions and volunteers including members of the Texas Archeological Society. In 2006, the Gault School of Archeological Research (GSAR) was organized and the author is proud to have served 8 years on its Board of Directors – six as the organization's Vice President. Originally, the Gault Project was centered at the Texas Archeological Research Laboratory (TARL) in Austin. In 2010, the project moved to the campus of Texas State University in San Marcos where it was housed as the Prehistory Research Project. The GSAR returned to TARL in 2019 after its 10 year term with Texas State expired. To date, a total of six Ph.D.'s and 14 Master's theses have been completed on Gault site materials. Key members of the research team over this period include Tom Williams (Doctoral dissertation on the comparison of Clovis and Solutrean core-and-blade technology) and his wife, Nancy Williams (nee Littlefield) (Master's thesis on Clovis bifacial flaking technology) (Figures 102 and 103).

Figure 101. Michael Collins, Chairman of the Gault School of Archeological Research and Principal Investigator of the Gault project. (Source: Gault School of Archeological Research)

Initial excavations at the Gault site (1998-2002) focused on undisturbed early deposits below the looted Archaic midden. These digs uncovered a sequence of cultural materials that dated from Early Archaic to Paleoindian times including early Paleoindian (Angostura, Barber, Golondrina, St, Mary's Hall), Folsom, and Clovis horizons. Coupled with the earlier Late Prehistoric and Archaic occupations, the Gault site has representations of all 11 recognized cultures in Central Texas archeology.

Figure 102. (left) Tom Williams, Assistance Executive Director of the Gault School of Archeological Research and expert on Clovis and Pre-Clovis lithic technology.(Source: Gault School of Archeological Research)

Figure 103. (right) Nancy Williams, Lab Director of the Gault School of Archeological Research and expert on Clovis and Pre-Clovis lithic technology. (Source: Gault School of Archeological Research)

The early excavations at Gault shed tremendous light on the Clovis occupation especially with regard to the lithic technology and the vast number of other tools associated with the Clovis tool kit that previously had not had much scientific attention or study. Over 600,000 Clovis artifacts, much of which was lithic debitage, have been recovered to date. Tools include projectile points, preforms, bifaces in all stages of production, overshot, channel, and other biface thinning flakes, biface and blade (conical and flat-backed) cores, blades, microblades, adzes, gravers, perforators, and worked flakes of all types plus 142 incised stones. Additionally, faunal material from the Gault site included mammoth, bison, horse, whitetail deer, pronghorn antelope, rabbit, birds, and an extensive amount of turtle (Lundelius 1998; Lemke and Timperley 2008). Study of this material largely resulted in our new, more complete understanding of the Clovis lifestyle (Collins 1990, 1999; Collins and Lohse 2004; Collins and Hemmings 2005; Shoberg 2007, 2009; Pevny 2009; Bradley et al. 2010; Littlefield 2015; Williams 2016). Of particular note, the evidence from Gault suggested that some Clovis campsites served as more permanent base camps from which seasonal hunting forays would take place.

Excavations from 2007-2015 took place at Area 15 of the Gault site and were specifically focused on targeting the older-than-Clovis occupation. Prior excavations, primarily in Area 12, had indicated the presence of human occupation below the Clovis horizon. As such, Area 15 was selected as it was believed based on the geology of the site to potentially have the thickest Pre-Clovis horizon. The excavation of Area 15 encompassed a 56 square meter grid which stepped down from the surface in one meter increments. Individual unit squares within this block were one x one meter in size which were excavated in arbitrary levels of 5 cm. Excavation was conducted from the surface through 3.5 meters of culture-bearing alluvial fill to the top of Cretaceous bedrock (Comanche Peak Formation) (Figure 104). An unexpected result of the Area 15 excavation was that the upper levels through the Archaic midden had escaped looting so the entire stratigraphic section was intact. As such, additional archeological research was conducted in the Early Archaic and Late Paleoindian levels as well as the older Clovis horizon. OSL dates were obtained through all stratigraphic horizons which showed a coherent sequence of lithic material with age dates matching those from other known central Texas locations (Collins et al. 2013; Rodrigues et al. 2016).

The Clovis horizon in Area 15 was approximately 25 cm in thickness. Below the Clovis horizon, the excavations at Area 15 encountered a nearly sterile unit 10 cm in thickness. Below this, extensive Pre-Clovis material was found for approximately 55 cm until bedrock (Figure 105).

Figure 104. Excavations at Area 15, Gault site, Bell County, Texas. The Pre-Clovis level had yet to be reached when the author took this photo.

A total of approximately 150,000 artifacts, mainly debitage, were recovered from the Pre-Clovis horizon at Gault. This includes 184 tools including stemmed projectile points, bifaces, blades, bladelets, blade cores, radial bend-break tools, and worked flakes (Figure 106). In order to remove the word "Clovis" from defining this earlier technology, the Gault team adopted the term "the Gault Assemblage" to define anything found below the sterile layer below Clovis. In general, the Gault Assemblage shares a biface and blade lithic tradition with Clovis but

