MAMMOTH TRUMPET

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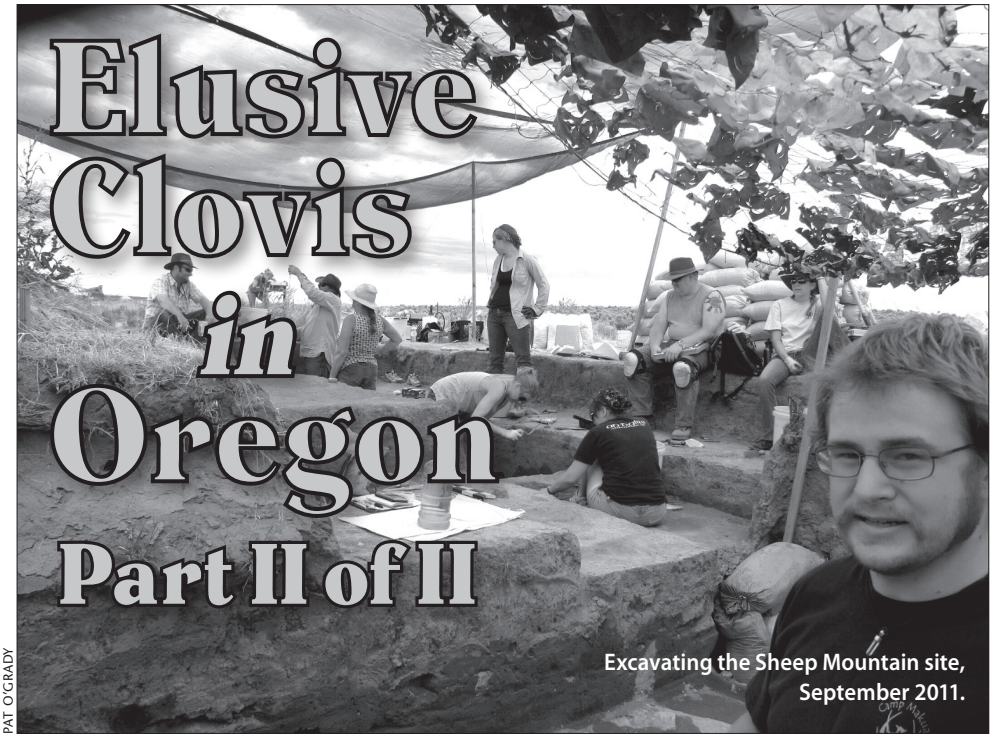
Elusive Clovis in Oregon

Part II of II



PAT O'GRADY

Excavating the Sheep Mountain site, September 2011.

At Sage Hen Gap, help from a Clovis authority

Patrick O'Grady, staff archaeologist for the University of Oregon Museum of Natural and Cultural History, conducted field schools at Sage Hen Gap in 2007 and 2008, during which time his team recovered roughly 1,300 artifacts as surface finds and excavated artifacts, including 13 fluted points and one stemmed point. Many of the artifacts from this highly eroded site had been significantly damaged by cattle trampling—a distinct hazard on BLM range lands, and frustrating to archaeologists seeking diagnostic-quality artifacts. Although Dr. O'Grady declares Sage Hen Gap "on hold for the time being," trenching continues along some of the draws leading to the main site in a search for ground less eroded and possibly more productive than the main site.

At about the time BLM archaeologist Scott Thomas and O'Grady descended on Sage Hen Gap, Michael F. Rondeau, a lithics specialist and retired 25-year veteran archaeologist for the California Transportation Department, entered the picture. Rondeau has seen a lot of Clovis tools. The Oregon project is part of his larger mission to build an information base on the technological and morphological

INSIDE

5 Arguing the case for pre-Clovis at the Debra L. Friedkin site
Churned soil. No radiocarbon dates. Inaccurate OSL dating. These are some of the reasons critics give for doubting the age of the Buttermilk Creek Complex, and project leader Mike Waters addresses them one by one.

12 Just how old is Goshen?
The Jim Pitts site only clouds the issue: Its lithic assemblage is a hodgepodge of Goshen, Folsom, Cody, Jimmy Allen, and Agate Basin. That's why lithics analyst Fred Sellet says we need a better measure of antiquity than typology.

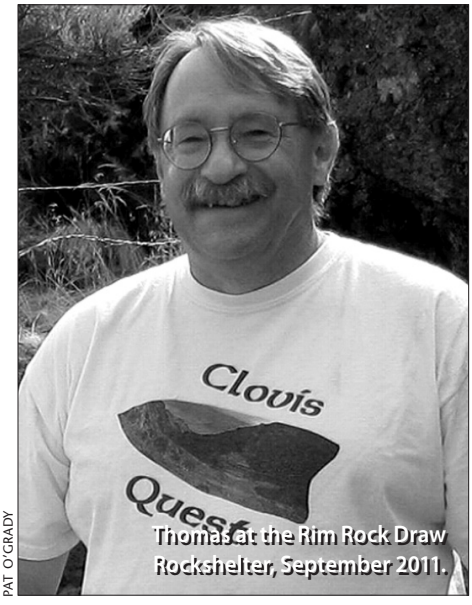
17 A Clovis cache with many secrets to divulge
Archaeologists Bruce Huckell and David Kilby have teased a lot of information from the toolstone found in the Beach Cache in North Dakota. They can only guess, however, why the cache was buried so close to a source of usable chert.

characteristics defining fluted points in the Far West, an expanded version of his original mission labeled the California Fluted/Lanceolate Uniform Testing and Evaluation Database project (CalFLUTED).

UNIVERSITY OF OREGON

O'Grady at the Sheep Mountain site, July 2010.

Taking his broader quest on the road, Rondeau spoke at a gathering at University of Oregon attended by O'Grady, who subsequently asked him to visit Sage Hen Gap. Rondeau recalls his first impression on arriving at the site: A group of volunteers had flagged artifact locations all over the surface of the site,



PAT O'GRADY

Thomas at the Rim Rock Draw Rockshelter, September 2011.

and he was told that Sage Hen Gap was a Clovis site. "I was skeptical," he admits, "refusing to call all fluted points Clovis owing to the lack of independently dated fluted points in the Far West." On his unexpected arrival at Sage Hen Gap, Rondeau was directed by O'Grady to "go find a fluted point." Forty-five minutes later he handed over a fluted point to O'Grady, saying, "Sorry it took so long!" Of more importance, he found that the flagged surface materials included cobble-cortex overshot flakes, biface overshot flakes, fluting flakes, small blade flakes, biface fragments with overshot flake scars, and unfinished fluted biface fragments. For Rondeau, these finds are clearly diagnostic of Clovis-style flaking technology and make a strong argument for Clovis presence in Oregon.

"This site really turned me around," says Rondeau, an energized member of the research team. He is coauthor of two articles on the team's findings in the 2011 *Current Research in the Pleistocene,* and

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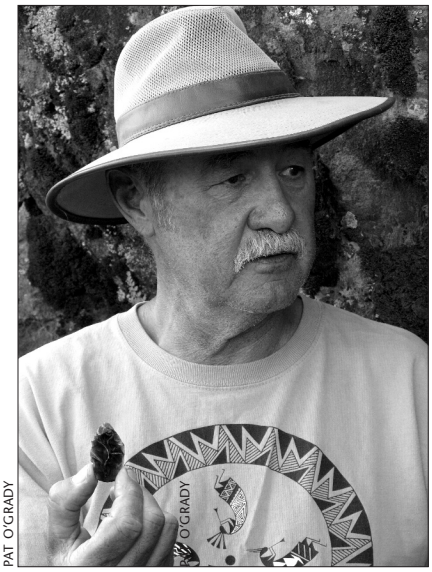
–Michael R. Waters, Director

he remains a lithics consultant for a suite of Burns-area sites found since his early visit to Sage Hen Gap.

At Sheep Mountain, help from good stratigraphy

Adding to the growing tally of productive sites is Sheep Mountain (35HA3667), situated in an upland basin north of a large playa valley near Wagontire. This site contains stratified deposits ½–6 m below the surface. O'Grady's team recovered four fluted points from the surface, and beneath a layer of Mazama ash ½ m below the surface they found five stemmed points and one fluted biface. This white ash was deposited with the eruption of Mount Mazama 7,500 calendar years ago, which formed the caldera now called Crater Lake; the points found below that ash layer therefore predate the eruption. Researchers have reached a "promising" gravel layer 2 m below the surface, where they hope next field season to recover even more significant finds with the help of a squad of professional archaeologists. Meanwhile, thousands of artifacts from previous excavations at the Sheep Mountain site are still being catalogued.



Rondeau at the Rim Rock Draw Rockshelter, 2011.

Sediment samples from throughout the project are being tested using optical stimulated luminescence (OSL), which dates quartz and feldspar grains often found in eolian sands (**MT 18-3,** "Luminescence Dating of Quaternary Sediments: New Methods for Dating Archaeological Components"). Although this technique introduces a 5% margin of error, it's a valuable resource for use when sediments lack sufficient organic matter for radiocarbon dating. O'Grady hopes to have refined dates sometime next year.

Rim Rock Draw Rockshelter: Maybe the best is yet to come

In the 2012 field season O'Grady's field school diggers will investigate the most intriguing of the sites on tap, a rockshelter known as Rim Rock Draw (35HA3855). Although no fluted points have yet been found at the site, Thomas calls it a "gold nugget" in the search for Clovis in the area. The site contains hearths with "lots of datable charcoal" that could eliminate a major problem that has been dogging researchers.

The rockshelter lies 4–5 ft above an ancient stream, Thomas says, "and has been so well hidden that it has not been battered by the elements or looted by pot hunters." Rim rock above the shelter is "littered with debitage, including stemmed points," Thomas says. An initial survey in and around the rockshelter has produced an extensive array of debitage and tools, including 26 stemmed points found around the exterior and 4 within it. Several bifaces well on their way to being finished, scrapers, knife blades, and some ground stone, including a mano that may have processed plant or animal material, share space on collection trays. Although preservation at the site isn't great, small-animal bone fragments have been found. Thomas plans to analyze pollen on ground stone and sediment samples, and use wear on tools and tool fragments.

"We have a hearth and an occupation surface with a concentration of artifacts suggesting a clear association," O'Grady says of this promising site. Charcoal from initial layers of the site is being analyzed to determine plant species around the site. Although archaeologists haven't identified any pre-Clovis or Clovis-age materials, they have recovered possible fluted bifaces and a biface with overshot flake scars near the site, as well as stemmed points that could help inform debates on styles of Great Basin Paleoamerican tools.

Thomas is particularly interested in fluted points recovered from several sites that are smaller than those common to many Clovis collections. "We are recovering fluted points that are about 60 percent the size of regular Clovis points," Thomas explains. The reason for the size difference is unknown. Here are some possibilities Thomas offers for researchers to consider:

- They are a transitional phase of fluted-point production.
- They reflect a change in available game. Smaller prey animals require the use of smaller projectile points.

