MAMMOTH TRUMPET

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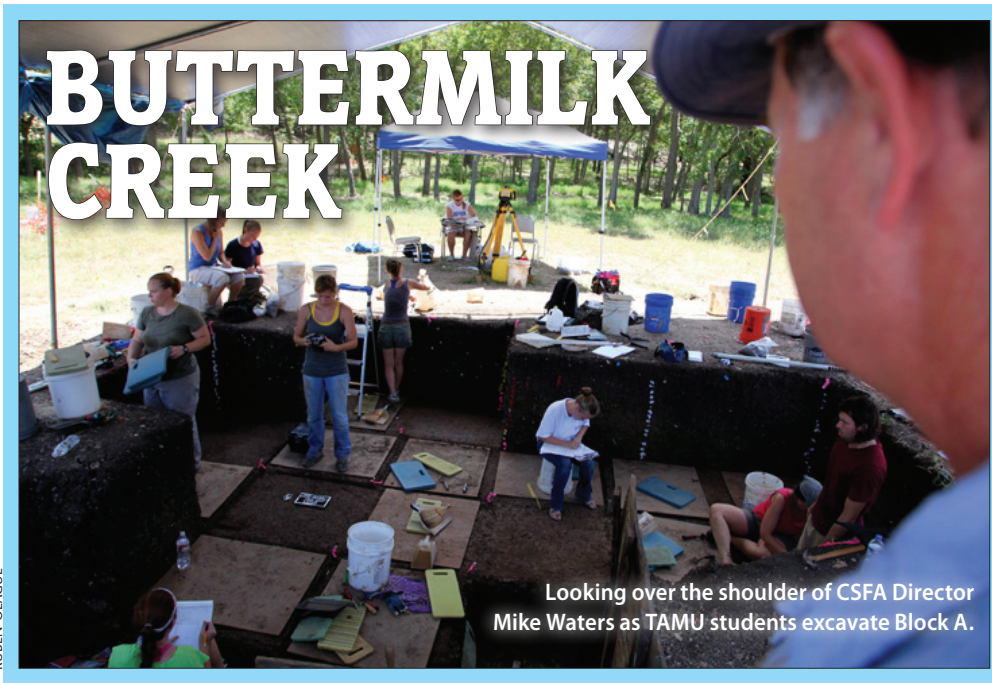

RUBEN OLAGUE

Looking over the shoulder of CSFA Director Mike Waters as TAMU students excavate Block A.

BUTTERMILK CREEK

Part I: A Pre-Clovis Occupation along the Margin of the Southern High Plains

THE SEARCH FOR PRE-CLOVIS occupations in the New World has been driven in part by our preconceived notions of what this record should look like. For Louis Leakey, steeped in the ancient archaeology of Africa, the crude chopperlike stones of the Calico site in the Mojave Desert in California fit his expectation that unsophisticated lithic technologies were used by the earliest folks in the Americas. For other researchers, more highly developed technologies closer to the European Upper Paleolithic blade technology, or even the Arctic microblade tradition, seem appropriate antecedents. Because Clovis is unique compared

INSIDE

with all the technologies that follow it in North America, many of us expect it should be unique in the temporal direction as well: an isolated cultural flowering, a kind of spontaneous technological mutation seeking a specific late-Pleistocene niche in which to flourish.

The Debra L. Friedkin site

Which is partly why the rather prosaic assemblage recently excavated from the Debra L. Friedkin site on the margin of the Edwards Plateau in central Texas has created such a stir: Underneath distinctive Folsom and Clovis strata lies a 20-cm-thick layer of sediment containing thousands of locally made chert artifacts.

The site is one of a string of sites located at the margin of the Southern High Plains along the outcrop of a major source of toolstone widely used throughout prehistory, the Edwards Plateau chert. This homogeneous light brown chert occurs as boulder-sized nodules within the Edwards limestone deposits that are exposed at the southern margin of the Plateau. This chert source was identified early on by foragers as exceptionally desirable toolstone, and people routinely walked hundreds of miles to obtain it. Friedkin is one of several important early sites that line the margin of this Plateau like a string of pearls, including such sites as Gault, with its Clovis-age cobble floor, and Aubrey.

UNLESS NOTED, ALL PHOTOS CENTER FOR THE STUDY OF THE FIRST AMERICANS

Forman collects OSL samples from Block A, 2007. The light-colored layer below his knees is the older colluvium, and the darker sediments above are the floodplain deposits.

The southern margin of the Edwards Plateau is relatively well watered, which would have increased the attractiveness of the area for mobile hunter-gatherers. CSFA Director Mike Waters, principal investigator at the Friedkin site, describes the site setting this way: "It is situated along Buttermilk Creek, a spring-fed creek that flows all year long so water is always abundant. Adjacent to the stream channel is a riparian zone with big trees, and outside of this, two terraces on the floodplain, then a colluvial slope, and finally bedrock of the Edwards lime-

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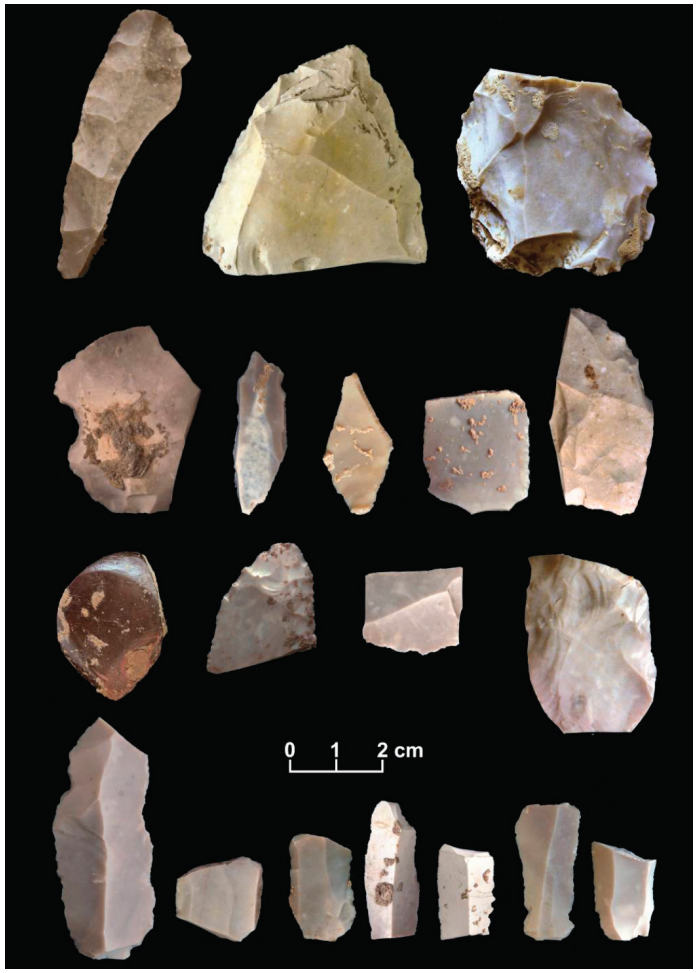
–Michael R. Waters, Director

stone. The site is located at the headwaters of the catchment."

Consistent with its prime location as a quarry, camping, and probable hunting locale, the Friedkin site contains evidence of regular use from Clovis through the late Archaic, a pattern consistent with 13,000 years of regular use documented at the nearby Gault site.

The site was certainly used at the end of the Pleistocene: three Folsom points were recovered from the 2.5-cm-thick Folsom layer; from the underlying thin Clovis stratum were recovered three bifaces with overshot flake-removal scars, three channel flakes, and five blade segments, but no projectile points. Both strata also contained a small quantity of other tools along with abundant micro- and macrodebitage.



Buttermilk Creek Complex artifacts from the Friedkin site. Top row, two bifaces and a discoidal core *(far right)*. Second row, utilized flakes. Third row *(left–right)*, ground hematite, bifacially flaked utilized flake, bend-break tool, and radially broken biface. Bottom row, blades and bladelets.

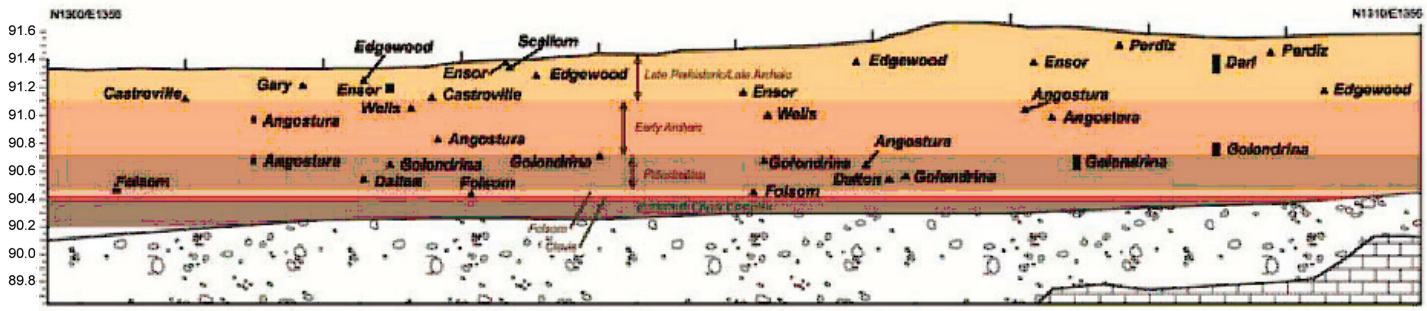
The pre-Clovis Buttermilk Creek Complex assemblage

The Friedkin site also appears to have been used earlier. As Dr. Waters and his team excavated below the Clovis level in the 52 1-by-1-m units in excavation Block A, they continued to discover artifacts: 2,268 pieces of macrodebitage (>3/8″), 13,204 pieces of microdebitage (<3/8″), and 56 tools, all of it made of Edwards chert. The lack of preservation of organic matter made it impossible to radiocarbon date the site. So Waters turned to luminescence-dating specialist Steve Forman of the University of Illinois–Chicago to provide optically stimulated luminescence (OSL) dates of the sediments containing the artifacts (**MT 18-3,** "Luminescence Dating of Quaternary Sediments: New Methods for Dating Archaeological Components"). Repeated dating of the sediments encasing the artifacts conservatively indicated a minimum age range of 13,200 to 15,500 CALYBP, hundreds to thousands of years before the commonly accepted age range of 12,800–13,100 CALYBP for Clovis. Dr. Forman's two columns of OSL dates show broad agreement between his OSL dates and the date ranges of Clovis and post-Clovis archaeological cultures.

Waters recollects, "We've worked on this for five years. In the first year when we found artifacts below Clovis, I thought, That's interesting, but I don't know what it means." But as subsequent excavation seasons yielded greater numbers of artifacts below the Clovis horizon, systematic differences between the two assemblages led Waters to conclude that the assemblage was similar, but not identical, to Clovis.