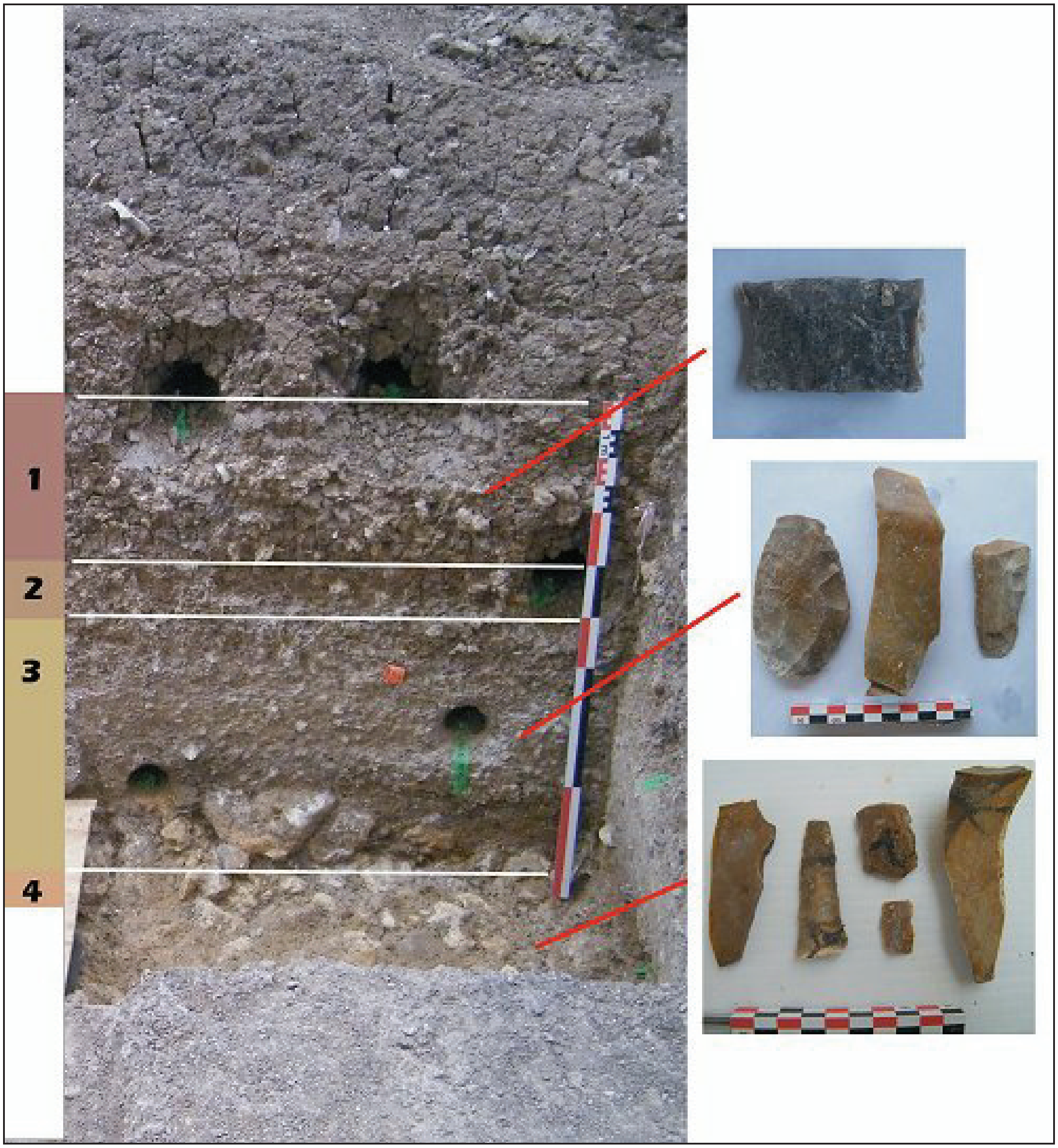


Figure 105. Stratigraphic cross-section for Area 15, Gault site, Bell County, Texas.
Level 1 is the Clovis horizon;
Level 2 is the sterile zone that occurs between Clovis and the older-than-Clovis material;
Level 3 is the Pre-Clovis horizon;
Level 4 is Cretaceous bedrock.
(Source: Gault School of Archeological Research)

manufacture of the tools differs from Clovis in a number of key ways. First, much of the Gault Assemblage exhibits the use of midline (comedial) flaking whereas Clovis used across-the-face or overshot flaking as a means to reduce biface thickness. Striking platforms are larger and less prepared in the Gault Assemblage than those seen in Clovis (Williams et al. 2018). Some rudimentary across-the-face flaking is occasionally present (Figure 107) but is difficult to say if this was planned or accidental.

One of the more unusual tools found in the Gault Assemblage (and at Debra Friedkin as well) are radially-fractured bend-break tools (Figure 108). On one side of the Buttermilk Creek valley, Cretaceous limestone (Edwards Formation) crops out. Large chert nodules are present in the limestone (see Figure 99) which erode out and tumble down into the valley floor (see Figure 100). There are also thin, 1-5 cm seams of chert present in the limestone. The Gault Assemblage people appear to have pried these seams of chert out and then struck them with

Figure 106. Gault Assemblage artifacts including projectile points (G, H, I, K, X and Y), bifaces (A, B, C, D, F, L, and P), blades (M, V, and W), blade core (E), gravers (O and T), end-scraper (Q), unifacial tool (N), worked flakes (R, S, T, and U), Area 15, Gault site, Bell County, Texas. (Source: Gault School of Archeological Research; Williams et al. 2018)

Figure 107. Biface from the Gault Assemblage which shows at least one across-the-face flake scar that extends beyond the midline, Area 15, Gault site, Bell County, Texas. (Source: Gault School of Archeological Research)

a hammerstone in the same manner one would break a plane of glass with a rock. The resultant fragments are exceedingly sharp and could have been used as fine-edged cutting tools (Figure 108). But the amount of work required to produce such an artifact begs the questions as to why would they go such trouble.

The projectile points from the Gault Assemblage exhibit two types of morphology – stemmed and lanceolate. Some exhibit slightly concave bases while others are clearly bifurcate (Figure 109). The bifurcate points are quite small (see scale on Figure 109) with an expanding stem and exhibit slight beveling. Several of the other projectile points recovered also are beveled and appear to have been produced from flakes and finished using pressure flaking. While on the surface they appear to resemble later Archaic point types, detailed analysis shows they are technologically and morphologically distinct (Williams et al, 2018). Most of the points recovered exhibit midline (comedial flaking) and only one has any grinding (smoothing) along the basal lateral edges. Another point shows weak shoulders and a contracting stem and is made of smoky quartz (Figure 110).