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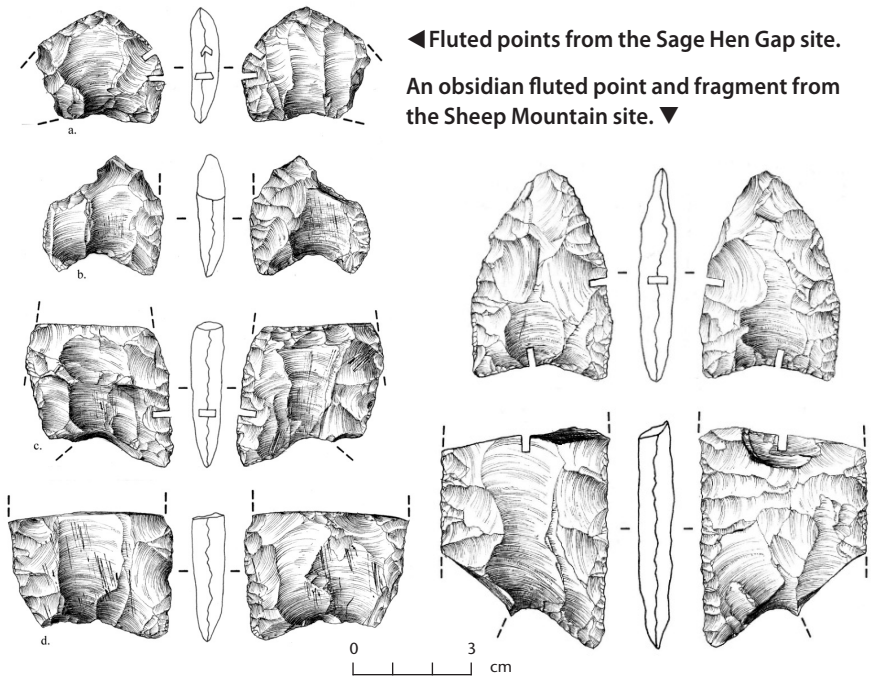

◀ Fluted points from the Sage Hen Gap site.

An obsidian fluted point and fragment from the Sheep Mountain site. ▼

BOTH: ERIC CARLSON

The Paleoamerican Odyssey Conference

A Focus on First Americans Archaeology

October 17–19, 2013 ▪ Santa Fe Convention Center ▪ Santa Fe, New Mexico

The most important event of its kind since the 1999 Clovis and Beyond Conference!

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Oct 17 The oldest sites in Siberia, the cultural traditions of Beringia, routes taken by the first Americans, and the genetic record.

Oct 18 The latest thinking about Clovis, extinction of the megafauna, the Western Stemmed tradition, and the archaeological record of South America.

Oct 19 The older-than-Clovis record at key sites across the Americas and how these and other sites provide the basis for a new understanding of the peopling of the Americas.

Banquet

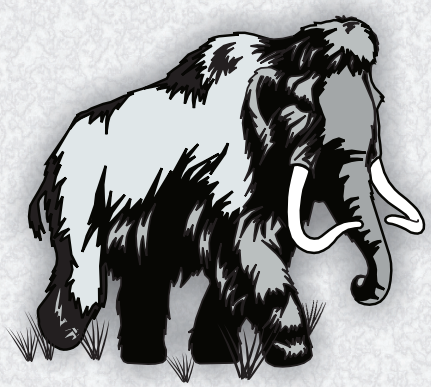
Diners at a special banquet at the end of the conference will enjoy as an additional treat a presentation on the late-Pleistocene colonizing of Australia.

Exhibits and displays

On display in a dedicated room will be artifacts from Paleoamerican archaeological sites—Clovis artifacts from caches and well-known sites, pre-Clovis artifacts from key sites, Denali and Nenana materials from Alaska, and many other collections.

Poster presentations

Researchers and students have the opportunity to display posters for guests to study and enjoy. Forms for submitting posters are available on the conference website.



To register, and to get more information on abstracts and speakers, hotel reservations, and submitting posters, log on to the Paleoamerican Odyssey Conference website

www.paleoamericanodyssey.com

The Paleoamerican Odyssey Conference is jointly organized by:

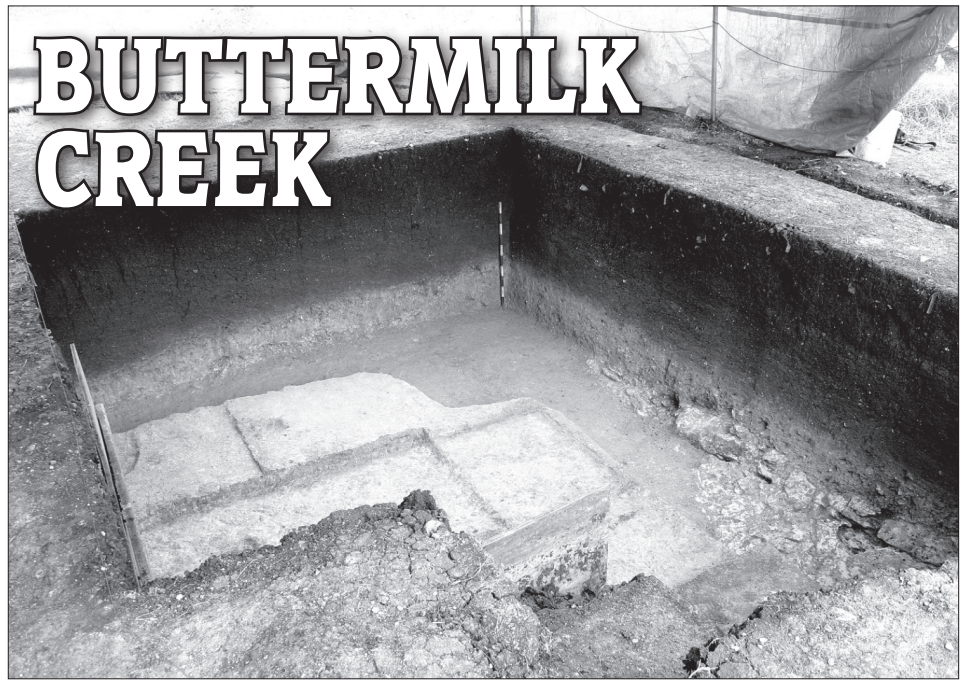
- **The Center for the Study of the First Americans, Department of Anthropology, Texas A&M University**
- **The Southeastern Paleoamerican Survey.**

The Smithsonian Institution is an academic conference affiliate.

BUTTERMILK CREEK

Part II of II: The Stratigraphic Context of the Pre-Clovis Occupation

THE DEBRA L. FRIEDKIN SITE, nestled on the banks of Buttermilk Creek in north-central Texas, has produced thousands of pieces of lithic debitage and more than 56 tools from a deposit lying stratigraphically beneath a Clovis layer. This assemblage resembles a typical Clovis assemblage in some aspects, including the presence of blades, but doesn't display other classic Clovis attributes: for instance, channel flakes and *outre passé* flaking are absent. Both assemblages are made from the local Edwards Plateau chert. Are these artifacts evidence for pre-Clovis occupation of the Americas, as argued by Project Lead, CSFA Director Dr. Michael Waters, or, as critics argue, are they simply Clovis artifacts that have been moved downward by natural processes? The resolution to this debate turns on the answer to two vital questions: 1) Is there geologic evidence to refute the charge by critics that all the pre-Clovis artifacts originated in the overlying, much-thinner Clovis deposit and were merely transported by churning? and 2) Is there sufficient integrity to the dates, obtained using optically stimulated luminescence, to assign the assemblage with confidence to a pre-Clovis age? For Waters, the answer to both questions is an emphatic "yes," but are his critics convinced?



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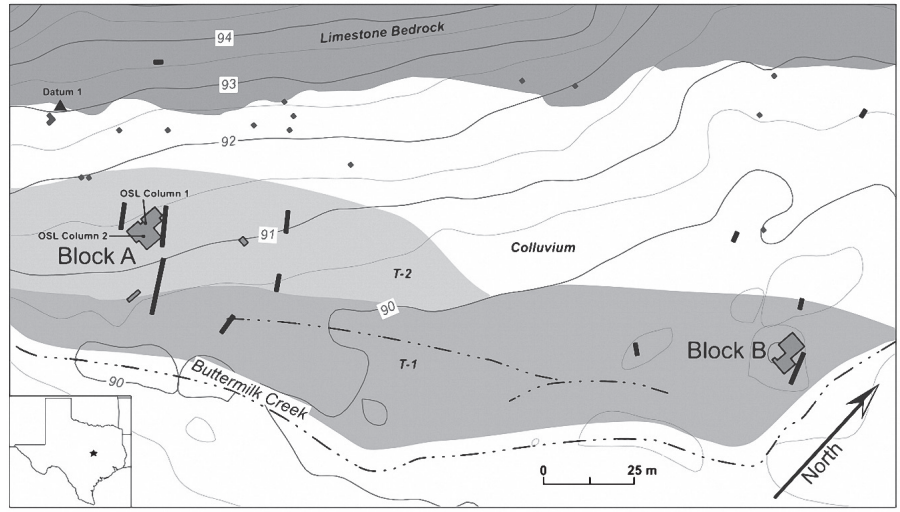
A view of the walls of Block A at the end of the 2007 season, showing limestone bedrock (foreground), overlying colluvium (light-colored sediments above the bedrock on both walls), and overbank floodplain sediments (dark layer). Scale is 1 m.

The evidence in detail

Topographically, the site stretches across two low river terraces adjacent to Buttermilk Creek. The stratigraphy associated with the two terraces is different, but together they reveal the landscape history along Buttermilk Creek. Geophysical work at the site shows that the sediments beneath both terraces are confined within a wide stream channel that was carved into the hard limestone. This channel became filled with gravels sometime during the Pleistocene.

The oldest deposit revealed in the upper terrace is a clay loam to gravelly clay loam. Loam is a mixture of sand, silt, and clay; a clay loam is loam that has more clay in it than coarse sand. These coarse-grained sediments were laid down at the toe of a colluvial fan that originated from the slope above the site. The age of this colluvium is unknown and does not contain artifacts. A 1.4-m-thick layer of clay overlies the colluvium. This clay was incrementally deposited by overbank



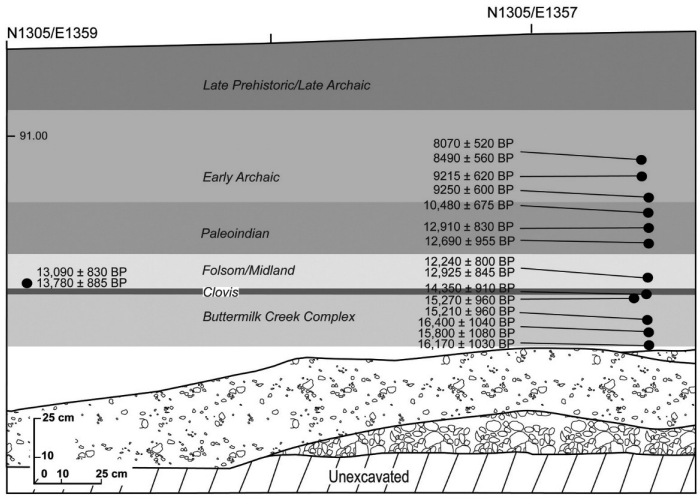
Map of the Friedkin site, showing the two excavation blocks, Buttermilk Creek, lower terrace (T-1), upper terrace (T-2), colluvial slope, and limestone bedrock that forms the margin of the valley.