The assemblage underlying the Clovis horizon—which Waters and his team have termed the "Buttermilk Creek Complex"—includes tools, cores, flakes, blades, microblades, and debitage of all sizes. The 56 tools include 12 bifaces, of which 6 are late-stage midsection and end fragments and 4 are smaller fragments from late-stage bifaces. On these bifaces, flake scars appear to terminate at or before the midline, suggesting that *outre passé* (overshot) flaking typical of Clovis biface thinning (**MT 26-2,** "What It Means to Be Clovis") was not a technique routinely used by these earlier site occupants.

North-south cross section through the site showing the location of the diagnostic artifacts.



Two more bifaces are present in the assemblage. One is a large lateral fragment, 59 mm long and 6.7 mm thick, possibly of a projectile-point preform. It has a clearly lanceolate shape outlined by flakes that terminate before the midline. An intended or unintended blow delivered a burin break that split the preform diagonally from near the tip on one side to near the base on the other. The basal fragment was not recovered.

The other biface in the assemblage is a kind of chopper or adze 48 mm wide and 15.4 mm thick. Its size and shape don't suggest an early-stage preform (certainly not one leading to a tool like the biface fragment above). Both faces of this tool have flake scars, some of which terminate past the midline. One face has stacked step terminations at the tip and along the lateral margins. These don't appear to be failed attempts at thinning and may therefore have been either a deliberate method for shaping the tool or the natural consequence of its use as a chopper.

The assemblage also contains a discoidal core that is flaked on both sides from all directions. It's relatively small, approximately 41 mm in diameter and 14.5 mm thick, and may be an exhausted core. It's certainly too small to have served as a preform for tools the size of the chopper or possible projectile point mentioned above.

In addition to the evidence for bifacial reducing, the assemblage also contains evidence for a blade-tool industry: 5 blade fragments and 14 bladelet fragments were recovered, although no blade or bladelet cores have been identified at the site. The longest blade fragment, 53.7 mm long, is a curved midsection piece with a triangular cross section formed by two dorsal scars. Three of the other blade fragments are similar to this in morphology but are shorter because both ends have been snapped off. The fifth fragment has a trapezoidal cross section formed by a trio of dorsal flake scars.

The bladelet fragments are similar in morphology to the blades; some have a triangular cross section formed by the prior removal of two flakes from the backside, others have a trapezoidal cross section resulting from three prior flake removals. Neither the blades nor bladelets were retouched, although at least some showed use wear along one or more edges. However, unifacial and bifacial retouch was evident on 23 normal and biface-thinning flake fragments. These flakes were modified into tools with notches, concave and convex edges, and graver tips. Also found was a golf ball–sized piece of hematite that is faceted and highly polished.

In addition to these finds, at least three dozen radially broken and bend-broken flakes were found. These have stout edges and sides created by snapping or breaking the flake on at least two or three sides. Microscopic studies of these tools indicate they were used as planes, likely to shape bone and antler.

Broad similarities with other assemblages

Waters is quick to point out both similarities and differences between the Clovis and the Buttermilk Creek Complex assemblages. "Biface technologies are present in both, as are blades and tools made on blades," he explains. "Where they differ is that Clovis is, on average, larger: Bifaces, blades, biface thinning flakes are all bigger." In addition, Clovis-style fluting of projectile points, extensive use of overshot flaking to thin bifaces, and the customary practice of isolating platforms and grinding prior to removing flakes all appear to be absent from the Buttermilk Creek Complex assemblage. Preforms are unfluted, channel

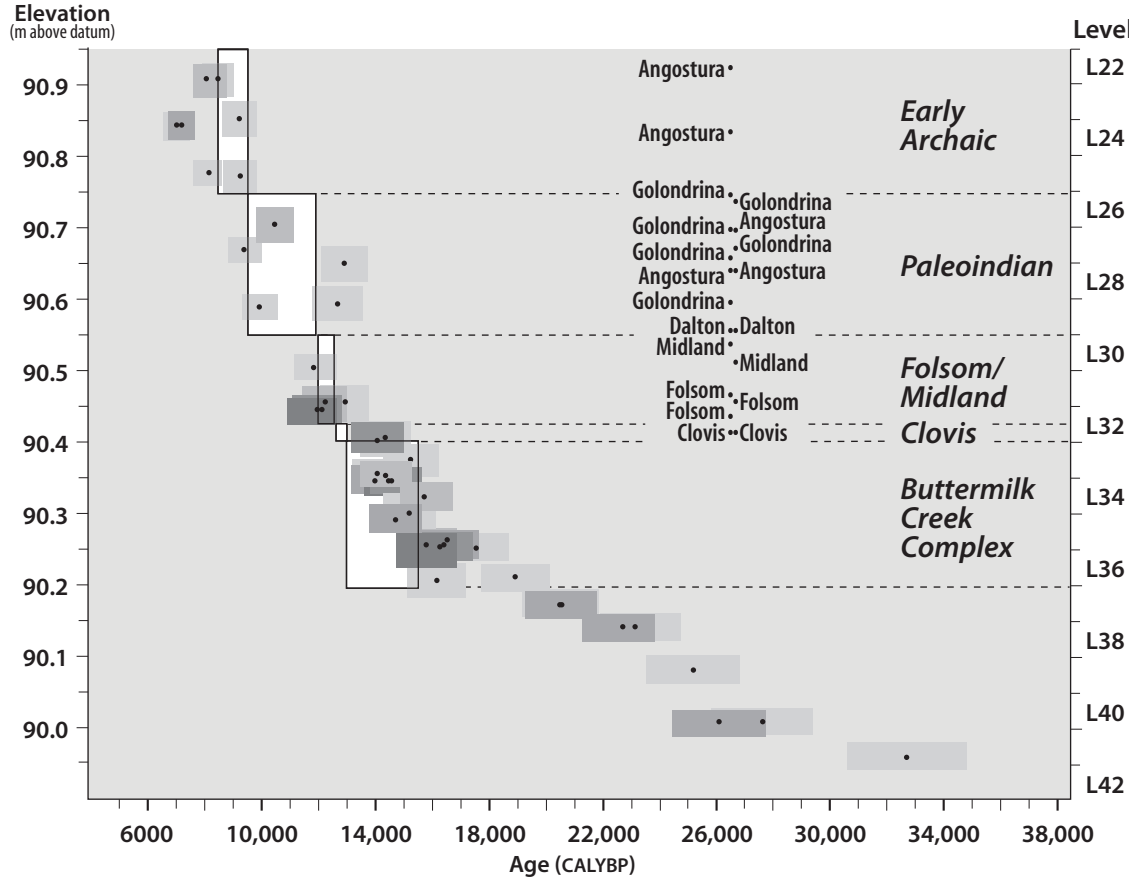


Chart showing all the OSL ages from Block A and the location of diagnostic artifacts. The black dot represents the date mean and the box around it the standard deviation of the sample.

flakes are absent, thinning flakes carry only to the midline, and flake-removal platforms are less robustly isolated.

There are similarities on the broad scale between the Clovis and Buttermilk Creek Complex assemblages, Waters points out, "but there are important differences in the peculiarities of the techniques used to make bifaces that separate the two assemblages. Also, we don't have a finished projectile point from the Buttermilk Creek Complex assemblage. It would be interesting to see if points were made on flake blanks, or if huge nodules were being reduced.

Block A excavation area (under the large canopy).

"Like the Buttermilk Creek Complex, the other credible pre-Clovis sites that are out there, such as the Schaefer and Hebior mammoth kill sites in Wisconsin, have biface, blade, and bladelet technology. This is the hallmark of early sites in North America."

Of sticks and stones and bones

Beyond that, Waters is excited by the evidence that suggests that the toolkit went far beyond stone. "A lot of tools showed evidence of heavy working of something hard, probably wood and bone," Waters states. For Waters, this opens the possibility that wood, bone, and ivory tools may have played a larger than suspected role in the late-Pleistocene toolkits in North America.

Waters continues, "I envision people arriving in the New World maybe around 16,000 years ago. They get into the lower 48 either through the Ice-Free Corridor—which may have been open at this time—or down the coast. They had with them a technology suite that included both lithic technology and osseous technology: bone, ivory and antler artifacts alongside lithic biface, blade, and bladelet technologies. They are hunting megafauna, as is evidenced by sites like the Manis mastodon [Washington State] and the Schaefer and Hebior mammoth kills. They are a small population in the Americas leaving a small footprint between 15.5 and 14.5 thousand years ago.

"Eventually that population got bigger, something happens, and Clovis develops. Everyone agrees it develops south of the ice sheets. Where it develops, why it develops, is a big mystery. I think Clovis technology spread across existing populations. There is no evidence anyone brought Clovis technology into the lower 48—it had to be invented down here and then spread rapidly."

Waters doesn't find strong evidence that people are in North America long before 16,000 CALYBP. But he is intrigued by the work of Dr. Steve Holen (Denver Museum of Nature & Science) at the La Sena site in Nebraska and the Lovewell site in Kansas. At these sites, bones from mammoths dating to about 20,000 CALYBP show evidence of green-bone breakage, indicating that humans may have used these carcasses as "quarries" for material to make bone and ivory tools (**MT 23-1,** "Early Mammoth Bone Flaking on the Great Plains"). "In those assemblages," Waters notes, "the bones sit in a fine-grain loess deposit, yet all the bones are broken. Spiral fractures are everywhere. There are impact fractures on all the bones, and there are bone flakes and bone cores. . . . It's really intriguing."

A dissenter speaks

Other archaeologists are less eager than Waters to embrace the idea of pre-Clovis populations in the Americas. Whereas Waters sees a distinction between Clovis and Buttermilk Creek Complex artifacts that warrants separating these into two "cultures," for others the similarities overwhelm the differences.

ROBB KENDRICK

Serious sifting of deposits.

Gary Haynes of the University of Nevada, Reno, agrees that the Buttermilk Creek Complex artifacts "look like a real good precursor to Clovis" but halts short of accepting the argument that these represent a separate cultural group. The dates on the Friedkin site, he argues, are not precise. "For the lowest levels of the Friedkin site," he points out, "we could be talking 3,000 years or 1,000 years or it could be part of Clovis. It looks like it has things in it that could become Clovis. It doesn't have everything—no overshot flakes, for instance—but if these are absent, is it necessarily not Clovis?"

For Dr. Haynes, nothing in the site shakes his belief in a single-migration event into the Americas, although he is willing

to push that date back a few thousand years to accommodate the Friedkin data. He argues that, at some point after people entered North America, "somebody added channel flaking [to this typical Upper Paleolithic assemblage]. It is not like fluting made the bifaces more efficient, although it may have made them thinner or easier to haft. Perhaps fluting functioned like a marker, a way of indicating group membership? But it makes more sense to think of a single moving population entering North America rather than multiple migrations. . . . It is stretching credulity [to have a thinly populated continent, and] to have people living somewhere, inventing fluting, and having it move out through a preexisting population" in the short timeframe of Clovis.