It is significant to note that all of the projectile points recovered from the Gault Assemblage were found in undisturbed sediments and date to greater than 13,800 years B.P. (Rodrigues et al. 2016; Williams et al. 2018). Moreover, the assemblage taken as a whole does not resemble any other Pre-Clovis archeological record in North America other than that at the Debra Friedkin site.

Figure 108. Bend-break tool from the Gault Assemblage, Area 15, Gault site, Bell County, Texas. (Source: Gault School of Archeological Research)

In contrast, the blade-and-core assemblage found within the lowest zone at Area 15 shares some commonalities with Clovis technology. Both technologies utilize conical and flat-backed (wedge) cores with acute platforms and unidirectional blade removal. However, in general, the Gault Assemblage blades do not show the same degree of platform preparation as exhibited within the Clovis horizon (Williams et al. 2018).

Samples for OSL dating were collected from all levels in Area 15. The results for the Archaic horizons, the Late Paleoindian horizon, and the Folsom and Clovis levels all corresponded to well-established age dates for their respective cultures (Williams et al. 2018). Four OSL dates were taken from the Gault Assemblage notably in the area where significant concentrations of artifacts, especially projectile points were recovered (Williams 2018). These sample yielded dates from 16,700 ± 1,100 B.P. to 21,700 ± 1,400 B.P. in the expected chronological order. Based on these results, the average age for the Gault Assemblage was determined to be 18,500 ± 1,500 years B.P. (Williams et al. 2018; Williams 2018).

Similar to the Debra Friedkin site, Gault lies in an area which contains vertisols. As such, extensive work was conducted to ensure that none of the upper material had worked its way down into the Gault Assemblage zone. While very minor movement of some small flakes was observed from one unit to another, there was no movement of any artifacts from any upper horizon down into the Gault Assemblage level (Alexander 2008; Gilmer 2013).

Another analytical test conducted on the Gault artifacts was an attempt to source the chert they were constructed from. Traditionally, Edwards chert has been identified by its strong yellow to yellow-orange to Ultra Violet (UV) light (Hoffman et al. 1991; Hillsman 1992). However, this test is not conclusive as other chert can also fluoresce under UV light. Moreover, UV light cannot distinguish where within the Edwards Plateau an individual chert may have come from. In 2012, Tom Williams and the author attempted to invent a test to determine chert origin using X-ray

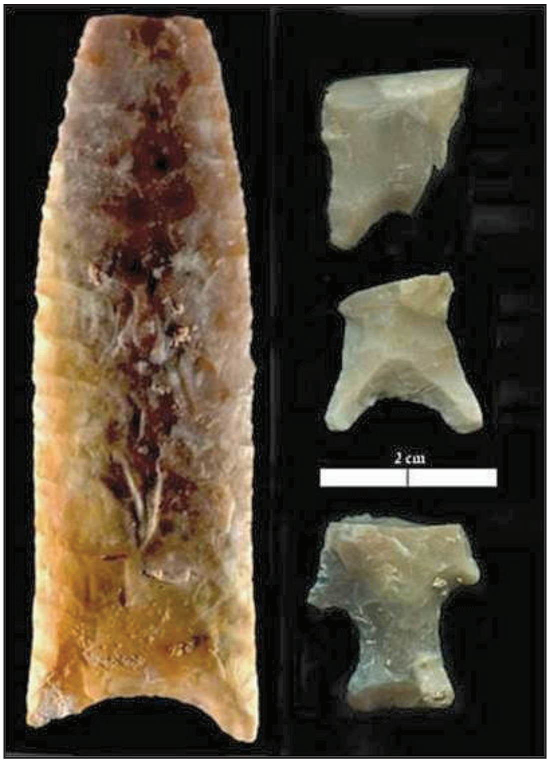


Figure 109. Lanceolate and bifurcate stemmed projectile points from the Gault Assemblage, Area 15, Gault site, Bell County, Texas. (Source: Gault School of Archeological Research)

fluorescence (XRF). We modeled our approach on the large 30+ trace element methodology developed by Andy Speer (2014) for Laser Ablation analysis (Speer 2014). This technique was partially successful and we were able to identify the presence of Edwards chert at a number of Clovis sites across Texas (Crook and Williams 2013; Williams and Crook 2013). We also used the same approach on the artifacts found at the Gault site. What we found was that the majority of Clovis projectile points had actually been made from cherts found outside the Edwards Plateau and had been discarded at the site when they were exhausted. Conversely, most of the blades and worked flake tools were made from local chert.

We also attempted to conduct a similar analysis on the Gault Assemblage tools (those that has been recovered by 2013) (Figure 111). Unlike the Clovis tools, the trace element geochemistry indicated that virtually all of Gault Assemblage tools had been made from local Edwards chert.

The similarities and differences noted in the lithic technology present in the Gault Assemblage suggest that there is no single, direct linear line toward Clovis technology (Williams et al. 2018; Gandy 2013, 2014). Parts of the technology, such as the blade-and-core tradition, may have continued in the Clovis levels. The projectile point technology, however, either completely disappeared and/or underwent significant change. Use-wear analysis showed that many of the Pre-Clovis tools were used in a similar manner to those during Clovis (Shoberg 2014; Ayala 2018).

Another curious fact is while incised stones have been found in many cultural horizons at the Gault site including Clovis, no incised stones were recovered from the Gault Assemblage. At the moment there is no explanation for the lack of art of any form in the materials below Clovis.

Currently only about three percent of the site has been scientifically excavated and yet has produced over 2.6 million artifacts (including all debitage). Gault is truly one of archeology's national treasures, a fact that was recently recognized by its official listing as both a Texas State Antiquities Landmark and on the listing of the National Register of Historic Places.