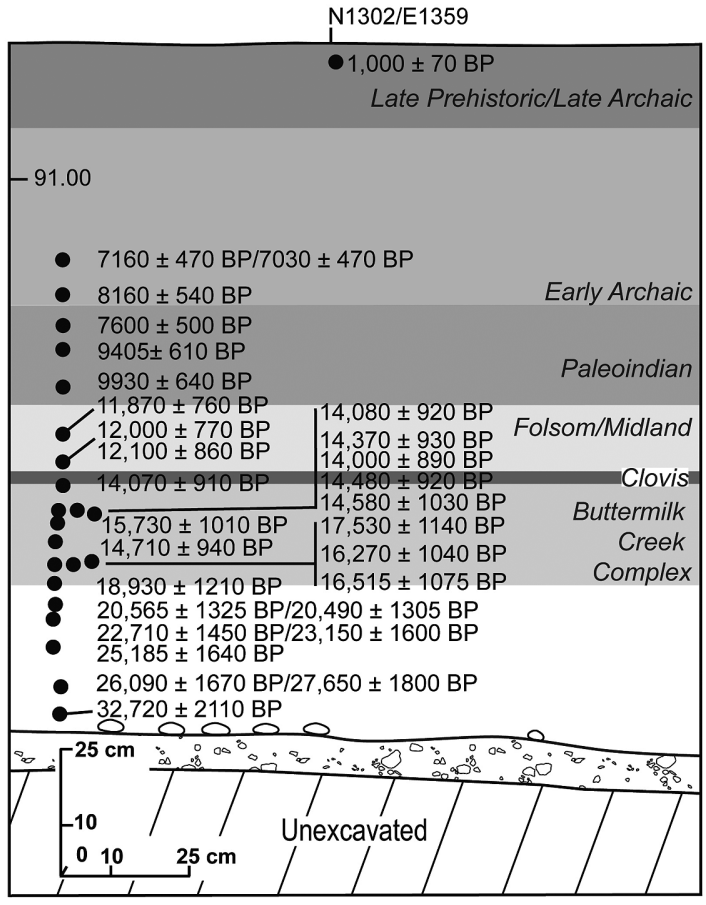
floods from Buttermilk Creek. Forty-nine OSL ages from these deposits reveal the history of floodplain deposition over the last 33,000 years, documenting periods of rapid and slow sedimentation. The lowest 5–25 cm of clay dates from 33,000 to 16,000 CALYBP and contains no artifacts. The overlying 25 cm of clay dates from approximately 15,500 to 13,100 CALYBP and contains the pre-Clovis artifacts. Sedimentation slowed during the Clovis time period and then increased dramatically during Folsom/Midland times when another 12 cm of clay was deposited. Sedimentation remained rapid during the subsequent late-Paleoindian and early-Archaic periods, slowed again during the middle-Archaic period, and then increased yet again during the late-Archaic and late-Prehistoric time periods.

The sediments beneath the lower terrace document periods of channel cutting and channel filling over the last 40,000 years. The oldest artifacts found in these deposits are Clovis, which rest along the base and edge of an ancient channel. Another channel dates to the middle-Archaic period. The geological histories of the two terraces are linked as one might expect; when channel cutting occurred, deposition was slow on the floodplain, and when sedimentation was rapid in the channel margin, it was also rapid on the floodplain.

The Vertisol: Churned or unchurned?

The modern soil at the site is a weak Vertisol. A Vertisol is a soil formed in clay-rich sediment that is subject to shrinking and swelling. Clay is an excellent absorber of water, and this ability is greater the smaller the clay-size particles. Soils with abundant fine clays tend to expand when the clay gets wet because fine clays such as smectite can hold lots of water in their matrix. Coarse clays are less efficient at holding water, so shrinking and swelling are minimal. In a Vertisol, the shrinking-swelling cycle produces planes of weakness in the soil, called "slickensides," that allow blocks of soil to slide past each other at a millimeter to centimeter scale. Moreover, a typical Vertisol has pronounced vertical cracking that can conceivably allow artifacts and younger sediment to move lower in the deposit when cracks open during dry periods. In a well-developed Vertisol, buried artifacts may move laterally and upward during wet periods when the clay in the soil expands, but only if a "master slickenside" has formed, and this type of movement will be confined only to this surface. These wet-dry cycles can be annual occurrences, so historically geologists suspected that these kinds of soils become heavily churned by this process. Some cracking, some slickensides, and other characteristics of Vertisols are evident at the Friedkin site, even in its oldest layers. This has prompted critics of the site interpretation to argue that the Buttermilk Creek Complex artifacts are Clovis artifacts that have been churned downward by this process.





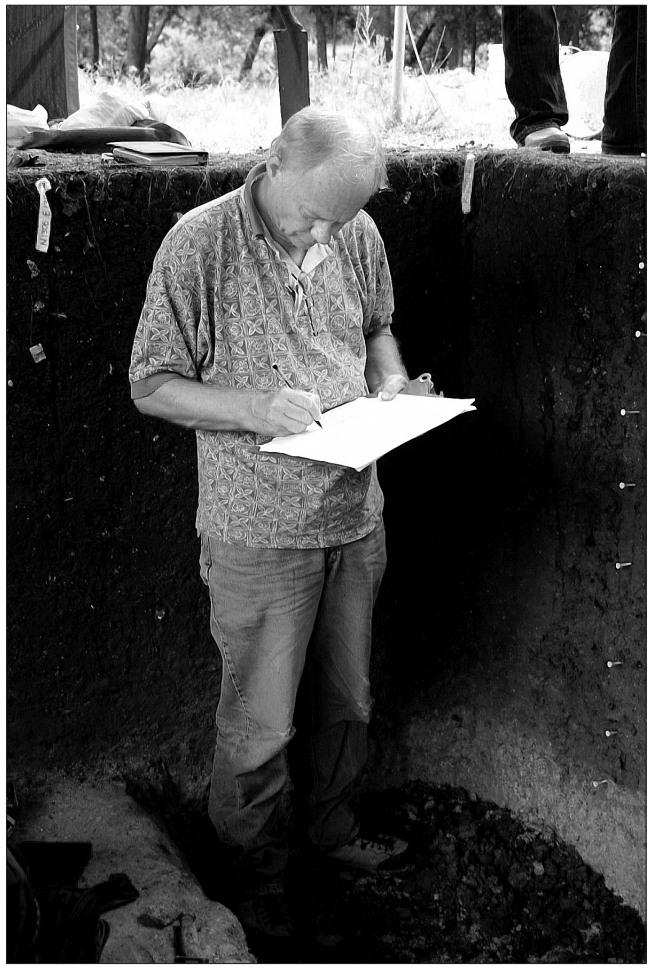
OSL ages from 2007 *(left)* and 2008 *(above).*

But veteran soil scientist and Vertisol expert Dr. Lee Nordt (Baylor University), who worked at the site, along with his colleague Dr. Steve Driese (Baylor University), says this is a comparatively weak Vertisol that has been minimally churned. First of all, he points out, the "clay content is not very high for a Vertisol, particularly with respect to the fine clay fraction" that is essential for vigorous shrinking and swelling. He further points out that the deposit is rich in both calcium carbonate and organic matter, substances that tend to lessen the magnitude of shrinking and swelling (the way temper stabilizes a ceramic). He goes on to argue that surface features associated with shrink-swell processes were not strongly developed at the site. In the subsurface there were "a few wedge-shaped aggregates, the occasional weak slickenside,

some waviness, some vertical cracking," but on the whole he deems it "a marginal Vertisol that does not express typical features of the soil order. In fact, it was so weakly expressed that we debated if it was even a Vertisol at all."

Nordt points out that at the time of Clovis and Buttermilk Creek Complex occupation of the site, no Vertisol may have been present. After all, soils form over time in a deposit, and the conditions for Vertisol formation may not have been present back then. For instance, he says that "you need a certain thickness of material—minimally 50 cm, but maybe more—to create slickensides. The Clovis and Buttermilk Creek Complex materials were only about 50 to 75 cm above the limestone bedrock, and less above the gravelly colluvium, so I doubt there was a Vertisol present when the site was originally occupied." Vertisol characteristics likely developed over time, but may have been weakly expressed until much more recently (if at all, considering that they are only weakly expressed today). Thus the opportunity to specifically intermix Clovis and Buttermilk Creek Complex artifacts through shrinking and swelling of clays may have been very limited. "The Buttermilk Creek Complex artifacts did not fall down cracks from the Clovis layer. There is zero evidence for that," he concludes.

Nordt goes on to say that even when slickensides and vertical cracking are present in a Vertisol, they don't completely churn the deposit. "Once the first crack opens and debris falls in," he explains, "this forms a plane of permanent weakness within the soil, and subsequent slickensides and cracks tend to occur in the same place year after year. Between the cracks, there is no mixing, so even near the surface at the Friedkin site, the cultural layers are still intact between the cracks."



Nordt documents the stratigraphy in Block A, 2008.

Additional evidence that the deposits aren't churned

Further evidence that churning has had negligible effect on the deposits comes from analyzing the calcium carbonate content of the soil. Soil properties change linearly with depth in an undisturbed deposit, and a disturbance disrupts this linear trend. For instance, desert soils often have a thick layer rich in calcium carbonate, which coats every rock and particle within the layer. If you find a tool coated in calcium carbonate in a soil containing rocks with no coating, you know the tool is out of place: It has different soil-formation characteristics than the surrounding soil.

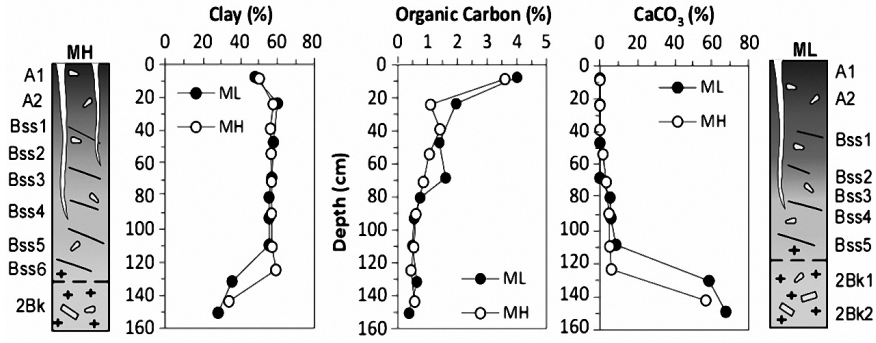
In the case of the stratigraphy at the Friedkin site, soil properties change systematically with depth, indicating that the deposit hasn't been churned and that ongoing soil formation hasn't been disrupted. In particular, there is a systematic increase in the calcium carbonate content of the soil with depth, and this is mimicked by an increasing incidence of artifacts with calcium carbonate adhering to them, and by an increase in the surface area of artifacts bearing calcium carbonate. Significant movement of artifacts would lessen the correspondence between the carbonate coating of artifacts and the calcium carbonate present in the soil surrounding the artifacts. This is not the case at the Friedkin site.

Further evidence that the deposits are minimally churned comes from the pattern of refits among artifacts. This is an area that Waters readily admits needs more work, but he points out that after several weeks' effort, Texas A&M University graduate student Tom Jennings identified a handful of refits within cultural layers—one refit from post-Folsom deposits, and four sets of refits within the Buttermilk Creek Complex strata—but so far none between cultural layers. Of these four refits, three had vertical separations of less than 7 mm and one set was found in screened material. The lack of vertical separation supports the argument that the deposits are not significantly churned: What is the likelihood in an assemblage of several thousand artifacts that refittable pieces would be churned to the same depth?

Waters points to other evidence that supports the argument that the deposits have experienced minimal movement: the uninterrupted progression of diagnostic artifacts from oldest to youngest within the stratigraphic profile, and the absence of artifact-size sorting from the bottom to the top of the profile in Block A. Finally, magnetic susceptibility measurements from the bottom to the top of the profile change systematically with depth. Dr. Joshua Feinberg and his graduate student Anna Lindquist (University of Minnesota) demonstrated that "the magnetic properties of the soil are characteristic of an undisturbed site, where the soil appears to have developed gradually as it was deposited over time."

