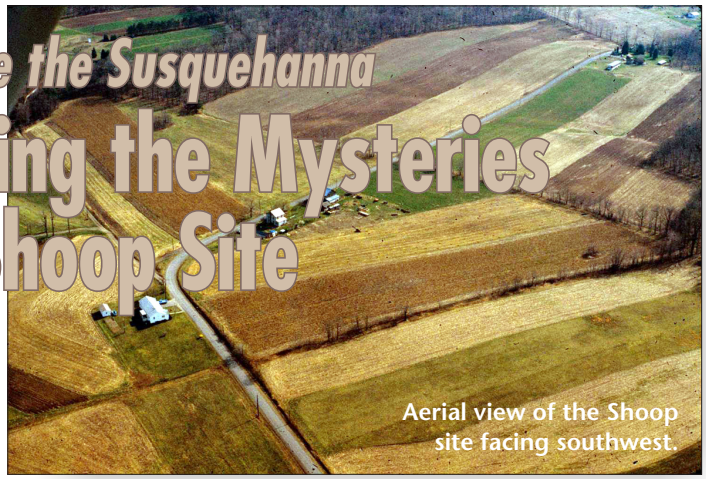
MAMMOTH TRUMPET

Volume 26, Number 1 | Center for the Study of the First Americans | Department of Anthropology
January, 2011 | Texas A&M University, 4352 TAMU, College Station, TX 77843-4352 | ISSN 8755-6898

World Wide Web site **http://centerfirstamericans.org and http://anthropology.tamu.edu**

High above the Susquehanna
Probing the Mysteries *of the* Shoop Site



Aerial view of the Shoop site facing southwest.

ALL PHOTOS: STATE MUSEUM OF PENNSYLVANIA

ON A LONELY, HIGH RIDGE in central Pennsylvania, nine miles east of the Susquehanna River, lies an ancient archaeological site that shouldn't even be there. Traditional logic dictates that the Shoop site (36DA20) should never have been occupied by Paleoamericans, at least not to any significant extent: The location is difficult to reach, there's no permanent water source within 300 m, and there are no easily extractable natural resources that might otherwise make the site attractive. "This is an out-of-the-way area, kind of out in the middle of nowhere," notes today's expert on Shoop, Kurt Carr of the State Museum of Pennsylvania. Yet there it sits, mute testimony that large groups of Pleistocene hunters repeatedly saw fit to make the site their temporary home.

It's reasonable to expect the occasional lithic scatter on a high ridge, where hunters might stop briefly to look for game and sharpen their tools, but Shoop is no mere hunting camp. In the 60-plus years since its discovery, the site has yielded a perplexing lithic assemblage consisting of approximately 7,000 artifacts scattered over at least 37 acres. The collection is characterized by a large number of "astoundingly reworked" fluted projectile points and endscrapers, and fully 98% of the artifacts are made from a lithic material that originates hundreds of miles away. Why, when suitable toolstones were readily available nearby?

This aura of mystery is one of the things that make Shoop so very interesting—which is why researchers keep revisiting it and its unique as-

INSIDE

semblage, trying to tease its story out of the stone and soil. Thanks to researchers like Dr. Carr, we may yet come to an understanding of why those early Americans chose Shoop, who they were, and where they came from.

Early and influential

Allowing that there are still some significant gaps in our understanding of Shoop, the site has had a surprisingly large impact on the field of American archaeology . . . and not always in a positive way. In fact, researchers' imperfect understanding of Shoop led them astray for years because they mistakenly assumed it was typical of its type. But that was almost inevitable: When John Witthoft published the first article on Shoop in the *Proceedings of the American Philosophical Society* in 1952, he was working in an archaeological vacuum. His was only the third major publication on a Paleoamerican site in the eastern United States—and the other two had appeared just the year before. It wasn't even clear at the time that the fluted-point technology expressed at Shoop was a variant of Clovis. Who could have imagined, half a century ago, a *continent-wide* fluted-point tradition?

Witthoft characterized Shoop as an overlook hunting camp (which it probably was). Unfortunately, his definition established the model for Paleoamerican settlements for the northeastern U.S. for decades to come. "People started looking for sites on the uplands," explains Carr. "It wasn't until later that we realized they were more likely to occur in the floodplains."

Although Witthoft was the first professional to systematically study Shoop, the site had been well known to local collectors since the 1930s, beginning with a gentleman named George Gordon. Edgar Howard, of the University of Pennsylvania, did some minor excavations in 1942 and concluded that the site had no visible stratigraphy. Indeed, there isn't much possibility of finding stratification at Shoop, because the soil is very thin and almost completely disturbed by agricultural practices. In many places the landowners are literally plowing bedrock.

Knowing this, Witthoft didn't bother to excavate when he arrived in 1950. Instead, he conducted a surface reconnaissance on an area of over 20 acres and collected a large and varied assemblage of lithic artifacts. He identified 11 artifact concentrations, though it's uncertain whether they were actual Paleoamerican individual activity areas or simply the result of decades of plowing. Witthoft later analyzed 53 projectile points, 400 tools, and 500 pieces of debitage from his and other collections. All but a tiny percentage proved to be made of an imported raw material, which seemed odd, considering that native jaspers were routinely used in other local sites. Witthoft identified the material as Onondaga chert, a dolomitic, cryptocrystalline toolstone that outcrops in western New York. Later research confirmed an origin at Divers Lake, 350 km northwest of Shoop.

Based on his analysis, Witthoft proposed a blade-based lithic tradition that he

MAMMOTH TRUMPET

The Mammoth Trumpet (ISSN 8755-6898) is published quarterly by the **Center for the Study of the First Americans**, Department of Anthropology, Texas A&M University, College Station, TX 77843-4352. Phone (979) 845-4046; fax (979) 845-4070; e-mail csfa@tamu.edu. Periodical postage paid at College Station, TX 77843-4352 and at additional mailing offices.

POSTMASTER: Send address changes to:

Mammoth Trumpet
Department of Anthropology, Texas A&M University
4352 TAMU
College Station, TX 77843-4352

Michael R. Waters	Director and General Editor e-mail: mwaters@tamu.edu
Ted Goebel	Associate Director and Editor, **Current Research in the Pleistocene** e-mail: goebel@tamu.edu
James M. Chandler	Editor, **Mammoth Trumpet** e-mail: wordsmiths@touchnc.net
Laurie Lind	Office Manager
C & C Wordsmiths	Layout and Design
Tops Printing, Inc.	Printing and mailing Web site: www.topsprinting.com
World Wide Web site	http://centerfirstamericans.com

The **Center for the Study of the First Americans** is a non-profit organization. Subscription to the **Mammoth Trumpet** is by membership in the **Center.**

Mammoth Trumpet, Statement of Our Policy

Many years may pass between the time an important discovery is made and the acceptance of research results by the scientific community. To facilitate communication among all parties interested in staying abreast of breaking news in First Americans studies, the **Mammoth Trumpet**, a science news magazine, provides a forum for reporting and discussing new and potentially controversial information important to understanding the peopling of the Americas. We encourage submission of articles to the Managing Editor and letters to the Editor. Views published in the **Mammoth Trumpet** are the views of contributors, and do not reflect the views of the editor or **Center** personnel.

–Michael R. Waters, Director

called the Enterline Chert Industry, arguing that it was among the oldest in the New World and certainly "prior to Clovis." His thesis was based partly on the fact that Shoop tools, especially fluted points, seemed quite primitive; in reality, they're just extensively reworked. He estimated the age of the occupation somewhere in the broad range of 8000–18,000 RCYBP. Even though no radiocarbon ages have yet been obtained for Shoop, it's clear today that Enterline is related to Clovis, and it has since been subsumed into that cultural continuum.

Fluted points (*top row*), endscrapers (*middle row*), and sidescrapers (*bottom row*) from the Shoop site.

Post-Witthoft Shoop

Shoop, particularly its lithic assemblage, attracted a good deal of attention in the years following Witthoft's investigations. Alex Krieger (1954), Edwin Wilmsen (1970), Stephen Cox (1972 and 1986), Gary Fogelman (1986), and Kurt Carr (1985) have reexamined the lithic assemblage. Cox's analysis of the Paleoamerican tools was particularly extensive; both he and Wilmsen focused on the edge angles of the tools, especially the 500 or so endscrapers. They concluded that the scrapers were mostly used for woodworking, a hypothesis that was recently confirmed by microscopic use-wear analysis of 14 endscrapers.

Witthoft's definition of Enterline as a blade-production industry didn't withstand scrutiny. Carr confirmed in analyses published in 1989 and 2008 that too many of the flakes recovered clearly aren't blades at all, just blade-like expedient flakes, and the assemblage otherwise bears none of the hallmarks of blade-production technology. Cox, Dennis Stanford, William Gardner, and others have concluded that Witthoft's pre-Clovis age estimate was also incorrect; they argue, for example, that the fluting technique dates the points to about 10,700–10,900 RCYBP. These recent revisions of Witthoft's conclusions shouldn't be interpreted as a criticism of his analytical skills. They simply reflect the benefit of decades of subsequent discoveries about what constitutes Clovis and the age of its various technological aspects.

Fluted points from the Shoop site. Extensive reworking accounts for the great variation in morphology.

Carr and his colleagues from the State Museum, Mercyhurst College, and Clarion University of Pennsylvania revisited the site in 2008, conducting both an extensive surface collection and excavating a number of test units. "We spent 12 weeks excavating there," he recalls. "When we were there, we were celebrities. . . . Collectors and other people came to see us, including people who were with Witthoft in the '50s." They also attracted the attention of film crews; excerpts of the filmed reports can be seen on YouTube.

These investigations, the first professional, systematic work conducted at Shoop since Witthoft's investigations, yielded 800 new artifacts, of which all but about a dozen were microdebitage. Although a few large artifacts may survive in unplowed areas, Carr concludes that most of the large tools have already been collected from the site. "After Witthoft, there was lots of collection at the site," he notes, "and people were paying money early on for artifacts from Shoop." Carr is quick to point out, however, that all four of the current landowners are excellent archaeological stewards, and are doing all they can to protect Shoop by not allowing any additional artifact collecting.

Why there?

