



MAMMOTH TRUMPET

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Center for the Study of the First Americans
Department of Anthropology, Texas A&M University
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Exploiting the South American forest

The timeless quality that seems to surround this image of a magnificent Brazilian Indian fishing with wooden spear isn't deceptive. Paleoamericans were finding valuable food-stuff in the plants, animals, and aquatic resources of the Amazonian rain forest when *at the same time* Clovis peoples far to the north were perfecting their skill at taking megamammals and the other animals and plants that made up their diet. In this newest installment of her series on Paleo South America starting on **page 4**, Ruth Gruhn introduces us to astonishing—and neglected—discoveries made of human colonizers in the forests of Brazil.



The Center for the Study of the First Americans fosters research and public interest in the Peopling of the Americas. The **Center**, an integral part of the Department of Anthropology at **Texas A&M University**, promotes interdisciplinary scholarly dialogue among physical, geological, biological and social scientists. The **Mammoth Trumpet**, news magazine of the **Center**, seeks to involve you in the peopling of the Americas by reporting on developments in all pertinent areas of knowledge.

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Clovis in the Southeast Conference 2005

ALL PHOTOS: DARYL P. MILLER SCIAA-USC



The display hall did a booming business.

The Columbia Metropolitan Convention Center in Columbia, South Carolina, was host October 26–29 to the Clovis in the Southeast Conference (www.clovisinthesoutheast.net). The event was organized by Albert Goodyear and Tom Pertierra of the Southeastern Paleoamerican Survey at the South Carolina Institute of Archaeology and Anthropology, University of South Carolina; Dennis Stanford of the Smithsonian Institution; Mike Waters of the Center for the Study of the First Americans; and David Anderson of the Department of Anthropology, University of Tennessee.

Among the 450-plus participants were professional and avocational archaeologists, geologists, paleontologists, historians, private collectors, and the general public. The combination proved to be a powerful one. Over the course of three

days the participants listened, lectured, discussed, viewed artifacts, and on the final day took a trip to Allendale County, South Carolina, the location of the Topper site.

According to Goodyear, "There has never been a conference done before on Clovis in the South. In the past decade much work has been done on important Southern sites such as Gault, Topper, Aucilla River, Carson-Conn-Short, and Cactus Hill." The result was a conscious desire among active researchers to come together to look more closely at Clovis in the Southeast. The organizers chose Columbia for two reasons. First, the city is home to Goodyear and the Southeastern Paleoamerican Survey. Secondly, the Topper site, with major Clovis and pre-Clovis components, lies just two hours away. The plan was to bring the leading researchers

INSIDE

4 Making a home in the rain forest of early Brazil

They lacked bison and mammoths, but Paleoamericans learned how to take advantage of nature's bounty in native plants and animals.

8 Putting a human face on Folsom bison hunters

Their kill sites tell Leland Bement a lot about these efficient hunters. Tornadoes and calamitous hailstorms are just his cost of doing business.

14 Plant templates of stone

Opal phytoliths speak volumes about ancient ecology and what animals and people were eating.

17 Stepping carefully in early Mexico

Human footprints left in volcanic ash are many thousands of years older even than Monte Verde. Trouble is, experts can't agree on how old the ash is or whether they are really footprints at all.

on prominent Southeastern Paleoindian sites and topics together with important Paleoamerican artifact collections, both institutional and private. Goodyear believes it was the "largest exhibition of Paleoamerican artifacts from the eastern United States ever displayed," and he may not be far off the mark.

Displays were an integral part of the successful conference. Thousands of artifacts from all over the Southeast and the Northeast were exhibited in a space adjacent to the lecture hall. Among famous sites represented were Topper and Big Pine Tree, Williamson, Gault, Cactus Hill, Page Ladson, Carson-Conn-Short, Thunderbird, and Shawnee Minisink. In addition to professional displays, many outstanding private collections on exhibit completed the picture of Clovis in the Southeast. The Williamson site of Virginia, displayed by Rodney Peck, has the largest concentration of fluted points in North America. The Virginia McCary fluted-point collection, exhibited by Jack Stallings and Jack Hranicky, probably the oldest and most complete collection from a single region in North America, dates back to the 1940s. Other notable displays included Brian Evensen's Paleoamerican artifacts from Florida rivers, the Ed and Richard Kilborne Collection of the Alabama Archeological Society,

Thorne Compton of the University of South Carolina. The first paper, "A Fresh Look at Clovis," presented by Michael Collins of the University of Texas, was a hemispheric review of what is Clovis and how it is recognized beyond fluted points.

C. Andrew Hemmings, University of Texas, presented a detailed listing of organic tools (bone, antler, and ivory) associated with Clovis. His abstract notes that 60 percent of the 235 known tools have been found in underwater contexts in Florida. His presentation was aug-

mented by examples of Clovis bone tools and other organic artifacts from the Aucilla River Pre-History Project.

Following Hemmings, Goodyear and colleagues reviewed evidence for the Clovis culture in Allendale County, South Carolina. Excavations of the Topper and Big Pine Tree sites produced abundant technological patterns that identify the Clovis culture. A variety of tools such as scrapers and denticulates suggest habitation related to toolstone quarries.

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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



*CSFA Director Mike Waters (left)
and Topper site principal
investigator Al Goodyear*

and Carl Yhanig's Little River site complex of Christian County, Kentucky. The exhibition hall also played host to Paleoamerican artist Dean Quigley, demonstrations by flintknappers, and a looping video presentation about the Topper site.

Day 1—What is Clovis, and where did Clovis peoples come from?

The conference began with a welcome by

Joseph McAvoy nicely summarized significant Clovis sites of the Nottoway River drainage system in southeast Virginia. Each of these sites, which include Williamson, Conover, and Cactus Hill, represents a unique piece of the overall Clovis landscape. Conover and Cactus Hill, for example, lie southeast of Williamson, and both sites contain Williamson chert. The famous Cactus Hill site, situated on a Pleistocene terrace, has yielded Clovis and pre-Clovis artifacts.

“From Iberia not Siberia” was the motto for Dennis Stanford and Bruce Bradley’s controversial Solutrean theory, which runs counter to the long-supported theory that the peopling of the Americas began with a migration across the Bering Strait and continued in a southward migration between two ice sheets in Canada during the Last Glacial Maximum (LGM). Instead, Stanford argues, Clovis first appeared on the East coast of North America, then spread to Canada. He suggests that radiocarbon dates support this notion, since they tend to progress in a northwesterly direction. Having researched extensively in Siberia, Stanford finds more commonality between the Solutrean region of the Iberian Peninsula and Clovis than between Northeast Asia and Clovis. He cites as an example the zigzag pattern Hemmings has found on organic tools, a pattern Stanford also saw in the Solutrean culture. Several possibilities explain how Solutrean people were able to migrate to North America. Boats are central to Stanford’s theory. “Of course they had boats,” he states matter-of-factly. “We need to stop seeing oceans and rivers as barriers—they’re highways.” He notes that as early as 30,000 years ago people were navigating rivers in Asia, proof that the technology was there. In addition, people of the Solutrean culture, a marine-based habitation, etched marine mammals and fish onto cave walls and hunted seals during the winter months. Stanford brings together key points to account for their migration across the Atlantic. Chief among them was opportunity, afforded by a significantly lower sea level and an ice bridge that connected New England to Europe. Regarding navigation, our thoughts harken back to the Vikings, who were able to navigate by sight because they could see from point to point. Moreover, the reflection of mountains could be seen for miles, and possibly from Europe. Seals, foxes, birds, and polar bears would have made up the bulk of their diet during the crossing.



Two speakers from University of Texas, Mike Collins (left) and Andy Hemmings.

Day 2—More about the Clovis culture, and an open forum

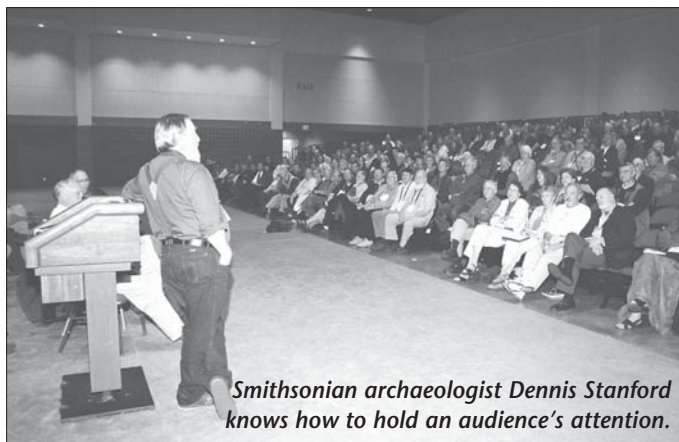
Friday’s schedule began with interdisciplinary papers from David Leigh, David Webb, and Thomas Stafford. Leigh, a professor of Geography from the University of Georgia, reconstructed how the shift from cooler and dryer climate at 20,000 yr B.P. to warmer moist climate at 15,000 yr B.P. changed braided rivers in the southeastern United States to meandering waterways, altering the landscape of river areas. Webb, of the University of Florida, reviewed Pleistocene megafaunal mammals in the Southeast, including *Mammuthus columbi*, *Mammot americanum*, *Bison antiquus*, *Palaeolama mirifica*, and *Equus* species, that were of economic importance to Clovis-age peoples. Stafford, a geochronologist and biogeochemist, and colleagues presented evidence for two final extinction events at 11,200 and 10,800 yr B.P.; they cite as evidence radiocarbon dates on extinct megafauna.

After a lunch break, geoarchaeologist Waters discussed his findings at the Topper and Big Pine sites.

Goodyear followed with evidence for pre-Clovis occupation at the Topper site.

Nuclear scientist Richard Firestone, of the University of California–Berkeley, argued the case for an extraterrestrial impact at the end of the Clovis occupation. Evidence of the catastrophic event can be found in materials dating back to 13,000 yr B.P.

Balancing Stanford’s Solutrean theory was the last paper of



Smithsonian archaeologist Dennis Stanford knows how to hold an audience’s attention.

the day by Anthropology professor Ted Goebel, of the University of Nevada, Reno, which explored the question, “Were Clovis ancestors in Siberia and Alaska?” In reply to Stanford’s assertion that Clovis ancestors haven’t been found in northeast Asia or Alaska, Goebel admits that he has found no ancestor in Siberia or Alaska. Nonetheless, he insists, the potential is there. His talk focused on evidence for pre-LGM occupations and the

commonality of tools found in warmer climates of North America and those in the Bering Strait area.

An open forum held that evening was a needed opportunity to review the lectures and discuss questions from participants. The event was preceded by summations of conference presentations from three authorities, Julie Morrow (currently the

continued on page 11

Paleoamerican Foragers in the Forests of Brazil



Many waterways such as this one likely led early Paleoamericans into the great Amazonian rain forest, where they were established by 11,000 radiocarbon years ago.