Haynes's discomfort with the Friedkin site, like that of other critics, stems not only from arguments over the relative similarities and differences between the Clovis and Buttermilk Creek Complex assemblages, but also from dissatisfaction with the site stratigraphy and dating methods. He grants that "Mike's not making anything up, and there are no major blunders." On the negative side, though, he notes that the artifacts sit in a soil called a Vertisol, which has the reputation for being highly churned. And he feels the OSL dates on the strata are problematic, not least because of the large error terms associated with them. Is it possible that the Buttermilk Creek Complex materials are simply "Clovis trampled under?" as Dr. Stuart Fiedel with the Louis Berger Group has suggested?

ROBB KENDRICK

Waters with students excavating Block A, 2008.

Much of the debate about the Debra L. Friedkin site in central Texas does not revolve around the pre-Clovis assemblage content but about its stratigraphic relationship to overlying Clovis and later materials. For instance, Fiedel argues that the Buttermilk Creek Complex materials are not a separate cultural manifestation, but "most likely the assemblage is trampled and drifted Clovis." Haynes has raised a second argument, that the Buttermilk Creek Complex artifacts represent Clovis materials that have been churned downward by the shrink-swell action of clays in the local soil, a Vertisol. He says, "We've been told for a long time that Vertisols move stuff up and down, and now Waters says they don't. Today there are no major cracks opening and closing, but I'm wondering if it could have happened 10,000 years ago?"

The problem, as Friedkin site archaeologist and project lead Mike Waters points out, is that "this is the wimpiest Vertisol you could possibly have. It just barely met the taxonomic qualification for a "Vertisol" and is not even classified as such by the Soil Conservation Service." Which begs several questions: What is a Vertisol? How (and when) did such a soil form at the Friedkin site? What is the evidence for (or against) churning and trampling of Clovis artifacts into older sediments as a potential explanation for the Buttermilk Creek Complex artifacts? These are some of the issues we'll address in part II of this series.

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METIN EREN

Metin Eren (University of Kent, Canterbury, UK) holding a replica Clovis point that he made from obsidian. Metin, an expert flintknapper who studied with Bruce Bradley, is reanalyzing lithic materials from the Arc site in New York and other Great Lakes assemblages previously identified as Gainey. There he has found evidence of the use of overshot and endthinning on bifaces and debitage, which contributes to his belief that there is no empirical or scientific basis for use of the term *Gainey*. He believes the materials from these sites are Clovis! Continuing work like this expands our knowledge of Clovis regional variability.

What It Means to Be Clovis

Part V: Bone Tools, and Summing Up

Roll the bones

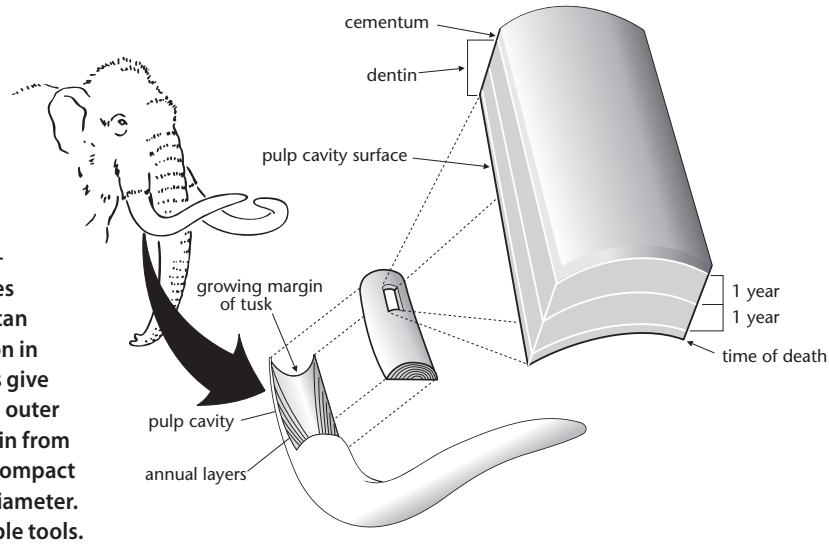
This brief foray into Clovis technology has overwhelmingly focused on stone artifacts because after 13,000 years or so, well, that's just about all that hasn't disintegrated. If you read literature on lithic analysis, chances are you'll run across some variation of the phrase, "Lithic artifacts are the most enduring-slash-abundant group of artifacts." Although stone materials can be affected post-depositionally by chemical and mechanical processes (e.g., patination, trampling, etc.), all in all they're fairly indestructible, especially when compared with bone and other organic materials, which are easily degraded by environmental agents, such as acidic soils.

Based on the number of identified Clovis kill sites, it's obvious that proboscidean remains (mammoths and mastodons) were an important source of food for some Clovis hunter-gatherers. But these shaggy giants were also an important source of raw material for making bone and ivory tools. While Clovis kill sites like Colby, Dent, Domebo, Lange-Ferguson, Lehner, and Murray Springs have provided good dates for the Clovis era, only a few sites have been dated to this time period based on dates obtained from osseous tools. Two dates, averaging 11,040±35 RCYBP, were obtained from bone points or rods recovered from the Anzick site in Montana. A single radiocarbon age of 11,050±50 RCYBP from Sloth Hole, Florida, is based on samples taken from an ivory point or rod. Taken all together, dates from these sites suggest that the last occurrence of mammoth in the United States is roughly 10,900 RCYBP. After this time, bison is the principal large extant species identified at Clovis sites.

Though we have good preservation of proboscidean kills, Clovis *osseous* tools—which include bone, antler, and ivory materials—are fewer and farther between. Preservation-wise, the cards seemed stacked against finding these elusive artifacts except where the environmental and depositional circumstances are just right, like those in some of Florida's submerged water sites. Organic materials may have a short life span once deposited into the sandy soils in Florida's upland areas, but Clovis

osseous artifacts are frequently found at wet sites. In fact, this state has the highest number of formal osseous tools (i.e., bone points and rods) to date, as well as the greatest variety.

With the exception of the Sloth Hole site, most of the osseous tools recovered over the last 60-plus years have been recovered from Florida rivers, so the context of these tools is problematic. Andy Hemmings and others contend that formal bone and ivory tools are actually as diagnostic of the Clovis era as stone fluted points. And he's got three good reasons to support his case. The first line of evidence is the simple fact that megafauna went extinct! That is, after the end of the Pleistocene these animals simply weren't available to hunter-gatherers. Sure enough, their bones don't show up at post-Clovis archaeological sites. Reason Number 2: Osseous tool industries associated with Folsom, Bolen, and other post-Clovis cultures are well known. Clovis is distinctly different in the form of their osseous tools and the kind of bone, ivory, and antler they worked into tools. "Green" or raw bone is pliable; old, dry, brittle bone isn't good toolstock. Even bone that's just a year old is too dry for making tools, as has been demonstrated with experimental archaeology . . . and there you have Reason Number 3.



AFTER DANIEL C. FISHER & BONNIE MILJOUR/UM MUSEUM OF PALEONTOLOGY

More than just a source of toolstock, tusks are useful for dating the age of proboscideans and the sites where they are recovered. The tusk "stratigraphy" can be identified in vertical or horizontal cross section in any portion of the tusk; these intersecting bands give ivory its characteristic strength. After removing the outer cementum, toolmakers would extract the dentin from between the pulp cavity and tip, leaving a dense, compact mass of ivory roughly 60 cm long and 10 cm in diameter. This core would then be further reduced into usable tools.

CHARLOTTE PEVNY

The bone point collected from a river in Florida (A) was probably used as a projectile (it's straight, not curved). To insure secure hafting to a shaft or foreshaft, the haft area was completely encircled with fairly straight grooves (B), and cross-hatching was scored on both sides of the bevel (C and D). This nonslip textured surface is especially clear in the close-up view in E.

Whence they came

Osseous tools are made from various skeletal elements of extinct fauna such as llama, horse, mastodon, mammoth, and wolf—except for tools recovered in Florida, where whitetail deer replaces ivory as the predominant raw material for osseous tools. (Though rare, whitetail deer existed before the end of the Pleistocene, and it's been assumed that these tools relate to Clovis times because they are morphologically similar to ones from good Clovis contexts; however, the tools made from whitetail deer have yet to be dated.) Regardless of the species of animal, Clovis bone toolmakers were discerning when choosing metatarsals (i.e., toes), kneecaps, jaws, teeth, and tusks as toolstock. These faunal elements weren't desirable as food (i.e., their BUI or *barbecue utility index* was fairly low), but they were targeted as tools for exactly that reason: They were tough yet workable materials.

Osseous tools came in many shapes and sizes and were used for a variety of tasks. It's no surprise that most of those activities are associated with hunting, considering that so much of our existing evidence about Clovis lithic technology relates to

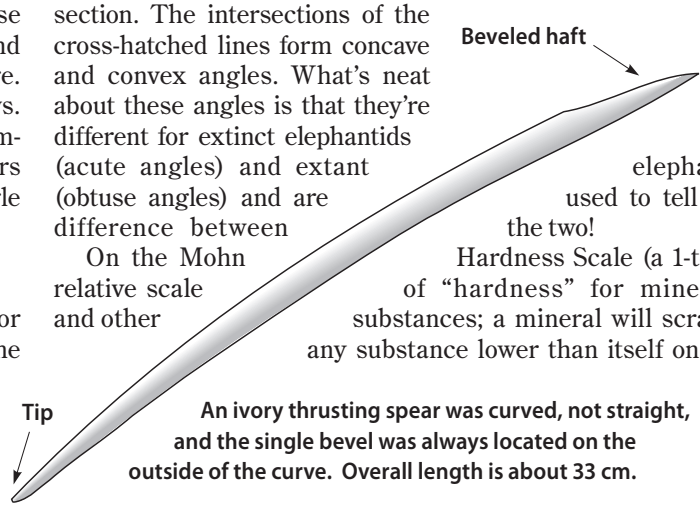
projectile points. Recovered osseous tool forms associated with venery include ivory and bone points, rods, wrenches, daggers, and atlatl hooks. These tools have really helped flesh out what we know about the organization of Clovis technology in relation to hunting. Other probable Clovis osseous tools include needles, awls, and billets. Probable, because most of these artifacts come from questionable archaeological contexts and await dating to definitively ascertain that they are Clovis in age. Besides variations in the type of tool and toolstock (bone vs. ivory), specific types of osseous artifacts differ among themselves. For example, some osseous points have barbs, others don't. There are thick and thin bone rods; some have a single beveled end and some are double-beveled.

Osseous reducing trajectory

Based on the lithic reducing trajectories we've identified for producing Clovis points and blades, it seems logical to assume that an identifiable trajectory for producing osseous tools exists as well. Let's imagine for a moment the process of making an ivory point out of a tusk. Though only one bone or ivory point preform has been identified (an ivory preform from Blackwater Draw, according to Andy Hemmings), we have enough compelling evidence to help reconstruct a hypothetical manufacturing sequence for ivory points, which were made from long thin splinters of mammoth or mastodon tusk. The first question we need to explore is, Why ivory?