The dissenters speak

But not everyone is buying the evidence that the sediments aren't mixed. For most skeptics, Dr. Vance Holliday (University of Arizona) among them, the absence of mixing is suspect. He points out that "they do a really good job of dealing with shrink-swell, magnetism, and the profile development, but it is hard to believe that you would not have mixing in a pretty thin zone" such as the 2.5-cm-thick Folsom and Clovis layers. "If they have a surface on which sediments are accumulating over 2,000 years, there must be some plant and animal mixing." The same holds true for the entire profile, including the Buttermilk Creek Complex deposit.



Changes in sediment and soil characteristics with depth.

Dr. Charles Frederick (C. Frederick Consulting geoarchaeologist) is blunter: "I don't buy it," he says. "In a Vertisol you have major restructuring of the deposit due to churning, yet how can you have a completely flat line separating Folsom and Clovis occupation surfaces? I can't quite get my head around it."

Frederick goes on to argue that many of the tests for stratigraphic integrity used by Waters's group may not be as informative as Waters claims. He argues that the "increase in carbonate with depth doesn't tell you much about site integrity. Carbonate development is ballpark, and you can get nodular carbonates in young deposits." Furthermore, magnetic susceptibility measurements can tell you "if you had wholesale disturbance" but won't necessarily detect smaller-scale movement within the deposit. "Have they shown me there is any reason to believe there is no mixing? No," he concludes.

What Frederick fails to allow for, Waters argues, is the likely variation among Vertisols in the degree of their development and their expression of Vertisolic traits. If the Friedkin site has, as Waters claims, the "wimpiest Vertisol," one that even the Soil Conservation Service didn't classify as such, then it's likely that large blocks of sediment are intact and stratigraphic integrity is sound. His claim is supported by the relative congruence between OSL dates and by temporally diagnostic artifacts found throughout the deposit.

More successful refitting of artifacts within the Buttermilk Creek Complex strata and proven absence of refits between cultural strata might make Waters's case more convincing for some researchers, but for others it would still not make it ironclad. Most would like to see more excavation, more artifacts, and more geological data.

But for some, even that would not be enough. As Holliday points out, "the bigger question is the dating."

OSL dates and implications for the peopling of the Americas

Of all the aspects of the pre-Clovis deposits at the Friedkin site in central Texas, perhaps none has prompted so much concern as the optically stimulated luminescence (OSL) dates. Most Paleoamerican archaeologists revere radiocarbon dating—AMS specifically—as the gold standard, and moreover consider it necessary to obtain repeat dates on organic matter—preferably artifacts—to establish the antiquity of ancient material in the Americas. But at the Friedkin site, organic matter is so poorly preserved that not a shred of datable organic material remains. Project leader Waters happily quotes a well-respected radiocarbon expert's assessment that "there's less carbon in the entire Friedkin site than there is in the blade of my knife."

OSL dating solves the carbon problem

So Waters collaborated with Dr. Steven Forman (University of Illinois at Chicago), a geologist who is a leading expert in OSL dating, to date the sediments containing the Friedkin site artifacts. OSL is an established method for determining how long ago a deposit was last exposed to sunlight, providing a method for determining the age of burial for occupation surfaces.

Sifting excavated sediments.

In OSL dating, an age is estimated by measuring the amount of energy trapped as charges in defects in the crystal lattices of sand- and silt-size grains of quartz and feldspar. Short exposure to sunlight (as little as 1 to 100 seconds), or brief heating at 200°C–400°C, effectively "frees" this trapped energy, so even brief episodes of sediment transport or exposure to sunlight can reset the OSL clock to "zero." This resetting is also called "bleaching." Once a bleached grain is reburied, it is exposed to ionizing radiation (alpha, beta, and gamma particles) from the natural radioactive decay of uranium-238 and thorium-232 decay series and potassium-40 within the deposit and also a

small cosmic dose. The rate at which mineral grains accumulate ionizing radiation, called the dose rate (grays/year*), is the denominator for the OSL age equation. The dose rate is reduced with increasing water content.

Determining an OSL date begins with taking short sediment cores from the deposit of interest under "zero light" conditions to avoid bleaching the grains. This is done by pounding pipes into the walls of the excavation. Back in the lab, the sample is stimulated with specific wavelengths of light (blue or infrared) that release trapped electrons, which emit a time-dependent light signal, a process known as luminescence. The amount of luminescence measured is calibrated to a known laboratory radiation dose (from a strontium-90 source), termed "equivalent dose." The age of the sample is calculated as the equivalent dose divided by the environmental dose rate. OSL ages are in units of calendar years from the date of collection.

OSL dates can be obtained on single grains of quartz sand, but the Friedkin site sediments are predominantly silt and clay. Silt- and clay-size quartz and feldspar grains used for the OSL dating are not from the local drainage (limestone), but are windblown particles originating outside the site area. Therefore the grains would have had plenty of time to bleach during transport before deposition and burial at the Friedkin site. Because the site sits near the head of the Buttermilk Creek drainage, the opportunities for sediments to be redeposited by stream channel processes (giving anomalously old ages due to possible incomplete bleaching) are minimal.

Excavating Block A.

"You can't do single-grain OSL on silt- and clay-size particles because you can't separate the sample into single grains. Electrostatic and Van der Waals forces between the grains prevent this. It simply can't be done," Forman explains. Instead, he used a combination of single-aliquot regenerative dose and multiple-aliquot additive dose techniques. In both approaches, luminescence signals are measured on multiple aliquots (or subsamples) of a single sample. The final date is the average of these determinations plus or minus one standard deviation. This technique is commonly used in silt-sized samples, where grain sizes are 4–11 microns.

*A gray is a unit for the absorbed dose of ionizing radiation, corresponding to one joule per kilogram.

Like all dating methods, OSL is subject to caveats and limitations that affect the accuracy and precision of the dates obtained, but the method has been successfully employed by geologists for a quarter of a century. Methods to detect and correct for these issues are well established.

A total of 49 OSL dates were obtained from two columns in excavation Block A at the Friedkin site. Although there are some minor reversals, there is good agreement between the two columns and between the OSL dates on the deposits and the artifacts that they contain. OSL dates for the Folsom/Midland level are 11,870±760, 12,000±770, 12,100±860, 12,240±800, and 12,925 ±845 B.P. They overlap at one standard deviation and are consistent with the calendar-age range for Folsom of 12,000 to 12,800 B.P. determined by radiocarbon dates from multiple Folsom sites. Dates from the top of the Clovis horizon are 13,090±830 and 13,780±885 B.P., and the dates immediately below Clovis are 14,350±910 and 14,070±910 B.P. If artifacts had petered out at this depth, the dates would hardly be controversial. But artifacts continued for 20 cm beneath the Clovis layer, terminating at deposits dating to 17,530±1140, 16,270±1040, and 16,575±1075 B.P. A total of 18 OSL dates were obtained in the pre-Clovis strata containing the Buttermilk Creek Complex artifacts.

Potential biases affecting the OSL dates

Critics of the Friedkin site have pointed out a number of ways that the OSL dates could be biased. Soil scientist Frederick has used OSL dating extensively in loose, sandy archaeological contexts. He points out that "a young deposit with a few older grains brought up in the profile by bioturbation would create a peculiar, one-way bias," making the deposit date appear older than it really was. "Obtaining dates on aliquots rather than single grains can easily be screwed up by mixed-age populations of grains," he cautions.

Frederick dismisses the concordance of OSL ages and culturally diagnostic artifacts from Clovis to the late Archaic, pointing out that age bias should increase with depth, affecting the Buttermilk Creek Complex dates to a greater degree

than younger dates. "Are there no worms moving stuff at the Friedkin site? No fauna mixing things up? It doesn't take very many worms mixing deposits to get older material into younger deposits to make it look old," Frederick argues.

A related problem that Dr. Gary Haynes (University of Nevada, Reno) points out is the potential for incomplete bleaching of some of the quartz and feldspar grains used in the OSL dates. This too would yield anomalously old OSL dates for samples.

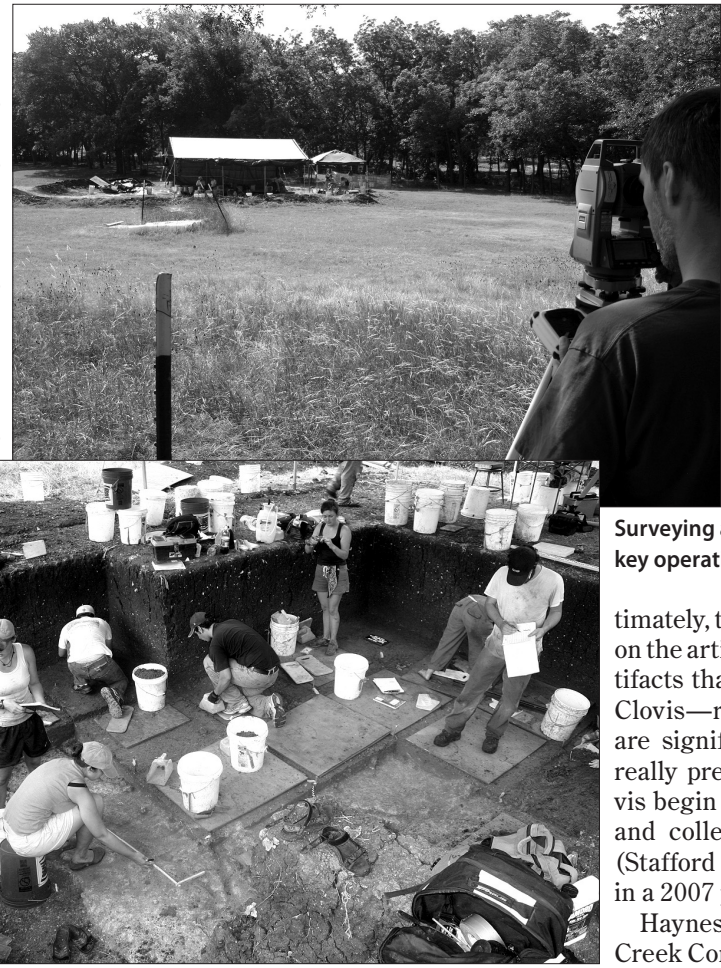
Either kind of mixing can be detected by analyzing the dates on aliquots from a single sample: The shape of the graph (unimodal, bimodal, multimodal) is diagnostic. If there has been no mixing, the graph of the dates on each aliquot of a sample should describe a normal curve centered on the mean value, a unimodal distribution. If there has been mixing, the curve of dates will have two (bimodal) or more (multimodal) peaks, with each peak corresponding to populations of grains of different ages. Frederick points out that if a deposit is mixed, the graphs of OSL age distribution for each level should become increasingly bimodal or multimodal with depth.

Although graphs of all of the OSL samples from the Friedkin site have not been published, one curve of an OSL date from the Buttermilk Creek Complex levels has been published. This graph is distinctly unimodal in shape and approximately normal in its distribution, indicating that the deposit is not significantly mixed and the ages are unbiased. Forman says, "We performed this kind of analysis on sediments down profile, and all the results were unimodal."

A second area of controversy concerning the OSL dates is the error term, which is typically around ±10% for single- and multiple-aliquot dates. Haynes argues that these large standard deviations might be "inflating the ages" and that perhaps the Buttermilk Creek Complex materials are "closer in age to Clovis" than Waters and colleagues think.