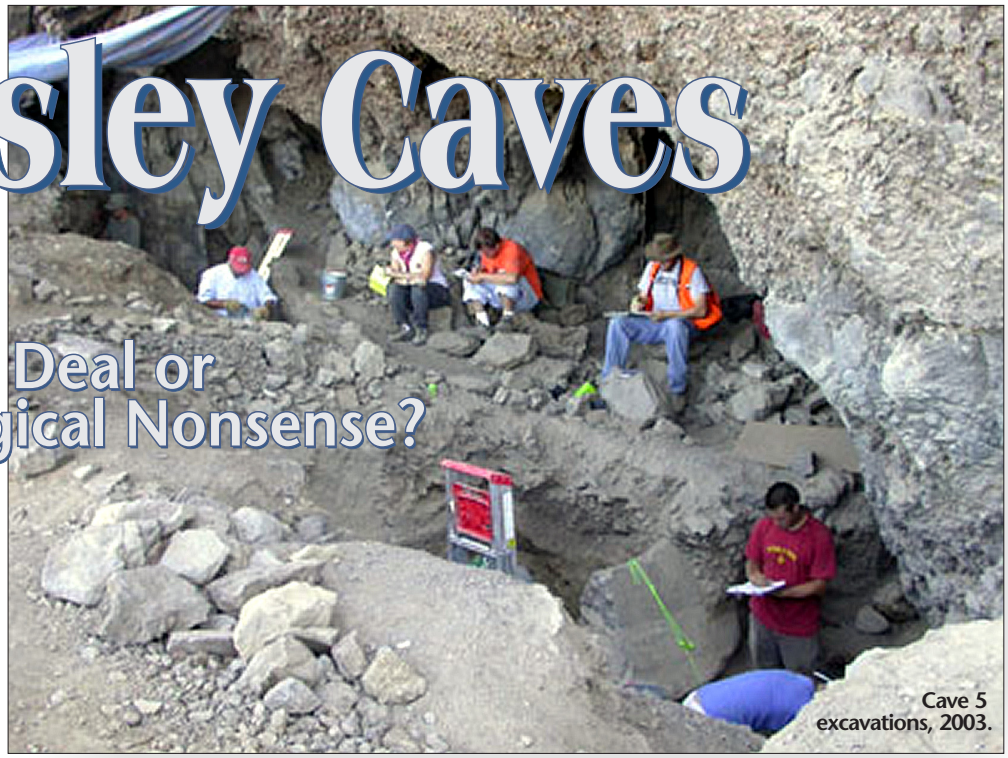
Various theories have been postulated to explain the odd location of the Shoop site. Witthoft's assessment of the site as an upland hunting camp is probably spot on; based on paleoenvironmental research, the site was apparently open grassland during the days of its initial human occupation, and then as now it offered "a commanding view" of the nearby Armstrong Creek valley. Furthermore, there's a natural cul-de-sac east of the site that would have been useful for trapping game.

"We have close to 90 fluted points from the site, and there are 500 endscrapers and 1,500 other tools," Carr reflects. "These were tools broken in use, not in production. It's hard for me to imagine the site didn't involve some form of hunting and processing." He suspects that caribou was the preferred prey, though elk is also a possibility. Deer wouldn't congregate in large enough groups to be worth such an effort, and although nearby swampy areas might have supported moose, they tend to be solitary animals. Even though no one has found fossil remains of caribou in Pennsylvania, Carr assumes they were present about 10,000 RCYBP, when they were definitely in neighboring New York. Which begs the question, How old is Shoop? The answer to that is still up in the air. About a third of the tools display potlidding consistent with burning in fires, but poor archaeological context and lack of charcoal preclude attempts at radiocarbon dating. The fluted points are diagnostic of late Clovis, but that's as close as archaeologists can place the time of occupation.

continued on page 11

Paisley Caves

Part II: The Real Deal or Scat-illogical Nonsense?



Cave 5 excavations, 2003.

UNLESS NOTED, ALL PHOTOS COURTESY UO NORTHERN GREAT BASIN FIELD SCHOOL

ANY CLAIM of a pre-Clovis component at an archaeological site is going to be controversial, and the Paisley Five-Mile Point Caves site is no exception. From the moment Dennis Jenkins, a Senior Staff Archaeologist at the University of Oregon Museum of Natural and Cultural History, and his colleagues announced in the 2008 issue of *Science* that they had recovered pre-Clovis human coprolites (mummified feces) from the caves, a firestorm erupted. Every aspect of the original study has come under scrutiny, and many archaeologists unfamiliar with the complex genetic technology used to analyze the coprolites are uneasy about the findings. Two rebuttals followed from the article in *Science*, one critiquing the genetic results, the other questioning whether the coprolites are from humans at all.

Questions about methodology from a master

One researcher who isn't uncomfortable with the technology is McMaster University geneticist Hendrick Poinar (**MT 20-3,** "Ancient DNA: A Tough Nut to Crack"). Dr. Poinar has made a distinguished career analyzing ancient coprolites from humans and animals from all over the world. So, not surprisingly, his first response to the article in *Science* was "Cool story. I'm glad they're using feces!" But, in the end, he wasn't swayed by the evidence. In a comment on the Paisley Caves story for *Science*, Poinar and his colleagues argue that the methods used to analyze the coprolites weren't rigorous enough to rule out a nonhuman source: Human genetic material from a later date, percolating down from above via urine or rainwater, could have contaminated animal coprolites with human DNA. Contamination by excavators and lab workers also cannot be ruled completely out. For Poinar, the paucity of associated lithic artifacts suggests that the AMS dates obtained on the coprolites are unreliable: The coprolites probably aren't human and are probably Clovis or post-Clovis in age. The debitage, like the DNA, could have been bioturbated down from layers higher up.

What they need, Poinar says, is "more samples and much more DNA data at quantitative levels that would argue for the DNA being endogenous and not due to possible leaching" from above.

In their rebuttal, Dr. Jenkins's team rejects these criticisms: The laboratory protocols used were the same employed by Poinar in his own research; multiple lines of evidence suggest that leaching of more modern mtDNA into the coprolites is

ANDREW CURRY

Jenkins in Cave 2 during filming of the History Channel documentary "All About Dung."

"unlikely"; and the original genetic tests were sensitive enough to pick up contaminating DNA, so the absence of such DNA is not due to error but is an attribute of the coprolites. Furthermore, they point out, the AMS dates were run on fibers in the coprolites, not on bulk samples, so the problems with the AMS dates raised by Poinar's group don't apply.

Are the coprolites even of human origin?

The second critique published in *Science* in 2008 focuses on the human attribution of the coprolites. Boston University geoarchaeologists Paul Goldberg and Francesco Berna, who worked on samples from one of Jenkins's coprolites, argue forcefully that the coprolite samples they have examined aren't human. To these researchers, who have worked extensively with herbivore coprolites, the stained outer surface and high fibrous plant content in the two samples they analyzed were more consistent with samples from herbivores rather than humans. In thin section, the coprolite samples are poor in calcium phosphate and undigested celluose is absent, conditions consistent with herbivore dung and the reverse of what would be expected in the scat of carnivores or omnivores such as humans.

The protocol for collecting coprolite samples borrows techniques from handling hazard materials, except here the aim is to protect the coprolites from the person.

Dr. Berna is emphatic and uncompromising: "The composition and morphology [of the coprolites] is not compatible with human excrement. We have comparative reference samples of coprolites from carnivores, humans and herbivores. When you compare, it is obvious. The coprolites that we analyzed are composed of degraded plant materials—grasses. We don't have seeds or grains or pollen, just chewed grass. This is compatible with the diets of grazers and herbivores, but not plants humans would eat."

Dr. Goldberg agrees, saying that "to demonstrate that the coprolites are human, Jenkins would have to prove the DNA is not contaminated. Also, they would have to explain why people are eating feathers and fibers and nothing else. If they were hunting, you'd expect to find other things in the coprolites."

Mt. Mazama volcanic ash (7640 CALYBP) near top of strata in Cave 2.

However, Jenkins's team counters that human coprolites would be expected to be similar to herbivore dung if the human diet is rich in fibrous foods, as it was in the prehistoric Great Basin and other regions of the world. In their rebuttal to Goldberg et al. (2008), they present data on coprolites recovered directly from Nubian mummies dating from A.D. 550–1450 collected by Jenkins's collaborator Dr. Linda Scott Cummings (Paleo Research Institute). Texas A&M University paleobotanist and palynologist Vaughn Bryant verifies that a similarly high fiber content, including large quantities of phytoliths, is common in human coprolites. The researchers argue that low levels of calcium phosphate have been observed in other Great Basin human coprolites. Finally, they argue that the genetic data can settle the issue: If the Paisley Cave coprolites are of herbivore origin, human mtDNA shouldn't be present, but herbivore and plant mtDNA should be. However, as Rasmussen, Cummings, and others show (2008), the coprolite that they examined for this study contained only human and plant mtDNA, indicating that the coprolites were not deposited by herbivores such as bison, horse, or camel. Plant DNA (cpDNA) in the coprolite matches to lodgepole pine (*Pinus contorta*) and needle-and-thread grass (*Hesperostipa comata*). These plant species were also found as pollen, macrofossils, or phytoliths in the coprolite.

Like many archaeologists, perennial skeptic Stuart Fiedel is hungry for more data to help evaluate the claims that the Paisley Cave coprolites are human: "I'd like to see a detailed description of their contents and dates, and a comparison with indisputable human turd samples from the region. You would expect some considerable difference between diets of the first people and of people adapting to early-Holocene conditions in the region. There's something suspicious if they look like 7000 B.C. turds."

None of these criticisms sways University of Washington zooarchaeologist Don Grayson. Dr. Grayson has studied faunal remains from cave sites throughout the Great Basin. When he saw the coprolites for the first time, he immediately thought "yes [these are from humans], there's nothing that I can think of that would look like that—like humans on a high-fiber diet."

Even iron-clad stratigraphy doesn't satisfy critics

Although researchers are still divided over the coprolite origins, almost no one questions the site stratigraphy. Photos of the strata show horizontally bedded sediments in the lower levels with good lateral and vertical integrity. Extensive AMS dating of organic materials in the lower levels of several of the

caves by geochronologist Dr. Tom Stafford (Stafford Research Laboratories) validates this relatively undisturbed stratigraphic sequence. A total of 76 dates have been obtained that are older than 10,000 CALYBP. The transitions from the early Holocene to the Clovis-age deposits and from these to strata containing pre-Clovis artifacts are firmly established. Jenkins happily observes: "Not only do I have a zillion dates, they are the best I can pay for."

Absent publications providing detailed stratigraphic data, however, Goldberg is cautious, stating that it is difficult to evaluate the site. "In the future, I would want them to publish a lot more detailed stratigraphic data" than the team has to date. He would particularly like to see close-up photos that document exactly which strata the coprolites are coming from, accompanied by micromorphological data detailing the origins of the sediments from which the coprolites have been retrieved.

But, as Texas A&M University geoarchaeologist and CSFA Director Mike Waters points out, well-dated strata are only the beginning point for assessing site integrity. The role of packrats in the formation of the archaeological site remains unresolved: "I visited the site and looked at the evidence. There is stratigraphic integrity there. The deposits are intact, but is the site intact? Were the coprolites brought into the deposits by packrats? Did people use the shelter as a latrine, or did they relieve themselves outside and the packrats retrieved the materials and put them in their nests?"