Ivory is the common term for *dentin*, which is the hard, smooth, yellowish white bony tissue located beneath the enamel in teeth. It forms about 95 percent of tusks, which are actually two upper incisors of extinct proboscideans. *Cementum* covers the outside of the tusk. Both are layered in appearance and display concentric bands. The unique herringbone-like pattern of these bands, referred to as Schreger Lines or the Schreger Pattern, are cross-hatched when viewed in transverse section. The intersections of the cross-hatched lines form concave and convex angles. What's neat about these angles is that they're different for extinct elephantids (acute angles) and extant elephants (obtuse angles) and are used to tell the difference between the two!

On the Mohn Hardness Scale (a 1-to-10 relative scale of "hardness" for minerals and other substances; a mineral will scratch any substance lower than itself on the scale and can be scratched by any substance higher than itself), super-soft talc scores a 1.0, ivory 2.5, quartz 7.0, and diamonds, the hardest, 10.0). So ivory has a low hardness score because of its organic nature, but it's still a tough, compact, and resilient material on account of inorganic constituents such as phosphate and calcium fluoride. Ivory is soft enough to shape easily into tools, but strong enough to stand up to repeated abuse.



An ivory thrusting spear was curved, not straight, and the single bevel was always located on the outside of the curve. Overall length is about 33 cm.

Now that we understand a bit about the origin of ivory and its physical properties, let's get back to our manufacturing sequence. The first step would be to acquire the raw material, meaning to remove the tusks from the skull of the animal. This is exactly the evidence we see on a proboscidean specimen from the Page-Ladson site in Florida. A 7-ft-long tusk of a large male *Mammut* was cut and twisted from the skull. Deep grooves girdle or circle the proximal end of the tusk where it emerged from the socket at the cranium. Experimental research suggests the cutmarks and grooves were made by stone tools, not by post-depositional processes. This particular tusk was then cached at Page-Ladson for later use.

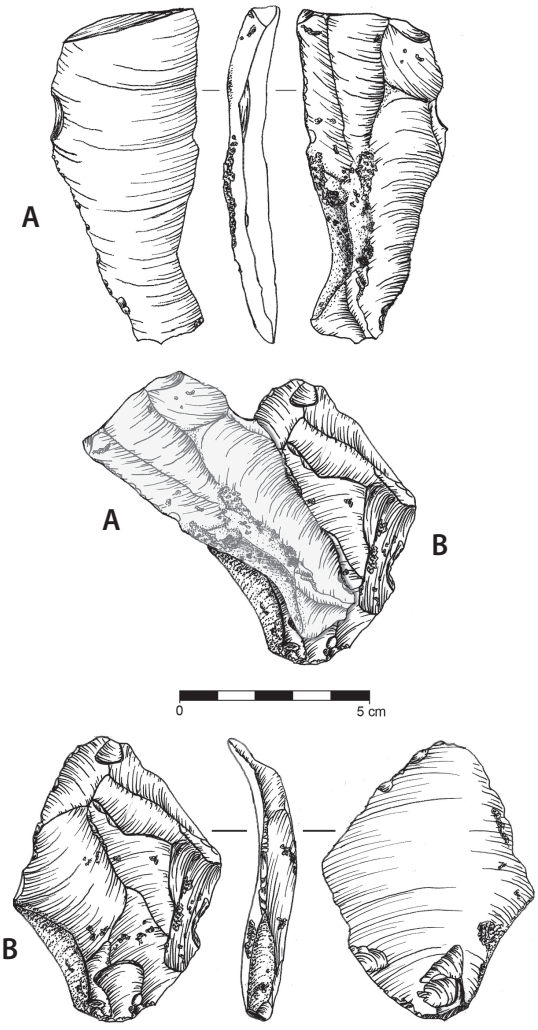
Subsequently the thick outer layers of the tusk would have to be removed, leaving a center core of dense, high-quality material that was preferred for making ivory points and rods. Two of these ivory cores have been recovered, one from Blackwater Draw in New Mexico, the other from Florida. An ivory core could then be separated into a number of sections, each of which

could become a tool. A small fragment of bone from Murray Springs provides an analogy for the process. The bone fragment, about 167 mm (6.6 inches) long, 38 mm wide, and 12 mm thick, is beveled at one end and has two V-shaped grooves parallel to the long axis of the fragment. These grooves are scored on opposite sides of the fragment exactly in line with each other, suggesting the intent was to split or snap the bone at this groove. The segments could then be worked into other shapes like bone points or other shaft components. Andy Hemmings noted thousands of ivory shavings (think of them as bone microdebitage) in a work area at Sloth Hole, Florida, that may have been generated when scoring or grooving ivory.

Next, the thin pieces of ivory could be shaped into points and rods. Most Clovis osseous tools were shaped into their final forms by grinding or abrading long splinters of ivory. Slivers were shaped into long tubes or cylinders by rasping away material. Grinding was also used for final finishing. A point, for example, was sharpened on one end and beveled on the other. The beveled end was then roughened with a series of thin, shallow hatched lines to ensure secure hafting.

The final step would be to straighten the point or shaft if needed. Experimental research suggests that Clovis bone "wrenches," like the one recovered from Murray Springs, Arizona, were effective for removing curves from bone or ivory shafts and foreshafts, possibly while simultaneously applying heat and moisture. Operations subsequent to this manufacturing and use trajectory would be reusing, refurbishing, and recycling osseous tools. A case in point is a recovered atlatl hook that was apparently fashioned from the basal portion of a beveled rod.

The discussion above raises an interesting question: Besides coarse-grained abrading tools, what other stone tools were used to create bone tools? In Europe and Asia during the Upper Paleolithic a popular tool, referred to as a *burin,* was used to engrave or groove osseous materials. Burin means "chisel" in French, and that's exactly what it is, a very narrow, sharp edge used to score a channel on a piece of bone. The groove weakens the bone in a precisely defined area, which then allows the toolmaker to snap the bone into pieces of the required shape in exactly the same way a glass cutter first scores, then breaks a sheet of glass into pieces of precise dimensions. Think how useful this technique would be for making small osseous tools like needles! As we noted above, the beveled hafting surface on bone rods were often engraved with thin parallel or subparallel lines to increase friction and provide a nonslip surface. Burins are conspicuously absent in great numbers from Clovis assemblages, though usewear studies of flakes and blades recovered from sites like Gault suggest that burin-like tools (they look slightly different, but serve the same purpose) were used by Clovis toolmakers.



CHARLOTTE PEVNY

The refitted artifacts in the center are the distal end of a blade-like flake (A) that was removed from a classic biface thinning flake (B). The single-faceted platform on the biface thinning flake is highly abraded. Clovis knappers generally had no problem choosing the right combination of techniques to get the job done.

They float through the air . . . or do they?

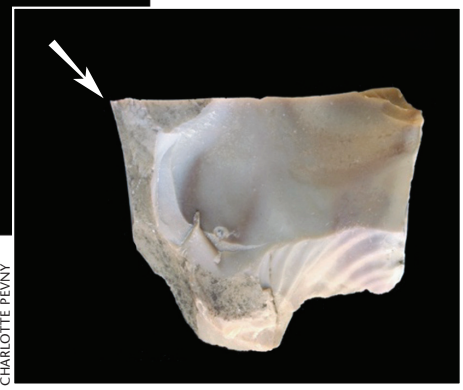
Clovis folks were obviously aware of the strength and workability of ivory. The tips of osseous points from Blackwater Draw, New Mexico, have impact damage—unequivocal evidence that these points were actually used for hunting. Because of the distinctive pattern of Schreger bands, we can tell that the proximal and distal ends of ivory points correspond to the proximal and distal ends of ivory tusks. This means that savvy toolmakers purposely chose the tightest, densest portion of ivory located at the tip or distal end of the tusk for the tip of the point—the end that received the most abuse and damage! And to minimize breaking during use, the thickest part of the point was always at the hafting location, thereby increasing the strength of the point where it would have been structurally weakest and subjected to the most stress.

Were osseous points hurled at the intended target from a distance, or were they thrust into hide and flesh from up close? The answer may be both because we have osseous atlatl hooks that suggest some of these points were launched as projectiles. Curved ivory points most likely served as thrusting spears. Curved points are generally longer than straight points. The beveled haft, which was probably attached to a long spear shaft instead of an intermediate foreshaft like osseous projectiles, was always located on the outside portion of the curve, thus making a weapon that could be repeatedly thrust downward and withdrawn. In contrast, a barbed osseous point was clearly designed to hold fast in the prey.

Bruce Bradley (Exeter University), Mike Collins (Texas State), and Andy Hemmings (Gault School of Archaeological Research) suggest that Clovis hunters needed a reliable "backup" technology in addition to stone points because making and using fluted points is a risky business. This may have been true. Although sharp-edged stone points create a larger hole upon entry into an animal and can wreak havoc on soft internal organs, they are extremely brittle and subject to damage and breaking in manufacture and use. Modeled failure rates based on bifaces recovered from Excavation Area 8 at the Gault site suggest a failure rate greater than 80 percent in biface production. Wet, green bone, on the other hand, rarely breaks when being worked, and osseous points are equally effective at penetrating hide, tissue, and bone. Witness the Manis mastodon in Washington—though it predates Clovis, nevertheless it's an instance of the tip of an antler projectile point embedded in a mastodon rib.

For art's sake

For years, pursuers of everything Paleoindian have asked, "Where's the art? Where's the Clovis art?" To date, we haven't identified elaborate cave paintings and detailed carvings like those created during the Solutrean in France and Spain. Just as we have found very few Clovis osseous tools, so we have been lucky to recover a mere smattering of ornamental or artistic items that don't seem to be "household goods": a disk carved from proboscidean bone, two ivory bead preforms, small engraved stones, and a few pieces of incised bone. Until recently there was no evidence of representational art (pictographs or carvings of extinct fauna) that convinced authorities (**MT 20-3,** "Proboscidean & Equine Petroglyphs?" **MT 25-2,** "Paleolithic Art in North America?"). This situation may have changed. Barbara Purdy (Emerita University of Florida and Emerita Florida Museum of Natural History) and others (including Dennis Stanford, Smithsonian Institution) have published on a bone fragment recovered from Vero Beach, Florida. This bone, recovered from the same site where Pleistocene fauna and human remains were identified between 1913 and 1916, bears an engraved proboscidean and a series of incised lines (**MT 27-1,** "Mammoth Engraved on Bone from Florida"). Though this fragment has passed a battery of authenticating tests, it has yet to be dated and has not been unequivocally verified as prehistoric.



CHARLOTTE PEVNY

The author used the sharp corner (arrow) on this flake of Edwards chert (obverse shown reduced in inset) as a burin to score elk bone.This chisel, small but sharp and strong, definitely worked. If hafted for leverage, it could carve grooves as deep as desired.