BORIS MALKIN

by Ruth Gruhn

BRAZIL IS A HUGE and diverse country, incorporating most of the great Amazonian rain forest in its northern and western regions, and featuring a vast dissected upland area with dry forest cover to the east and south. By the end of the Pleistocene, Paleoamerican peoples had become established in all major environmental regions of Brazil.

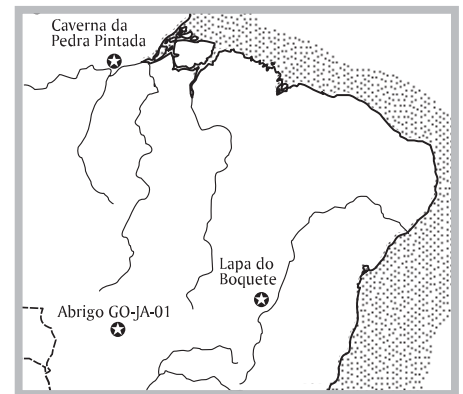
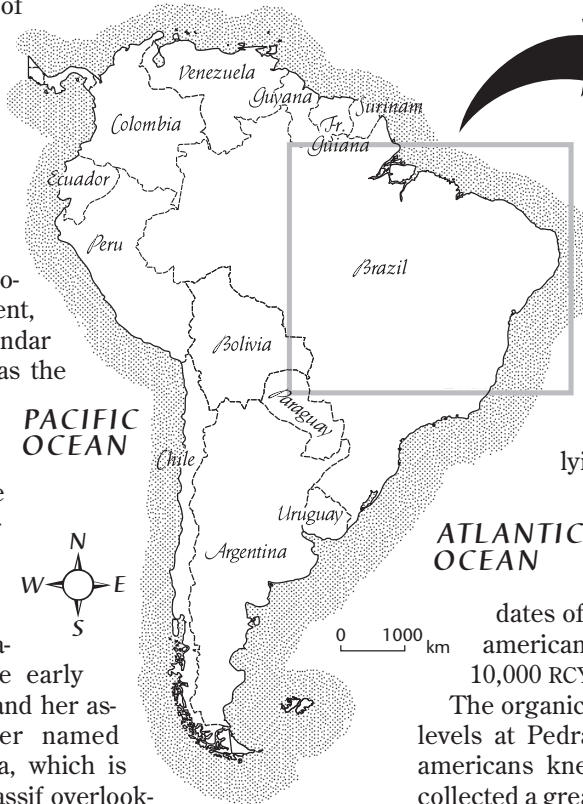
Amazonian Paleoamericans

Around 11,000 RCYBP (radiocarbon years before present, approximately 13,000 calendar years), at the same time as the Clovis people and other groups flourished in North America, different Paleoamerican peoples were exploiting the varied resources of the tropical rain forest along the lower Amazon River in Brazil. They are known from excavations conducted in the early 1990s by Anna Roosevelt and her associates at a rockshelter named Caverna da Pedra Pintada, which is situated in a sandstone massif overlook-

ing the broad floodplain of the great river near the present town of Monte Alegre in the state of Pará.

At Pedra Pintada, the Paleoamerican occupation is re-

Localities discussed
in this article



cord in a 30-cm-thick deposit of black sand overlying a sterile yellow sand deposit and bedrock, and well separated from an overlying early-Holocene ceramic-age horizon by ca. 30 cm of sterile tan sand. The Paleoamerican zone was rich in carbonized plant remains, and charred palm nuts from the earliest occupation floor in the zone produced two dates of ca. 11,200 RCYBP. Later dates from the Paleoamerican zone range in stratigraphic order up to ca. 10,000 RCYBP.

The organic remains recovered from the early occupation levels at Pedra Pintada indicate that these tropical Paleoamericans knew the rain forest and the river well. They collected a great variety of tree fruits and palm nuts, captured



Our guide Valdemar stands in the *caatinga* in central Bahia state. This thorn forest contains a great variety of edible plants as well as game, exploited by early Paleoamericans.

Paleoamericans in the eastern and central Brazilian uplands

Indeed, the abundance of rock art in caves and rockshelters in the dissected uplands of eastern and central Brazil has enticed archaeologists to excavate at a number of sites that have proved to contain late-Pleistocene occupation levels. Half a dozen archaeological sites, widely distributed in eastern and central Brazil, have yielded radiocarbon dates of 11,000 RCYBP or older for Paleoamerican occupations. Two of these sites—the Toca do Boqueirão da Pedra Furada in the state of Piauí, and the Abrigo de Santa Elina in the state of Mato

forest tortoises and aquatic turtles, gathered river mussels, caught a variety of large and small fish, and hunted small forest animals and birds. Roosevelt notes that many of the plant species are adapted to zones of forest disturbance, so it is probable that the early Amazonian Paleoamericans, like their contemporaries in tropical Colombia, were already modifying the environment. Most of their tools and utensils, and even their weapons, may have been made of vegetal materials gathered in the forest.

Although good toolstone was procured within the region and there was a great quantity of flaking detritus in the Paleoamerican occupation levels, only about two dozen formal stone tools were recovered in excavation, including a few fragments of stemmed triangular points; other biface fragments; and a variety of uniface artifacts including limaces (thick elongate steeply retouched uniface tools), which are also featured in contemporary Paleoamerican assemblages at archaeological sites farther south in the dry forests of the uplands of eastern and central Brazil.

The Paleoamericans at Pedra Pintada also painted figures on the rock walls of their shelter. Abundant lumps of red laterite and splatters of red pigment, found within the Paleoamerican occupation levels, were correlated by physical and chemical analyses to the paint on the cave wall above the excavated area. The designs include geometric forms, simple figures of humans and animals, and handprints. The production of rock art, apparently a practice unknown in North America at the time, was a common feature of early cave and rockshelter sites throughout much of South America.

Grosso—have produced radiocarbon dates over 15,000 RCYBP; but I shall defer description of these two sites and others until the final article in this series reviews the evidence for a very early occupation of South America.

The area of eastern and central Brazil south of the Amazon lowland is an ancient dissected highland region featuring large mesas and plateaus, and broad upland valleys. The climate is semi-arid, with a long dry season. Vegetation cover over this vast interior area is distinctive. Very widespread in the drier

northeast is *caatinga*, thick thorn-scrub forest with tall cacti. In the more humid area farther to the southwest, the *cerrado* vegetation zone characteristic of the central uplands also features low forest and scrub, but with open areas of savanna-parkland as well. Both these major vegetation zones of eastern and central Brazil offer an abundance of edible or useful plant products, as well as a great variety of game. As Valdemar, our guide in central Bahia state once told us, a person who knows the bush will never suffer hunger here.

Abrigo GO-JA-01

Excavations at a series of rockshelters in the area of Serranópolis in the southwest part of the



Limaces, elongate plano-convex uniface artifacts, characterize the Paranaíba phase in southwestern Goiás state, a dissected upland area within the *cerrado* vegetation zone in central Brazil.

PEDRO SCHMITZ

state of Goiás by Pedro Schmitz and his associates in the 1970s led to the definition of a distinctive early complex called the Paranaíba phase, dated back to ca. 11,000 RCYBP. This area of Goiás is very rugged, dissected upland country, with many mesas and deep valleys. The vegetation cover is *cerrado* and the climate is semi-arid, but it may have been cooler at the end of the Pleistocene.

tion, which served to define the Paranaíba phase, was radiocarbon-dated between $10,740 \pm 90$ RCYBP and 9060 ± 65 RCYBP. The early occupation level, in a matrix of disintegrated sandstone, was marked by thick lenses of charcoal and ash, abundant food refuse, and well-used stone artifacts. The site was clearly a residential base camp. The food refuse at the Abrigo GO-JA-01 indi-

convex face. Use-wear studies suggest that these distinctive early artifacts served as large endscrapers. The Paranaíba assemblage also includes a great variety of unifacially trimmed flake tools used as scrapers, knives, or perforators.

It is notable that despite the apparent emphasis on hunting, bifacial stone projectile points are very rare in or absent from Paranaíba phase assemblages. Among all the stone artifacts collected from the many Goiás sites, there were only several fragments of triangular stemmed points. Uniface industries are characteristic of eastern and central Brazilian archaeological sites, and bifacial stone projectile points were very rare in the area until late prehistoric times. Most likely, projectiles were armed with points made of wood, bamboo, or bone splinters—the types of weapon point still preferred by Indians in the Brazilian forests even now.

Lapa do Boquete

Near the town of Januária in northern Minas Gerais, in the valley of the great São Francisco River, is a large limestone massif containing many caves and rockshelters, notable for prolific rock art. The most spectacular panels were painted by late prehistoric peoples, but there is evidence that Paleoamericans also painted on rock faces. Alan Bryan and I located several potentially important sites in this area in 1976, and subsequently André Prous of the Museu de Historia Natural in the city of Belo Horizonte carried out excavations in several of the rockshelters. The oldest archaeological remains that have been recognized to date in the Januária area were in the Lapa do Boquete, a large limestone rockshelter overlooking the forested floodplain of the Peruaçu River, a tributary of the São Francisco River, a tributary of the São Francisco River (MT 12-4, "Brazilian Rockshelter Reveals Details Dating to Pleistocene").

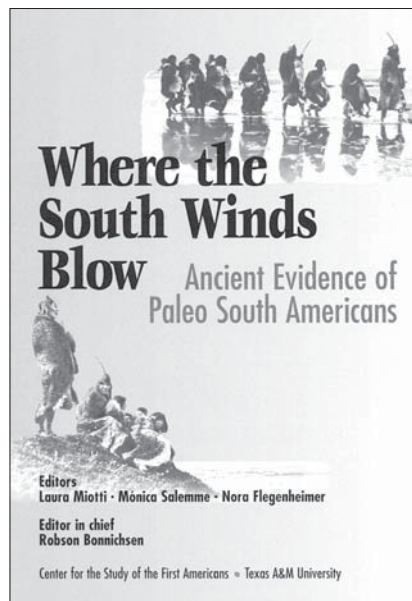
Level VIII, the basal occupation level in the Lapa do Boquete, has now produced five radiocarbon dates on charcoal ranging between $12,070 \pm 170$ RCYBP and $11,000 \pm 300$ RCYBP. A calcareous silt deposit 10–20 cm thick, it was rich in charcoal and ash, with many hearths; and food refuse was abundant, indicating intensive use of this excellent

From CSFA

Where the South Winds Blow: Ancient Evidence of Paleo South Americans

Laura Miotto, Mônica Salemmé,
and Nora Flegenheimer, editors

WHERE THE SOUTH WINDS BLOW is a collection of new papers about the earliest archaeological discoveries in South America. The editors are leaders of a new generation of competent young scholars who are conducting careful research in seeking to understand the peopling of southern South America. The early prehistory of South America is poorly known by the English-speaking world. This edited volume, translated from Spanish, contains 21 short and "pithy" papers documenting some of the most important recently investigated early archaeological sites in South America. These papers, which report poorly known Paleoamerican complexes and excavation of sites older than 11,000 radiocarbon years before present, cover issues in geoarchaeology, geo-



chronology, Pleistocene extinction, and paleoecology. Collectively, these studies report new empirical evidence important for understanding the peopling of South America, including new dates suggesting that South America was occupied by Clovis times. Future attempts to explain the peopling of the Americas will have to take this new evidence into account.