Dr. Waters is also very cautious about the lithic assemblages, concerned about the possibility that the lithics entered the pre-Clovis strata through bioturbation. Recognizing that local obsidian abundant in pluvial lake gravels would have been a source of toolstone throughout site occupation, Waters suggests refitting. "If refitting could be documented within the pre-Clovis assemblage, and there were no refits between the pre-Clovis assemblage and younger assemblages, this would be very compelling" evidence that bioturbation is not bringing younger lithics down into older strata. This would nicely complement the obsidian hydration data, which show consistent but overlapping increases in hydration rind thickness with depth.

Student Cassie Albush holding a *Camelops* vertebra found in deposits dating to 14,300 CALYBP.

Not all archaeologists feel the issue of site formation processes is critical to establishing the antiquity of the human coprolites. As Grayson points out, "You don't have to worry about the stratigraphy since you have clearly human coprolites with direct radiocarbon dates. There is nothing wrong with the dates and nothing in print that questions the dates."

Perhaps the driving undercurrent of concern about the Paisley Caves centers on the site contents. Waters asks, "What kind of site is it if it's just coprolites? Does it represent two or three hunters on an expedition, holed up in the shelter for an evening? Did they camp adjacent to the shelter?" In his characteristically blunt way, Dr. Fiedel echoes this concern: "Behaviorally, the data suggest that the rockshelter is occupied by people who do nothing but relieve themselves in it and then move on."

"The thing that amazes me most about Paisley Caves" continues Waters, "is the preservation of an ephemeral occupation. Because there are only a few coprolites and artifacts in the pre-Clovis level, it suggests that people were there for a short period of time, perhaps only a few days. To have this ephemeral use preserved for thousands of years, and then to find it is mind-boggling. What are the odds of preserving and detecting such an ephemeral occupation?"

Jenkins is tightening up, but not giving up

More excavation always seems to be the panacea for criticism. New excavations in 2009 and 2010 uncovered pre-Clovis-age deposits in Cave 2 and expanded the excavations of these strata in Cave 5, yielding more coprolites for analysis as well as additional faunal remains and an expanded collection of lithic debitage. One excavation unit produced horse and camel bones in the same level as a handful of lithic debitage.

To amass the most convincing evidence of human occupation from his site, Jenkins has teamed up with a host of researchers who are recognized experts in their fields: Geneticist Eske Willerslev of the University of Copenhagen is heading up the coprolite DNA research; Dr. Bryant is looking for pollen, phytoliths and other botanical remains from the reconstituted fraction; Dr. Karl J. Reinhard of the University of Nebraska is looking for human-specific parasites; Brian Hockett of the Bureau of Land Management is analyzing the fauna; Tom Stafford is producing a long series of additional radiocarbon dates at the site (94 dates and counting!); and Oregon State University geoarchaeologist Dr. Loren Davis is collaborating with Dr. Stafford on the stratigraphy.

In response to criticisms that the DNA in the coprolites analyzed so far has come from modern contamination, Jenkins has extensively modified his methods for handling coprolites to dramatically reduce the likelihood of modern contamination: Coprolites, now handled only by individuals clad in Tyvek suits, are immediately sealed in sterile containers and shipped directly to Willerslev's genetics lab. Willerslev handles the split, sending a fraction on to Bryant for reconstitution and further analysis.

To counter criticisms surrounding the authenticity of the human attribution of the coprolites, and to settle matters relating to diet, Jenkins is expanding his analysis of the coprolite contents. He is sending portions of the recently excavated coprolites

continued on page 10

Prehistoric Florida Submerged

Finding Cultural Clues on the Continental Shelf

WHEN YOU GET RIGHT DOWN TO IT, all archaeology is a kind of detective work: we dig up clues (often literally), then piece them together in an effort to understand what life was like in bygone ages. For the sleuths investigating the initial peopling of the Americas, one of the biggest obstacles to progress has always been the fact that not only is the trail stone cold, but much of it also lies underwater. Until recently, technological limitations have thwarted our efforts to overcome this challenge; but fortunately, that's beginning to change. For the past few summers a team of dedicated researchers, led by James M. Adovasio and C. Andrew Hemmings of Pennsylvania's Mercyhurst College, has combined new technology with plenty of old-fashioned hard work to coax the sea into giving up some of its secrets.

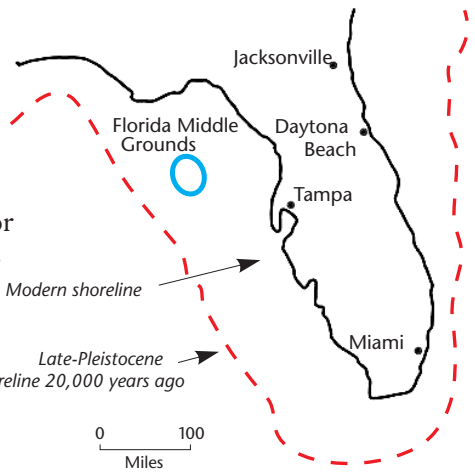
What they've found is still preliminary—but as the technology matures and the project evolves, it has the potential to stand American archaeology on its head.

Water, water everywhere

By the height of the Last Glacial Maximum (LGM), about 22,000 RCYBP, the intense cold had locked up much of the Earth's seawater in miles-thick continental ice sheets. As a result, oceanic coastlines lay as much as several hundred kilometers farther afield than they do today, exposing a much greater land area to exploitation by both wildlife and humans. It stands to reason that at least some of the earliest American cultures would have exploited the landscape and resources along the ocean's edge . . . but the evidence for these occupations is almost impossible to find, given the geological changes that have occurred since.

As the ice retreated far to the north, it reshaped the geography of the post-Pleistocene world in startling ways. Glacial scars became the Finger Lakes of upstate New York and the Seven Rila Lakes of Bulgaria; fine silt from glacial outflows blanketed vast tracts of Eurasia and North America; and the land itself rose up in isostatic rebound, no longer crushed under countless tons of ice. Perhaps the most widespread change, and arguably the most frustrating one for First Americans researchers, was the 75- to 120-m rise in sea level that resulted as the ice melted.

Today, many of the most interesting Pleistocene landscapes lie beneath the sea.



Enter NOAA

Researchers have been itching to study the submerged continental shelf since at least the 1960s, when it was first suggested that the earliest Americans must have utilized it heavily when it was exposed. At the time, however, the cost would have been astronomical—and the technology simply wasn't there. That's no longer the case; it's now possible for scientific desire and technological feasibility to meet somewhere in the middle, and not surprisingly, they have begun to do so.

Perhaps best known for his work at Meadowcroft Rockshelter, a pre-Clovis site in southwestern Pennsylvania, Dr. Adovasio has stood at the vanguard of First Americans studies for decades, steadily working to advance our knowledge of these elusive people (**MT 25-1, -2,** "Paleo Woman: Lost to History"). The opportunity to extend his reach from the terrestrial to the nautical occurred at a recent meeting of the Society for American Archaeology, when he struck up a conversation with NOAA (National Oceanographic and Atmospheric Administration) archaeologist Frank Cantelas, who is associated with their underwater grants program. Adovasio knew that NOAA funded shipwreck studies, but was surprised to learn that they wanted to look in other directions as well. No, the NOAA archaeologist told him, they had never sponsored a systematic scrutiny of Pleistocene underwater landforms. "So in 2007," Adovasio recalls, "we put together a proposal to scrutinize an area west of St. Petersburg in order to

look at everything from the LGM beach to the modern shoreline, to study what they might look like under their modern biomantle, and to look for things like prehistoric river channels, sinkholes, and the like."

When fieldwork began in July 2008, Adovasio's team focused on three areas: the edge of the continental shelf; the Florida

NOAA

Adovasio preparing to hand an underwater camera to diver Jessi Halligan.

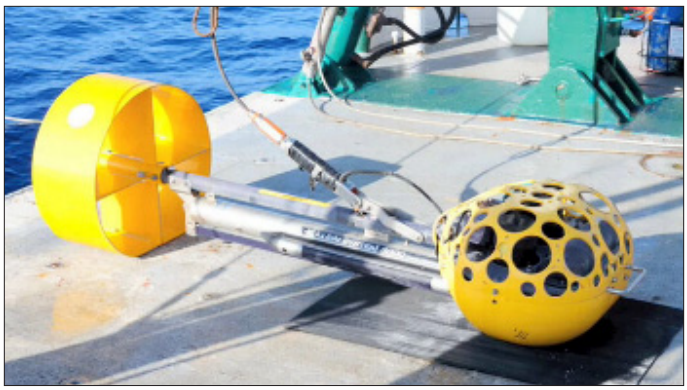
Middle Grounds (FMG) and, to the west of that, the ancient Clovis shoreline; and the edge of the FMG, which corresponds to the end of Clovis. The team looked at all those areas the first year, quickly locating the remains of the LGM shore (which retains a series of remarkably intact near-shore features), as well as what they interpret as karstic sinkholes or cavities that may contain archaeological materials. They also identified the Paleo Suwannee—that is, an extension of the existing Suwannee River channel across the continental shelf. In 2005, other researchers had traced the channel out as far as 20 km; Adovasio's team picked it up about 25 km out, and by the end of the 2009 field season had traced it as far as 160 km into the Gulf. In addition, they found the ancient channel of the modern St. Marks River, and located several submerged chert outcrops that might have served early humans as toolstone quarries.

Smart uses for new gadgets

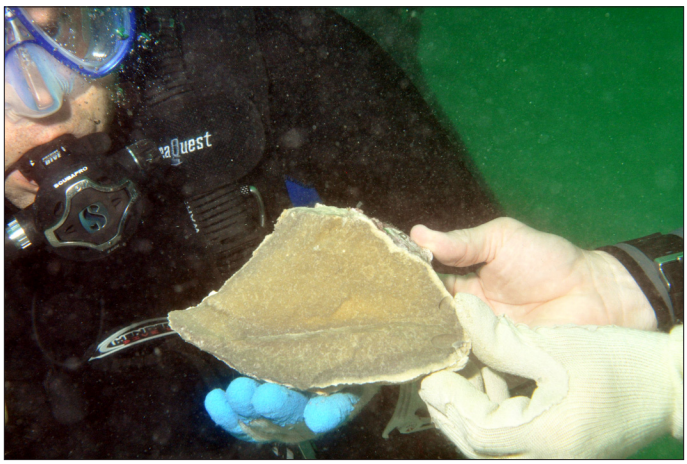
Since the beginning of the project, the team has creatively combined sub-bottom profiling and side-scan sonar technology in ways that provide a better view of the ancient undersea topography than either can alone. "There was a steep learning curve in determining which methods and hardware would produce the best results," Adovasio admits, "and we're still in the process of finding them. We haven't created a revolutionary piece of machinery or anything like that, but I think the way we're working with the current technology and pushing its limits, we're getting the kinds of insights into prehistoric submerged sites that we'd hoped to get when we proposed this enterprise."