Summing up: Simply Clovis?

Perhaps my opinion is biased because of my enthusiasm for "all things Clovis," but I feel overwhelmingly positive about our current state of knowledge of the Clovis culture. Sure, there's more work to be done. There's *always* more work to be done. Nonetheless we have substantiating data collected from Clovis sites with either good stratigraphic context, Clovis points in the right sequence within those contexts, or radiocarbon dates that agree with the known calibrated age of Clovis. These sites represent a host of different activities (e.g., acquiring game, procuring raw material, making tools, caching, etc.); their toolkits, although understandably diverse in content, share overlapping components, particularly the fluted Clovis point. At site after site we see the same suite of manufacturing techniques used to make those points, as well as ubiquitous Clovis blades.

And yet, we find variations in Clovis subsistence, settlement patterns, and degrees of mobility. You ask, Why? Good question!

These sites, located across the entire width and breadth of the U.S., experience enormously diverse environmental conditions. It's therefore reasonable to expect that Clovis people adapted to their unique environment and developed subsistence strategies to cope with plenitudes and scarcities of resources (water, food, toolstone, etc.). The idea that the presence of Clovis points at archaeological sites translated into a pan-continental similarity along other lines, for instance, diet (if people have Clovis points, then they *must* be hunting and eating mammoth), couldn't be more untrue.

To explore the reasons why these differences exist within Clovis, archaeologists often compare groups separated about as far as you could imagine along a continuum (a sort of sliding scale). Comparing and contrasting exposes patterns. Simply put, it's a useful way to arrive at an understanding of why things are as they are. We especially like to use diametrically opposed pairs of words; some of these we've discussed in the last few issues of the *Mammoth Trumpet*: hunter/gatherer, settlement/mobility, curated/expedient, reliable/maintainable . . . the list goes on. Antonyms help us describe people and their behavior. Unfortunately they also shape our archaeological expectations. It's a rare occurrence when anything is strictly black and white.

Clovis adaptations revisited: Generalized specialists or specialized generalists?

G*eneral* and *special* are diametrically opposed descriptors often used to describe Clovis diet and technology. If your diet is generalized, you eat a wide variety of foodstuffs like meat, vegetables, and grains . . . not quite omnivorous, perhaps, but your diet is well rounded. On the other hand, if your diet is specialized, there are probably a limited number of items on the menu (e.g., a vegan diet excludes animal-derived products). Impressive Clovis kill sites identified early in Paleoindian studies left a lasting impression. The viewpoint of Clovis as "specialized" is what David Meltzer (Southern Methodist University) refers to as "historical inertia." That is, an idea becomes so firmly stuck in our belief system that it takes a whole lot of evidence (and a lot of force) to dislodge it. It's taken about 80 years, a lot of additional evidence, and some healthy debate to dispel the notion that all Clovis folks relied mainly on megafauna to fulfill their nutritional needs, and that their technology—the means to solve problems—centered solely upon procuring extremely large mammals.

This pervasive viewpoint didn't develop out of thin air: It's influenced by all those Clovis kill sites in Oklahoma, South Dakota, Wyoming, Colorado, Arizona, and New Mexico. The San Pedro Valley in Arizona boasts the densest concentration of mammoths in association with Clovis points of anywhere on Earth. Jesse Ballenger (Statistical Research, Inc.), having tracked the number and locations of these mammoth kill sites in the San Pedro basin, estimates that one out of every five Clovis-age mammoth localities has Clovis points. That's an impressive ratio. Ballenger believes that the San Pedro basin was once home to many mammoths, a sort of refugium from unfavorable environmental conditions elsewhere, and that Clovis hunters exploited the herds with such success that they significantly reduced the mammoth population in this region.

So far no Clovis kills of proboscideans have been found in the eastern U.S., though poor preservation may be obscuring kill sites. Mammoth remains in the East without associated tools or other evidence of human intervention have been identified, however, so obviously the archaeological record isn't completely biased. And cached tusks found at sites in Florida must have been placed there by humans. What's missing is prima-facie proof: proboscidean remains with a Clovis point embedded in a bone would do nicely. It's likely, of course, that Clovis folks in Florida were using bone and ivory points to pursue game.

So yes, Clovis hunters actively pursued really big game in some regions, but they also preyed upon not-so-special smaller creatures. And these comparatively bite-sized fauna aren't just recovered from campsites; they're also recovered from kills! In addition to mammoth, bear, tapir, rabbit, and muskrat were recovered from the Lehner kill site in Arizona. Reptiles and amphibians were fair game too. Believe it or not, turtle bones are documented at more Clovis sites (e.g., Blackwater Draw and Aubrey) than almost any other species! Frog bones from the Gault site, Texas, and abundant fish remains at the Shawnee-Minisink site in Pennsylvania round out a surely incomplete list. Shawnee Minisink is also one of the few sites with remains of edible plants like hawthorn, blackberry, and chenopod (**MT 22-2,** "A Spring That Keeps Flowing: The Shawnee-Minisink Clovis Site").

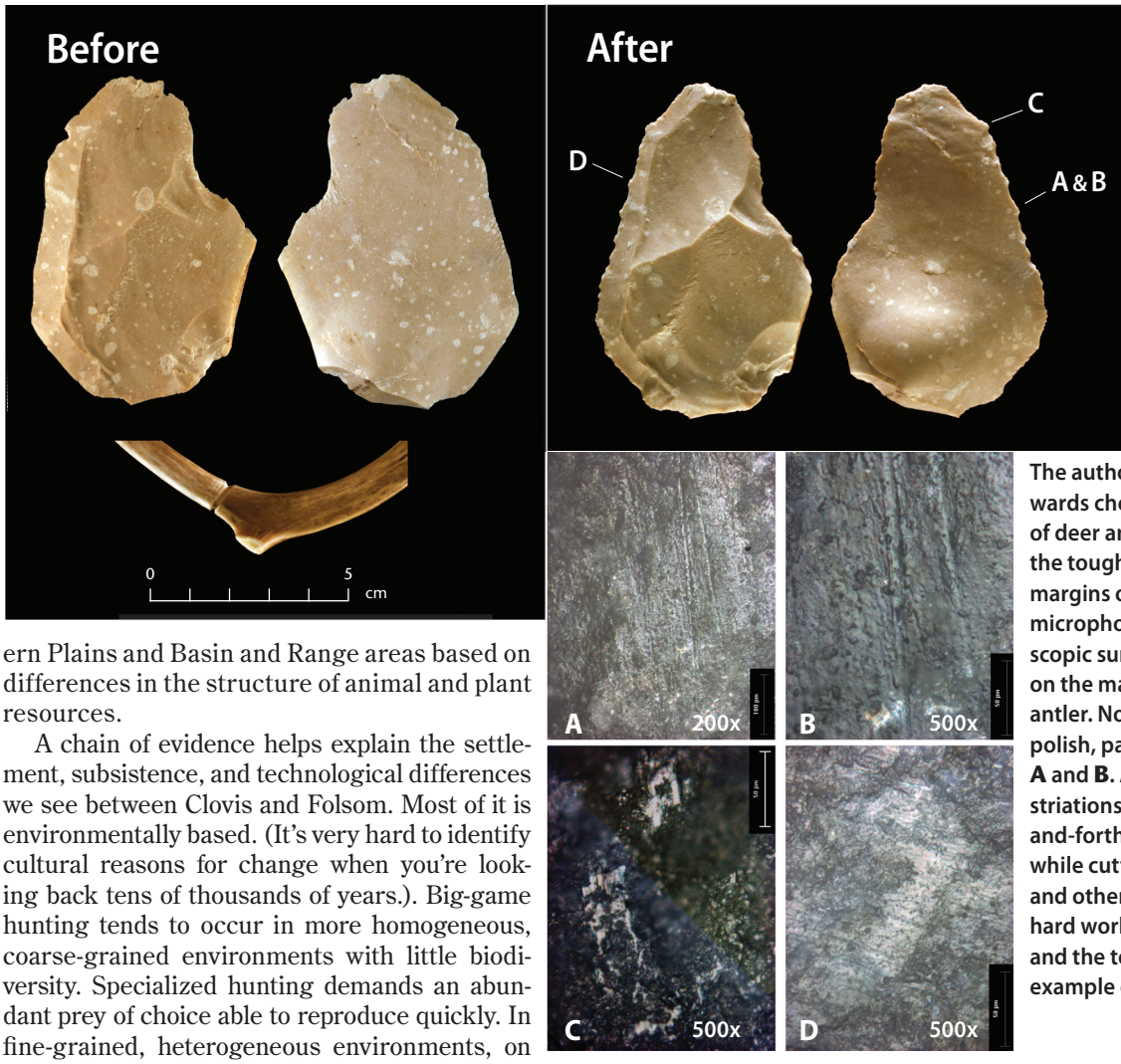
There are other reasons to believe that, even though Clovis folks hunted, they weren't necessarily specialists. The big bison kills (up to 200 animals in some instances) and the use of "jumps" or drives on the Plains don't show up until well past Clovis times. Even Folsom hunters—the quintessential specialized big-game bison hunters of the Plains—didn't rely on these means of acquiring large numbers of animals very often.

What do "specialized" adaptations look like?

To give you a clearer picture of what a generalized adaptive strategy looks like, let's contrast it with what is viewed as specialized strategies used by Folsom (the people, the point, and the period of time that follows Clovis). Let's review what we know. Folsom sites are fairly restricted to the Rockies, Great Plains, and adjacent prairies; they aren't pancontinental. Compared with the eastern woodlands, for example, the plains are pretty homogeneous, with extensive grasslands and, in the past, lots of bison. Folsom sites are associated with extinct bison bones—no mammoth or mastodon. The Folsom diet is specialized. Surely they had a wider variety of protein sources, but they focused primarily on bison in a pretty specific region. Technologically, Folsom hunting relied on the exquisitely fluted Folsom point, although in some instances knappers chose not to flute. (We're not 100% certain why this is, but it could be to avoid risk; that is, if a Folsom hunter was down to his last point and the next opportunity to acquire toolstone was too remote, he might decide it was too risky to remove the fluting flake.)

Folsom toolstone travels far and wide, consistent with what you'd expect of a really mobile group. And lithic raw material in Folsom habitats is unevenly distributed on the landscape; there's a lot of distance between available stone outcrops. To cope with these inconsistencies, Folsom hunters had to plan their trips accordingly. If you're highly mobile, then it's smart to travel light and carry just what you need. The Folsom specialized toolkit revolved around curated tools with a long use life, particularly large transportable ultrathin bifaces that could be used as cores. Flakes detached from these cores could be made into other tools. Bifaces could be recycled into other tools after they were exhausted from their original purpose. There's no evidence of a highly structured blade technology in Folsom like we see in Clovis times; lugging around the materials for another toolset would have taken too much effort. And Folsom knappers had a different bag of reducing tricks. They were mainly making points from smaller flakes (not small, mind you, just smaller). Overshot thinning is a thing of the Clovis past. This wasteful and potentially risky flaking technique had two strikes against it in Folsom times. That no Folsom caches have been identified to date suggests that Folsom folks either didn't need to plan ahead or weren't able to—they were just too mobile, and perhaps there was no guarantee they'd get back to a given location.