Figure 110. Projectile points Gault Assemblage, Area 15, Gault site, Bell County, Texas. The contracting stem point made from smoky quartz is on the far right. (Source: Gault School of Archeological Research)

Figure 111. Tom Williams (left) and the author (right) analyzing Gault Assemblage tools by XRF analysis. Note we are wearing blue rubber gloves in order to not contaminate the artifacts prior to their analysis for starch grains and blood proteins.

Lewisville and Hickory Creek, Texas

The Lewisville site (41DN72) lies in southeast Denton County near the confluence of Hickory Creek and the Elm Fork of the Trinity River. The site is located on the west side of the Elm Fork close to the location of Lake Lewisville dam. Lake Lewisville, as it is now known, was the expansion of old Lake Dallas and serves as a primary water supply for Dallas, Denton, Highland Park, and University Park, as well as many of the local communities bordering the lake. The enlarged lake was originally called Garza-Little Elm Reservoir but was renamed Lake Lewisville in the mid-1970's to avoid legal confusion resulting from the government's naming of the dam as Lewisville Dam.

The location was originally discovered in the early 1950's when removal of dirt for the construction of the dam exposed an immature extinct bison. Nearby, a small area of darkened, fire-hardened clay was observed, but at the time this was believed to be natural and not a cultural feature. When it became apparent that the completion of Lake Lewisville would inundate the area, members of the Dallas and Texas Archeological Societies began to explore the borrow pit as well as the area of darkened clay. Believing the feature likely to be man-made and of possible great age, excavations were initiated in 1956 and continued into 1957 (Figure 112). A total of 21 fire-burned features were exposed which were interpreted as hearths. In Hearth #1, a Clovis point made from an opaque white chert was recovered (Figure 113) (Crook and Harris 1957, 1958). The hearth also produced burned carbon material which subsequently yielded a radiocarbon date of "greater than 37,000 years B.P." (Figure 114) (Crook and Harris 1962). Additional artifacts including a crude quartzite chopper, a well-used quartzite hammerstone, and four worked chert bifacial thinning flakes were recovered in the gullies of the borrow pit near the hearths (Crook and Harris 1957).

Figure 112. Wilson W. "Bill" Crook, Jr. (left), the author's father, and R. King Harris excavating the Lewisville site in 1956.

As would be expected, the extreme age date coupled with its association with a Clovis projectile point initiated a great deal of controversy. Scientists who had never visited the site claimed that the hearths were not in fact, cultural features but burned pack rat nests (Heizer and Brooks 1965). Even Crook and Harris' scientific integrity was challenged by claims that the Clovis point had been "planted" (despite the fact that the Clovis point had been jacketed in plaster and removed with the entire section of hearth material; when the point was removed, its fire hardened impression could be seen in the clay; until recently, the entire block was curated at Dennis Stanford's lab at the Smithsonian). When the lake was inundated in April 1957, not even Crook and Harris believed that the controversy surrounding the site would ever be resolved.

In 1978 a drought brought the level of Lake Lewisville down such that many of the hearths were again exposed. A re-excavation of the site was conducted in 1979-80 by Dennis Stanford of the Smithsonian Institution. The excavation was terminated in 1980 when heavy rains subsequently raised the lake and re-inundated the site. However, Stanford was able to confirm the original conclusions of Crook and Harris as well as provide a more refined interpretation of the site. Cross-sections of the burned areas showed that they were indeed man-made hearths (Stanford 1982; Dennis Stanford, personal communication 2008; 2013). Two independent laboratories (University of Illinois and Harvard) confirmed the anomalously old age dates of the hearths but also found that some of the carbon material may have been admixed with lignite which served to contaminate the sample and generate an anonymously old age date (Stanford 1982). Lignite can be found in the Cretaceous Woodbine sandstone which crops about one kilometer west of the site. A postulated age date of roughly 12,000+ years B.P. was assumed for the Lewisville site so as to more clearly place it in the range of a Clovis occupation (and thus match the Clovis point recovered from Hearth #1). Stanford also noted that this represented the oldest known use of fossil fuels in North America (Stanford 1982).

Figure 113. (left) Clovis point recovered in situ from Hearth #1, Lewisville site.

Figure 114. (right) Charcoal collected for radiocarbon dating from Hearth #1, Lewisville site.

After excavation of the site was completed in 1957 and before its inundation, a local resident visited the area of the excavation and found a large quartzite chopper near the excavated hearths. The artifact was placed in a box with a site label and stored in the man's garage. After his death, his granddaughter, Ms. Elaine Waite of Little Elm, Texas, rediscovered the box and its contents. Subsequently, she learned of my research along the East Fork of the Trinity and contacted me asking if I was related to the Wilson Crook who had excavated the Lewisville site. When I replied that I was his son, she gave me the artifact with the expressed desire that I study and record it as part of the Lewisville site record.

The artifact found by Ms. Waite's grandfather was recovered from the bottom of the borrow pit reportedly "near to where the excavations had taken place" (Elaine Waite, personal communication, 2014). It is composed of a tan to light yellow-brown tabular metaquartzite. Minor red hematite staining is present on the obverse face, probably the result of heat treating. The artifact has been flaked on one edge to form a large chopping tool. Minor flaking is present on the obverse face along the cutting edge in order to create a bifacial chopping edge. Microscopic examination of the flaked edge shows some polish but no obvious striations which could be associated with a particular function (Figures 115 and 116). The chopper is distinctly tabular in shape. Length of the left lateral edge is 122.5 mm; length of the right lateral edge is 151.1mm; and the length of the bottom edge is 191.3 mm. Thickness at the proximal end of the chopper is 33.1 mm, rising to a maximum thickness of 41.1 mm near the center of the artifact. Thickness of the flaked edge ranges from 5.9-9.1 mm. The artifact is both large and quite heavy with a total weight of 725.7 gm. The artifact's heavy weight makes it possible that it was used either single or two-handed (Crook 2014). The nearest source of tabular sandstone is approximately 250 km to the north in Pittsburgh County,