Their effectiveness took a step forward in 2009, when they were able to tweak the technology in ways that not only increased resolution, but also collected data in half the time. "This lets us see in real time what the seafloor is like, and what is immediately below it," notes Andy Hemmings, Adovasio's co-Principal Investigator. "It essentially cuts an electronic backhoe trench directly below the boat, in the middle of a side-scan sonar swath 100 to 300 yards wide."

Adding to the rigors always associated with undersea archaeological work, logistical issues required the team to work on a grueling schedule. "Our crew [in 2009] consisted of one research diver and eight archaeologists: three Ph.D.s, four graduate students, and one undergraduate student," explains Texas A&M grad student Jessi Halligan. "To maximize expensive boat time and equipment rentals, we were working on a 24-hour schedule. This meant that every day, everyone would take at least one shift monitoring the remote sensing gear during the night, while we would dive during most days." Halligan was

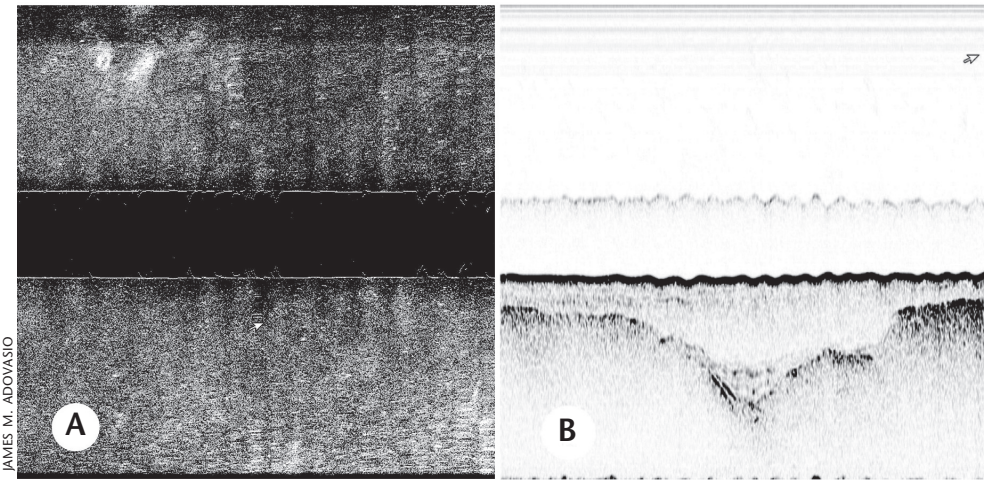


NOAA



JAMES M. ADOVASIO

***Above,* the towfish; *below,* a chert nodule from an inundated outcrop off the coast of Florida.**

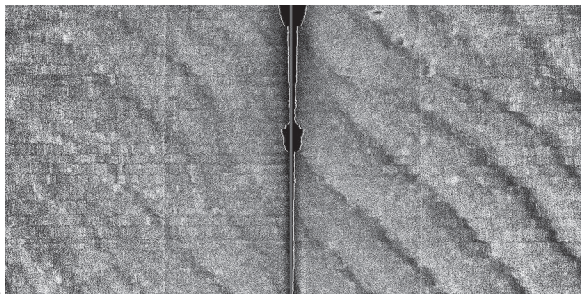


JAMES M. ADOVASIO

A, side-scan sonar image of a segment of the Paleo Suwannee River valley; nothing is visible. B, sub-bottom profile image of the same area, clearly showing the river channel.

a diver, and also one of two crew members charged with managing data and maintaining the towfish, the electronic data collector towed behind the ship.

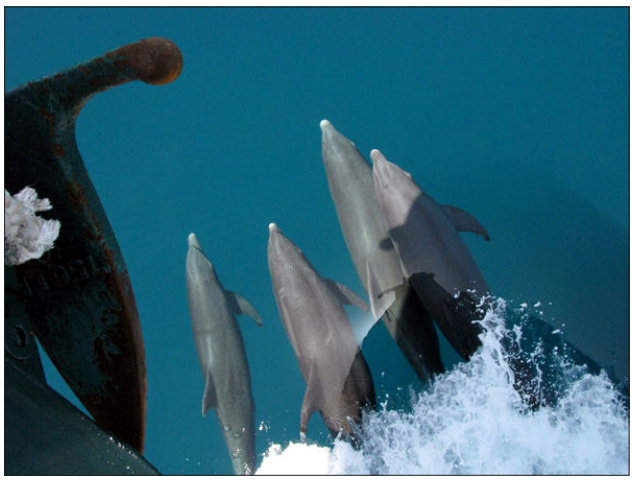
Unexpectedly, the towfish acquired a retinue of undersea admirers: inquisitive dolphins, which interfered with the painstaking work of mapping the ocean floor. "We had as many as 45 dolphins around it at times, so we learned a new hazard to archaeological fieldwork," Hemmings reports. Meddling dolphins eventually put the towfish out of commission, and the team had to dive to investigate interesting spots.



JAMES M. ADOVASIO

Record of bottom-imaging scan showing subsurface sand ridges preserved near the LGM beach.

The team first dove in 80–105 ft of water, and found only limestone outcroppings; but at sites 45–65 ft deep, they hit chert bedrock immediately adjacent to the river channels. Hemmings estimates that those locations last saw the light of day at least 8,000 years ago. One of the most interesting sites, located where the intersection of the Paleo Aucilla and another river form nearly a right angle, is a feature that suggests chert-rich subsurface deposits. The team calls the site Thor's Elbow. "In the few places we know of like that in Florida," Hemmings points out, "there are *massive* Paleo sites." Early occupation sites on shore were almost invariably chosen with ready access to freshwater and toolstone, and it's likely the same criteria would apply to occupation sites out on the continental shelf.



NOAA

Dolphins off the starboard bow.

The way forward

Prehistoric inundated archaeology has never been easy, and the complications involved in deep dives are particularly frustrating. In some cases, limited air supplies and the need to avoid decompression diving severely limit the time divers can spend on the bottom. At Thor's Elbow, for example, Hemmings was able to stay down only nine minutes, just long enough to pound a core, cap it, and hand it off to Halligan to take to the surface. Furthermore, the daily expenses of this type of fieldwork are staggering; hence the tight 24-hour schedule and field seasons of just a few weeks.

Scientifically, these are early days yet. Nevertheless, data collected so far make it possible to form a model that will narrow the team's focus in future seasons. As Adovasio explains, "I think we're homing in on three kinds of site setting situations: sinkholes and karstic features, which we know accumulated late-Pleistocene and Holocene materials in terrestrial locations; river-edge locations, which might contain materials in overbank deposits; and chert outcrops. In the three places where we thought we might find chert, we did find chert. We're comfortable with the accuracy of where we think such sites ought to be; now it's a matter of examining them thoroughly enough that we're reasonably comfortable we can find cultural materials, and then being able to determine what those cultural materials tell us."

In addition to honing their technological edge with sub-bottom profiling and side-scan sonar equipment, the team members are working to extend the limits of their diving capability. According to Hemmings, they're slowly but surely becoming technical divers. Their next goal is to reach as deep as 165 ft without decompression, then 225-plus ft with mixed gases—before going even deeper. "Where the LGM coast would have been is about 365 feet deep," Hemmings points out. "That's awful deep for diving. Do we really expect to find people there? No, because we don't have people in the Americas 22,000 years ago . . . but then again, how many people have looked at soils that age? Our work

has a tremendous potential to push the early end of when humans entered the New World, simply by looking at areas people could have occupied that haven't been previously accessible."

Hemmings (*left*) and Adovasio at sea during the 2009 field season. ▶

Crew members with bottom-imaging displays during the 2008 field season. Hemmings is second from left, Jessi Halligan is at the extreme right. ▼

BOTH: NOAA

Adovasio agrees, pointing to two discoveries that have been especially significant: verifying that existing rivers extend well out onto the continental shelf, and finding and sampling chert outcroppings. "If we'd been permitted to have single-malt scotch on board," he muses, "that would have been an occasion to sample it!"

In the upcoming field season, Adovasio and his team intend to study those locations in greater detail and thereby estimate the potential for identifying preserved archaeological sites. They intend to go back to some of their high-potential locations with a dredge, to remove the biological cover and look for intact late-Pleistocene sediments and associated archaeological materials. They've targeted several sites for the summer of 2010; if one pans out, they plan to excavate the following summer.

Ultimately, Adovasio asserts, NOAA needs to interface with other agencies like the National Science Foundation to underwrite activities on a scale that aren't just "preliminary shots in the dark." That's why, he says, publications like *Mammoth Trumpet* are important. "One of the things you do is bring continuing archaeological research to a wide and diversified audience, as it's being done. What we're trying to do is not only to reach the scholarly community, but to transmit this to the lay public . . . actually pursuing the educational moment in the broad perspective.

"I think the most important vehicle for doing that is sitting down and talking to people like you, the way I'm doing now." MT

–Floyd Largent

How to contact the principals of this article:

C. Andrew Hemmings
Mercyhurst Archaeological Institute
Mercyhurst College
501 East 38th Street
Erie, PA 16546
e-mail: chemmings@mercyhurst.edu

Jessi Halligan
Department of Anthropology
Texas A&M University, 4352 TAMU
College Station, TX 77843-4352
e-mail: jessihalligan@tamu.edu

James M. Adovasio, Provost
Senior Counselor to the President
Dean, The Zurn School of Natural Sciences & Mathematics
Director, Mercyhurst Archaeological Institute
Mercyhurst College
501 East 38th Street
Erie, PA 16546
e-mail: jadovasio@mercyhurst.edu

Paisley Caves

continued from page 6

to labs that specialize in analyzing zooarchaeological materials such as bone fragments, insects, and fish scales; macrobotanical remains such as seeds, pollen and phytoliths; and the presence of human-specific and other parasites, bacteria and viruses.

In spite of this, Berna is not convinced that contamination from later or modern DNA could ever be completely ruled out. He recommends that Jenkins "keep excavating in nice contexts. Tools would be stronger than the genetics. Contamination is always there with genetics. Obsidian hydration works in some places, not others. But there is such good organic preservation in the caves, Jenkins should rely on dates on organic materials" to best establish a pre-Clovis presence in the Americas.