—Copy from the rear cover
ISBN 1-58544-363-8 \$25.00

Here the Paleoamerican people could find a variety of food resources distributed from valley bottom to mesa top; and good quartzite toolstone very close to their rockshelter campsites, which cluster near active springs in the canyons.

The major site excavated by Schmitz and his associates was the Abrigo GO-JA-01, a very large high rock overhang at the base of a sandstone cliff. There are many pictographs and petroglyphs on the shelter walls, but their age cannot be determined. The earliest occupa-

cates an emphasis on hunting a great variety of medium-sized or small animals—deer, armadillo, rodents, small marsupials. Remains of tortoises, lizards, fish, and birds including rheas (large ostrich-like flightless birds) and rhea eggs were also found on the occupation floors. Palm nuts and other forest foods were collected in season.

The stone industry of the Paranaíba phase features limaces, large elongate uniface tools made on thick blades. They are plano-convex in cross section, with careful steep retouch covering the



Rock art, common in caves and rockshelters in Brazil, leads archaeologists to early sites. This panel is in the Toca dos Buzios in central Bahia.

available within the region. There was very little evidence of bifacial flaking: the assemblage featured utilized flakes and scraping tools with marginal unifacial retouch. The distinctive limace form is notable in the Paleoamerican assemblage at the Lapa do Boquete, as at numerous other early archaeological sites in eastern and central Brazil. It is virtually a horizon marker for late-Pleistocene/early-Holocene archaeological sites in interior Brazil.


shelter. The Paleoamericans exploited a wide variety of local food resources: plants, animals, mollusks, fish. A distinctive artifact type commonly found at archaeological sites in the *cerrado* zone of eastern Brazil is the *quebra-coco*, a flat stone slab with a shallow circular hollow on the surface, into which a small palm nut was placed, to be cracked open with a hammerstone. Both types of stone artifact were found in Level VIII at the Lapa do Boquete together with abundant charred palm nuts and other large seeds. As well, deer and various small animals were hunted by the Paleoamericans. It is apparent that maximum use was made of animal resources, as the bones are highly fragmented. Aquatic resources were also procured from the river or a nearby lake: Level VIII contained numerous shells of freshwater mussels, and some fish bones. Also collected by the Paleoamericans was the giant terrestrial gastropod *Strophocheilus*, which emerges from dry-season hibernation underground early in the rainy season. This snail, which can be up to 15 cm long when fully extended from its large shell, provides a good source of protein. Archaeological sites in eastern and central Brazil are often littered with its shells.

It appears that, like their contemporaries in the Caverna da Pedra Pintada, the Paleoamericans at the Lapa do Boquete created rock art. There are designs in red paint on the walls of the rockshelter, and a limestone slab with red pigment on it recovered from Level VIII may have been a paint palette.

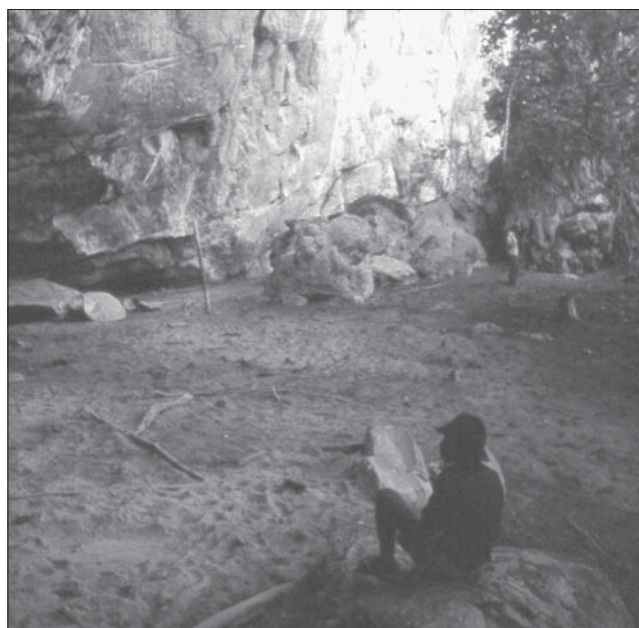
Flaked-stone artifacts recovered from Level VIII in the Lapa do Boquete were made of chalcedony, quartzite, or quartz

Taking stock and looking ahead

The Paleoamerican foragers who lived in the Caverna da Pedra Pintada, the Lapa do Boquete, and the Abrigo GO-JA-01 ca. 11,000 radiocarbon years ago were not strangers in the land. They knew their local territory very well, and exploited its varied resources to the fullest. The land must long have been theirs, and they marked possession of place with rock art. Evidence of their ancestors, the first explorers and pioneer settlers in the Brazilian forests, is yet to be recognized.

South of Brazil, as one moves into the temperate zone of the Southern Cone, the forest environment gives way to a cool grassland or steppe which extends east of the Andes southward to Tierra del Fuego at the tip of South America. In the next article in this series, I shall describe Paleoamerican hunters in Patagonia. 

The earliest occupation level in the Lapa do Boquete, in Minas Gerais state, has produced five dates between 12,000 and 11,000 radiocarbon years ago.



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Probing the Past



Primary butchering damage on the Cooper bison remains.

Leland Bement *and the* Paleoindians of Oklahoma

THE FIRST AMERICANS, whoever they may have been, didn't leave us many clues about their culture. What we do know is written mostly in stone and bone, and tells the story of small, mobile groups of big-game hunters who preyed on animal populations unaccustomed to a human presence. But we know little about them beyond their basic subsistence patterns, and even that knowledge is incomplete. Only a few dedicated (and lucky) researchers have been able to fill in details beyond the fact that they knapped pretty projectile points and liked to eat Pleistocene megafauna. Leland C. Bement, of the Oklahoma Archaeological Survey (OAS), is one of those few.

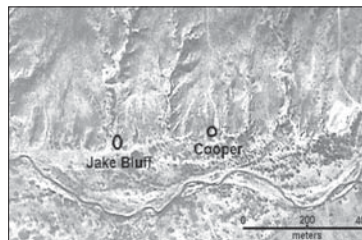
While there are older claimants for the title of First American, the earliest societies for which we have systematic evidence are the various Paleoindian cultures, all dating to about 9000–12,000 RCYBP (about 10,000–14,000 CALYBP). The Great Plains region, including the great state of Oklahoma, is studded with their material remains. Unfortunately, since cultural mores can't be preserved in stone and dirt, until recently the finer details of their lives escaped us. Besides meat, what else did they eat? Did they have art? A complex belief system? How did they hunt? Were they careful conservators of their resources, or profligate wasters?

Leland Bement and his colleagues have found at least par-

tial answers to some of these questions. Not only have they refined our understanding of the bison-hunting techniques of the Paleoindians, they've given us a glimpse into a bygone people's spiritual and artistic life as well.

Bone, bone on the range

Until accepting his current position with the OAS in 1992, Leland Bement was probably best known for his work in central and

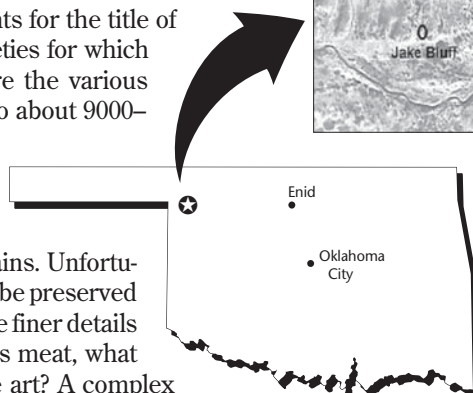


west Texas. For his M.A. research he analyzed fossil material from Bonfire Shelter, the famous Paleoindian/Archaic bison jump in southwest Texas (MT 18-2, "Pollen and the First Americans"); his Ph.D. dissertation covered 5,000 years of cultural use at Bering Sinkhole in

Kerr County, Texas. "My interests have always been lithics and bones—interests developed growing up in a family always in the outdoors," says Bement.

Since the early 1990s, his name has been all but synonymous with two bison kill sites that he and his colleagues have spent years studying, Cooper and Jake Bluff. The sites lie on the same stretch of floodplain of the Beaver River, a reach of the

North Canadian that passes through Harper County, Oklahoma. The Cooper Site (34HP45) came first, manifesting initially as a

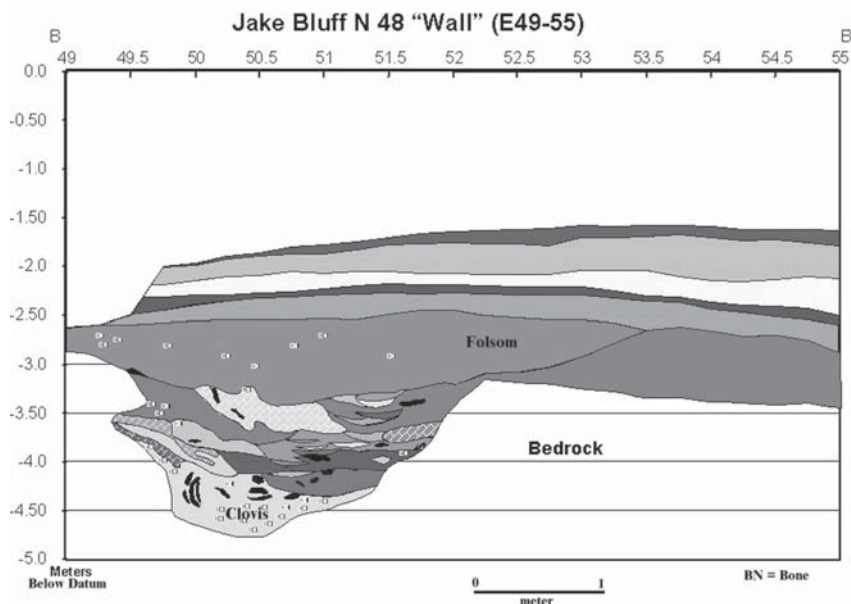


scatter of bison bone eroding out of a cutbank in a newly acquired Wildlife Management Area. When Bement and game warden Dick James visited the exposure in 1992, they found bison vertebrae and leg elements sticking out of a talus slump.

moved from these animals. This pattern is repeated in all three kills."