To make these comparisons, we focus on the obvious differences between groups. What we need to explore is the anomalies, the deviations from the norm. We see variation in Folsom strategies, of course, just as in Clovis. Chances are, these differences are the result of environmental influences. Daniel Amick has documented regional (or subregional) variation in Folsom land use and technology within the South-



ALL: CHARLOTTE PEVNY

The author used this flake of Edwards chert to "girdle" the piece of deer antler. Look how much the tough antler changed the margins of the flake! The four microphotos show the microscopic surface at various areas on the margin after cutting antler. Note the well-developed polish, particularly in images A and B. All four images show striations that indicate the back-and-forth motion of the tool while cutting. Cutting antler and other osseous materials is hard work, both on the cutter and the tool. This is an extreme example of use wear.

ern Plains and Basin and Range areas based on differences in the structure of animal and plant resources.

A chain of evidence helps explain the settlement, subsistence, and technological differences we see between Clovis and Folsom. Most of it is environmentally based. (It's very hard to identify cultural reasons for change when you're looking back tens of thousands of years.). Big-game hunting tends to occur in more homogeneous, coarse-grained environments with little biodiversity. Specialized hunting demands an abundant prey of choice able to reproduce quickly. In fine-grained, heterogeneous environments, on the other hand, variety is the spice of life. A diverse selection of foodstuffs often produces generalized strategies like those seen during the Clovis era.

Raw material and mobility

The nature of a culture's lithic technology is shaped by decisions involving toolstone, including accessibility (how does the location and distance to a source affect what I want to make?), availability (can I get stone of the size and quantity that I want?), and quality (can I make the tools I need from the stone?). Archaeological evidence tells us that Clovis toolmakers generally preferred high-quality cryptocrystalline stone, sometimes available only after traveling great distances. Clovis sites in the West enjoy more diverse sources of toolstone than sites in many areas of the central and eastern U.S., which have only locally available raw material. Toolstone accessibility is a major factor in differences in mobility between Clovis people in different parts of the country.

And, of course, new exceptions continue to come to light. James Dunbar has noted that seemingly lower-quality, coarse varieties of coastal plain chert were used at Page-Ladson, Florida, to make a few tools, but these tools included a projectile point and a scraper. These tool forms were usually made from the good stuff! In contrast, lower-quality lithic materials at Murray Springs were made into expediently used heavy-duty chopping tools. The quality of the chert available at the Pavo Real site in Texas (right up the way from Gault) was much poorer than what we've come to expect from Clovis assemblages on the Edwards plateau. But that didn't stop Clovis knappers from using it to make both bifaces and blades.

Clovis knappers definitely chose high-quality toolstone most of the time. Their job was easy when it was readily available and really "sweet." That's why blade and biface technology show up in a big way at sites in central Texas. (By the way, blade and biface technology isn't really as efficient as we believed it to be. It's actually quite wasteful, as you can see in the vast quantity of waste stone in Excavation Area 8, a lithic workshop at the Gault site. But when you have access to that much great toolstone, why bother to be thrifty?)

Very little exotic, nonlocal stone has been found at Gault. Nearly all the discarded, worn-out tools are made from stone available right there at the site. In fact, tools made from lithic materials available in central and south Texas seemed to stay in those areas during Clovis times. The same holds true for toolstone native to the northern portions of Texas, like Alibates and Tecovas. If mobility is measured by the distance that toolstone was transported, then folks on the Southern Plains didn't see any need to be mobile. Only at certain times of the year did hunting parties head west to sites like Blackwater Draw. A generalized, diversified technology fits a less mobile lifestyle.

Generalized technology: A recap

Whatever the raw material, it was used to outfit a pretty diverse toolkit. We've covered the ins-and-outs of bifaces, blades, expedient tools, and osseous tools. The most important lesson to be learned from the evidence related to reducing bifaces and producing projectile points is that the process of making these tools was remarkably similar from site to site, varying only because of differences in raw material and the individual knapper's "touch." An array of tools were used to procure a wide variety of plant and animal resources. This generalized toolkit remained generalized even after proboscidean extinction. Clovis technology didn't really change. This is clear from evidence gathered at Gault: Where the later Clovis deposits only contain bison, the classic fluted Clovis point nonetheless remained the weapon of choice. If varying behavior is a response to varying or fluctuating environments, and if people deal with these changes and the associated risk by adapting their technologies, what does this say about Clovis? They were already generally adapted by the time elephants were taken off the menu.

Continue to question

Our evolving view of Clovis depends on our ability and willingness to explore new models and hypotheses. We must remain open-minded and continue to question the things that don't make sense—the anomalies. Take, for instance, the Aubrey site in Texas. With an average date of 11,570 ± 70 RCYBP, Aubrey is the oldest site in the bunch. And if you think about that date and the artifacts recovered from the site, an interesting question pops to mind: Why can't Aubrey be pre-Clovis?

Aubrey's dates are problematic for a few reasons. First, the dated charcoal wasn't collected from a specific geologic stratum or from a hearth, pit, or other archaeological feature. It was collected from the thin surface of the Clovis occupation, which is sandwiched between much older sediments below and Clovis-age sediments above. The sediments below the Clovis surface ranged from 12,335 ± 170 RCYBP to 14,200 ± 220 RCYBP, way too old for Clovis. And therein lies the problem: The samples used to date the Clovis component may have originated from the older deposits. It's also possible that the charcoal was contaminated by coal-bearing deposits even further down. However, oddly enough, the materials from the layer directly adjacent to and above the Clovis surface dated to 10,940 ± 80 RCYBP—well within the range of Clovis as we know it.

To make matters even more interesting, the tools and debitage recovered from the site resemble Clovis in some ways, but not in others. For example, there is evidence at the site of both biface and blade technology (but not a whole lot of either). Only two bifaces were recovered from the site: a fluted point and a broken biface. Small blades, bladelets (even smaller blades), and a core-tablet flake were identified, but no blade cores. Actually, only one other core of any kind was found (of course, Aubrey is located in an area that's poor in raw material, and toolstone was used at the site parsimoniously). The site yielded lots of unifacial implements and late-stage debitage related to resharpening unifaces and bifaces (so bifaces were there at some point, they just weren't left at the site). This assemblage resembles that from the pre-Clovis component at the Debra L. Friedkin site farther south near Gault. Hmmm, older dates . . . comparable artifacts. . . . It's a topic worth pursuing, but we'll have to leave it for another time.

re·gion (rē′jən). *n.* part of a country that has definable characteristics, but not always fixed boundaries.

David Meltzer, Bradley Lepper, and many other Paleo researchers in the eastern U. S. have long maintained that Clovis was a generalized adaptation. Eileen Johnson and Mike Collins have

continued on page 20

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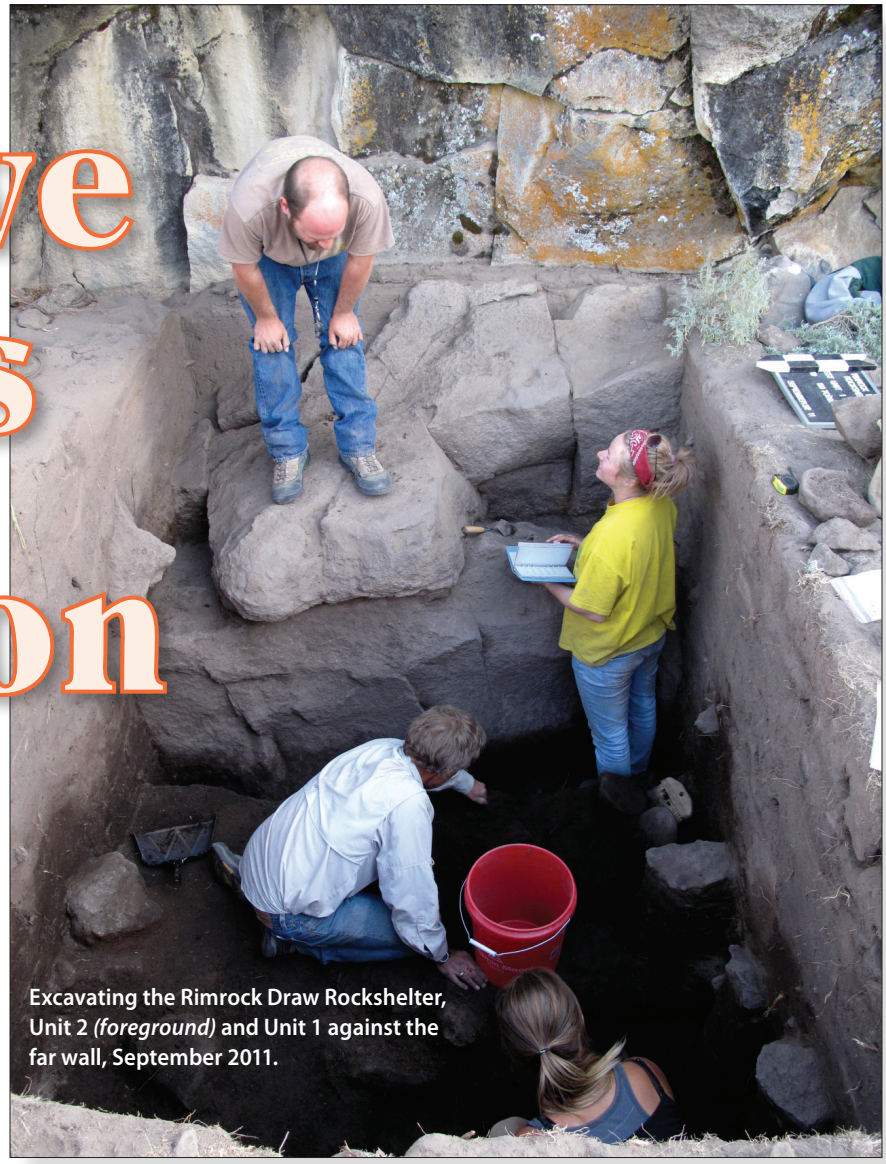
Elusive Clovis in Oregon Part I



Excavating the Rimrock Draw Rockshelter, Unit 2 *(foreground)* and Unit 1 against the far wall, September 2011.

PAT O'GRADY

OREGON isn't known as hospitable country for finding fluted projectile points associated with occupations of the Clovis culture. That may be changing. Archaeologists here have opened a new window in the remote southeastern corner of the state, illuminating a much richer Paleoamerican presence than previously known.