The recent seasons have been productive, and visitors to the site have been impressed. New excavations have increased the number of tools in the pre-Clovis strata. Should they prove to have some sort of integrity as an assemblage, concerns about the coprolites-only nature of the site should wane. Jenkins continues to invite friends and skeptics to visit the site. It's perhaps worth noting that his strongest critics—Poinar, Goldberg, Berna, Fiedel, and anthropologist Dr. Gary Haynes of the University of Nevada, Reno—have yet to make the trip.

Hamilton College Paleoindian researcher Dr. G. Tom Jones remarks that "if my understanding is correct, Jenkins is now recovering materials from another of the caves that are equally

old as the original coprolites. They have also recovered a small assemblage of artifacts. Mostly flakes, I believe, but still a nice adjunct to the fecal remains. This material is coming from well-stratified deposits of fine-textured materials where there seems to be little disturbance and where stratigraphic mixture is pretty easy to detect when it occurs. I think it's getting harder and harder to find problems with this record."

Waters probably speaks for the majority of archaeologists when he comments that "Dennis is doing a good job. I like the fact that he has brought in a solid scientific team. The right people are working on the site. But before we can pass final judgment on the site, we need a good site report. It is incumbent on Dennis and his team to get the data out there so people can decide about it."

Jenkins agrees, saying, "I just want this to be science. There's no room for this to be personal." MT

–Ariane Oberling Pinson
Renaissance Science Consulting
Departments of Anthropology and Geography,
University of New Mexico
Departments of Anthropology and Geography,
Central New Mexico Community College

Probing the Mysteries of the Shoop Site

continued from page 3

A downside of Shoop, compared with other regional Paleo sites like Vail, Debert, and Bull Brook, is that any hearth features would have been obliterated by almost two centuries of plowing. Carr holds hope for a small swale that apparently has escaped the plow, but he hasn't been able to examine it since his last visit in 2008. "I think there's charcoal at Shoop," he says, "it's just a matter of finding it."

A compelling possibility

Given the evidence, Carr has formed an intriguing hypothesis that neatly encapsulates the mysteries surrounding Shoop. The Pleistocene occupants, he believes, entered Pennsylvania from the Great Lakes region while following migrating caribou, most likely during the Younger Dryas climatic interval. He's still unsure whether one group or successive groups camped at Shoop as they drifted south. "I think the multiple concentrations suggest it was occupied by groups of 25 to 30 people, possibly separate groups, over a period of as little as 50 years," he says. "We don't have good horizontal control of the artifact assemblages, but when we compare different concentrations, we do see some noticeable differences."

Carr (*left*) at the Shoop site with Lloyd Chapman of the National Park Service, 2008.

Most of the lithics are made of Onondaga chert simply because the occupants came to the site carrying that material. "They probably arrived from the north, which is where the stone came from, so that's what they used," Carr theorizes. "They weren't familiar with the local materials." This is another point that argues for large migrations across a relatively short time frame: Occupants familiar with the area would have had a better knowledge of local lithic sources. As it is, all the tools from Shoop were resharpened and reused until they couldn't be used again—"characteristic of what happens to a tool assemblage that's been moved 200 miles from its source," notes Carr.

Where do we go from here?

Although the Shoop site has been well known since the 1950s and studied repeatedly since, its origins remain enigmatic. Why did Paleoamericans visit the site, especially in such numbers, and why did they reuse foreign toolstone to such an extent when local lithic sources were readily available? Carr's theory of their origins is logical and compelling, but verifying what was happening there requires further work, especially in areas of the site that haven't been disturbed by plowing. Carr is confident this will eventually occur; and when it does, we may finally have some answers to our questions about this unusual occupation.

Despite its obscure origins, Shoop influences modern thinking about Paleoamerican settlement patterns in the Mid-Atlantic. "One of the interesting things about Shoop is that it seems they adapted to the environment very quickly," says Carr. All across the continent, in fact, we see local adaptations developing rapidly in the late Pleistocene. A prime example is the adoption of fluting technology: Regional knappers from coast to coast came up with unique variations of fluted points from the word go, and that in just a few decades.

"This rapid adaptation may be what was happening with Shoop, too," Carr suggests. "They were moving south to exploit *something*, possibly migratory animals. The Younger Dryas shift probably happened in someone's lifetime. How did local cultures react to that? If we could get some better dates on Shoop, I believe it would be *very* important to understanding human cultural adaptation over the very short term." MT

–Floyd Largent

How to contact the principal of this article:
Kurt W. Carr
Senior Curator
State Museum of Pennsylvania
300 North Street
Harrisburg, PA 17120-0
e-mail: kcarr@state.pa.us

The Ceramic Gap

THE MOST ANCIENT CERAMICS in the world are found in Asia, appearing in the archaeological record possibly as early as 18,000 CALYBP. Three thousand years later descendants of Asian people appear in the Americas, yet ceramic artifacts don't grace the American archaeological record for nearly another nine millennia.

What caused this ceramic gap? Was pottery positioned at the wrong time or place to migrate to the Americas? Could the technology have made the trip, but later somehow got lost? Or was this valuable technology simply left behind? And if so, why? All these subplots are possible, some more probable than others, but they all have one thing in common. They all have their origin in Asia.

ELISABETTA BOARETTO

Vessel masterfully reconstructed from ceramic fragments found in Yuchanyan Cave before excavation.

What happens in Asia, stays in Asia

The subject of ceramic history is so broad and deep that to explore it fully would take lifetimes. Examples from its technological summit stir images of goliath Greek amphorae, Basketmaker pottery, perhaps even Venus of Willendorf–like statuettes. Our interest, though, is in the very first ceramics, which appeared on the continent of Asia. The world's most ancient pottery, dating to 16,000–18,000 CALYBP, was found in Yuchanyan Cave in the Yangzi River basin in southern China by a team of archaeologists that included Elisabetta Boaretto of Bar-Ilan University in Israel and other scientists.

Dating ancient artifacts can be tricky, and ceramic remains pose additional complications. Dr. Boaretto and collaborators were consequently painstakingly thorough in their methods. They dated both bone and charcoal samples, in strata where pottery was discovered and also in layers above and below the pottery to obtain a high level of precision. Sediment mineralogy was checked for any disturbances that might introduce errors into the dates. Samples were prescreened in the field and again in the lab to eliminate suspicious specimens. "In short," Boaretto sums up, "we integrate all possible information to increase the accuracy and precision of the ^{14}C date from the analytical and from the archaeological context point of view." The result is a trustworthy date on the oldest pottery known to man.

ELISABETTA BOARETTO

Excavating Yuchanyan Cave; *inset,* location of site in China.

China isn't alone when it comes to ancient pottery. The Japanese archipelago boasts a number of sites containing dated ancient ceramics. In fact, Yaroslav V. Kuzmin of the Institute of Geology and Mineralogy at Novosibirsk, Russia, believes that Japan has the most abundant records of the earliest pottery in East Asia. Japan's earliest ceramic type, from the Incipient Jomon period, dates to 15,600–16,800 CALYBP. The authenticity of these dates was initially disputed on account of "old carbon" emissions from volcanic eruptions; dendrochronology, however, put these suspicions to rest. The results from dating Holocene tree rings corresponded with the C-14 dates, confirming that although Japan may not have the oldest pottery in the world, it isn't far behind China.

Dr. Kuzmin also investigated ceramics from Initial Neolithic sites in the Russian Far East 3600 km from the Bering Strait excavated in the 1990s and 2000s. Here he found evidence of ceramic technology associated with charcoal dates as old as 14,100–16,500 CALYBP. When ceramic artifacts were directly dated instead of associated charcoal, they returned dates even a few hundred years older.

But hold the phone. Directly dated? Yes, such experiments are in the works. Kuzmin explains that direct dating of pottery is necessary due to the poor stratigraphy at the locality. So he and his colleagues have attempted to date pottery tempered with organics (organic material mixed with the clay to fire the pottery) by using the accelerator mass spec-

trometer (AMS) method. The process involves dividing the sherds into interior and exterior parts, then combusting them. Using different temperatures and oxidants for combustion, they obtained results in the neighborhood of those obtained dating charcoal in close relation to ceramic sherds.

So can pottery be directly dated? Suzanne Eckert of Texas A&M University gives her affirming nod that dating this way is in the realm of possibility. She should know; she's experimenting with a procedure to radiocarbon date soot and residues on ceramics herself. Yet she warns that you "cannot simply grab any particular sherd and date it." She cautions that the potential problem with Kuzmin's technique is that, even though he is attempting to date the plant fibers added by humans at the time of manufacture, these plant fibers can be contaminated by carbon that occurs naturally in the clay. Although not a specialist in Russian Far East ceramics, Dr. Eckert suspects that these vessels were not fired to a temperature high enough to burn off naturally occurring organics. These organics would skew the radiocarbon date toward the age of the clay, not of the manufactured pottery. It wouldn't make the sherd look . . . well, as old as dirt, but somewhere between the age of the sediment and the age of the ceramic.

ELISABETTA BOARETTO

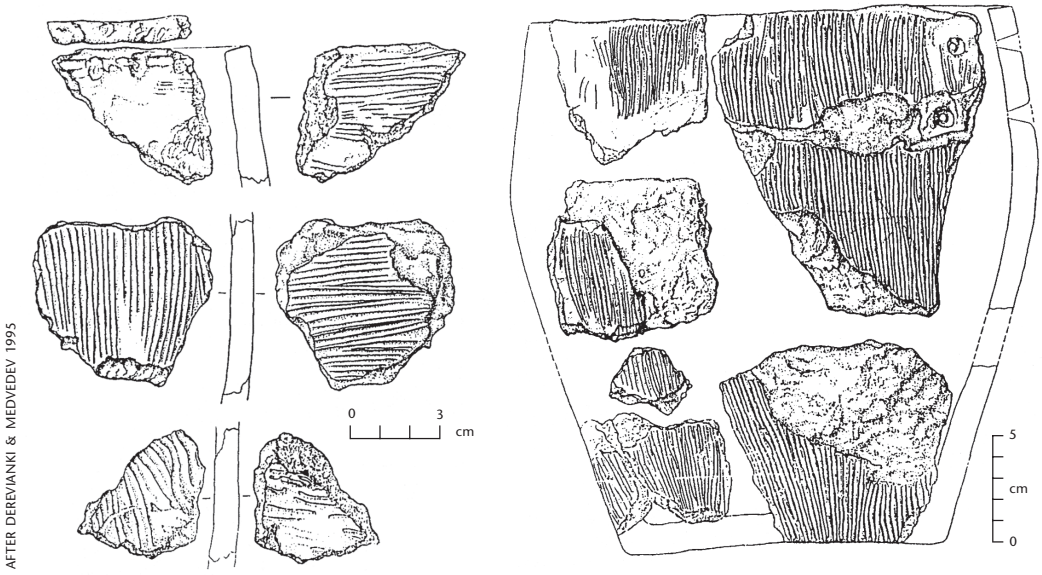
Boaretto with the children of the family that housed her during the excavation of Yuchanyan Cave.