Excavation of the upper bone bed yielded not just intact skeletons but also numerous Folsom points, flake tools, and plenty of sharpening flakes. In addition to the professional archaeologists who excavated the site, Mother Nature insisted on lending a hand. Unfortunately, she used a storm as a digging tool. "We had been cleaning off an area where two skeletons converged with the skulls lying next to each other," Bement recalls. "That night, a tornado came directly over the site and totally destroyed those two skulls and many of the bones articulated with them. It was a destructive event not usually covered in the general taphonomic literature." Even the most robust bones were hammered to bits by hail.

Excavation continued the next year with OU



Stratigraphy of the Jake Bluff site, showing Clovis and Folsom occupations.

After monitoring the site for about six months, Bement and colleague Kent Buehler discovered that someone had pulled some bones from the cutbank—leaving behind the tip of a Folsom point. "This point was the first artifact found from the exposure," explains Bement, "and was our first evidence that the bones had a cultural component."

The right person for the job

Bement immediately recognized the site's value and laid plans for systematic investigations of the find. The work began in 1993, with the clearing of a 6-m (about 20-ft) profile immediately adjacent to the river. These efforts exposed three separate concentrations of bison bone within the sediments of a buried Pleistocene arroyo, which were dated to 10,600, 10,550, and 10,530 RCYBP—all well within the Folsom time range.

The uppermost concentration yielded complete, articulated bison skeletons that bore evidence of what Bement calls "gourmet" butchering, in which only select masses of meat were taken. Indeed, this method of butchering proved to be predominant at Cooper; according to Bement, "cut mark and blow damage is found primarily on the ribs and vertebra of the Cooper animals, indicating the shoulder, rib, and hump meat was re-

students, Oklahoma Anthropological Society volunteers, and visiting Texas archaeologists. The Cooper site ultimately yielded a dataset rarely rivaled in the Paleoindian literature. In all, 32 whole or partial Folsom points were recovered from the site, accompanied by numerous other flakes and flake tools. The lithics consisted primarily of Alibates dolomite from the Texas Panhandle and Edwards chert from central Texas, with a single point of Niobrara jasper from Kansas or Nebraska. Alibates dominated the lithic sample; combined with the tooth eruption patterns of the bison, which suggested they died about 4–6 months after calving season, this indicates that Cooper was repeatedly occu-

piated by one or more Folsom groups that traveled east off the *Llano Estacado* of Texas, arriving at the Beaver River in late summer or early fall.

A painted skull

It was during the 1994 season that the most exciting find was made: between the middle and lower bone beds, the excavators uncovered a painted bison skull. The skull had been



Leland Bement (left) and geoarchaeologist C. Vance Haynes at the Jake Bluff site in 2004.

trampled by the bison of the second kill, ca. 10,550 RCYBP, but had clearly been defleshed and weathered by natural processes well before the kill event—and just as clearly painted with two red hematite zigzags. Hematite has a long history of

Jake Bluff artifacts. A, Folsom point; B, drill; C–E, Clovis points.

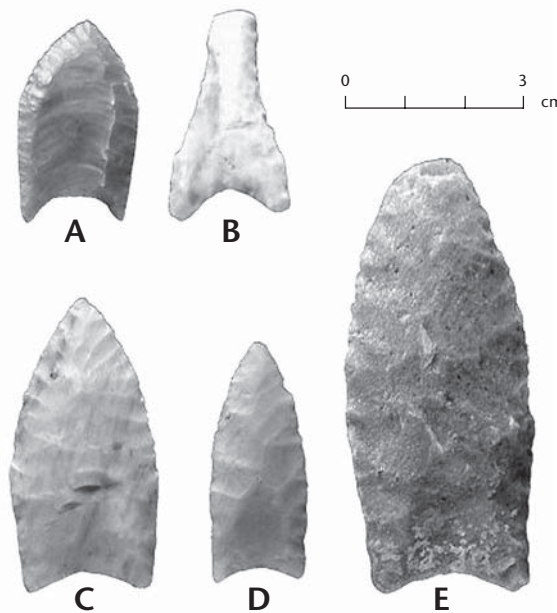
ritual use in the New World, and has been found in a number of Paleoindian contexts.

“The significance of the painted bison skull at Cooper is often lost in the research of the other aspects of this site, and Paleoindian studies in general,” Bement points out. “The painted skull is perhaps the single most significant find to come from Cooper. It provides us with a glimpse of a part of Folsom lifeways that is not the mundane part of subsistence acquisition.” The skull appears to represent part of a “pre-kill, hunting magic ritual possibly aligned with bison calling rituals in later cultures.” It harks back to the Upper Paleolithic hunting rituals of Eurasia, and brings to mind painted Siberian mammoth skulls and cave paintings in Lascaux and elsewhere. Although hunting rituals are known for cultures all over the world in every era, there was little evidence of it associated with Paleoindians until the Cooper skull was found.

Back in time to Clovis

The 1994 season also saw the discovery of the second of the Beaver River kill sites. Because the excavators at Cooper hadn’t uncovered the bison processing area that should have existed there, they thought it might be a good idea to check elsewhere along the floodplain margin. Based on what they had discovered at Cooper, Bement and his colleagues had developed the “Cooper Model” of bison hunting, which he and coauthors Brian Carter and Scott Brosowske described in *Current Research in the Pleistocene*, vol. 16 (1999), as “integrating large numbers of animals, gourmet butchering techniques, little carcass dismemberment, seasonal redundancy, ritual, and the possible aggregation of more than a single group of hunters.” During their pursuit of the model, they investigated the nearby bluff line and found a site they called Jake Bluff (41HP60).

“Jake Bluff is one of those sites that just keep nagging at you,” reflects Bement. When the surveyors discovered it, it consisted of a scatter of weathered bovid bone protruding from what seemed to be sand dune deposits. A radiocarbon assay of a bone fragment yielded

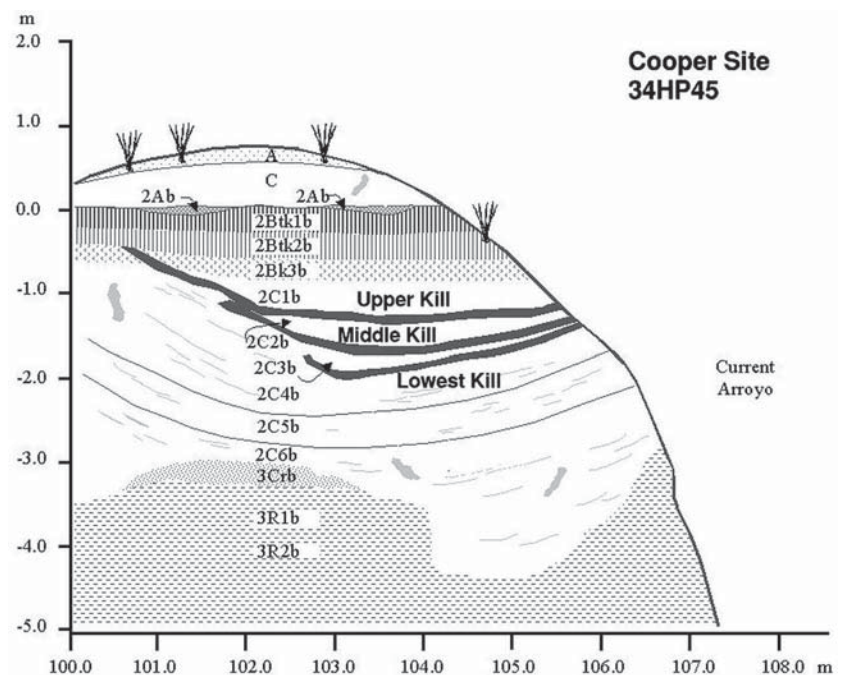


a modern date, though the size of the bones suggested to Bement that the animals were in the size range of the bison found at Cooper. But, “With the analysis of the Cooper material in full swing, Jake Bluff was put on the back burner,” he says.

Later work revealed many more bison bones, some articulated, all embedded in a reddish sediment very like the matrix at Cooper. This time a bison tooth found on the gully floor was dated to 10,750 RCYBP. Another Folsom bison kill, they figured, though the material came from a high spot on the bedrock; the gully hadn’t been completely investigated yet. The shocker came in 2002, when a projectile point was finally found—a *Clovis* point. Suddenly Jake Bluff was older than Cooper, and possibly not related

to it at all. “With the discovery of Clovis in the gully, the site took on new meaning,” says Bement. “Here, instead of a Folsom kill, was a Clovis bison kill utilizing a gully in an apparent arroyo trap-style bison hunt.”

The Clovis occupants, whose presence was confirmed with a second point later that season, also utilized the trapped bison differently. Unlike their Folsom descendants, they appear to have butchered the trapped animals completely, leaving piles of disarticulated bones on the old gully floor. Furthermore, analysis of the gully stratigraphy seemed to preclude a link between the bones on the gully rim and the Clovis occupation. The nature of the upper bone bed, with its articulated limb bones separated from otherwise articulated skeletons, seemed more typical of a Folsom occupation. This



Stratigraphy at the Cooper site, showing all three bone beds.

hypothesis was confirmed with the discovery of an associated Folsom point in 2004, making Jake Bluff a rarity in archaeological annals: a Paleoindian site with stratified Folsom and Clovis components.

Questions answered . . . and more asked


Whether Jake Bluff and Cooper are directly related, despite their close proximity, is a question that “drives straight to the heart of our research,” Bement says. Jake Bluff was discovered during a test of the Cooper Model, and like the Lipscomb (and maybe Lake Theo) sites in Texas, it seems to fit the model well. The Clovis finds add time depth to the model and suggest it was Clovis people who pioneered this method of hunting. But whether the Folsom component at Jake Bluff is related to the Folsom occupation at Cooper remains a mystery.

The Cooper Model research program now includes not just an examination of bison kills but also paleoenvironmental reconstruction; the team has grown to include a geographer, a palynologist, a geologist, a taphonomist, and a lithics specialist. Bement is quick to offer credit to those colleagues: “My co-PI [principal investigator] is Brian Carter, soils scientist at Oklahoma State University. Others involved in this work include Eileen Johnson, Thomas Stafford, Linda Scott Cummins, and Marvin Kay.”