Success is due in large part to a systematic and concentrated effort by the Burns District of the federal Bureau of Land Management to examine agency holdings with an eye to uncovering Paleoamerican occupations. These "Clovis Quest" exploratory surveys are a departure from the agency's high-priority applied surveys supporting specific projects, such as controlled burns for habitat restoration, tree and brush removal, and road maintenance. Guided by the principles of geoarchaeology, a marriage of soil science, geology, and anthropology, researchers in recent years have systematically recorded ancient sites while tramping across this arid sagebrush-dotted terrain—which, at 3½ million acres, is larger than some European countries.

The feds and academe working together

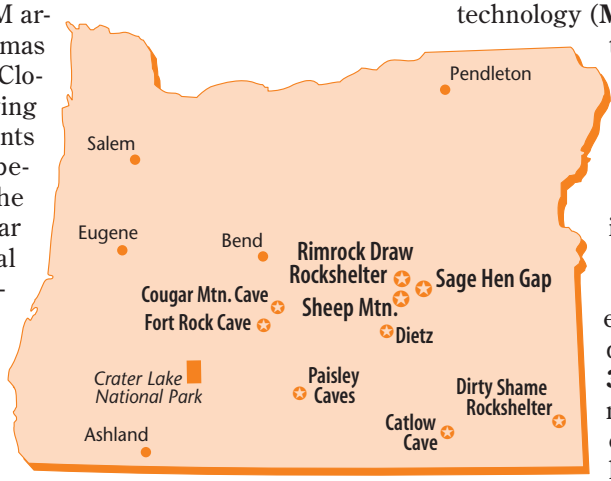
Scouting by BLM, in concert with University of Oregon field school excavations, has paid surprising dividends:

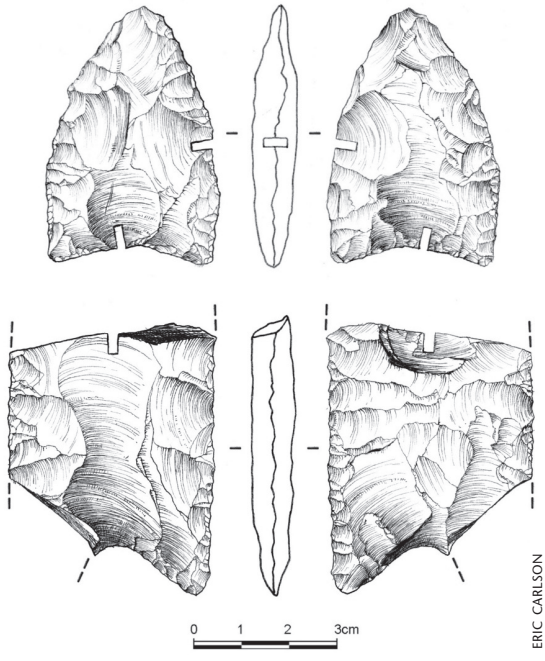
- Four fluted-point sites, and one tantalizing rockshelter with possible Clovis-age stemmed points and hints of fluted points yet to be found. In this article we'll discuss three of these localities: Sage Hen Gap site, Sheep Mountain site, and Rim Rock Draw Rockshelter.
- Dozens of projectile points and related debitage. These include large stemmed points possibly of Clovis age, and fluted points considerably smaller than found in most Clovis collections.
- Thousands of late-Pleistocene and Holocene artifacts.
- A growing list of potentially rich ancient sites. Archaeologists are convinced that the northwest quarter of the district is an untapped treasure trove for First Americans research.

Survey results, excavation data from new finds, and renewed investigation of a previously identified site containing a fluted point are providing "a significant advance" in understanding Paleoamerican occupations in Oregon, says Patrick O'Grady.

He is a staff archaeologist for the University of Oregon Museum of Natural and Cultural History in Eugene, and principal investigator for excavations conducted to date in the Burns District.

Dr. O'Grady and BLM archaeologist Scott P. Thomas stop short of pasting "Clovis" labels on their growing collection of fluted points and related debitage because sediments in the sites investigated so far lack sufficient charcoal and other organic materials needed for radiocarbon dating. Without reliable geochronological dating, fluted-point finds can't be pegged to the accepted timeframe for Clovis occupations, 11,050–10,800 RCYBP (**MT 22-3, -4,** "Clovis Dethroned"). Researchers are confident they'll get confirming dates, possibly from charcoal samples from Rim Rock Draw Rockshelter or from OSL dating of sediments now underway at the Sheep Mountain site (see below). Despite the current absence of confirming dates, however, they're convinced they've found examples of Clovis lithic technology, which is well defined in archaeological literature and familiar to *Mammoth Trumpet* readers (**MT 26-1, -2, -3**, "What It Means To Be Clovis"). Although firm dates would be a clincher, says Thomas, "there's no question Clovis people were here." He is confident a case can be made based solely on the technology: distinctive fluted points, blade and point fragments, and specimens of cores and debitage that have accumulated over four field seasons of targeted survey and excavation. "We are still very much in the early stages of understanding fluted-point sites in Oregon," says O'Grady. Like Thomas, he is confident radiocarbon dates will confirm that they are unlocking the secrets of Clovis occupations in Oregon.





ERIC CARLSON

An obsidian fluted point and fragment from the Sheep Mountain site. The rectangular notches mark where samples of material were taken for obsidian hydration dating (MT 23-4, "Through a Glass Darkly: Dating Obsidian Points").

A tough row to hoe

Thomas's drive to find Clovis sites in his region began about a decade ago when researchers from the University of Nevada, Reno asked his help in finding "old dirt"—possibly containing Paleoamerican material—that might be exposed in ditch profiles or along profiles exposed by erosion. "This sounds easier than it actually is," says Thomas, who was pleasantly surprised when Clovis-style points started accumulating "almost by accident." Researchers also found very old Western Stemmed Tradition (WST) points in the vicinity of fluted points. Some Great Plains and Great Basin sites that yield WST points are Clovis age, yet apparently share no affinity with Clovis lithic technology (**MT 26-4**, "Fluted and Stemmed Technologies in the Great Basin"). This puzzler cuts the ground out from under the theory that WST points represent a transitional phase of technology. It's another mystery for Thomas and his colleagues to unravel.

In 2007, Thomas found an obscure entry in agency archives, a record made in 1984 of a fluted-point site known as Sage Hen Gap (35HA3548)—to become the second site in Oregon where more than one fluted point had been discovered. The other is the Dietz site (**MT 3-1,** "The Clovis-Archaic Interface), about 30 miles south of the Sage Hen Gap site. Discovered by Dewey L. Dietz in 1982, the Dietz site lies in a dry lake basin. Both WST and fluted points, with related debitage, have been recovered on or near the surface. Although the Dietz site has never been officially dated, it is considered the first of at least three Clovis sites recognized to date in Oregon, based on evidence of fluted-point technology.

Thomas and O'Grady knew that a number of isolated fluted points had been found over the past 50 years in the Alvord Desert, a pluvial lake basin on the east side of Steens Mountain, so a Paleoamerican presence in the region didn't surprise them. But Thomas wanted to reinspect Sage Hen Gap. On visiting the site, his crew found two more fluted points and several overshot flakes. Obsidian hydration tests told him they came from a deeper time frame than he had previously thought. "That's when I decided to begin a systematic search for Clovis-age materials," he recalls.

Two weeks every year, Oregon Archaeological Society volunteers now go on a "Clovis Quest," seeking "old dirt" around ancient lakes and other high-probability areas, especially draws leading to heights overlooking prime grazing areas, old water channels, and potential travel routes between ancient water sources. Covering the Burns District is a daunting task. Only about 10% of the district—one of the most isolated areas of the state—has been surveyed, Thomas says, so there's no dearth of unexplored territory to choose from.

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Part II: Ancient dates and knitted brows

The FIBER of Their Being

Direct Dating Fiber Artifacts

A SITE whose fiber artifacts have been shelved, occasionally taken down and pondered, then reshelved is Guitarrero Cave *(Cave of the Guitarist)*, located at 2,580 m.a.s.l. in the north-central highlands of Peru. Only 20 m deep, it's sometimes referred to as a rockshelter. Despite the lack of depth, it contains a wealth of archaeological artifacts that span thousands of years. Exactly how many thousands has long been subject to debate, but evidence suggests its intermittent use dates possibly as early as the Pleistocene.

When anthropologist Thomas Lynch first excavated the cave in 1968 he found three Ceramic-age tombs and, more interesting to us, two earlier complexes. Complex I, the earliest and rearmost in the cave, included stone tools and remains of deer and small rodents. Complex II yielded a tool assemblage and comparable animal remains, with a bonus of wood and an enormous collection of plant-fiber artifacts. In this first instance he took 39 dates, though none from plant-fiber artifacts, and was stunned when the results suggested that humans may have occupied the cave as early as 15,000–14,000 CALYBP. For an upland Andean site this seemed impossibly antiquated, so research continued.

Nature and man, it seems, have conspired to frustrate efforts of archaeologists to fathom occupations of Guitarrero Cave. Percolating ground water had destroyed all datable material in Complex I. Closer inspection, however, revealed that its tool assemblage and that of Complex II were similar. Though the complexes were separated stratigraphically, it became apparent they were more likely a single complex, not two. Making sense of the stratigraphy of the lower components of Guitarrero Cave has been complicated by the digging of the later tombs and subsequent looting of the tombs. Adovasio reasoned that dates on clearly man-made objects like baskets or rope would go a long way toward allaying concerns about the stratigraphy.

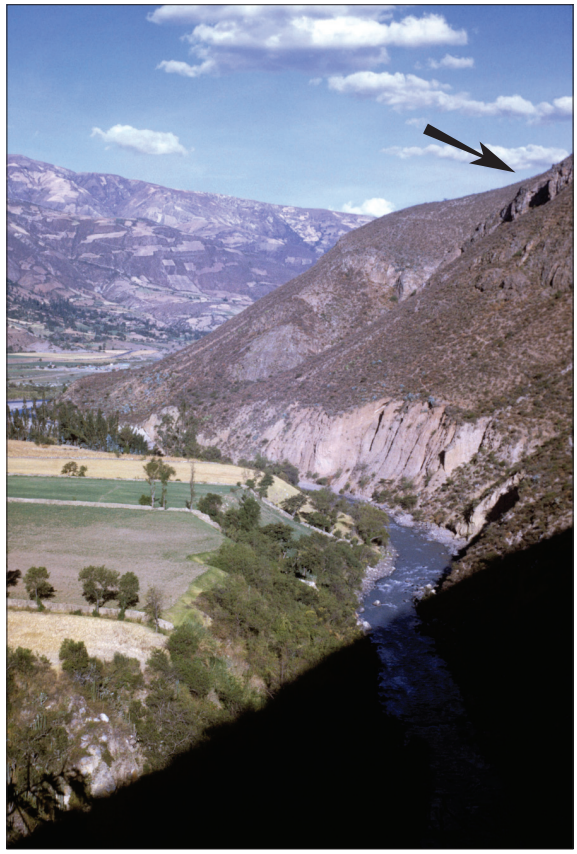
Lynch and Adovasio returned their attention to the site in the early '70s, and a few years later Adovasio, along with Robert F. Maslowski of Marshall University Graduate College, thoroughly examined the cordage and textiles but had to stop short of radiocarbon dating the material. Decades have passed since then, and with advanced technology now available Lynch called on Jolie and Geib to join the team to directly date three strands of cordage and three textiles, certain evidence of human presence, from Guitarrero Cave.