In their paper "Direct Radiocarbon Accelerator Mass Spectrometric Dating of the Earliest Pottery from the Russian Far East and Transbaikal," O'Malley, Kuzmin, and colleagues discuss the difficulties of separating the plant fibers from the naturally occurring organics. Sometimes it isn't possible. Nonetheless, they believe their technique accomplishes just such a separation, so they date only the plant fibers. This new method of dating pottery isn't universally accepted among archaeologists concerned with directly radiocarbon dating pottery, but some authorities suggest it holds interesting possibilities for future research. It's encouraging that charcoal samples from primary contexts at the Gromatukha site in the Russian Far East appear to confirm ^{14}C dates of pottery from the same contents.

New World, no pottery?

Despite evidence that ceramics technology was in use in Asia well before the first migrants crossed over to the Americas, no whisper of pottery pops up in the American archaeological record until 5,500 years ago. And as Dr. Tom Dillehay of Vanderbilt University points out, that was in South America. It took North America *another* 2,000 years after that to climb on the band wagon; the earliest evidence of pottery on this continent is a late-Archaic site on Stallings Island in Georgia, an island in the Savannah River north of Augusta, that dates to 3500–3800 RCYBP (3700–4200 CALYBP). That's a gap that spans millennia. Perhaps "gap" isn't the right word—canyon, gulf, or chasm might be a better choice.

The point is, pottery shows up late in the game with New World players. Is it possible that ceramics technology made the migration and only later got lost somewhere along the way? Such occurrences are unusual, Eckert says, though not entirely unheard of. In fact, she believes exactly such a case happened in Polynesia. So the question now becomes, Could evidence of early New World pottery, say in Alaska, have gone unnoticed in the archaeological record? Dr. Steven Simms from Utah State University and Dr. Andrew Ugan of the Smithsonian Tropical



AFTER DEREVIANKI & MEDVEDEV 1995

Pottery of the Osipovka culture (7800–13,300 RCYBP) from the Gasya site in the Russian Far East.

Research Institute don't think this is the case. They, along with Jason Bright of the University of Utah, have put a great deal of effort into discovering the relationship between mobility and manufacturing ceramics in the Great Basin. If ceramic implements were in use, surely some trace of them would have been discovered by now in early sites. It's appearing more likely that although the technology existed in Asia, the New World simply missed the ceramics bus.


STEVEN R. SIMMS


TOM D. DILLEHAY

Above, **Simms in Argentina, 2010;** *right,* **Dillehay in the lab.**

That won't fit in my carry-on

It seems odd that early migrants would intentionally leave behind a valuable technology. We know that pottery was being manufactured in the Russian Far East at the right time to be carried with other camp goods by the first migrants. What we don't know, however, is how widely the technology was spread among the population. Did all these ancient Siberian groups possess the knowledge of how to shape and fire pottery, or was it a skill known only to a select few? Eckert points out that although some ancient Siberians clearly had ceramic technology, it's possible that migrants to North America came from groups that lacked it. After all, the technology to carry limitless music and books on pocket-size devices exists today, but not everyone owns an iPod or a Blackberry. We can't expect that everyone of those ancient groups was up to date on the latest fad.

Eckert gives another spin on the same theory. Perhaps, she suggests, ceramics manufacturing was a responsibility assigned to specific members of the group, such as certain women or the elderly. If these people didn't make the trip, then neither did their knowledge. Throughout history it's the case that individuals possessing unique hard-learned skills are absent in the first wave of migrants to arrive in a new land. Some artisans are left behind, some come along later. Except in this case, when the sea level rose and the Land Bridge was submerged, the option to follow was lost.

Taking a step back and looking from a different view at a New World bereft of pottery, is it possible that ceramic technology was purposely left behind? Perhaps these original hunter-gatherer travelers didn't find it practical to tote their ceramics. After all, a clay pot is neither the lightest nor the easiest item to carry. Why drag along a bulky pot that will most likely break anyway? Mobility and pottery aren't the happiest bedfellows.

This is where Ugan and Simms step in. They point out that, contrary to what we might think, many mobile groups did make use of ceramic technology. By examining how much time and care a potter invests in creating a vessel, Ugan and Simms tell us, we can predict what kind of handling the item is expected to endure. Pottery made by someone on the go isn't made with the detail and attention invested in a vessel that is expected to last years. After all, who takes fine china on a picnic? To assess the potter's intent, Ugan and Simms consider such factors as wall thickness, temper, size, and surface finish, but they caution against generalizing. Some factors, wall thickness, for example, may swing either way. The potter in a sedentary society may take care to thin the walls of a pot because he expects the pot to last a long time and considers it worth the effort; on the other hand, the potter in a highly mobile group may do the same thing to make the pot lighter and therefore easier to carry.

Ugan and Simms's experiments with this technique in the Great Basin on Fremont

continued on page 20

KENNETH E. SASSAMAN

Examples of the Stallings Pottery tradition from sites in the Savannah River valley. This is the earliest dated pottery in North America.

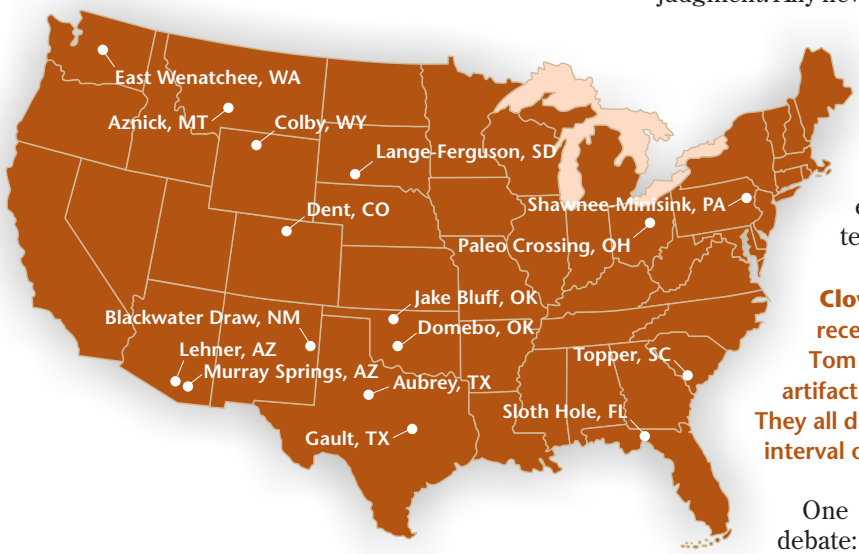
What It Means to Be Clovis

Part I: Simply Clovis

THE WEALTH OF KNOWLEDGE we have amassed on the Clovis culture would stun any archaeologist 10 years ago and utterly dumfound a top-notch authority 50 years ago. Data from recently discovered sites, reanalysis of materials from known sites, and even a possible extraterrestrial event (a comet now demands consideration) have shaken up the scientific community and stirred archaeologists to discuss in a big way what is Clovis and what isn't.

But this is what scientific inquiry is all about, a willingness to question existing beliefs and explore fresh possibilities as new information comes to light. **CSFA** was founded on this principle and today remains determined to keep an open mind about how the Americas were settled. Who got here first? Where did they come from? When did they arrive? These questions drive the Clovis-First vs. pre-Clovis debate, which challenges a cornerstone of North American anthropology.

The case for pre-Clovis today rests on shaky evidence—it's lean, varies widely from site to site, and either hasn't been formally published or was published so recently that the archaeological community hasn't had time to assess it and pass judgment. Any newly discovered site that possesses acceptable *bona fides*, meaning good stratigraphic context and reliable geochronological dates, is certain to be recruited by one side or the other in this contest of opposing hypotheses. Paradoxically, the case for pre-Clovis has to be pleaded in terms of Clovis evidence—in this contest the Clovis-First team has a clear home-field advantage.



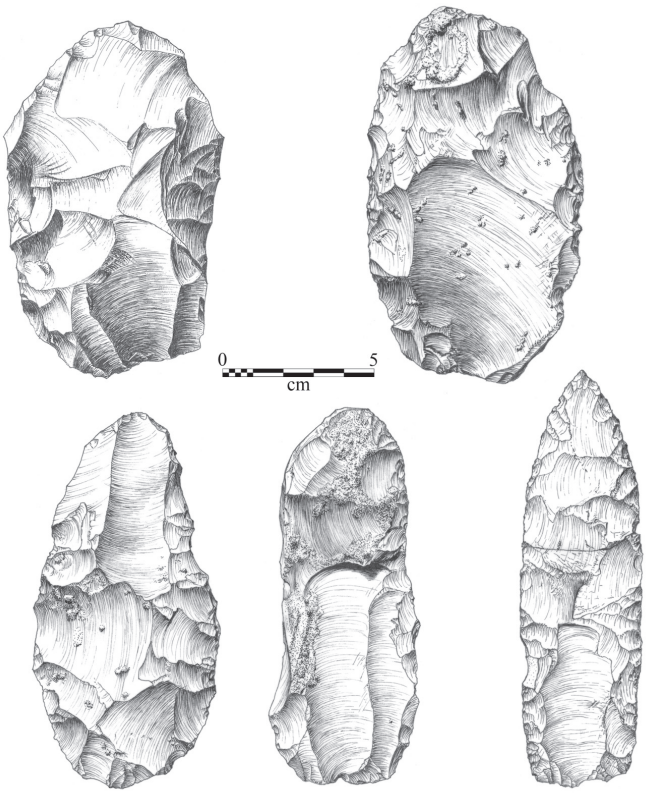
Clovis sites. All these sites either were recently redated by Mike Waters and Tom Stafford or have diagnostic Clovis artifacts from secure stratigraphic contexts. They all date within the remarkably narrow interval of 10,765–11,125 RCYBP.

One obvious fact trumps all arguments in this debate: We can't agree on what isn't Clovis unless we agree on what *is* Clovis.

Keeping up with an ever-expanding database

New scientific techniques and solid scholarship have so enlarged our knowledge of Clovis technology and lifeways that the conventional wisdom of 40 years ago is today permanently consigned to the rubbish heap of history.