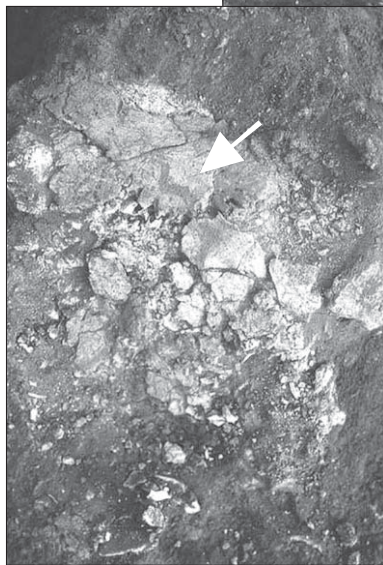
Since 2002, the Cooper Site has been listed on the National Register of Historic Places because of its contributions to our understanding of America’s prehistory. The only excavations that have been conducted there since Bement’s crew back-filled their last trenches have been performed by plundering relic collectors, who pulled apart an unexcavated block after the 1994 excavations, strewing bones everywhere. However, Bement hopes to return to Jake Bluff in 2006, and gully probing in the vicinity of the two sites will continue.

What does the future hold for Bement and his team? Currently they’re excavating the late-Archaic Certain site in west-



ern Oklahoma, where five arroyos and a cliff were used to trap and kill 800-plus bison. “Other projects include a suite of Clovis to late-Paleoindian sites in the Oklahoma Panhandle that we have just begun to look at for paleo-environmental reconstructions,” he states. “Sooner or later these sites will require excavation to explore their cultural deposits.” With luck, the new sites will provide new clues into the lifeways of the people who left them behind—adding a few more brush strokes to the picture of what it was like to be one of the first humans to experience life on this continent. 

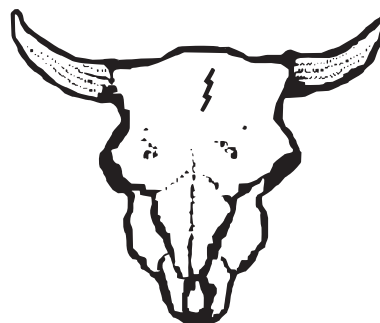
—Floyd Largent



▲ The middle bone bed at Cooper.

◀ The remains of the painted bison skull, in situ. Note the painted zigzag (arrow).

Below, drawing of the skull, from “A Painted Skull from the Cooper Site: A Folsom Bison Kill in NW Oklahoma” by Bement et al. in *Current Research in the Pleistocene*, vol. 14 (1997).



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Clovis in the Southeast Conference 2005

continued from page 3

Station Archeologist at Arkansas State University), Stanford, and Goodyear. They noted conference highlights and added personal perspectives on topics needing further discussion and notable speaker presentations. They were unanimous in

their praise for the contributions made by avocational archaeologists. Stanford’s comment, “We can make great progress if we trust each other,” emphasizes the necessity of scientists and avocationalists working together. Goodyear spoke about the need for new hypotheses, such as Stanford’s Solutrean theory, to infuse energy into First Americans research, for new theories challenge us to open new possibilities, and through collaboration we can explore these possibilities.

Morrow spoke passionately about the importance of using soil data in research. She spoke highly of John Foss of Soil International Inc., who collaborated with Goodyear and Larry West in preparing the paper, "The Role of Soil Morphology in the Delineation and Interpretation of Stratigraphic Units at Clovis Sites in the Southeast." Their presentation stressed the importance of soil morphology as a key to understanding the complex stratigraphy of Clovis sites in the Southeast. Soil morphologic studies evaluate the weathering stages of soils, which in turn can greatly enhance our understanding of the soil weathering cycles of an excavation based on time and parent material.

Jim Welch, formerly of South Carolina Educational Television, served as moderator of the open forum. All participants were free to ask questions and discuss points of conflict in a more formal setting. A particular benefit of the forum proved to be insights from scientists who hadn't appeared as speakers. After much debate, the general consensus reached was that we need to start looking at the peopling of the Americas as a process and not an event.

Day 3—A visit to the Topper Site

About 400 participants made the bus tour to the Topper site, where open excavation units were exposed. Goodyear, principal investigator at Topper, described the stratigraphy of the excavation unit spanning the Holocene/Pleistocene periods that has produced pre-Clovis artifacts. Both Goodyear and geoarchaeologists familiar with Topper fielded questions from participants. Happily, the weather was as amiable as the company, and touring the excavated areas was an opportunity for unhurried discussion. The trip, a superb finale to a successful conference, gave professionals, scientists, and avocationalists the opportunity to view and discuss Clovis units alongside pre-Clovis. After the visit to the site, everyone was whisked away to the Allendale Paleo-Indian Expedition campgrounds, where the Clariant Corporation, owner of the land where the Topper site is located, provided whole-hog barbecue with traditional Southern sides—definitely a conference high point!

Conclusion

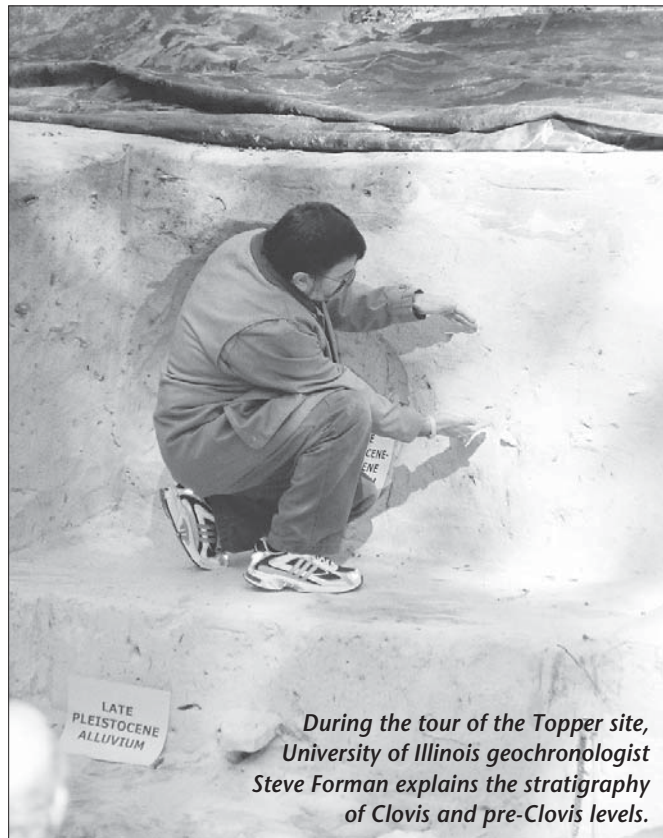
So where do we go from here? As a result of the conference, archaeologists now have a better definition of Southern Clovis and an improved typological classification of Clovis

points versus other fluted points. There are, however, still many questions left unanswered. What happened to Clovis peoples? Why did they disappear? Or did they evolve into

another culture? For Goodyear, Topper's post-Clovis decline in fluted points raises the question, Is this a regional trait specific to the Carolinas or is it more widespread? If so, does this imply a major demographic change after Clovis? For continued study, more radiocarbon dates are needed on Clovis in the South.

To aid in the research, David Anderson's database at the University of Tennessee (e-mail: pidba.utk.edu) is refining our information on typology from digging at Cactus Hill, Gault, and Carson-Conn-Short so that we can more accurately define what is a Clovis point in the South. In addition, Goodyear is working to collect and publish the speaker presentations. The book will insure that the Clovis in the Southeast conference is remembered as a landmark event in archaeology, particularly in enlarging our understanding of the Clovis culture.

—Erin Curtis



During the tour of the Topper site, University of Illinois geochronologist Steve Forman explains the stratigraphy of Clovis and pre-Clovis levels.

standing of the Clovis culture. 

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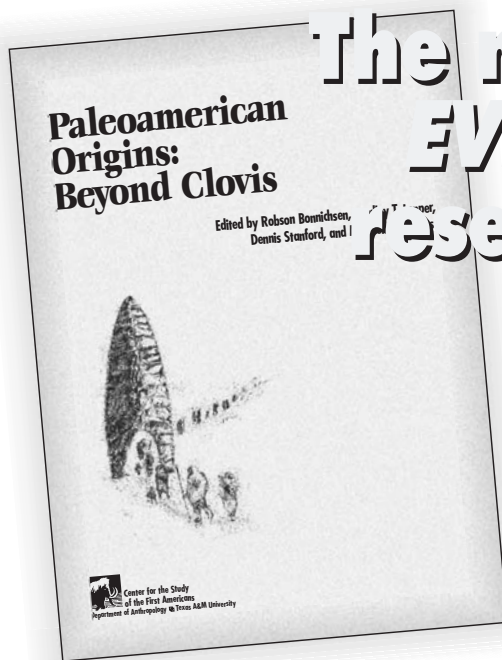
For information on the conference, log on to www.clovisinthesoutheast.net/

About the author Erin Curtis is an undergraduate student at the University of South Carolina. In December 2006 she will graduate with a degree in Media Arts and a minor in Film Studies.



Erin with Dennis Stanford

Documentary filmmaking is her emphasis in media, with particular interest in environmental and social issues. Since May 2005, Erin has been working alongside Albert Goodyear and USC to document the evolution of the Allendale Paleoamerican Expedition as part of an undergraduate research initiative.

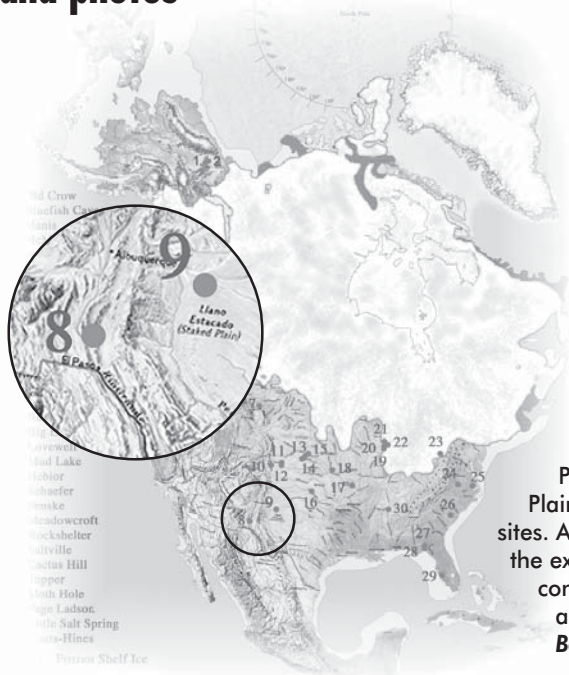


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This collection of 23 papers by today's foremost authorities explores in depth our current knowledge of the First Americans, the people of the Clovis culture—and those who may have preceded them to these shores. In this lavishly illustrated 384-page book, scholars present evidence of early human occupants in North and South America, drawing on research in such disparate fields as archaeology, genetics, and skeletal studies.