Dr. Vance Holliday (University of Arizona) is also concerned about the large standard deviations. "It's hard to know what to make of them," he says. "There's clearly no precision in the dating." Like Haynes, Holliday would be far happier if the site could have provided radiocarbon dates. "It has always been a problem that OSL does not have the precision of radiocarbon," he argues, "and you tend to get large standard deviations. Ten percent is not unusual." Absent radiocarbon dates, Holliday, like Frederick, would prefer to have seen single-grain OSL dates. He likens aliquot dating to a conventional radiocarbon assay on a handful of charcoal and single-grain OSL to an AMS date on a single seed.

On the other hand, neither the lack of radiocarbon dates nor the dependence on OSL dating troubles Dr. David Anderson (University of Kentucky). He thinks the Friedkin site materials are as old as Forman's dates place them. He reasons that "it is difficult to argue that the age is wrong with that many consistent OSL dates. There are multiple independent lines of evidence indicating that the artifacts below Clovis are real, and in what appears to be undisturbed context."



Surveying and excavating Block A, key operations of a 5-year project.

Clovis, Pre-Clovis, and the Peopling of the Americas

In the end, wishing isn't going to make organic matter suddenly appear at the site or miraculously enable single-grain OSL dating. Ultimately, the evaluation of the site rests on the artifacts themselves. Are the artifacts that lie stratigraphically below Clovis—regardless of whether they are significantly pre-Clovis in age—really pre-Clovis artifacts? Does Clovis begin at 13,100 CALYBP, as Waters and colleague Dr. Thomas Stafford (Stafford Research Labs) suggested in a 2007 paper in *Science*?

Haynes claims that the Buttermilk Creek Complex artifacts do not constitute evidence for a pre-Clovis occupation. He believes the OSL dates are "inflated" relative to what he maintains is the true age of the Buttermilk Creek Complex artifacts, about 1,000 years before Clovis. "I'm always willing to believe that there might be a precursor or proto-Clovis that might be ancestral by a thousand years, but not a separate, preceding-migration event. There is only one event," he insists, not multiple events. "What we are looking at under Clovis [at the Friedkin site] is just early Clovis." According to his model, people entered the New World 13,000 to 14,000 CALYBP with a typical Upper Paleolithic toolkit and, along the way south to the lower 48, "somebody added the channel flaking. It is stretching credulity to have people living somewhere, inventing fluting, and having it move out across the thinly populated continent in such a short timeframe."

Holliday seems to agree that there is only a single archaeological culture prior to Folsom in North America when he says of the Friedkin site materials, "It would be really cool if Clovis turned out to be a lot older than we are thinking." Dr. Stuart Fiedel (Louis Berger Group) would concur, arguing that "the assemblage might be an early facies of Clovis, like Aubrey (if those radiocarbon dates are valid)."

But Anderson doesn't think there's enough information at present to determine cultural affiliation either way: "Additional excavations and a larger artifact sample will be needed before comparative and classification questions can be addressed" in the assemblage.

Other archaeologists, however, see things very differently. Paleoindian specialist Dr. Tom Jones (Hamilton College) argues for an early migration into the Americas along a coastal route, with only gradual penetration into the continental interior. And it would make sense to find Clovis, Folsom, and later artifacts on top of the earlier assemblage at Friedkin because the Edwards Plateau chert source was likely "part of people's cognitive map for a long time," since everyone had the problem of finding toolstone in a toolstone-poor region. "The Clovis use of this region may represent a continuation of a pattern of earlier use of the sources."

Waters believes that whoever entered North America and settled at the Friedkin site may have been ancestors of Clovis, but they were not yet Clovis. "Clovis," he says, "is home grown in the Lower 48, but it had to come out of something with biface and blade technology. The credible pre-Clovis sites that are out there all contain biface, blades, and bladelet technology. This is the hallmark of early sites in North America. Clovis technology developed and spread quickly—there is no evidence anyone brought Clovis technology into North America from anywhere. It had to be invented in what is now the United States and spread." And for Waters and his team, the Friedkin site is conclusive evidence for the existence of that previous population.

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Suggested Readings

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Pointed Questions—

The Jim Pitts Site


Block excavations, 1993.

SOUTH DAKOTA ARCHAEOLOGICAL CENTER

NEAR THE MYSTERIOUS Jim Pitts site, one of the oldest archaeological sites in South Dakota, the rolling plains change quickly to rocky outcroppings and hogbacks as the Black Hills loom on the horizon. About 62 million years ago, an uplift tilted layers of sedimentary rock to form ridges that ring the higher, central hills. A valley squeezed between the hogbacks and the higher elevations, known locally as the *racetrack*, has sheltered the enigmatic site for thousands of years.

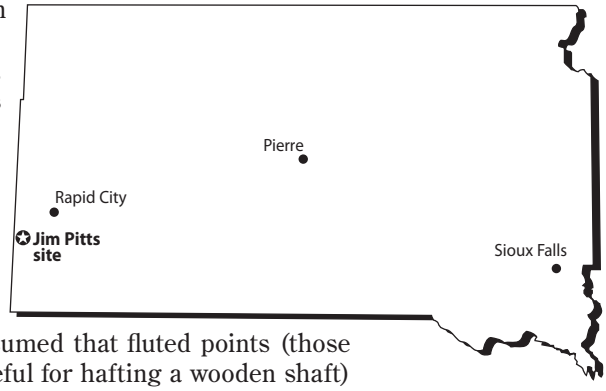
The Jim Pitts site raises as many questions as it answers for anthropology professor and veteran lithic analyst Frédéric Sellet (pronounced Sel-LAY *à la mode Française)* of the University of Kansas. The multicomponent site, where Paleoamericans apparently first set up housekeeping during the Goshen age, dates at its lowest level to 10,185 RCYBP, yet a wide array of point types were uncovered in the several levels of the site, including Goshen, Folsom, Agate Basin, James Allen, Cody, Alberta, and an occasional fishtail point. The fishtail points don't fit precisely into any known category. A generic term, "fishtail" is used to describe points that have a fishtail-shaped base. The implications for restructuring the Paleoamerican cultural landscape of the South Dakota Plains were somewhat obscured by the muddy waters of conflicting data found at Jim Pitts.

Obsession with point types complicates dating

In the years before radiocarbon dating appeared on the scene, archaeologists organized Paleoamerican chronology by the similarities and differences between point types and the position of the stratigraphic layers that contained them. But the rarity of stratified sites handicapped data collection. Sellet believes that the study of Paleoamerican archaeology cries out for a more refined chronology to assist in identifying the earliest residents of the North American plains.

Since the 1920s and 1930s, Paleoamerican archaeologists have depended on projectile point types as a means to organize the cultural landscape and fill in time gaps created by the discovery of the first Clovis and Folsom points. After these point types came to light, most archaeologists assumed that fluted points (those with a longitudinal groove useful for hafting a wooden shaft) represented the earliest points used on the Great Plains. This assumption was somewhat ruffled by the recovery of unfluted Goshen points in the deepest levels of the Hell Gap site in Wyoming and by the early dates recorded for the Goshen occupation at the Mill Iron site near the South Dakota/Montana border. If future data suggest that Goshen points are actually as old as Folsom or Clovis, Paleoamerican chronology will have to be redefined.

The term "early Paleoamerican" has been loosely used to characterize Clovis and Folsom discoveries on the Northern Plains, while "late Paleoamerican" referred to varied assemblages that postdate the 10,000 RCYBP threshold. This classification, however, completely ignores Goshen, Agate Basin, and Hell Gap, which overlap the "early Paleoamerican" and "late Paleoamerican" boundaries. Beyond the semantics lies a more important question. After 11,000 RCYBP, do data show a significant change in behavior, population, and mobility as some studies seem to suggest? Did rapidly changing climactic conditions (increasingly warm and dry) cause changes in the available food sources, reducing human mobility and widening the diet? Did larger, more scattered herds of bison cause Paleoamericans to become more territorial? "These questions beg for well-documented answers," says Dr. Sellet.

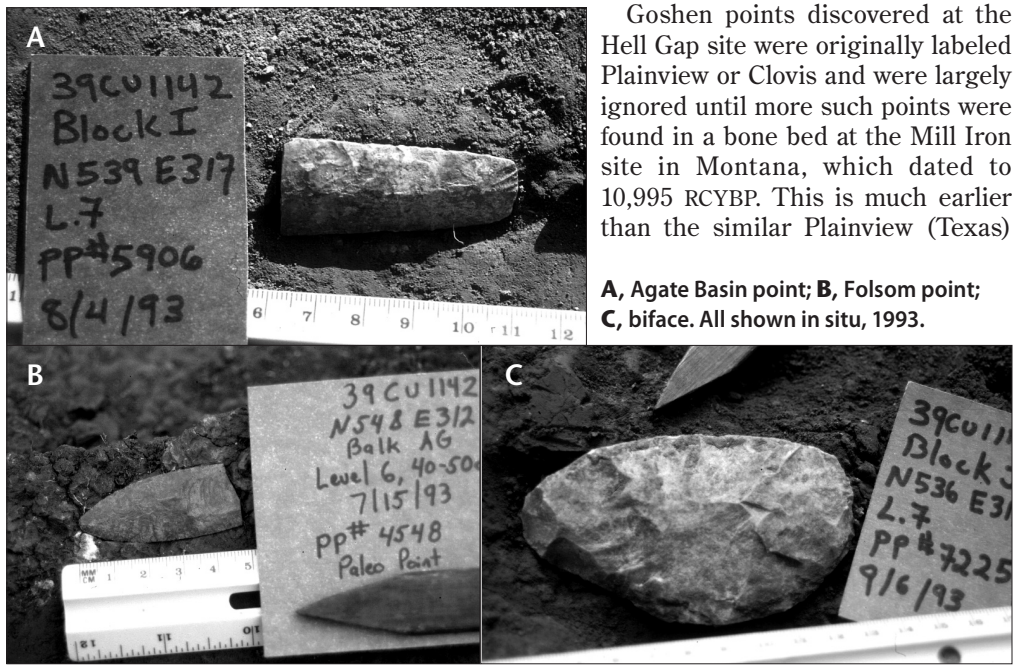


The Goshen complex

The discovery of Goshen points during excavation is a rare event, and little is known about these elusive residents of the Great Plains. Goshen appears to be a separate cultural complex that existed in the time period between Clovis and Folsom. First identified at the Hell Gap site, the Goshen point

is named for the county in eastern Wyoming where the site is located. Although it is customary for archaeologists to name point types after the site where they are discovered, the Hell Gap site produced three new, distinctive point types, and by the time a Goshen point showed up, the name "Hell Gap" was already taken. Frederick points would also eventually make an appearance there.

Sellet's report, "The Jim Pitts Site: A Stratified Paleoamerican Site in the Black Hills of South Dakota," first appeared in 2009 in *American Antiquity*. The intent of the report was "to refine available chronological and typological information on the ill-defined Goshen complex," and it incorporates information from several sites on the Great Plains. Deposits at the Jim Pitts site, which provided its ancient inhabitants with shelter from the elements as well as access to a wide range of food sources and lithic raw materials, show that the site remained occupied from the late Pleistocene/early Holocene to the 20th century A.D.



A, Agate Basin point; B, Folsom point; C, biface. All shown in situ, 1993.