For instance, identifying the iconic fluted projectile point with extinct Pleistocene megafauna once dominated our perception of Clovis hunter-gatherer subsistence; our fixation on Clovis the mammoth hunter overshadowed the "gatherer" aspects of Clovis diet, which we now know included small game and plant resources (**MT 25-4,** "The Paleoindian Menu: Subsistence and Diet"). Or consider how evidence collected in the last decade from the south-central and southeastern United States demonstrates that blades and blade cores aren't an "occasional" occurrence at Clovis sites; blade production was a principal component of the Clovis technological repertoire, particularly where abundant, high-quality toolstone was easily available (**MT 20-1, -2,** "Assault on Gault"). And whereas we once considered Clovis caches



FRANK WIER

Clovis bifaces from the Gault site, Texas. Note the large flake scars that travel across the midline of the biface and the removal of endthinning, or fluting, flakes. Clovis knappers fluted early and often! The preform at lower right was nearly finished when it broke.

merely static finds, which we studied because they helped us understand Clovis tool production, we now comprehend the behavioral aspect of caching; it was a strategy used by Clovis folks who were familiar enough with their surroundings to risk storing implements on the landscape for future use—a real-world solution to known environmental conditions, not just a collection of "lost" tools (**MT 22-2,** "Snapshots in Time: New Insights from Clovis Lithic Caches").

The point is that our understanding of Clovis is fluid, continually changing as new evidence comes to light. Keeping in mind past perceptions (and misconceptions) and how our knowledge has progressed, let's move forward on the Clovis-First vs. pre-Clovis debate by simply asking, What *is* Clovis?

The organization of Clovis technology

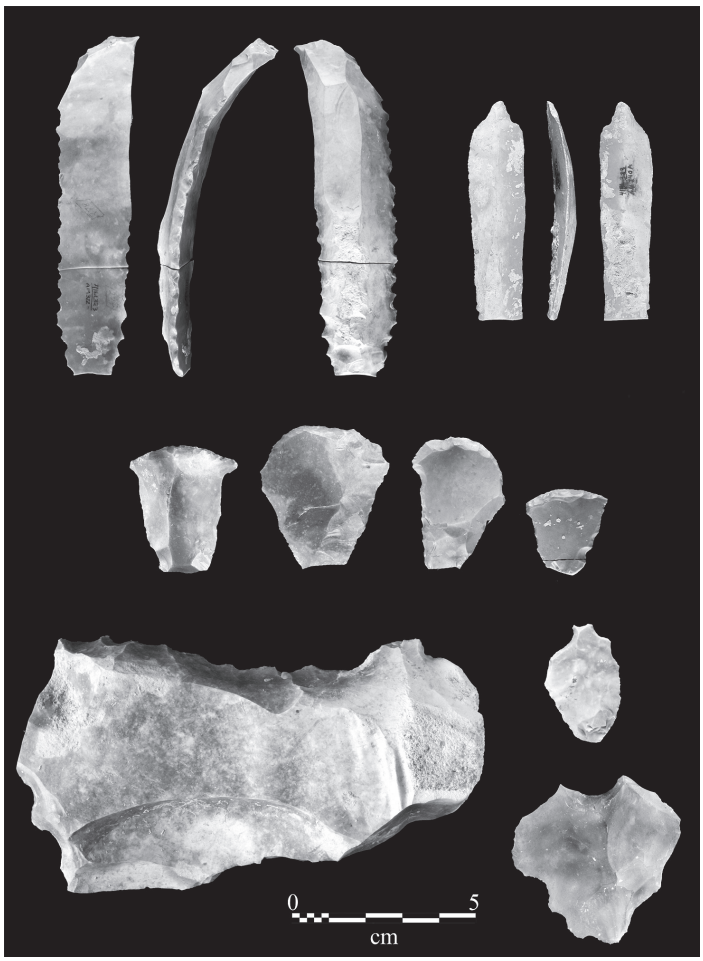
The first question to ask is, Why is Clovis technology important? How can material remains contribute to our understanding of who first settled the Americas?

Archaeologists study the technological organization of a culture to learn how its members adapt available resources for use in their strategies for survival. These strategies have economic dimensions (for example, obtaining and storing food, acquiring materials for clothing, shelter, and tools) and social dimensions (division of labor, planning migrations and hunts, establishing and maintaining authority, disposing of the deceased). The environment sets the stage;

SCOTT MINCHAK

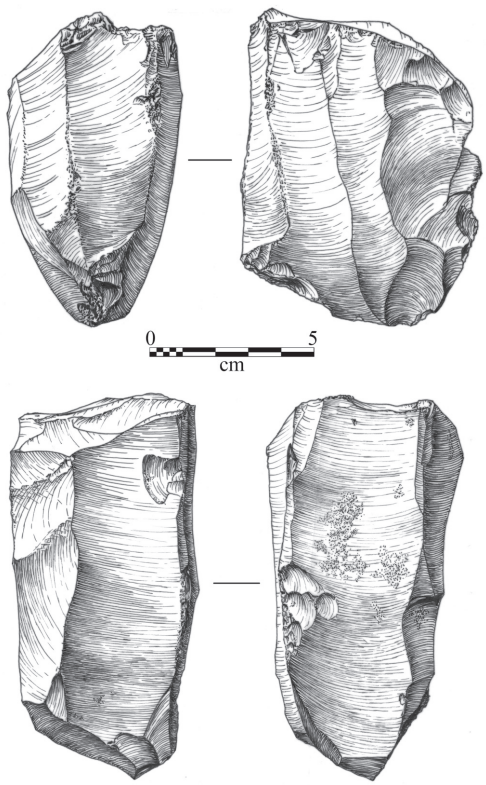
Clovis blades come in a variety of shapes and sizes.

it presents a complex of conditions and defines the problems that must be solved by creating and applying technological



CHARLOTTE PEVNY

Clovis blades and flakes were made into tools designed to get the job done—cutting, scraping, or boring holes. Use-wear research shows that the tools pictured here were used on a variety of hard and soft materials, like wood, bone, hide, and meat.



FRANK WIER

Clovis blade cores. These typical examples are from south central Texas.

strategies. The business of the artifact analyst is to identify technologies, understand how these technologies were employed in social and economic strategies, and theorize how technological change relates to long-term cultural change.

In the case of Clovis, the artifact analyst's principal interest is lithic technology because of the near-total absence of perishable artifacts, except for a few of bone, after 13,000 years. Clovis lithic technology is the manifestation of a strategy that orchestrated the tasks of acquiring toolstone, manufacturing tools, maintaining them, and discarding them when they were no longer usable.

If Clovis tools and the technology used to create them can be precisely defined, then archaeologists have a standard for comparing artifacts from potential pre-Clovis sites. Coupled with radiocarbon dates for all known Clovis sites in North America (**MT 22-3, -4,** "Clovis Dethroned: A New Perspective on the First Americans") and genetic data (Goebel et al. in "Suggested Readings"), these multiple lines of evidence give us the clearest template of what constitutes Clovis technology and paint the most complete picture of what life was like during the Clovis era.

This article is the first installment of a series that reviews the most recent evidence of Clovis technology—think stone and bone tools! Our focus will be on sites with diagnostic Clovis artifacts, backed up with solid stratigraphic context and credible radiocarbon or OSL dates. Of course, compelling evidence from sites of less certain provenance also begs to be addressed. Each installment of this series will address a different class of artifacts of the Clovis toolkit: points and bifaces, blades and tools made from blades, and bone tools. We'll review what we know about each component and how recent discoveries have expanded or altered the sum of our knowledge.

A brief review . . .

If you're a regular reader of *Mammoth Trumpet*, then you know that Clovis is identified by a distinctive type of fluted projectile point that is found widely distributed across North America. This projectile point, and the cultural phenomenon associated with its makers, was named after the type site discovered in the late 1920s near Clovis, New Mexico. But *Clovis* has come to mean so much more. It is synonymous with a lifestyle practiced by mobile hunter-gatherer people who burst upon this continent at the end of the last Ice Age about 13,000 years ago during a time of rapid environmental change, and after no more than 400 years surrendered stewardship of the land to new cultures. Clovis is typified (and parodied) in the movies and on television in scenes depicting

scraggly, fur-wearing hunters with spears tipped with stone points stalking the obligatory woolly mammoth or saber-toothed tiger.

Archaeologists use the term *Clovis* to refer to substantial items such as tools, diet, even the people themselves. Notwithstanding continent-wide similarities in certain aspects of Clovis life, we can't say with certainty that these people shared precisely the same mores, that is, the same religious beliefs, morals, and mortuary practices, the more ephemeral aspects of human life that are nearly impossible to identify archaeologically. University of Nevada anthropologist Gary Haynes in *The Early Settlement of North America: The Clovis Era*, a comprehensive review of all things Clovis (see "Suggested Readings"), uses "Clovis era" to characterize the traits of fluted-point assemblages that date to an interval around 11,000 RCYBP. **CSFA** Director Mike Waters and geochronologist Tom Stafford discovered that this interval is very small indeed, spanning as little as 250 years.

Haynes cites no fewer than 14 traits that he considers typical of Clovis artifact assemblages, including:

- the presence of bifacial, fluted projectile points often made from nonlocal stone
- bifaces used as multipurpose tools and preforms
- blades and blade cores
- cutting and scraping tools made on flakes or blades
- multifunctional tools such as scrapers with graver spurs
- the occasional presence of bone and ivory tools
- the occasional presence of hearths
- infrequent presence of plant foods and small animals
- tools made of high-quality stone, which may originate from sources over 250 km away
- sites associated with water sources or water near areas where stone is available to make tools.

Clovis points. Though these iconic projectile points vary in size and the type of toolstone they were made from, they all have the characteristic lanceolate shape, distinctive fluting flakes removed from the basal edges, and grinding on the lower edges and bases. The large horizontal point at the bottom is a bit longer than 20 cm.

Notice how many things on that list have to do with rocks? Obviously, it's because rock is so enduring. Common sense tells us that Clovis folks wore clothing, probably made rope and cordage from plant fibers, and most likely fashioned bags and other containers of hide or leather. Unfortunately, with just a few exceptions these perishable organic materials haven't stood the test of time. Osseous (bone) tools have been recovered from a mere handful of sites like Murray Springs in Arizona, Blackwater Draw in New Mexico, and the Anzick cache in Montana.

How did Clovis people use the landscape?

Archaeologists use artifacts and their association with each other to understand the purpose sites served. Despite the pervasive presence of Clovis projectile points across the North American continent and in practically every conceivable environmental setting, not every tool type is present at every site. To date, archaeologists haven't recovered the complete Clovis toolkit from any single site. This is because different types of sites represent different activities or groups of activities. For example, what is often referred to as a Clovis "kill" site is a location where game, usually the remains of mammoth or less often bison, was acquired and processed. What might that look like archaeologically? Artifacts would likely include fairly specialized tools like fluted projectile points, as well as a few tools used to skin and butcher the animals. There may also be small pieces of stone debris (debitage) detached when tools were resharpened. And with a little luck there may be some portion of the skeleton left.