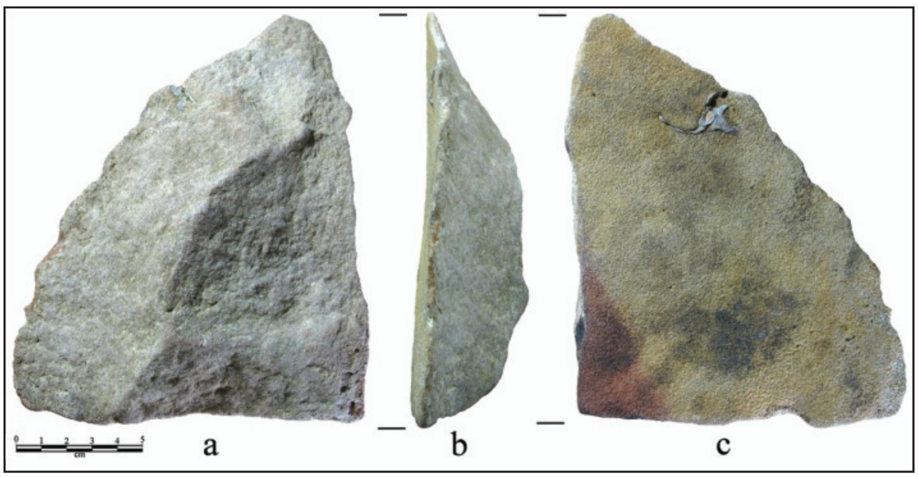


Figure 115. Large chopper made of meta-sandstone found at the Lewisville site.

Oklahoma at the edge of the Ouachita Mountains. There, the Carboniferous Jackfork Formation crops out in tabular beds up to 15 meters thick (Klein 1966; Morris 1964). The Jackfork is typically a thick, consolidated flysch-deposited sandstone that occurs over most of the Ouachita Mountains (Morris 1971). However, at its westernmost exposure, it has undergone low-grade metamorphism. Hydrothermal fluids have cemented parts of the sandstone into a hard, flakable lithic material. In Pittsburgh County in particular, quarries have been found where Jackfork quartzite was accessed by prehistoric peoples over a long period of time. Nearly two meters of knapping debris have been found at some of these quarries (Don Wyckoff, personal communication, 2014).

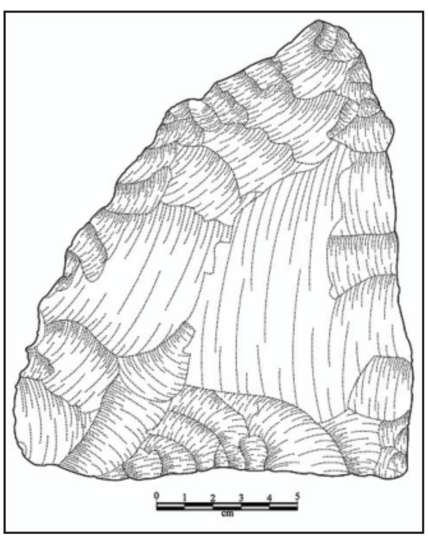


Figure 116. Illustration of the artifact pictured in Figure 115.

After the discovery of the Lewisville site in the early 1950's, Crook and Harris extensively the explored the area for similar age sites. As the Lewisville site occurred near the junction of Hickory Creek with the Elm Fork of the Trinity, exploration upstream along Hickory Creek was one of the primary areas to survey. About 15 km upstream from the Lewisville site, a Columbian mammoth (*Mammuthus columbi*) was discovered and excavated by the University of North Texas in 1951-52. The mammoth was found in the base of a gulley in a small sand and gravel barrow pit for the adjacent Atchison Topeka and Santa Fe Railroad. Extensive exploration by Crook and Harris in this pit revealed a pocket of burned mammal bones within the same geologic horizon as the cultural materials found at the Lewisville site. Bob H. Slaughter of S.M.U. later identified the faunal remains as belonging to bison, camel, tortoise (probably *Testudo sp*.), and gastropods (*Anguispira alternata*) (Crook and Harris 1957, 1958; Crook 2013). Careful excavation of the burned bones revealed the presence of three small worked flakes in clear association with the mammal remains (Figure 117).

Figure 117. Worked flake assemblage found in association with burned Pleistocene mammal bones, Hickory Creek (41DN63) site.
Left to Right:
Flake #1 - Purple-black quartzite;
Flake #2 - heavily patinated white to light-gray Edwards chert;
Flake #3 - red-brown quartzite

A small amount of charcoal was found in a clay lens next to the area containing the burned bones and worked flakes. As the occurrence was very similar to the 21 hearth features found at the Lewisville site, all the material was carefully excavated. In particular, the recovered charcoal was wrapped in aluminum foil and sealed in glass jars for possible future radiocarbon dating. Due to the relatively small amount of charcoal material collected, no date was possible to obtain in the 1950's by conventional radiocarbon technology.

Examination of this material under 20-60x revealed the presence of small (<10mm) circular pieces of charcoal embedded in reddish clay-rich sand, which contained a large amount of microscopic charcoal grains admixed with the sediment. A split of the recovered carbon material was sent by the author to Beta Analytic, Inc. for radiocarbon dating. After pretreatment, 21 grams of charcoal and organic sediment was recovered and subjected to Accelerator Mass Spectrometry (AMS) dating. Radiocarbon age of the charcoal material was 32,180 ± 230 B.P. (Radiocarbon Years), with a two-sigma calibrated date of 35,625 to 36,625 calendar years B.P. This is very similar to dates obtained from the Lewisville site (Brannon et al. 1957; Fergusson and Libby 1962; Crook and Harris 1962; Li Liu et al 1986).