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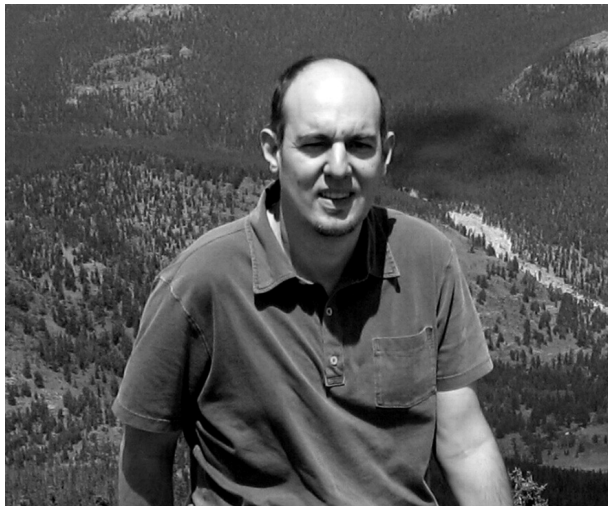
"I was brought in to the study of the Jim Pitts site because most of my expertise is in stone-tool analysis," Sellet says, "and because I had worked on previous artifact collections of similar age, specifically the Hell Gap site." Sellet didn't work on the original excavation of Jim Pitts, but joined the project in 1999.

"The most interesting thing about the site for me was the lower Goshen level," Sellet says. "It involved a long occupation and was intriguing because it is one of very few Goshen sites on the Northern Plains. Most other Paleoamerican sites are kill sites, which provide very short windows on the past. Jim Pitts is a stratified site with a succession of occupations. It spans pretty much the entire Paleoamerican period with the exception of Clovis.

"The Paleoamerican toolkit was designed to be portable," Sellet explains. "Paleoamericans planned their needs in advance. Evidence indicates that the tools at the Jim Pitts site were replaced in bulk, during gearing-up episodes." This kind of long-range planning is a cultural phenomenon that is most highly visible at camp sites with long-term occupations. Lithic material recovered at kill sites is unlikely to illustrate this kind of gearing-up behavior. That the Goshen-age residents were wasteful and discarded tools that were still functional suggests that access to raw material was not a major concern.

Goshen points discovered at the Hell Gap site were originally labeled Plainview or Clovis and were largely ignored until more such points were found in a bone bed at the Mill Iron site in Montana, which dated to 10,995 RCYBP. This is much earlier than the similar Plainview (Texas) complex. Sellet prefers the term Goshen for points of this type, since such points have recently been dated stratigraphically at several other Great Plains sites.

Radiocarbon dating performed on 24 individual samples taken from the Jim Pitts site showed two spatially distinct clusters, one in the southern section of the main camp and another at the northern edge of the site. Most showed dates consistent with their stratigraphic positions. The Goshen bone bed consistently dated to about 10,200 RCYBP, using tests on charcoal and corroborated by a similar tooth date. Although the dates show a clear chronology for the earliest inhabitants of the site, the number and age of the subsequent occupations were more difficult to determine. The northern part of the site shows a more loosely defined stratigraphy with greater soil compression in some areas. The Cody occupation at the site defied accurate dating.



FRÉDÉRIC SELLET

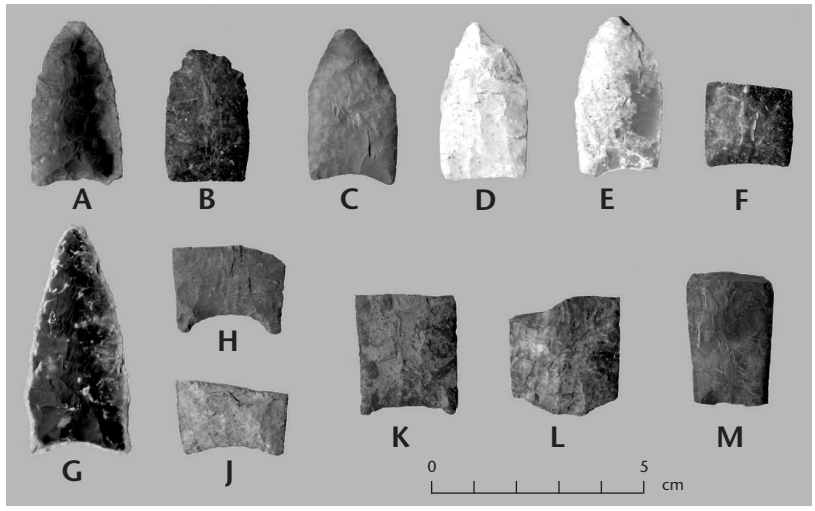
Sellet, a recent photo taken in the Rockies.

Goshen variability

Sellet noticed a wide range of morphological and technological differences among Goshen points at Great Plains sites. Variation in the shape and size of Goshen points suggests a single short occupation at each site, which makes it difficult to classify them consistently. A Folsom point can always be characterized by its flutes, a Cody point by the square stemmed base, but Goshen points refuse to fit a strict template. The base varies from straight to concave, with or without ears, and the sides

are sometimes parallel, sometimes constricted, and sometimes expanding. Tips range from triangular to curvilinear, and even flaking patterns are inconsistent. Craftsmanship varies even among points recovered in the same area. Goshen assemblages can be distinguished from other highly diagnostic point types like Folsom or Agate Basin, but variability within the Goshen type makes it difficult to trace its evolution through time or space.

To confuse the issue further, no definite chronological framework has yet been established for Goshen points. No one knows exactly when the type starts, when it ends, or its geographic range. In view of the ambiguity surrounding Goshen, Sellet believes that typology alone is not sufficient to define Goshen points and that we should rely instead on site specifics, stratigraphic references and relationship to other Paleoamerican points, to pin down its chronology. At present, the data inferred



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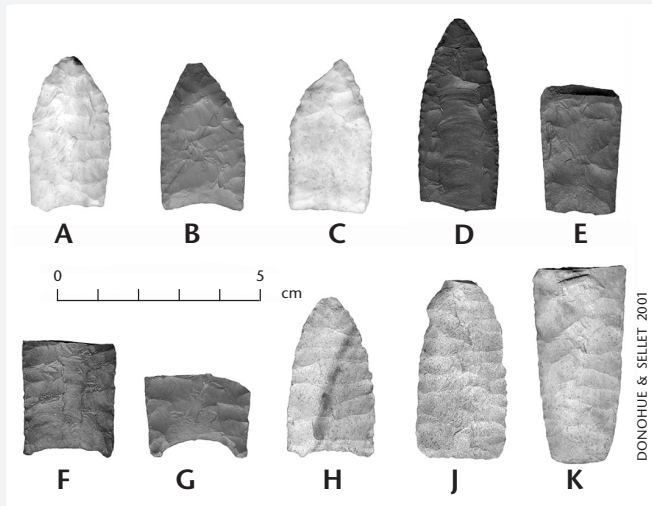
Points and fragments from the Jim Pitts site. All are Goshen except G, which is one of three Fishtail points found at the site.

DIGGING Jim Pitts

A SURVEY CREW working with Jim Donohue in the Black Hills on a project for the South Dakota Department of Transportation in 1991 discovered a site, that upon excavation, turned out to be highly unusual: a hunting camp dating from about 1948, which sat above archaic occupations and multiple Paleoamerican occupations at the same site. Christened the Jim Pitts site, the find generated excitement among Donohue's team at the South Dakota Archaeological Research Center. Until its discovery, most of the Black Hills Paleoamerican lithic record had come from surface finds.



DONOHUE & SELLET 2001

Points and fragments from the Jim Pitts site: A–C, E–H, Goshen points; D, Folsom point; J, Goshen preform; K, Agate Basin Point.

The Jim Pitts Site rests in a wide valley between hogback ridges that are the first elevations encountered upon entering the hills. Occupants in the valley therefore had convenient access to the resources of both ecosystems. The site yielded a wide variety of projectile points that aren't often found together. "The area is a patchwork of prairie and forest with box canyons nearby," says Donohue, "and is ideally situated along a natural highway for the migration of bison and other game in and out of the Black Hills."

Discovered in 1991 prior to reconstruction of US Highway 16 and excavated in 1993, the Jim Pitts site has produced a rich lithic assemblage including 25 points or point fragments. But its real importance lies in the remarkable variety of point types discovered there. The list is long and includes Goshen points, a Folsom point, some examples of Agate Basin points, a variety of unclassified fishtail points, a Cody knife, a single James Allen point, and many non-diagnostic fragments. A wide variety of natural resources including high-quality lithic materials would have been readily available in the area throughout prehistoric times, and a handy outcrop of Spearfish chert lies a few hundred meters away. Paleoamerican hunters may also have found nearby canyons convenient for trapping and killing large game.

Early test excavations of the site were done in winter while snow was still on the ground, but excavation was put off until early spring and continued for several months thereafter. Donohue noted that cultural material occurred in two distinct strata. The upper, Stratum I, yielded late- and middle-Holocene-age materials; Stratum II extends into Leonard paleosol and contained a Paleoamerican projectile-point base. "The Leonard paleosol," Donohue explains, "is a buried topsoil that was stable and shows signs of a much lusher environment than we find here today. It's a transitional soil that is considered a rough boundary between the Pleistocene and Holocene periods."

Once eligibility for the National Register was established, excavation took place in three phases. In the first phase, blocks were excavated in two areas containing intact deposits, followed by intensive investigating with three-dimensional mapping in the southeastern site area. In the second phase, four backhoe trenches were dug

from Goshen points in stratigraphic context are scanty and radiocarbon dates span more than a thousand years.

Sellet believes it's unlikely that the lithic technology that defines Goshen points would remain unchanged for that long, since most Paleoamerican point types come and go within a few centuries. Precise definition of the Goshen point type will require additional sites and larger assemblages. Even with additional data the quest may prove futile if variability at the site level proves as vague as the variability between sites.

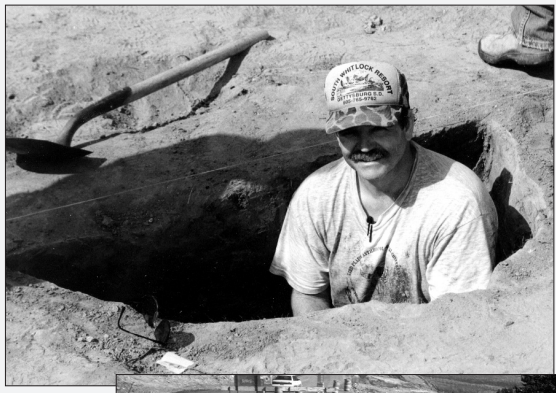
At the Jim Pitts site, Goshen points are the only type found in the lower bone bed, below Folsom, Agate Basin, fishtail, and Cody points. But a few Goshen points have also been discovered at the same level as several of these other types. The temporal resolution at the site just isn't clear enough to provide definitive answers.

Questions remain

The Jim Pitts site stratigraphy and chronology only partially answer questions about the relationship between Goshen, Folsom, Agate Basin, fishtail, and late-Paleoamerican points. What they show is that Paleoamerican point typology is more complex than we originally thought. Great Plains terminal-Pleistocene sites often display a mix of point types. Kill sites, occupied for short periods, may contain a single point type, but long-term occupations like the Jim Pitts and Hell Gap sites yield evidence of a complex set of cultural behaviors. The presence of more than one projectile type at the same level may be the result of trade or population aggregation. Moreover, the infusion of new technology could mean that diverse manufacturing techniques existed simultaneously within a Paleoamerican group.

"While the Jim Pitts site presents exciting information, it is also frustrating," Sellet says. "The Paleoamerican sediments were near the surface, and there had been some disturbance caused by burrowing rodents and other occurrences that blurred the clear picture. At any archaeological site there will be vertical movement. The single Folsom point was just a few centimeters above the Goshen points, which gives us a hint

to recover geomorphic data in an area that didn't contain cultural deposits. In the final phase, Stratum II was excavated, a section that extended under the old Highway 16 roadbed. Because Stratum II would soon be destroyed by the highway project, this phase required removing fill in 10-cm levels, bagging material from each level, and water screening it in the lab. "It took nearly three years to screen the tons of material we removed from under the roadbed," Donohue remembers, "but because of the urgency of reconstructing the highway, our time at the site was extremely limited."