The engine driving this landmark publication is the 1999 Clovis and Beyond Conference, convened in Santa Fe, New Mexico, by CSFA founder Rob Bonnichsen, where theories were aired that shook long-standing paradigms and invited scientific inquiry in exciting new directions. *Paleoamerican Origins: Beyond Clovis* is the direct product of that conference. Here top scientists of the Americas argue their case for who the First Americans were, and they back their arguments with compelling evidence.

More than 100 maps, illustrations, and photos



◀ Skull of Minnesota Woman, 7900 RCYBP (Douglas W. Owsley and Richard L. Jantz)

Female mandible chin forms; the middle one is late Plains Archaic (George W. Gill) ▼

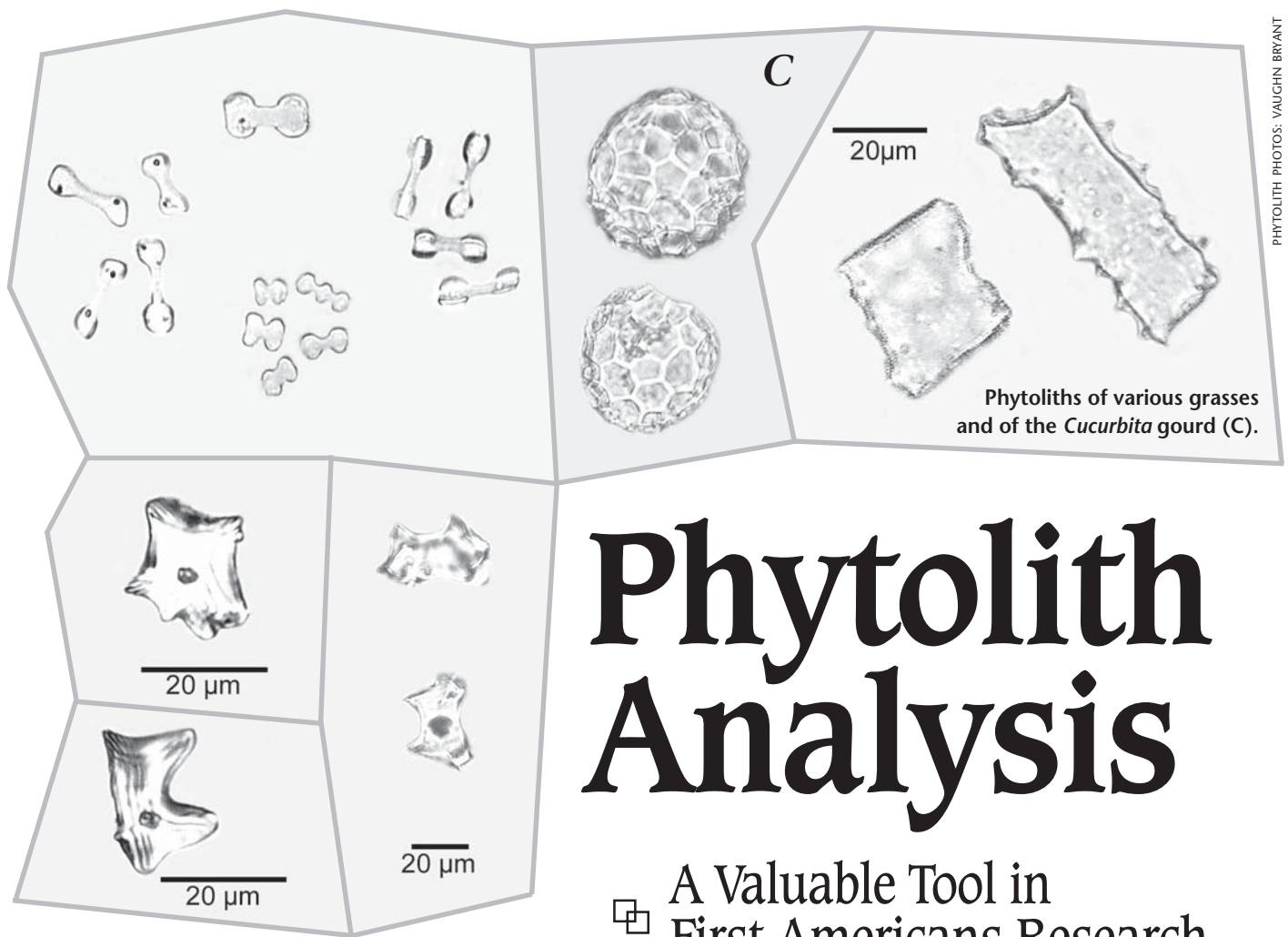


◀ Dated pre-Clovis sites in North America (Dennis Stanford et al.). This is one of six maps—five are full page-size!—by Smithsonian artist Marcia Bakry, showing locations of dated North American Paleoamerican sites through the Goshen/Plainview period and of known South American sites. All are executed in full color, which shows the extent of glaciation, shelf ice, and exposed continental shelf then existing. These maps alone make *Paleoamerican Origins: Beyond Clovis* an invaluable reference tool.

Plotting the course of future inquiry

Tomorrow's scientists will find persuasive counsel in *Paleoamerican Origins: Beyond Clovis* on where best to focus research and fieldwork to enlarge our understanding of how the Americas were peopled. Equally important are sober predictions of the ways in which social and political forces may shape the thrust of future inquiry into Paleoamerican prehistory.

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Phytolith Analysis

□ A Valuable Tool in First Americans Research

PALEOENVIRONMENTAL SPECIALISTS call them opal phytoliths, the microscopic (10–100 microns long) silica particles formed as a normal process in many living plants. Their delicate appearance is deceptive, for even though most plant material decays quickly when the plant dies, these tenacious bits of silica, if not destroyed by breakage, erosion, or dissolved by highly alkaline soils, can survive for millions of years.

They are invaluable for reconstructing the environmental conditions of humankind's past because a phytolith is a template of the distinctive size and shape of a plant's cells, like a fingerprint, that identifies a particular family. By analyzing phytoliths, scientists can determine the type of plant they came from, in many cases genus and species as well. In some cases it's even possible to distinguish between the wild and domesticated forms of a plant species, thereby giving us insight into how agriculture developed.

Silica, the key element

The word phytolith originates from the Greek, meaning "plant stone." (There are also calcium oxalate phytoliths, such as those produced by cacti, but this article focuses on the more

abundant silica bodies.) Within groundwater is silicic acid, the soluble form of silica. Second only to oxygen, silica is one of the most abundant elements on earth. It is constantly changing states, dissolving into a liquid state and precipitating out of water into a solid state. When a plant takes in water through its roots, it also takes up the silica. The plant cannot use or absorb the silica, so it is deposited between or within its cell walls, forming a silicon copy of a plant cell, a phytolith. Not all plants form phytoliths, and those that do vary in the quantity produced as well as the location of deposition within the plant. They can occur in any plant structure—stems, leaves, roots, fruit, seeds, inflorescences, etc.

We aren't certain why plants produce phytoliths. Some studies have shown a direct correlation between the amount of silica within a plant and its ability to resist fungal disease. Greater amounts of silica also increase the rigidity of plant leaves, which increases the surface area open to sunlight thereby increasing photosynthesis.

The uneven history of phytolith research

Phytoliths were first observed in living plants by a German botanist in 1835, a time when researchers were exploring

smaller and smaller particles using new and improved microscopes. Around 1900, their usefulness in archaeological investigations was becoming recognized as studies of phytolith production, morphology, and taxonomy appeared in scientific publications. Research stalled in 1936, however, when the Nazi regime came into power in Germany. Since the vast majority of phytolith literature was written in German, the body of research remained obscure to English-speaking scientists. Finally, in the mid-1950s, phytoliths were observed in Britain and North America, encouraging greater research and propelling the use of phytolith analysis in studying environmental history. After 1971, when archaeologist Irwin Rovner published "Potential of Opal Phytoliths for Use in Paleoecological Reconstruction" in *Quaternary Research*, their use became more systematic.

Finding clues to the human past

An archaeological site may yield three basic categories of plant remains: macrofloral, microfloral, and chemical. Macrofloral remains are those that are visible to the naked eye, such as seeds, nuts, charcoal, and large objects like tree trunks and logs. Microfloral remains require magnification to view, such as pollen, phytoliths, and diatoms. Chemical remains include such evidence as phosphates in soils and residues such as protein and starch left behind on prehistoric tools and vessels used to process plants. From this simple background phytolith analysis developed. Thus far tucked away on a thin branch of paleobotany, its appreciation as a valuable resource for reconstructing ancient environments is growing fast.



MIKE WATERS

Because the information gathered from each area of analysis (i.e., macrofloral, microfloral, chemical, and their subcategories) is not entirely redundant, the data obtained are used in a complementary fashion—to fill in the blanks in one area with the results of another. This is especially true with pollen and phytolith analysis. Because most pollen is windblown, their particles are scattered over a wide area, far afield from the exact location of the originating plant. Adding to this is the lack of knowledge regarding wind direction at the time the pollen became airborne and how far away the releasing plant was located. Phytoliths, on the other hand, are generally deposited

in place at the time of decay. Some plants, such as grasses (including cereals like wheat, oats, and barley), beans, squash, sunflower, and elm, produce large quantities of silica particles. Others form none or varying degrees in between. The same diversity of production also applies to pollen. A species of plant may be under-represented in pollen studies, but richly represented in phytolith analysis, and vice versa. So when the results of these individual studies are compared, they provide a much more complete representation of paleoenvironment than can be obtained from a single method.

Many of the plants consumed and used by prehistoric peoples are represented in the data obtained from pollen, phytolith, starch, and other methods of analysis. Not only can they provide information about Paleoamerican diet, phytoliths found adhering to ceramic vessels and lithic tools can also indicate how certain plants were processed and provide clues to a specific tool's function, provided the artifacts have not been cleaned or handled excessively after recovery. Phytoliths, along with pollen and plant macroremains, can even be recovered from coprolites—preserved human feces (**MT 20-3**, "Ancient DNA: A Tough Nut to Crack")—providing insights into meal patterns and paleo-nutrition, seasonal availability, and storage of off-season foods.

Phytoliths at Cactus Hill

Not only can phytolith analysis help to reconstruct paleoenvironments and diet, it is also proving to be a useful tool in validating the stratigraphic integrity of First American sites and corroborating dating analysis as well. The Cactus Hill site project in southeastern Virginia, led by Joseph McAvoy of the Nottoway River Survey, has been a subject of controversy regarding its pre-Clovis dates. Charcoal remains found 10–15 cm below a Clovis occupation have been dated to $15,070 \pm 70$ RCYBP, suggesting pre-Clovis occupation. Sandy, windblown deposits like those at Cactus Hill are likely to exhibit a greater degree of post-depositional disturbance, calling into question the validity of the radiocarbon results.