In the late 1970's, an extreme drought briefly re-exposed part of the Lewisville site. A short excavation was conducted from September, 1978 until February, 1979 when the site was once again inundated by the waters of Lake Lewisville (Stanford 1982). A new hearth (Hearth 22) was uncovered during the excavations and carbon material obtained for radiometric dating. A date of 26,610 ± 310 (RC Years) was obtained by the Illinois State Geological Survey (Li Lui et al. 1986). While younger than the "greater than 37,000 years" date originally obtained for Hearth 1 by Crook and Harris (1957, 1962), the date was still significantly older than the age of the Clovis material found at the site. Noting that the Cretaceous Woodbine Formation, known to contain lenses of lignite, cropped out less than two kilometers from the Lewisville site, Johnson (1982) proposed that the aboriginal inhabitants of Lewisville must have used lignite as a fuel source along with local wood, which would thus account for the anomalously old radiocarbon date obtained in all the hearth radiocarbon analyses. In support of this hypothesis, the Illinois Geological Survey conducted a detailed analysis of both Lewisville hearth materials along with Denton County lignite from the Woodbine Formation (Shiley et al. 1985). The Lewisville site carbon analyzed included both samples from the newly discovered Hearth 22 (Stanford's excavation) as well as material collected by Crook and Harris in 1956 from Hearth 8 (Shiley et al. 1985). The carbon and associated hearth sediment was subjected to a series of analytical tests including X-ray power diffraction analysis (XRD), Neutron Activation analysis (INAA), as well as Mossbauer Spectroscopy to search for pyrite decomposition products (hematite, Fe_2O_3) as well as authigenic kaolinite ($Al_2Si_2O_5(OH)_4$), both known by-products of coal (lignite) combustion. Both the XRD and INAA analyses not only failed to show any lignite combustion products but also demonstrated that the Lewisville hearth material was mineralogically quite different from Woodbine Formation lignite. A small peak assumed to be hematite was found in the Mossbauer analysis of the hearth material and as a result, limited support was given to Johnson's hypothesis that lignite had indeed been admixed with charcoal (Shiley et al. 1985).

In addition, the radiocarbon laboratory at the Illinois State Geological Survey noted that Lewisville hearth carbon readily dissolved, even in cold dilute sodium hydroxide. This is characteristic of low-grade coals that have been oxidized by exposure to the air for a long time (Dennis D. Coleman, personal communication, 1986). The results were used as further support for the admixed lignite theory.

In order to determine if the Hickory Creek carbon material was similar to that from Lewisville, a portion of the split not utilized for radiocarbon analysis was subjected to both an alkali (sodium hydroxide) wash as well as X-ray powder diffraction analysis. With regards to exposure to sodium hydroxide, no dissolution of the carbon material was observed. Moreover, Beta Analytical in their pre-treatment of the sample for radiocarbon dating also failed to see any unusual dissolution. X-ray diffraction analysis of the sediment showed it to be composed of a clay-rich quartz sand. Clays present were predominantly montmorillonite $[(Na,Ca)_{0.33}(Al,Mg)_2(Si_4O_{10})(OH)_2 \cdot nH_2O]$ and illite $[(KH_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}(OH)_2 \cdot H_2O]$, with only minor kaolinite. Limonite and hematite were found to be common constituents of the original formation sand (thus the yellow and reddish coloration) and are therefore present in the formation naturally and not solely as the result of lignite combustion. These results confirm those of the Illinois State Geological Survey and do not support the hypothesis of the use of lignite at Hickory Creek.

The lack of any evidence of lignite use at Hickory Creek supports the conclusion that the radiocarbon date is unaffected by contamination from older carbon material. The direct association of charcoal with burned, broken Pleistocene mammal bones coupled with three worked lithic flakes further supports the observation that the bones, the flakes and the charcoal are the result of human occupation at the site. The lack of evidence for lignite combustion (no evidence of pyrite decomposition and lack of extensive authigenic kaolinite) supports the conclusions reached in similar analyses of Lewisville hearth material by the Illinois State Geologic Survey. Lastly, the date obtained from Hickory Creek is consistent with the estimated age of the Hickory Creek terrace (Ferring and Yates 1998).

The problem with Lewisville (and by extension, Hickory Creek) has always been the occurrence of a Clovis point, which has a well-established and quite limited temporal range, associated with the significantly older radiocarbon dates. This association presumably provided motivation for later researchers to explain the point's presence via the lignite combustion hypothesis (Johnson 1982; Stanford 1982). The presence of human occupational materials on a geologic formation (Hickory Creek terrace) also believed to be considerably older than Clovis, presents an additional anomaly. This has historically been explained by stating the occupation was on a weathered surface (Stanford, 1982). The results described herein from Hickory Creek do nothing to help explain the age-cultural material anomaly and instead lend support to a human occupation in the area in excess of 35,000 years B.P. As this date remains considerably older than the generally accepted older-than-Clovis claims in North America, both Lewisville and Hickory Creek remain somewhat problematical sites.

A further link between Hickory Creek and Lewisville can be seen in Flake #2 (see Figure 117), which has been found to be geochemically similar to Gault area chert. The flake is strikingly similar in color to both the Clovis point found in Hearth 1 by Crook and Harris in the original excavation of the Lewisville site and to flakes found in hearth material (Hearth 22) in the 1978-79 reinvestigation of Lewisville led by Dennis Stanford (Stanford, 1982). The close proximity of the Hickory Creek site to Lewisville (only 15 km upstream) makes it possible that the two occupations are related. This observation is further strengthened by the fact that the flakes from the Hickory Creek site are from the same geologic context as the Lewisville hearths. A detailed XRF analysis of both the Lewisville Clovis point and the flakes recovered by Stanford in 1978-79 could potentially further confirm the two site's association, but for now, both sites remain an intriguing mystery piece in the puzzle of the Peopling of the Americas.

