MAMMOTH TRUMPET

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Center for the Study of the First Americans
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NEW PUBLICATION SCHEDULE

Your next **Mammoth Trumpet** will go to press 1 January 2007 (instead of 1 December 2006). Thereafter this newsmagazine will be published quarterly on January 1, April 1, July 1, and October 1.

How do you make a successful Clovis dig?

DARYL P. MILLER, SCIAA-USC

Al Goodyear, the man who has done it at the Topper site in South Carolina since 2004, has found the answer. Start with the richest quarry-related site in the Southeast; be lucky enough to find a property owner (in his case, the Clariant Corporation) who encourages you to dig, protects your site from intruders, and provides you with sumptuous facilities for eating, bathing, and just plain relaxing; and have the gift for firing 100 volunteers with the thrill of discovery. This photo shows just a few who participated in the 2006 season. Our lead story on **page 1** is Dr. Goodyear and the ongoing Clovis excavation at the Topper site.

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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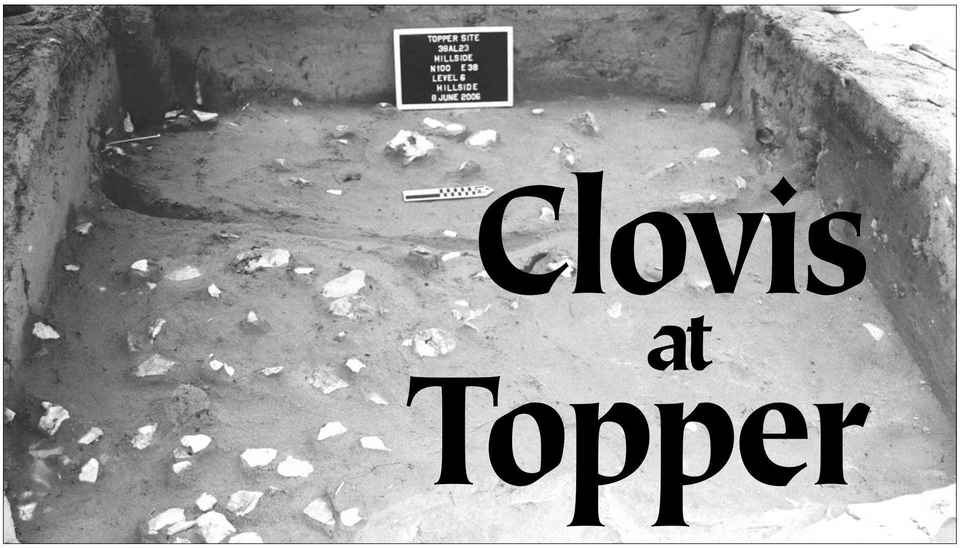


Clovis at Topper

ALL PHOTOS: DARYL P. MILLER, SCIAA-USC

Level 6 of the hillside unit excavated in 2006 by Ashley Smallwood's team. They counted 125 artifacts in this one level alone! (The trench near the rear was made by a mole that paid a visit the night before this photo was taken—a thoroughly undisciplined team member.)

INSIDE

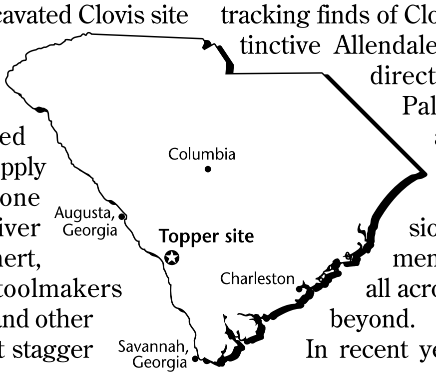
4 Our earliest woman has lots of surprises
For years Arlington Springs Woman was misidentified as a man. Now we know she shared her island off the California coast with pygmy mammoths. Thanks to another island dweller, Peromyscus nesodytes, *we also know she's older than we thought.*

10 A whole range of ecological niches in one country
Ruth Gruhn, our tour guide through Paleo South America, introduces us to Peru, whose ocean beaches, grassy alpine slopes, desert, and jungle invited the first human settlers to make the home of their choice.

7 New Books
TAMU palynologist Vaughn Bryant takes a close look at a new edition of a classic text on phytoliths and declares it an amazing book that's "well worth the cost."