Looking to corroborate the dates with other analyses,

McWeeney (ballcap) collecting soil samples from pre-Clovis levels at the Topper site in South Carolina for phytolith analysis in 2001. Her expertise complemented the skills of other specialists in the team—experts in microwear analysis, geoarchaeology, and radiocarbon dating—assembled by principal investigator Al Goodyear, director of the Allendale Paleoindian Expedition.

paleobotanist Lucinda McWeeney, owner of Botanical Hill and Archaeobotanical I.D.'s in New York, and curatorial affiliate at the Yale Peabody Museum, analyzed the phytolith remains at Cactus Hill. Also, James C. Baker of Virginia Polytechnic Institute and State University in Blacksburg analyzed the soil's phosphate content. Dr. McWeeney based her investigations on a study of sand dunes in Britain that found that the number of phytoliths in a stratum is directly related to human occupation (Powers et al. 1989). When humans inhabit a site, they bring into their living space a diversity of plants to use for various purposes; as a result microscopic



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THE CENTER FOR THE STUDY OF THE FIRST AMERICANS announces the renovation of the Center's Web site at centerfirstamericans.com. On this Web site, you will find information about the history of the Center, educational opportunities, graduate student profiles, and overviews of ongoing Center research and results.

Image Gallery Over 200 color photographs are available. These photographs include the Gault Clovis site, Texas; Hueyatenco site, Mexico; Paleolithic sites in Russia; Topper site, South Carolina; Danger Cave, Utah; and more.

Useful Resources on the Web The site offers a page where you will find links to useful Web sites dealing with First Americans archaeology, late-Pleistocene environments and animals, and geoarchaeology.

Mammoth Trumpet and Current Research in the Pleistocene We have also put volume 1 (1984) through volume 18 (2003) of the *Mammoth Trumpet* on line. If you have never seen the earlier issues or want to reread an article, they are all available. However, the current and past two years of the *Mammoth Trumpet* are only available through subscription. Archives of the table of contents of all volumes (volume 1, 1984, to volume 21, 2004) of *Current Research in the Pleistocene* are available on the Center Web site. We have also made it easier for you to order the forthcoming issue or back issues of *Current Research in the Pleistocene* by adding convenient and easy-to-download order forms. Further, all available Center books are listed on the Web site with a direct link to the Texas A&M University Press, where these books can be ordered.

We hope you like the new look of the Center Web site. We will be updating it from time to time with more photos, Web links, current research, and other items. Jonathan Doll is the chief Web designer on this ambitious remake of the Center's Web site.

—Mike Waters, CSFA Director

phytoliths are deposited in abundance throughout that locale. McWeeney hypothesized that if the dune sediments had been disturbed, we would expect that the number of phytoliths present would be homogeneous throughout each level. Her findings, however, indicated that this wasn't the case. A 60-cm column of sediment was excavated in 2.5-cm increments. "The quantity of phytoliths *did* change," McWeeney reports. "They fluctuated very closely to the changes in phosphates and the changes in artifacts." A second column was also analyzed. She reports that "the phytoliths weren't as right-on, even though they did fluctuate. But the phosphates were much more in-sync with the artifacts." The combined efforts of


phytolith, phosphate, and artifact analyses for the Cactus Hill site indicate undisturbed strata and evidence of human occupation at the pre-Clovis level. McWeeney is hopeful that additional funding will be found to perform statistical analysis of phytoliths at Cactus Hill "to see if there's a variation in plants—and that would be a very interesting study."

A source of datable carbon

Phytoliths are also a source of carbon samples for accelerator mass spectrometry (AMS) radiocarbon dating, for as phytoliths are formed, tiny particles of the original plant material are encapsulated within the silica body. Despite the rigors involved—the amount of carbon trapped is minute, the extraction process

is rigorous, and the cleaning process to remove surface carbon to eliminate contamination is intense—the data potentially available make these efforts worthwhile. Naturally, corresponding dates from as many dating methods as possible serve to support the validity of each individual date obtained. Given the lingering debate over pre-Clovis cultures, authenticating dates at Paleoamerican sites is crucial.

A science coming into its own

Phytolith analysis as a scientific tool continues to blossom as techniques are refined and new procedures are developed. Before this field can reach its full potential, it must become better known. Research endeavors that gain media attention will promote a greater understanding by the general public. Such attention would generate additional research funding, as well as career opportunities in industry and academia, fueling the growth of phytolith analysis. 

—J. L. Boldurian

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Suggested Readings

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Toluquilla, Mexico: American Laetoli?

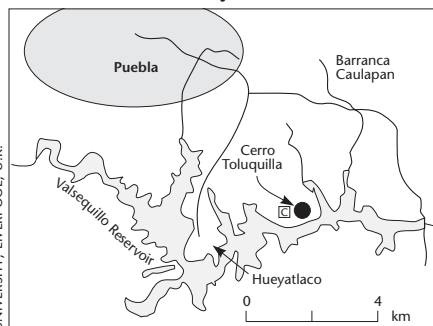
ON A SMALL HILLSIDE near the Mexican city of Puebla, a series of oddly familiar depressions pepper an ancient volcanic surface. Some people claim they're footprints, both human and otherwise; others insist they're just random pockmarks that have weathered oddly over the years. Both sides of the debate are stalwart in their beliefs. One camp holds fast to a date of 40,000 years for the hardened ash; the other claims the ash is 1.3 million years old. Literally written in stone, the find has stirred a brisk new debate about the timing of the first occupation of the Americas.

The stuff of controversy

The marks that some researchers interpret as fossil footprints are located on the surface of an abandoned quarry called Toluquilla, near the Valsequillo Reservoir and the famous Hueyatlatco archaeological site. The material once quarried there is Xalnene ash, a coarse volcanic tuff that's mostly basaltic in nature; the matrix itself is composed of small fragments called *lapilli*. These lapilli derived from two sources: the nearby monogenetic (one-eruption) volcano called Cerro Toluquilla, and the local bedrock that was mixed into the tephra by the eruption. The result is a mix of limestone, basalt, and other materials that Dr. Silvia Gonzalez, the codiscoverer of the footprints, whimsically calls "tutti-frutti rock."

Paul Renne, Director of the Berkeley Geochronology in Berkeley, California, points out that the Xalnene ash is actually a sequence of thin ashes that are technically called lapilli tuffs. "They're composed of fragments of lava deposited by a series of eruptions, probably over a very short time period," says Dr. Renne. The components are slightly welded together, which suggests they were very hot when deposited.

Near the top of Cerro Toluquilla (Toluquilla Hill) the ash is more than 2 m thick, and at its base is as hard as concrete—perfect for construction material. With a little coaxing (and some heavy steel implements), the ash breaks into handy brick-like



chunks that make a superb building stone. According to CSFA director Michael Waters, who's conducting geoarchaeological investigations at Hueyatlatco, the Xalnene ash "breaks out

in sheets about 10 centimeters thick, and the locals chop and cut the rock into blocks. These rectangular blocks are then used for courtyard walls, building walls, and the like." According to Dr. Waters, the locals are still actively quarrying downslope from the site.

Footprints in time?

Gonzalez, Waters, and Renne are all prominent figures in an ongoing controversy over the finds at Toluquilla, which have the potential to be a paradigm-shifting discovery—if they're really footprints. The outcome could reshape our understanding of the timing of human occupation of the Americas, and possibly even offer new insight into the evolution and behavior of human beings.

The area around the Valsequillo Reservoir is no stranger to archaeological controversy. During investigations in the 1960s, Cynthia Irwin-Williams found what she believed was pre-Clovis evidence dating to about 20,000 yr B.P., a little old, but not unreasonable. Among the items found were the remains of extinct animals (mastodon, camel, and horse) and a number of well-made stone tools, described as comparable to the best work of European Cro-Magnons. In the 1970s, Dr. Irwin-Williams's finds were reinterpreted by Virginia Steen-McIntyre, Roald Fryxell, and Hal Malde as being over 250,000 years old, based on mineral weathering studies and three different dating methods: uranium series, tephra-hydration, and fission-track.

Unsurprisingly, the archaeological community rejected the dates as far too old for the region. However, some of the researchers involved continued to insist that modern humans were present in Mexico 20 times earlier than previously thought (and about twice as early as *Homo sapiens* is thought to have existed). The radical fringe has taken this as evidence of a vast archaeological cover-up intended to hide the true antiquity of modern humanity.

Geoarchaeological and archaeological studies are being conducted at Hueyatlatco by Waters, and his American and Mexican colleagues. This research is re-

**The “tutti-frutti” rock composed
of Xalnene ash.**

solving the issues at this site; however, the evidence is preliminary at this time, so that’s a story that has to wait for another time to be told.

A new chapter in prehistory . . . maybe

The Toluquilla “footprints” were discovered by accident in 2003, when Silvia Gonzalez and her team were scouting the region as part of an unrelated project. Dr. Gonzalez is a highly regarded geologist and geoarchaeologist on the faculty of Liverpool John Moores University in England. While she undertakes many projects in the northwest of England, she maintains an abiding interest in Mexico, since she originally hails from Mexico City.

“I was already working quite a lot with the Quaternary sequences in the basin of Mexico, and was very keen on megafaunal extinctions and volcanic events,” she explains. “In Mexico there were very large collections of human and animal remains that were more or less neglected in terms of dating and analysis, so I decided to start a program of dating human and megafaunal remains; and that’s how it started.”

Gonzalez and her team also perform excavation and mapping work in support of the dating program. It was during one such round of fieldwork that she and several colleagues, including professors David Huddart of Liverpool John Moores and Matthew Bennett of Bournemouth University, found the purported footprints. Says Gonzalez, “The reason I

The quarry surface, Cerro Toluquilla in the background. ►

Prepared slabs of quarried Xalnene ash. ▼

spotted them was, in the past I’ve studied footprints preserved in England that are about 5,000 years old, so I already had experience in how to describe and identify them.”

Intrigued, Gonzalez and her team started clearing off large areas of the quarry surface. They soon began to see patterns. Not all the depressions were interpreted as human footprints; cloven-hoofed ungulates and big cats were also represented, and their prints often showed up in trails. Even some of the human prints were found in trails. “They may be just three or four steps in case of humans,” states Gonzalez, “but you can follow them.”

Fossil human footprints are not unknown in the archaeological record. Possibly the best-known example occurs at Laetoli in East Africa, where Mary Leakey found a line of human footprints in a type of hardened, muddy ash. The material dates to over 3.5 million years ago, meaning that the Laetoli prints must have been made by early Australopithecines.