BOTH: SOUTH DAKOTA ARCHAEOLOGICAL CENTER

◀ Donohue excavating a cache pit at Whitehorse Creek, a site dating to the Plains Village period (Extended Middle Missouri, A.D. 1200–1500) located in Dewey County, about 150 miles northeast of Rapid City, 2000.

▼ Bagging up the Jim Pitts site, 1993.

In all, 1,837 faunal remains, including 1,352 specimens from the Goshen component of the site, were mapped in situ, giving archaeologists an unprecedented opportunity to study the activities of Goshen hunter-gatherers in a residential setting containing a bone bed. Bones from no fewer than 5 bison (132 bone specimens), along with mule deer (7 specimens), and antelope (2 specimens) indicate that bison were the focal prey species during this occupation. Most kills were probably made in the vicinity of the site, although some meat and marrow-bearing carcass segments may have been transported from distant kills.

The lithic assemblage of the Jim Pitts site includes 7,783 artifacts. The most abundant material is local Spearfish chert, followed by a gray Morrison quartzite and various other quartzites, nearly all of which can be found in the area of the Black Hills. Donohue and his team found flakes, cores, and large blanks for unifacial knives, evidence that residents at the lower Goshen level of the camp were well provisioned with finished tools and toolstone.

Interestingly, the different point types unearthed in the area were most often made of the local Spearfish chert. The artifacts made from this material showed up in numerous, widely spaced concentrations, which suggests a series of toolmaking episodes. Morrison quartzite, the second most commonly found raw material, seems to be concentrated in one tight area, suggesting a single intense toolmaking event or possibly a single phase of occupation. Such behavior points to large-scale toolmaking for future use, which was probably done when hunters were idle. All the evidence points to a technology based on long-term planning.

Also discovered in the Goshen level of the Jim Pitts site was an intriguing antler tool, a rare find in Paleoamerican sites. Possibly from an elk or a large mule deer, the poorly preserved piece may have been used as a flintknapping tool, perhaps a soft hammer or burnisher. It adds further mystery to the intriguing Jim Pitts site.

"It's very likely that there are other similar sites nearby," Donohue says, "and we intend to do further investigation out there in the near future."

–Martha Deeringer

about the temporal relationship between Goshen and Folsom, but is not definitive by itself."

For Sellet, the site raises other questions. The oldest dates associated with Goshen points overlap the youngest Clovis dates. Folsom also overlaps Goshen, and Goshen seems to extend beyond the Folsom period. Is it possible that Goshen and Folsom people worked side by side, each making their unique point type? Did they pass manufacturing methods along to each other?

Stratified camp sites on the Great Plains often have complex formation histories that frustrate efforts to determine the chronological order of point types. For Frédéric Sellet, the key to better organizing the Paleoamerican cultural landscape lies in the archaeologist's ability to sort out these confusing clues.

"If, a thousand years from now, archaeologists investigate my history," Sellet says, "they'll discover mixed messages. I'm a Frenchman living in North America with an American wife and daughter, and I drive a Toyota. You can see how easily the discovery of just one of these clues could lead to incorrect assumptions." MT

–Martha Deeringer

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Elusive Clovis in Oregon

continued from page 3

- Or they were simply the expression of a stone tool craftsman's esthetic desire to produce smaller points.

Payoff in the future of Great Basin studies

The impact of this ambitious research on our knowledge of Paleoamericans in Oregon remains to be seen. After examining lithics from the Oregon sites and from sites in the West, Rondeau has reached a broad conclusion embraced by the other researchers: "I just think that there are a lot more fluted points out there than the archaeological community thought." He thinks it likely that many of the best examples today lie in the hands of collectors and have never been scientifically studied, thereby creating the illusion that the Far West doesn't have many fluted-point sites. The Burns projects are shattering that misconception.

Based on his analysis of the Burns-area sites, Rondeau sees no reason not to call the fluted points Clovis. The northern Great Basin appears to abound with fluted-point technology. To Rondeau "it appears the area was populated with people who may turn out to be of Clovis age" when dates are secured.

Although he hasn't yet seen material from the Rim Rock Draw Rockshelter, Rondeau is eager to return to the site next field season and examine the finds as they surface. He isn't alone. Excitement among the other researchers runs high. "I really think this search for Clovis is in my blood now," Thomas says. As a measure of his optimism, he hopes the rockshelter eventually produces fluted artifacts and radiocarbon dates that will make it the first firmly dated Clovis site in Oregon, possibly the Pacific Northwest. The thought of it "is driving me crazy," he says, "and I can't wait to get back out there." MT

–George Wisner

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GARY VAUGHN

A Beach's Buried Treasure

Excavation team in the 2007 field season *(left-right)* Kilby, Christina Sinkovec, Huckell, Chris Merriman (holding a Clovis blade fragment found in situ), and Carolyn Gabe.

A CACHE OF ARTIFACTS tucked away by ancient Americans stands a chance of discovery today only if it was forgotten by the original owners. Considering that these antiquated safety deposit boxes were intended to keep their contents out of the hands of strangers, recovering them is often more an accident than a planned exercise. Deducing exactly what *has* been found is where scientific know-how comes into play.

The Beach Cache of southwestern North Dakota is a stored cache that, fortunately for us, was both forgotten and found. Gary Vaughn, a student at the University of New Mexico, brought the site to the attention of anthropology professor Bruce Huckell. Vaughn had seen the cache years earlier and wondered if it might be Clovis. In 2006 Dr. Huckell and Dr. J. David Kilby, then a graduate student of Eastern New Mexico University, set to work and concluded that the cache was Clovis. The next few years found them analyzing the lithic artifacts and identifying the toolstone. Plotting the sources of the raw material yielded a prize as valuable as the artifacts themselves, a map of Clovis mobility.

A-treasure hunting we will go

In a pirate story, at some point its characters deposit their treasure on some lonely beach for safekeeping. Although this story has its buried treasure near the town of Beach in southwestern North Dakota, here we trade pirates for Paleoamericans, doubloons for bifaces, and dispense with the ocean altogether.

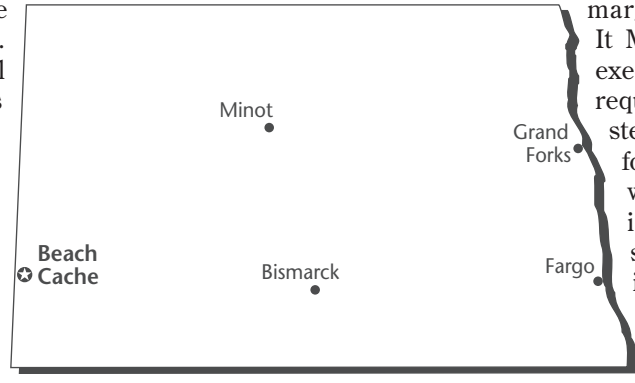
In 1970 Alan Miller set out 15 km northeast of Beach to hunt pheasant. What he bagged instead was a sizable red porcellanite biface, which naturally piqued his interest. Over the next few years he recovered 56 artifacts from the spot, which lay in a field owned by Donald Abernethy, and he wasn't the only one searching. Abernethy with the help of friends dug several pits within an area of 3½ by 4½ m and found another 80 artifacts. The significance of the site wasn't realized until 2005, when Vaughn told Huckell of Miller's collection.

They found the site remarkably intact for having been discovered nearly 40 years before. It lay near the summit of a slightly sloped ridge bordering a drainage. Plowing had exposed the artifacts originally found on the surface, but the lower portions of the cache remained undisturbed. The pits Abernethy had dug extended at deepest only a foot below the surface. He described finding several closely spaced volleyball-size pockets, each containing stacked artifacts. Huckell and Kilby knew that all known Clovis caches housed artifacts in a single large pit (**MT 22-2,** "Snapshot in Time: New Insights from Clovis Lithic Caches").

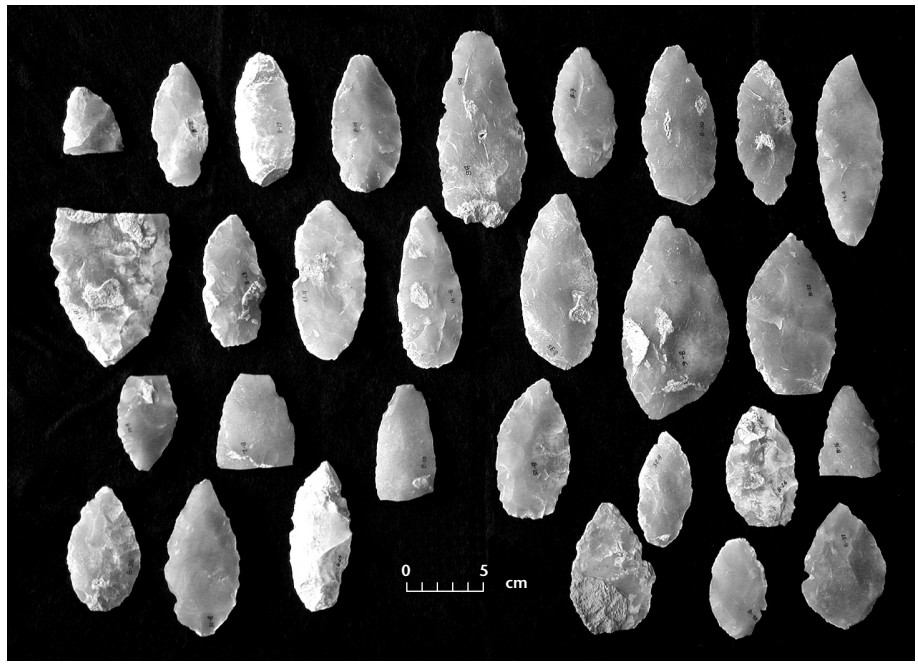
And these artifacts were Clovis. Of about 140 known recovered from the site, 103 were still in the hands of Abernethy, Miller, and other local collectors, all of whom allowed the scientists to study them. Of the total assemblage, 99 were bifaces and 4 were blades or bladelike flakes.

The hallmarks of Clovis knappers

The first unmistakable Clovis diagnostic was the consistent use of overshot, *outre passé,* flaking, which, as Huckell explains, "refers to the removal of a flake that is struck from one lateral margin and which travels completely across the width of the biface and terminates by removing a portion of the opposite margin" (**MT 26-2,** "What It Means to Be Clovis"). To execute this risky technique requires three conditions: "a steep exterior striking platform"; striking the platform with practically "straight in" contact; and a forceful strike. The goal, says Kilby, is to create the largest possible flakes that can be used as blanks for making other tools. In other cultures an overshot flake usually indicates a knapper's mistake, but Clovis knappers perfected the technique. Two-thirds of the bifaces from the Beach Clovis Cache showed signs of overshot flaking on one face, and nearly a third displayed overshots on both faces.



The second telltale sign that identified the artifacts as Clovis was the presence of blades. Blades and their parent cores appear in Clovis sites across North America. Though other cultures made and used blades, the Clovis blade-reducing technique is recognized by certain defining features. As far as Paleoamericans are concerned, Kilby says, "south of the ice sheets" Clovis has a monopoly on blades. Of the four blades discovered from the Beach Cache, three bore the distinguishing striking platform that identifies it as Clovis. "In my experience," Kilby sums up, "when you have both blade reduction and systematic overshot flaking on bifaces present in a lithic assemblage, you can proceed with some confidence that the assemblage is Clovis even when diagnostic artifacts are not present."