AFTER PHIL GEIB

Intertwined information

Were ancient Americans scurrying up the glacier-covered Andes 15,000 years ago? It doesn't look like it. The evidence says they be-

haved like sensible people and waited for the glaciers to subside before occupying the high-altitude cave. The direct dating of cordage and textiles gives the occupation of Guitarrero Cave an age of 12,100–11,800 CALYBP (10,200 RCYBP), right on the cusp of the Pleistocene-Holocene transition. These new dates for Guitarrero Cave dovetail nicely with models for glacial retreat and highland colonization for that part of the Andes. Jolie explains that these events varied along the length of the range. "Glaciers," he says, "would've provided a serious obstacle to human colonization to high altitude . . . any earlier." And glaciers weren't the only obstacle to colonizers. For lowland people to suddenly relocate to high altitudes would be impossible because they would need time to acclimatize to the forbidding environment. Not only would they have to deal with the cold and the rough terrain, their bodies would need to adapt to the rarified atmosphere. Adovasio and Jolie point out that hypoxia, a consequence of inadequate oxygen, adversely affects work capacity, metabolism, and reproduction. The physiological limitations of the human body make colonizing high altitudes a gradual process.



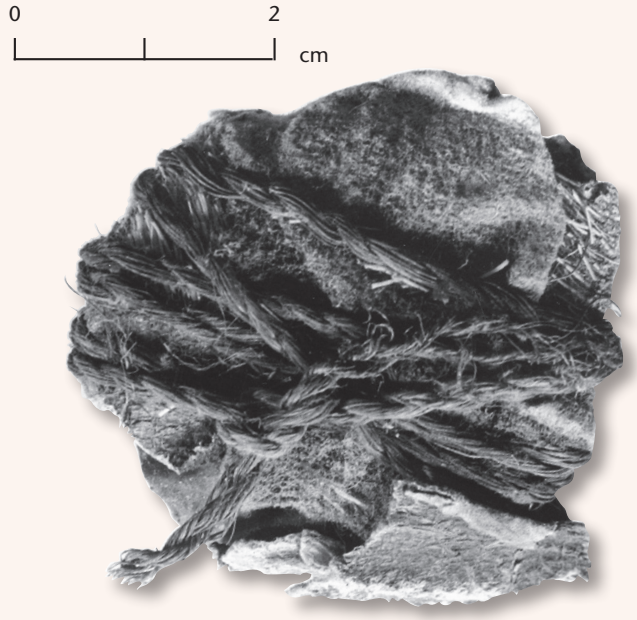
THOMAS F. LYNCH

Guitarrero Cave *(arrow)* overlooking the Rio Santa Valley, near Mancos, Peru. Lynch recalls, doubtless tongue-in-cheek, "what fun it was to climb up there every morning."

Essential to surviving in the cold of recently deglaciated mountains is warm clothing. Abundant plant-fiber artifacts found in Guitarrero Cave ("four coils and two bundles of finely processed fiber . . . 53 lengths of unknotted and knotted cordage of variable diameter, and three fragments of finely woven textiles of different structural techniques") suggest that the cave may have served a workshop for just such articles. What's more, its location at the lower extremity of high altitudes would have made the cave an ideal rest stop, a conve-

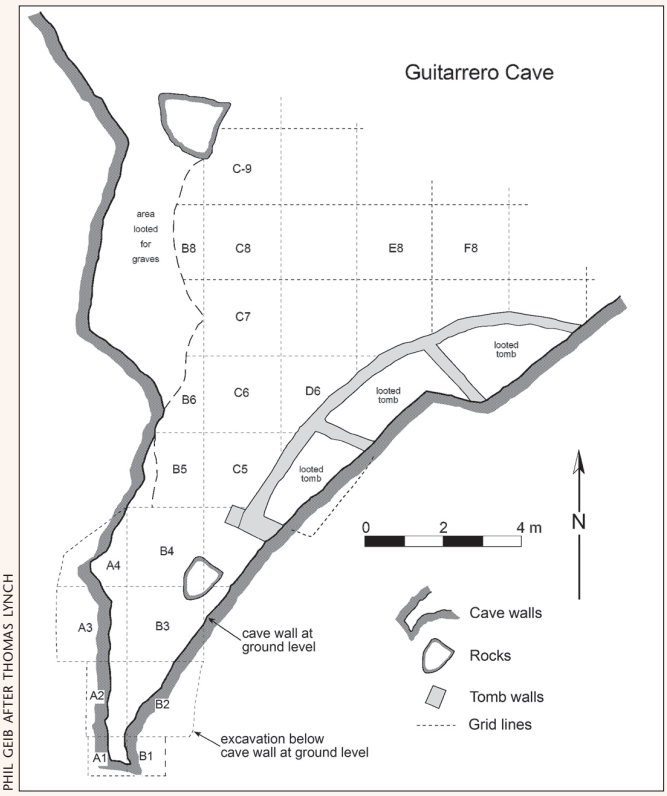
Guitarrero Cave

The 1969 Field Work



ALL PHOTOS UNLESS NOTED: THOMAS F. LYNCH

Scraper wrapped in deer hide, tied with cord, from Complex II. Lynch calls this "a splendid artifact."



PHIL GEIB AFTER THOMAS LYNCH

Plan view of Guitarrero Cave.

nient place to reprovision for treks to upper elevations. Besides clothing, highland expeditions would need "gear for transport, trapping, hunting and cooking."

If the cave was a weaving workshop, that begs the question, Were women present on these early mountain explorations? Though archaeological and ethnographical evidence indeed concludes that such tasks were customarily the province of women, it isn't a certainty in the case of Guitarrero Cave. Jolie nevertheless finds that the data reasonably argue for the presence of women.

Leaving them in stitches

Direct dating plant-fiber artifacts knits a greater measure of certainty into the dates for sites lucky enough to have them. The fiber the occupants left gives us proof of their being and, to the archaeologist's delight, incontrovertible proof of the age for their being.

Guitarrero Cave, though younger than originally supposed, has some of the oldest directly dated fiber artifacts in the New World. Armed with their secure dates, we can confidently state that between 12,100 and 11,300 calendar years ago, people were pushing into the highlands of South America. That they accomplished this with success verifies that their bodies were conditioned to accommodate the demands of higher elevation, which in turn indicates that they had settled the lowlands well before fixing their sight on the mountains.

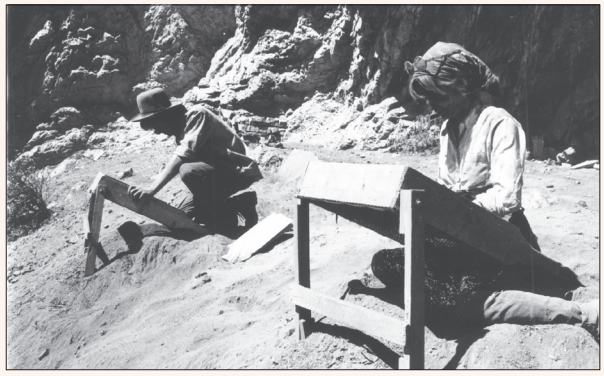
Other questions go a-begging answers. Were women among the first explorers to venture into the mountains? How long did it take for lowland people to adapt to highland life? And how long did they occupy lower elevations before venturing into the mountains? Some of these strands of thought have been interlaced into a secure bundle. Other threads lie loose, subject to speculation. Weave them together as you like, but remember, scientific hypotheses are always perishable.

–K. Hill

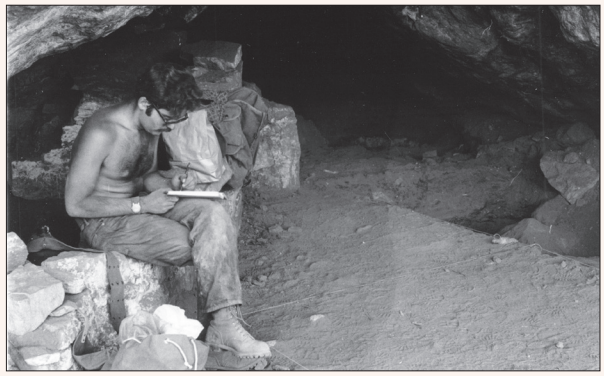
THOMAS F. LYNCH

Lynch *(left)* with Chilean archaeologist Mario Rivera at a mastodon site near La Serena, Chile, 2009.

Excavating Guitarrero Cave, 1969.



John Alden and Barbara Deutsch Lynch screening deposits.



Anthony Ranere taking notes in Guittarrero Cave.

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Suggested Readings

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What It Means to Be Clovis

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consistently rooted for broad-spectrum hunting *and* gathering for the Southern Plains and its peripheries (where you might expect a more specialized lifestyle based on the environment). Hunting mammoth was only one of many successful strategies for putting dinner on the table, just as overshot flaking is only one technique for making a Clovis biface. Compared with other cultures, Clovis folks were adapted to a wide range of environments and were generalized hunter-gatherers similar to later Archaic peoples (or perhaps even pre-Clovis peoples).

–Charlotte Pevny

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Elusive Clovis in Oregon

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"We try to focus on about 1,000 acres a year," he says, with potential sites filtered through the prism of geoarchaeology.

Thomas's Clovis search was firmly underway and excavations begun when Thomas joined forces with O'Grady and his University of Oregon field school students. O'Grady is no stranger to the district. He pursued his doctorate work there, and later engaged in post-fire rehabilitation surveys around the tiny communities of Wagontire and Riley.

PATRICK O'GRADY

An obsidian fluted biface fragment from Big Stick Quarry, located 3 km from the Sheep Mountain site. This and other artifacts appear in an article by O'Grady, Rondeau, and Thomas in *Current Research in the Pleistocene* 28 .

Surface finds, usually in areas occupied by ancient lakes, include stemmed points more than 7,000 years old and an occasional fluted point. Although this country is extremely dry now, pollen samples suggest to O'Grady that it was much wetter during the late Pleistocene. Great expanses of grassland, and pine and spruce forests and deciduous trees at lower elevations would have been the rule. Bison, camel, and mammoth likely roamed the area, as well as numerous smaller animals—a smorgasbord for Paleoamerican hunters. Because water was readily available, Clovis-age hunters likely foraged widely across the landscape. Later-age sites record that with increasing aridity over the millennia, groups became concentrated around dwindling water holes.

–George Wisner