And Then There's the Cerutti Mastodon: Amazing Discovery or Equifinality

The Cerutti Mastodon site began as a paleontological discovery in San Diego County, California. In 1991, construction on State Route 54 near San Diego discovered a large amount of Pleistocene mammal bones. Richard Cerutti, for whom the site is named, is credited with investigating the find and determining that it was significant enough to warrant further study. The site was then subsequently excavated in 1992-93 by a team from the San Diego Natural History Museum led by Thomas Deméré.

The excavations recovered part of a juvenile male mastodon (*Mammut americanum*) including both tusks, three molars, four vertebrae, sixteen ribs, two phalanx (toe) bones, two sesamoids, and over 300 other bone fragments. The remains of mammoth, ground sloth, horse, camel, and dire wolf were also found at the same locality. Five large cobbles were recovered in association with the bone bed. The sediments surrounding the mammal bones were very fine-grained, having been deposited as a result of low energy stream flow. The presence of five large cobbles was seen as anomalous.

Figure 118. Cerutti mastodon assemblage in situ. The large "anvils" and "hammerstones" can be seen in the middle of the photo amongst the mastodon bones.(Source: ResearchGate.net from Steve Holen)

The Cerutti materials remained in storage until they were re-studied between 2008-16 by a team led by Steve Holen of the Center for American Paleolithic Research in South Dakota. Holen and his multi-disciplinary team studied the five cobbles and determined that two were anvils made from andesite, two were hammerstones also made from andesite, and the third hammerstone was made from granitic pegmatite. Small flakes had been removed from the hammerstones which refit; examination of the flakes showed no re-working or use-wear. Their presence amongst fine-grained sediments was also seen as probable evidence for human transport into the area. No other stone tools were found anywhere in the bone bed. One of the mastodon tusks had also been found upright, as if it had been intentionally placed in that position as a signal to the location of the carcass (Holen et al. 2017).

The mastodon bones were dated a number of times using Uranium-Thorium methodology. The dates were all fairly consistent and coalesced around an age of 130,000 ± 9,400 years B.P. (Holen et al. 2017). Holen's team further concluded that some of the mastodon bones showed evidence of having been broken by humans (spiral fractures). No cut marks were present on the bones and none of the other mammals in the bone bed showed any signs of butchering (Holen et al. 2017).

To bolster their claim for the site, the authors conducted numerous experiments on freshly killed elephant bones using hammer-and-anvil techniques to break the bones to get at the marrow. Similar bone fractures and use-wear as seen on the hammerstones and anvils were observed in the experiments (Holen et al. 2018).

As would be expected, given the large age gap between even the earliest Pre-Clovis discoveries in North America and those associated with the Cerutti mastodon, most researchers responded to the discovery with both skepticism and criticism. A number of critics have argued that the evidence presented does not rule out the possibility that the mastodon bones as well as the large cobbles could have been damaged by the weight of the heavy construction vehicles before the bone bed was exposed. Other critics cite the lack of lithic tools at the site, which even at 130,000 years ago, were well-developed and present at similarly aged sites around the world. This is especially true given the supply of good lithic toolstone in the general area of the site (Braje et al. 2017). The lack of cut marks on the bones was also seen as evidence that no human activity was present (Braje et al. 2017). Moreover, if the site is real and dates to 130,000 years B.P., it is unclear *which* hominin would have been present: Archaic Homo? Homo erectus? Neanderthal? Denisovan?

Noted astrophysicist Carl Sagan once said “Extraordinary claims require extraordinary evidence”. The researchers comprise a large, multi-disciplinary team that has done quality scientific work and have steadfastly defended their claims (Holen et al. 2018). However, at the end of the day, absent any definitive proof of human activity including flaked stone tools or cut marks, it may prove impossible to “prove” their find is the result of humans.

DNA Research

The subject of DNA analysis of early human skeletal material in Siberia and North America is a very complex subject and much too involved to fully discuss here. As a result, I have chosen to only include a brief summary below of two of the major analyses and the conclusions that can be drawn from their study.

Several recent DNA analyses have added greatly to our understanding of the Peopling of the Americas. The analyses come from the skeleton of a juvenile male at the Mal'ta site in Siberia near Lake Baikal, and from the child buried with the Anzick Clovis cache in Montana. One of the problems facing archeologists in trying to determine the lineage of the First Americans is the almost complete absence of human remains that date to either the Clovis or older-than-Clovis periods. Pre-Clovis sites are rare; Pre-Clovis human remains are virtually non-existent.

The Mal'ta skeleton was dated to approximately 24,000 years B.P. whereas the Anzick child was dated to roughly 13,000 B.P. (Morrow and Fiedel 2006; Raff and Bolnick 2014; Raghavan et al. 2014). DNA extracted from the Mal'ta skeleton indicates that about 80 percent of all Native Americans, including the Anzick child, derive from this population (Raghavan et al. 2014; Rasmussen et al. 2014). Thus the people in central Siberia had to have migrated east to Beringia and then into North America sometime between the age dates of the two burials (Callaway 2014). The new age date of 24,000 B.P. from the butchered horse mandible from Bluefish Caves in the Yukon would suggest that this migration occurred near the top end of the age bracket.

Another interesting piece of evidence is that elk (or Wapiti) have been dated to enter North America from Siberia sometime in the range of 18,000-15,000 B.P. (Leper 2014). This is potentially important as elk have been strongly linked to human hunting throughout the world.