The Liverpool team never expected their footprints to be that



ALL PHOTOS: LIVERPOOL JOHN MOORES UNIVERSITY, LIVERPOOL, U.K.

old, but they collected samples from the local Xalnene ash, lava, and associated sediments, and immediately submitted them for dating. One of the dating methods applied was the argon-40/argon-39 ($^{40}\text{Ar}/^{39}\text{Ar}$, or Ar-Ar) method, based on the radioactive decay of potassium-40 and the resulting ratio of two different isotopes of argon, the third most com-

mon gas in the Earth’s atmosphere. However, the Toluquilla Ar-Ar samples were inconclusive, either because the amount of argon in the samples was too small or the samples too young. Also dated, using optically stimulated luminescence (OSL) methods, were conspicuous orange brick-like particles that were interpreted as burned lake sediments. These fragments yielded an age of around 40,000 CALYBP. Electron spin resonance, radiocarbon dating, and uranium-series dating were also used to assay the various sediments and associated materials in the sequence above the ash, and the results were up to 40,000 years old.

Ultimately, the team identified and mapped, using laser imagery, more than 250 depressions they believe to be human and animal footprints. In July 2005, they announced their findings in a press release associated with the presentation of laser 3-D recon-

structions of the footprints at the Royal Society Summer Exhibition in London. The archaeological world was, needless to say, more than a little surprised to hear that humans may have been in the New World some 26,000 years earlier than Monte Verde.

A storm brews

Good science involves a certain amount of conflict. Claims are made based on interpreted evidence, they stir debate, and the evidence is reexamined

and eventually accepted or rejected based on its own merits. It wasn’t long after the Gonzalez press release that the debate about the Toluquilla footprints began. As researchers like David Hurst Thomas muttered about “science by press release,” other scientists working in the area were taking a look at the evidence firsthand.

Not everyone interpreted the marks at the Toluquilla quarry the same way the Gonzalez team had done. According to Mike Waters, who examined the quarry surface several times, the alleged footprints actually appear to be eroded tool marks from quarrying activity. “The locals use picks and pry bars with chisel ends to quarry the stone,” he says. “They’ll chop out large blocks 2 or 3 meters on a side. As they’re chopping down, they hit underlying layers of tuff, creating divots or depressions.” According to Waters, the exposed depressions later fill with sediments and weather into odd shapes, a few of which resemble human footprints. “It’s just weathering,” he asserts. “One or two look like prints, but most



do not. When you look at the whole assemblage, it's obvious they're not footprints."

Dr. Patricia Ochoa-Castillo, Director of the Hueyatlatco Archeological Project, agrees. "After crossing the area and observing the marks at great length," she recalls, "we arrived at the conclusion that it is not possible to distinguish a pattern of tracks." She goes on to state that the Toluquilla surface displays marks made by heavy machinery, which have been eroded into various shapes.

To Gonzalez and her large multidisciplinary team, many of the marks are clearly footprints. Gonzalez points out that much of the quarry surface is covered with debris and slopewash. "Part of the problem with people not seeing the footprints," she cautions, "is that they didn't clean them off. To see them you must remove the surface sediments, as in a proper archaeological excavation. If you don't do that, you don't see anything."

Clearly, some people can see the purported footprints; some cannot. Dr. Gonzalez stands behind her team's dating, especially in light of more recent findings (more on that later) over the two and a half years they've spent examining and mapping the footprints. In an effort to clarify the issue, the doubters, led by Waters and Renne, collected new samples for dating. What they discovered seemed to strike the final nail in the coffin of the footprint theory—assuming that their results are correct.

Older than expected

In 2004, Waters and Ochoa-Castillo invited Renne to date the Hueyatlatco site, as part of a team attempting to clarify the site's stratigraphy and age. At the time, Renne had heard about the alleged footprints but hadn't thought much about them. When told that the Hueyatlatco site was quite close to the Xalnene quarry, he asked to inspect the "footprints." Accompanied by Waters, Ochoa-Castillo, and several others, Renne visited Toluquilla in June 2004.

"We spent about an hour perusing the site," Renne recollects, "and I collected a sample of the Xalnene ash right in the center of the exposed surface.

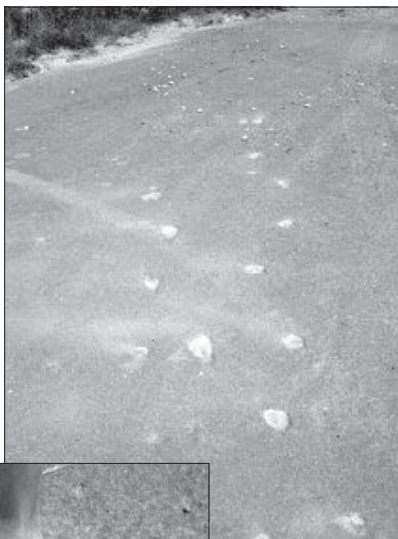
Photographs of where I sampled later proved to match those shown by Gonzalez et al. on their Web site. I didn't do anything with the sample until July of 2005, when the Gonzalez team issued a press release that stirred a huge media frenzy. It was then that I decided to analyze the sample I had collected to test the claimed age."

Renne specializes in dating objects using both the $^{40}\text{Ar}/^{39}\text{Ar}$ method and paleomagnetism, which tracks changes in the Earth's magnetic field over time. He utilized both methods to date the Xalnene ash. Given the ratio of the argon isotopes in the sample, he concluded that the ash is 1.3 million years old—much, much older than the Gonzalez team believes it to be. The paleomagnetism data seem to back up the Ar-Ar date. "As is often the case, we found two components," Renne reveals, "one

formed when the rock cooled initially, which has reverse polarity, and one of normal polarity, which formed later, during weathering." The reverse polarity of the first component indicates that the magnetic minerals in the rock last cooled and hardened when the Earth's magnetic polarity was the exact opposite of what it is now—more than 790,000 years ago.

Another flurry of controversy greeted the publication of these results by Renne, Waters, Ochoa-Castillo, and several colleagues in the December 2005 issue of *Nature*. Many took the great age reported for the Xalnene ash as a death knell for the alleged footprints. Renne says that there's a finite possibility that these could be human footprints made 1.3 million years ago, when the ash was still hot, but that "it would be staggering if they really were footprints of that antiquity. . . . It would be amazing that, after centuries of archaeological exploration in the Americas, this was the first evidence found."

Gonzalez, for her part, isn't convinced. She believes that the dates published in the *Nature* article need to be replicated, ideally by an independent third party. Particularly troubling are the Ar-Ar dates obtained by Renne's team, since the samples her team collected provided no reliable results. "Renne's date doesn't make sense in terms of the overall geologic sequence that we have there," she says. "That's why we were shocked by the 1.3 million years date; you would have 1 million



▲ Purported human footprint trail at Toluquilla.

◀ An apparent left human footprint compared with an actual foot.

years from the Quaternary period missing. We've spent two and a half years doing this mapping, looking very hard, and have found nothing to support the idea that a big part of the Quaternary is missing. The sequence seems to

have no gaps."

Gonzalez suggests that Renne might have dated reworked sediments that were much older than the typical Toluquilla lapilli, a possibility Renne rejects. "There are a few chunks of obviously non-magmatic material, which are typically entrained in an eruption of this type, but I scrupulously avoided them," he maintains. "Secondly, the paleomagnetic data indicate that they have not been disturbed since cooling." He admits that it isn't routine to use the Ar-Ar method to date small ash samples, as both his team and Gonzalez's have done, but points out that his lab is optimized for dating small, young samples by the $^{40}\text{Ar}/^{39}\text{Ar}$ method. "This kind of work is our bread and butter."

Waters echoes Renne's confidence in the new dates. "That's why you run multiple samples and use different techniques,

which Renne did. The paleomagnetism is another nail in the coffin—it clearly demonstrates that all the lapilli are associated with the eruption. Plus, we have Ar-Ar dates from the Xalnene at another site, and the results are the same.”

Meanwhile, Gonzalez and her team are waiting in the wings with new data, which include soon-to-be-published dates in the range of 100,000 CALYBP for lake sediments below the ash. “I think that this is a compelling argument that something is wrong with the 1.3-million-year-old date,” she says confidently.

Footprints—or not?

To the casual observer, the geochronological situation at Toluquilla may seem hopelessly tangled. Not only are

Matthew Bennett of Bournemouth University, with a Toluquilla “footprint” model made by laser imaging and rapid prototyping.



there a spate of wildly divergent dates from two groups of respected scientists, there are still the claims of ancient human occupation during the mid-Pleistocene, 250,000 to 330,000 years ago, to deal with. The result is a situation that’s unlikely to be resolved anytime soon. This troubles Ochoa-Castillo. “This is the way scientific myths are created, and they are difficult to deny,” she says. “I believe we need to avoid creating false expectations, so we should first exhaust all academic avenues before presenting data like this to the public.”

But the cat, as they say, is out of the bag. Setting aside the timing issue, what the controversy boils down to is, Are the depressions at Toluquilla really footprints? Silvia Gonzalez, David Huddart, Matthew Bennett, and their collaborators say they are, and they’ve spent more than two years investigating the Toluquilla finds. “We recognize that there are some quarry marks and weathering marks,” Gonzalez says. “They are very sharp, very obvious patterns. However, we use very stringent criteria to identify both animal and human prints.”


Their care and confidence don’t quiet their skeptics. “The reported footprints just appear to be weathered quarrying marks,” declares Mike Waters. He adds that the geochronological evidence shows that the depressions, if footprints, would have been made while the ash was still hot. It seems unlikely that either humans or animals would want to walk on such a hot surface.

Of course, Waters is prepared to reevaluate his opinion if the Gonzalez team presents compelling evidence that the Toluquilla finds truly are preserved human footprints. “They need to peel back more layers of the Xalnene to see if the marks can be found entombed in unquarried stone,” he opines. “They also need a physical anthropologist on their team whose specialty is bipedal locomotion to evaluate them.”

Renne’s sentiments are similar. “If they want to make a credible case,” he declares, “they will have to excavate the ash and

find footprints on freshly exhumed material. The existing surface is just too obviously impacted by modern human activities to support the claim.”

Gonzalez and her team are working on doing just that. “The only way to calm the critics would be to excavate an area where there has been no quarry activity and uncover more footprints,” she says. “We will do this as soon as we can.” Efforts are underway to acquire the permits necessary to conduct the excavations.

Gonzalez is confident about what they’ll find, but admits that they’ve got a tough row to hoe. The local stratigraphy is very complex, and there are numerous potential complications stemming from the composition of the sediments and the likelihood of reworking. She invites her critics to join them in the effort. “Only when we join forces in trying to understand the problems and challenges here,” she declares, “are these problems going to be solved.” 

—Floyd Largent

The research to evaluate the age of the Toluquilla quarry footprints was supported by the North Star Archaeological Research Program at the Center for the Study of the First Americans. To learn more about the Toluquilla footprints, visit the Center’s Web site, www.centerfirstamericans.com

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