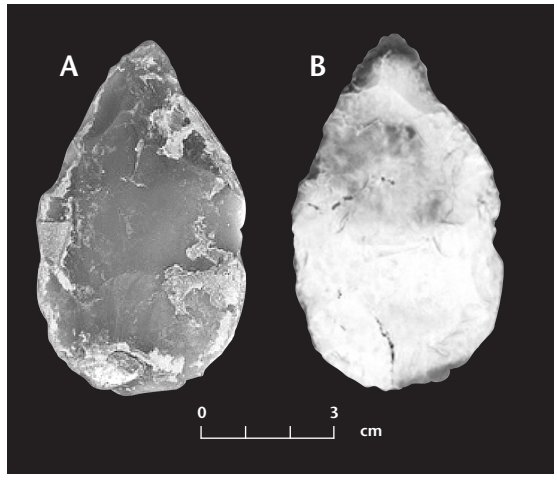


GARY VAUGHN

All the Sentinel Butte (White River Group) chert bifaces in Alan Miller's collection.

Rock relatives

Having identified the creators of the Beach Cache artifacts, Huckell and Kilby focused on the raw materials used to make them. The point of origin for the most prominent toolstone, White River Group Silicate (WRGS), which accounts for 58 of the 103 artifacts in the collection, wasn't immediately apparent because this chert outcrops in Colorado, Nebraska, South Dakota, and Wyoming. Today chert can often be traced to its source. The process known as laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), for example, can detect the unique proportions of trace elements that identify a particular quarry (**MT 26-4,** "The Fluted Point of Ramah Chert"). As we'll see, Huckell and Kilby would use a different analytical technique called instrumental neutron activation analysis (INAA) to accomplish the same purpose.



CATHERINE BAUDOIN

A biface of Sentinel Butte (White River Group) chert. Face **A** is heavily patinated. Face **B**, virtually unpatinated, bears remnants of calcium carbonate and scars from a pair of large overshot flakes.

To make the situation both more complicated and intriguing, Miller told the scientists that chert similar to the toolstone used in the WRGS bifaces could be found only 19 km southeast of the cache at the top of a landform called Sentinel Butte. It isn't unusual for cached material to derive from sources hundreds of miles away; in fact, the very nearness of Sentinel Butte seemed odd. Considering, however, the number of places WRGS originates and the fact that this material made up more than half the cache, in this case logic wasn't lacking.

When Huckell and Kilby arrived to investigate Sentinel Butte they found it well named. It covers more than 200 acres and towers over a backdrop of undulating hills, ridges, and valleys. It seems unlikely that ancient people viewing it from a distance could have resisted the timeless human impulse to reach the highest point in sight. Huckell and Kilby made it to the top too, and there discovered the chert outcrop. They found abundant nodules 5–10 cm long, and even larger tabular nodules were scattered here and there and may have been more plentiful in the past. The pieces were starting to fall into place.

The WRGS bifaces from the cache are 61–132 mm long and 31–76 mm wide, smaller than typical nodules found at Sentinel Butte and therefore possibly made of toolstone from there. (By comparison, Beach Cache bifaces constructed from Rainy Buttes silicified wood and porcellanite were 150–303 mm long and 71–111 mm wide.) So far, so good.

The next step was to determine whether Sentinel Butte chert could be distinguished from WRGS from other sources. For this test, Huckell and Kilby used instrumental neutron activation analysis (INAA), which detects the constituent elements in material, a process analogous to DNA testing to determine an organism's genome. First, samples of chert taken from different points at the Sentinel Butte quarry were analyzed to confirm that chert throughout the outcropping was homogeneous. The results were conclusive: All specimens bore sibling-like chemical signatures. Next, the data were compared with those of WRGS from

other sources, such as White River Badlands in South Dakota and Table Mountain in Wyoming, and with look-alike chert such as Knife River flint. The scientists found that although Sentinel Butte chert had 18 elements in common with its WRGS cousins, its greater proportions of sodium and antimony made it chemically distinct from other WRGS and their look-alikes.

J. DAVID KILBY

The principal players in the Beach Cache discovery at the site, 2006: *(l–r)* Gary Vaughn, David Cameron (Vaughn's brother-in-law and Alan Miller's cousin), landowner Don Abernethy, Huckell, avocational archaeologist Jan Cummings, and hunter Alan Miller.

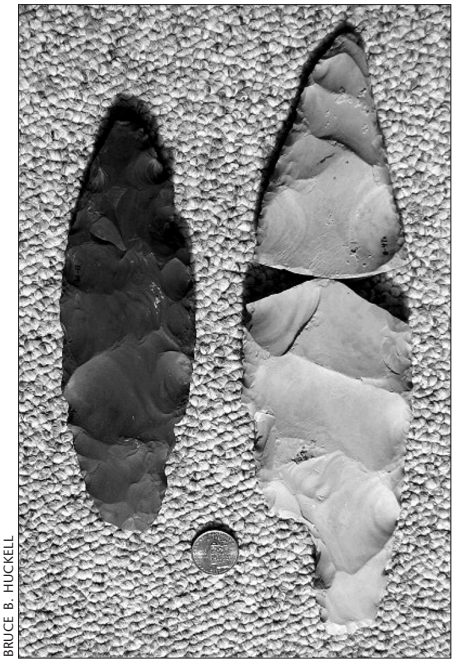
All that remained was to test the Beach Cache artifacts. Huckell and Kilby chose three bifaces, broken by plowing, for INAA testing. The results confirmed that the chemical composition of the toolstone matched that of Sentinel Butte chert within 92.94%. Sentinel Butte chert was the raw material for the bifaces after all.

Mapping mobile knappers

Identifying the sources of raw materials used by Paleoamerican toolmakers is of paramount importance because it describes a map of a group's movements, pinpointing the locations of the quarries visited and the final known stop, the cache. With this information the archaeologist can construct a model of their mobility pattern.

Huckell and Kilby set to work classifying the different toolstones used to make the Beach Cache artifacts and their origins. Material for the 58 WRGS bifaces, which constitute more than half of the assemblage, was quarried at Sentinel Butte, less than 20 km southeast of the cache. Orthoquartzite, a distant second used to make only 12 bifaces, may have come from the Black Hills in South Dakota or either Spanish Diggings or Bear Lodge Mountains in Wyoming. These three possible sources lie 270–500 km from the Beach Cache. Eight bifaces and two blades are made of Rainy Buttes silicified wood, whose source in southwestern North Dakota is only 80–90 km from the Beach Cache.

All the traceable material found in the Beach Cache derived from localities south of the cache, indicating the group was traveling northward. Other materials found in the cache, such as agate, petrified wood, and porcellanite, come from unknown sources. Although one of these unsourced materials, a dark chalcedony, resembles Knife River flint, it doesn't respond to UV light as Knife River flint does. For Kilby, this reinforces the suggestion that our Clovis group was moving northward. Knife River flint, he points out, is found northeast of Beach and is notably missing from the cache.



BRUCE B. HUCKELL

Porcellanite bifaces from the Beach Cache bear overshot-flaking scars distinctive of Clovis toolmaking.

Why cache?

Why were the artifacts cached so near a source of workable chert? Huckell and Kilby suggest that instead of storing these tools in a place remote from a source of toolstone, perhaps this group was stockpiling materials in the vicinity of a future hunting site. For the most part the bifaces are only roughly shaped in the early stages of tool making. They have the potential, however, to become blade tools, bifacial knives, and Clovis points. Thus they are the ready makings of an arsenal for hunting and butchering game, anything from megafauna to modern-sized deer that might seasonally pass through the area.

A Clovis hunter in need of a replacement weapon might find himself dangerously pressed for time, especially if the numbers of some prey animals were dwindling toward the end of the Pleistocene. Having a store of materials at hand would save the time required to travel

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GARY VAUGHN

At the Rainy Buttes silicified wood source in 2007 *(left-right)* Kilby, Al Miller, discoverer of the Beach Cache, and Huckell.

to the nearest source, Sentinel Butte, locate nodules of suitable size, knap from them preforms and cores, and transport them 19 km on the return trip. For the 58 WRGS bifaces found in the cache, Huckell and Kilby conservatively estimate the time it would have taken four toolmakers to complete these tasks at 29.65 to 33.275 hours. The Beach Cache would have been a welcome time saver for a hunter.

More prizes to come

What started out as a few isolated artifacts found on the surface by a hunter in 1970 has grown into a large collection of cached Clovis tools. Plowing made possible discovery of the cache. Much to Huckell's relief, the owner of the field discontinued cultivation in 1980 (a magnanimous gesture that Huckell says is definitely not typical of his experiences with caches and landowners), thereby preserving the rest of the archaeological site. Huckell and Kilby have excavated the Beach Cache for the last three field seasons, "all very brief," Huckell admits. Nonetheless their labors have borne fruit. Over the past three seasons they have uncovered what seems to be a work area containing a few discarded flake and blade tools, including an "overshot-terminated biface reduction flake," the thumbprint of Clovis. These flakes could have been made on the spot from larger blanks, or they may have been flakes produced at the quarry. Also recovered were "flakes" that had been knocked off cached artifacts by plowing.

Perhaps the most tantalizing find was scattered bits of charcoal they uncovered in the same area, one of which was radiocarbon dated to 11,600 RCYBP (ca. 13,500 CALYBP). Huckell calls this an "intriguing age." Well he should, for it surpasses the earliest extreme of the Clovis timeframe. (The Lange-Ferguson site in South Dakota, the oldest unquestioned Clovis site and the only dated Clovis site in the Dakotas, dates to 11,080 ± 40 RCYBP. The Aubrey Clovis site in Texas has been dated to ca. 11,570 RCYBP, but this age is the subject of debate.) Huckell wants to test more charcoal to authenticate the first radiocarbon date. If it is correct, not only is the Beach Cache the northernmost Clovis cache (tying the Pelland Blade Cache in Minnesota, Kilby notes), it ranks among the oldest dated Clovis sites.

Huckell and Kilby plan to enlarge the excavation. No gold, of course. The secrets of the cache are their plunder.

–K. Hill

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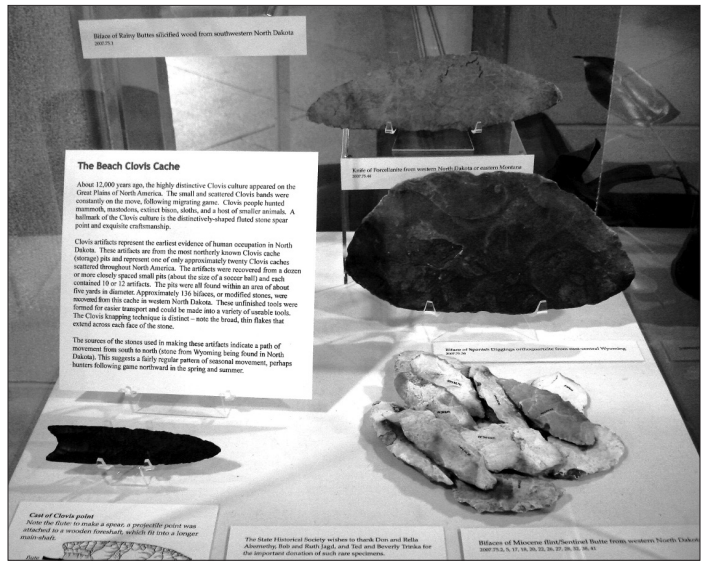

GARY VAUGHN

Artifacts of the Beach Cache on display at the North Dakota Heritage Center Museum in Bismarck, which now safeguards most of the Beach Cache. (The fluted point at left is not part of the cache.)