Is this the earliest date people could have migrated into North America? Based on our current evidence, which is admittedly scarce, the answer would have to be yes. However, recently a new population in northern Siberia has been discovered through DNA analysis which dates to before 31,000 years B.P. There are no living peoples or skeletal remains anywhere in the world that tie to this new DNA group. So, either they have no descendants in the New World or we have yet to discover them.

DNA evidence is intriguing but the database on early settlers in North America is so thin that it is hard to say that the current evidence tells the entire story of the Peopling of the Americas. The bottom line is we simply need more data points.

Discussion

So where do we stand in our current understanding of the Peopling of the Americas? First, the large number of new discoveries made over the past two decades has greatly enhanced our understanding of what it means to be Clovis. The Clovis tool kit is now much more well-defined and as a consequence, previously overlooked tools such as blades, blade cores, overshot flakes, etc. are now recognized as integral to the Clovis lithic assemblage. More of these tools are being rediscovered in older collections as well as are being recognized in the field from new sites. Moreover, we are now beginning to look at Clovis not as a separate culture per se, but as a highly skilled lithic technology that for some (as yet) unknown reason spread rapidly over most of North America and was adopted by many groups of peoples living in many different environments.

Second, the last decade in particular has seen a huge leap forward in the discovery and excavation of new sites that solidly pre-date Clovis. As such, the long-held "Clovis First" theory is no longer a valid concept. In fact, if forward research continues to show more evidence of human beings occupying parts of North America earlier than 20,000 years B.P., we may ultimately be looking at "Clovis Middle"! As a result, Tom Williams of the Gault School of Archeological Research has recently proposed that we should no longer refer to any of the occupations in North America that date to before 13,500 years B.P. as "older-than-Clovis" or "Pre-Clovis". Instead, he proposes the term "Upper Paleolithic" (Williams and Madsen 2019). Some researchers have already pushed back saying that the term "Paleolithic" should apply only to the Old World – Europe, Africa, and Asia – and its use in North America is confusing. I have carefully read Tom's paper (included in the references at the end of this paper) and his arguments make a lot of sense and in my opinion, should be adopted.

However, with new Upper Paleolithic discoveries have come more questions than we currently have answers. Recently, Tom Williams gave a presentation entitled "The Deeper We Dig, The More Questions Arise" (Williams 2017). And that's the nature of science. Frequently new discoveries that expand our knowledge base answer one question but then pose many more that we currently do not have answers to. For example, just some of the major unknowns that remain to be resolved in the future include:

1. How do any of the cultures that pre-date the advent of Clovis relate to each other?
2. Do these different lithic traditions represent multiple pulses of settlement or are they merely local adaptive variances?
3. Are any of these lithic technologies a true antecedent of Clovis?
4. Where and how did the Clovis technology develop and why did it spread so rapidly across the North American continent?
5. How does the DNA evidence we have now relate to the archeological discoveries?

Ten to twenty years ago, if a student had come to me and said that he or she wanted to make a career out of studying the Peopling of the Americas, I would have probably advised them to find another niche in North American archeology. I would have said that the story was largely filled in and there were only a few things that needed to be cleared up. How wrong was that! Today, if a student approached me with the same question I would tell them about how lucky they are to come along at this time when there is so much to work on and study. I will likely not live long enough to witness all of it, but the generation of young archeologists today will be the people who will literally be at the forefront of writing the new story of the Peopling of the Americas. So, instead of it being a niche field, today is THE time to be involved in North American archeology.

Lastly, in this pursuit of a new understanding of the issue, we must maintain an open mind to each new discovery. That does not mean we should not critically question each new piece of the puzzle, as in the case of the Cerutti Mastodon site, but we should be flexible to changing our current theory or theories when new, solid data is found. My father in a very colloquial way used to tell me that in pursuit of science, I should be guided by the principle of "there are no green lizards on this island until I find one tomorrow" – meaning it is alright to have theories, just don't become so wed to them that you become inflexible to change when new information warrants changing the theory.

Acknowledgements

This is admittedly a very brief summary of the current status of the research on the Peopling of the Americas. It is based solely on my understanding of the issues and interpretation of the data that is in the literature or has been told to me personally by the Principal Investigators involved in various projects. Any mistakes or misinterpretations of the sites and data discussed herein are purely my own.

As I stated in the introduction of this report, I was literally born into the middle of the Peopling of the Americas controversy. I have also had the exceedingly good fortune over my lifetime to meet and become friends with many of the people whom I have written about in this report. Starting with my father, Wilson W. "Bill" Crook, Jr. and his colleague King Harris (Lewisville and Hickory Creek), I have become good friends with Mike Collins, Tom and Nancy Williams (Gault), Mike Waters (Debra Friedkin, Page-Ladson, Topper, and Manis Mastodon), Charlotte Beck and George Jones (Western Stemmed Tradition), Don Wyckoff (Burnham), Andy Hemmings (Florida Pre-Clovis), Julie Morrow (Clovis), and Vance Haynes (defender of the Clovis First theory and my professor of geomorphology). I have also met and had conversations with Dennis Stanford, Bruce Bradley (Solutrean Theory), Jim Adovasio (Meadowcroft), Darrin Lowery (Parsons Island, Miles Point), Al Goodyear (Topper), Dennis Jenkins (Paisley Caves), Reid Ferring (Aubrey Clovis site), Dave Meltzer (Peopling of the Americas), and Marilyn Shoberg (Clovis tool use-wear analysis). Other people I have met and have helped me along the way in my understanding of the issues and/or lithic technology include Tom Jennings and his wife Ashley Smallwood (Topper, Debra Friedkin, Hogeye Cache), Ashley Lemke (Gault, Great Lakes caribou hunting), Elton Prewitt (Gault), Robert Lassen (Folsom), Sergio Ayala (Gault) to name just a few. Lastly, I would like to thank my wife, Ginny Crook, for many of the excellent photographs of the artifacts which appear within this volume.

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