Kill sites are most often found in the Southwest and Plains

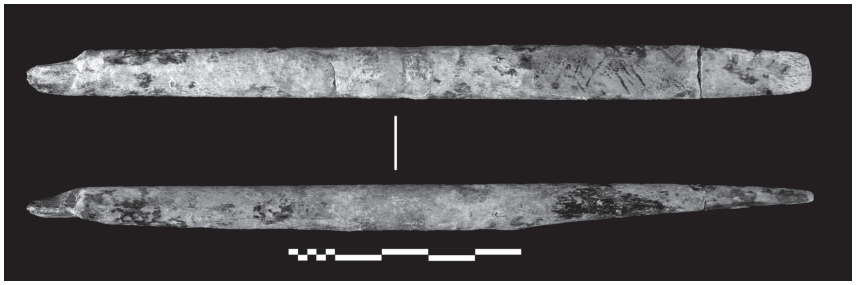
CHARLOTTE PEVNY

regions of the U.S. In the early years of research, what we learned about the Clovis era was based in large part on evidence recovered from these sites (hence the monolithic Big-Game Hunting Theory that dominated our thinking for so many years). Clovis kills include such well-known sites as Blackwater Draw Locality No. 1 in New Mexico, Colby in Wyoming, Dent in Colorado, Domebo in Oklahoma, Lehner in Arizona, and Murray Springs in Arizona.

Making tools

Where did Clovis hunter-gatherers obtain the stone to make their tools? At quarries, or toolstone procurement sites, which may have been located some distance from other resources such as food and water. The overwhelming majority of the artifact assem-

blage from a quarry consists of debris remaining when stone was reduced. Tested nodules or cobbles, expended cores, manufacturing rejects such as broken bifaces, and knapping tools including hammerstones are the kinds of artifacts recovered from quarries. Diagnostic artifacts like finished Clovis points usually aren't found at quarries. Clovis quarry sites are few in number. The Yellow Hawk site in Texas is a potential candidate, though contextually there are problems with the recovered assemblage.



CHARLOTTE PEVNY

Clovis beveled bone rod with incised lines. Finds of Clovis tools made from bone or other organic materials are few and far between.

Life and work at a campsite

Campsites were seasonally occupied locations where inhabitants remained for days or perhaps weeks. A campsite usually displays a diversified artifact assemblage and may retain semi-permanent evidence of occupation, perhaps hearths or even dwelling structures, because folks resided in the area for a considerable spell or regularly returned to the same location. Campsites were workshops where food and hides were processed and all stages of tool manufacturing were performed, including knapping tools from blanks or cobbles, heat treating, recycling and resharpening, and producing expedient tools (general-purpose throwaway implements). We can find almost any stone tool in every stage of manufacture at a campsite—expedient tools, scrapers, drills, burins and gravers, repaired or reworked tools, and finished projectile points. Clovis campsites like Aubrey in Texas and Shawnee-Minisink in Pennsylvania also have yielded the remains of foods drawn from a variety of animals and plants, proof that Clovis folks had a more well-rounded diet than we earlier supposed.

The types of site differ according to the particular activities the Clovis inhabitants were engaged in. A campsite associated with procuring game (kill-camp) is structured differently than a camp site associated with a quarry (quarry-camp). Clovis kill-camps are located adjacent to kill sites at Blackwater Draw in New Mexico and Murray Springs in Arizona. These campsites appear to have been occupied briefly during and after kills; the artifact assemblages comprise tools used to process prey and some evidence of tool manufacture and maintenance. In the case of a large-scale Clovis camp, its inhabitants may have been engaged in several industries. The Gault site in central Texas, for example, a quarry-camp that was occupied over a considerable time or many times, shows evidence of a wider range of activities than simply quarrying. The Topper site in South Carolina, which boasts an easily accessible outcropping of Allendale chert, a fine toolstone, is a textbook example of a Clovis quarry-related site.

Clovis caches are a unique kind of site consisting of closely clustered, apparently "stored," implements or materials. Tools in caches aren't worn out like the broken and discarded tools found in kill and camp sites, but show little use and sometimes are even in pristine condition. Caches were created for either utilitarian or ceremonial motives. Clovis caches discovered across the U.S. vary widely in their settings and contents.

Archaeology is nothing without context. Now we've set the stage for our next installment, where we'll look in detail at a specific component of the Clovis toolkit and tell why it's important to the Clovis-First vs. pre-Clovis debate.

–Charlotte Pevny

About the author Charlotte Donald Pevny received her Ph.D. from Texas A&M University in 2009. She was a post-doctoral Fellow at the Center for the Study of the First Americans from 2008 to 2009. Dr. Pevny's dissertation focused on Clovis lithic technology and tool use at the Gault site in central Texas. She also has worked at the nearby Friedkin site, which has Clovis and pre-Clovis components. Her research interests include use wear and experimental archaeology. She is particularly interested in site-formation processes and understanding the effects of post-depositional processes on lithic assemblages from early sites. Pevny currently works in the field of cultural resources management as a project manager for R. Christopher Goodwin & Associates, Inc., in New Orleans, Louisiana.

Suggested Readings

Goebel, T., M. R. Waters, and D. H. O'Rourke 2008 The Late Pleistocene Dispersal of Modern Humans in the Americas. *Science* 319: 1497–1502.

Haynes, G. 2002 *The Early Settlement of North America: The Clovis Era.* Cambridge University Press.

Mallouf, R. J. 1989 A Clovis Quarry Workshop in the Callahan Divide: The Yellow Hawk Site, Taylor County, Texas. *Plains Anthropologist* 34:81–103.

Tankersley, K. B. 2004 The Concept of Clovis and the Peopling of the New World. In *The Settlement of the American Continents: A Multidisciplinary Approach to Human Biogeography*, edited by C. M. Barton, G. A. Clark, D. R. Yesner, and G. A. Pearson, pp. 49–63. The University of Arizona Press, Tucson.

Waters, M. R., and T. W. Stafford, Jr. 2007 Redefining the Age of Clovis: Implications for the Peopling of the Americas. *Science* 315:1122–26.

The Ceramic Gap

continued from page 14

and later cultures show promise. They are confident that the technique can be applied elsewhere, with the caveat that different ceramics made by different cultures require special attention. Could it be used in the Russian Far East to shed light on the mystery of why ceramics stopped short of crossing continents all those years ago? Maybe. Ugan suspects that the archaeological record in Siberia may be too meager for detailed investigation. As an alternative he suggests looking for clues at other cultures during periods of ceramic development, such as the New World during the late Holocene.

"Pottery," says Ugan, puzzling over the ceramic gap, "is one solution to a problem of transporting, cooking, and storing." It's only one solution of many, some more costly than ceramics, others less. Boiling stones, storage pits, and basketry, he points out, are alternatives that cultures around the world have used as effective substitutes for pottery. Nonetheless we're left with the question, Why would Asian people discard ceramics for something else before hitting the Americas? Perhaps, Ugan proposes, there was some sort of shift in this people's way of living their highly mobile lives. When this occurred, "pottery was not the right tool for that kind of lifestyle."

One last possible theory . . .

There's another possible explanation to account for the mystery of why ceramics technology, developed in the Russian Far East early enough to board the Bering Strait Express, hasn't showed up in the oldest New World sites dating to 15,000 calendar years ago. But this assumes that those sites, Clovis sites, are the oldest sites in North America. Could there be older sites that haven't yet been discovered? Are there as yet undiscovered sites with evidence of pottery making that date to the time of its infancy in the Russian Far East? For the moment it's a question that can't be answered, but it's another reason to keep our eyes peeled for what turns up in the pre-Clovis bag of surprises.

–K. Hill

How to contact the principals of this article:

Suzanne Eckert
Assistant Professor
Department of Anthropology
Texas A&M University
e-mail: sleckert@tamu.edu

Tom D. Dillehay
Rebecca Webb Wilson University Distinguished Professor of Anthropology, Religion, and Culture and Professor of Anthropology
Department of Anthropology
Vanderbilt University
Nashville, TN 37325
e-mail: tom.d.dillehay@vanderbilt.edu

Elisabetta Boaretto
The Martin (Szusz) Department of Land of Israel and Studies of Archaeology
Bar-Ilan University
Tel Aviv, Israel
e-mail: elisabetta.boaretto@weizmann.ac.il

Steven R. Simms
Professor of Anthropology
Utah State University
Logan, UT 84322-0730
e-mail: s.simms@usu.edu

Yaroslav V. Kuzmin
Institute of Geology and Mineralogy
Siberian Branch of the Russian Academy of Sciences
Koptyug Ave. 3
Novosibirsk 630090, Russia
e-mail: kuzmin@fulbrightweb.org

Andrew Ugan
Smithsonian Tropical Research Institute
e-mail: UganAS@si.ed

Kenneth E. Sassaman
Hyatt and Cici Brown Professor of Florida Archaeology
Department of Anthropology
1112 Turlington Hall
P.O. Box 117305
University of Florida
Gainesville, FL 32611-7305
e-mail: sassaman@ufl.edu

Suggested Readings

Boaretto, E., X. Wu, J. Yuan, O. Bar-Yosef, V. Chu, Y. Pan, K. Liu, David Cohen, T. Jiaoh, S. Li, H. Gu, P. Goldberg, and S. Weiner 2009 Radiocarbon Dating of Charcoal and Bone Collagen Associated with Early Pottery at Yuchanyan Cave, Hunan Province, China. *Proceedings of the National Academy of Sciences* 106(24):9595–9600.

Bright, J., S. R. Simms, and A. Ugan 2005 Ceramics from Camels Back Cave and Mobility in Farmer-Forager Systems in the Eastern Great Basin. In *The Archaeology of Camels Back Cave*, by D. Schmitt and D. Madsen. University of Utah Anthropological Papers 125. University of Utah Press, Salt Lake City.

Kuzmin, Y. V., 2006. Chronology of the Earliest Pottery in East Asia: Progress and Pitfalls. *Antiquity* 80(308):362–71.

Nesterov, S. P., M. Sakamoto, M. Imamura, and Y. V. Kuzmin 2006 The Late-Glacial Neolithic Complex of the Gromatukha Site, Russian Far East: New Results and Interpretations. *Current Research in the Pleistocene* 23:46–49. Center for the Study of the First Americans, Texas A&M University, College Station.

O'Malley, J. M., Y. V. Kuzmin, G. S. Burr, D. J. Donahue, and A. J. T. Jull 1999 Direct Radiocarbon Accelerator Mass Spectrometer Dating of the Earliest Carbon Dating of the Russian Far East and Transbaikal. *Mémoires de la Société Préhistorique Française,* Tome XXVI [Supplément 1999 de la *Revue d'Archéométrie*].

Simms, S. R., 1997 Plain-Ware Ceramics and Residential Miobility: A Case Study from the Great Basin. *Journal of Archaeological Science* 24:779–92.