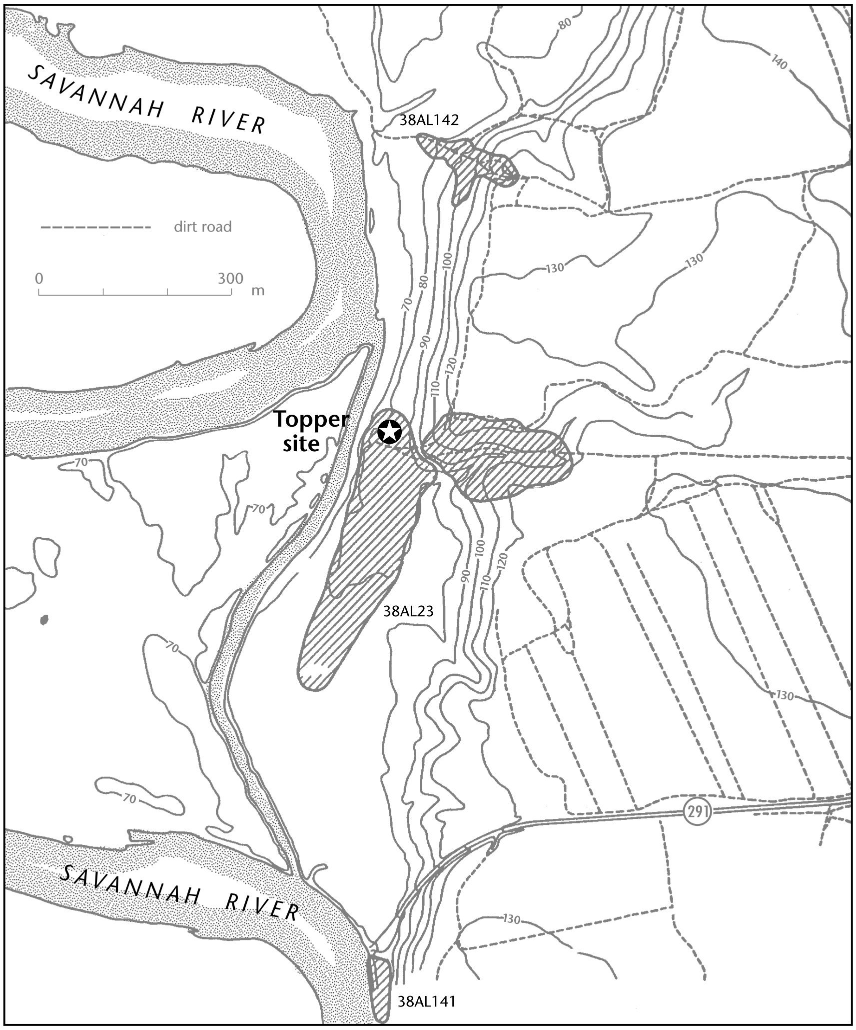
TOPPER, set hard against the Savannah River in Allendale County of South Carolina, is the queen of Southern quarry-related Clovis sites.

What sets Topper apart from other Clovis sites in the South found near major chert sources—Thunderbird, Wells Creek Crater, Adams, and Carson-Conn-Short are notable examples—is its distinction of being the southernmost excavated Clovis site in the Southeast. Its location at latitude 33 influenced the kinds of tools knappers made. Blessed with an inexhaustible supply of high-quality toolstone from outcrops and river cobbles of Allendale chert, generations of Clovis toolmakers created projectile points and other artifacts in quantities that stagger scientists who today visit Topper. By tracking finds of Clovis points made of distinctive Allendale chert, Al Goodyear, director of the Allendale Paleoindian Expedition and principal investigator of the Topper site, is defining the dimensions of a Clovis settlement complex that extends all across South Carolina and beyond.



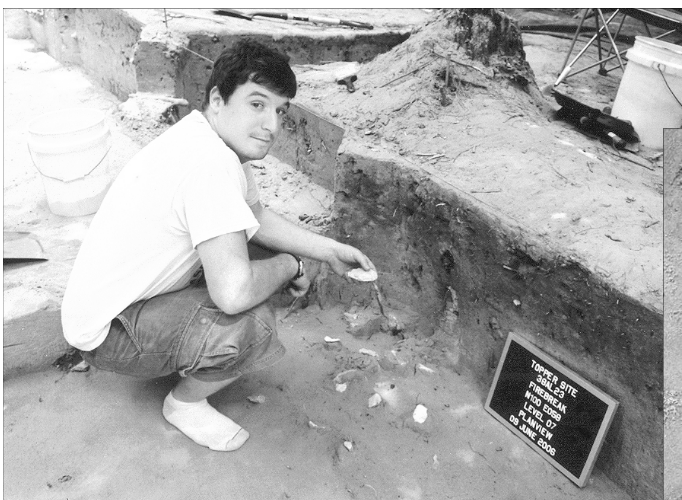
In recent years Topper has been inextricably linked with the *pre-Clovis* investigations being pursued by Dr. Goodyear's team just a few meters from the Clovis excavations. News of possible evidence that humans made primitive tools at Topper 50,000 years ago has been broadcast on CNN and published in major newsmagazines

Nature put everything in place to make a splendid Clovis site at Topper: A spur (chute channel) of the Savannah River sweeps past a hilltop containing a chert outcrop. The outcrop became exposed sometime around Clovis times or before, providing fine toolstone. Around the same time the Savannah River cut into its present meander pattern, which exposed natural chert deposits in the bottom of the river. Today, Shane Miller says, "If you were to dive around out there, you could pick yourself up a big boulder."



across the country and around the world, including *Time,* the *New York Times,* and *American Archaeology.* The reaction of the scientific community has ranged from enthusiastic support to let's-wait-and-see, to skepticism, and sometimes to outraged disbelief—understandably, since until just a few years ago the Clovis-first gospel preached that the first Americans appeared no earlier than 13,000 calendar years ago.

Happily, no controversy clouds the solid scholarship practiced by Goodyear, his colleagues, and the wildly enthusiastic volunteers who flock to Topper to dig Clovis year after year. Witness the supremely successful Clovis in the Southeast conference last October in Columbia, South Carolina, which drew overflow crowds of scientists, avocational archaeologists, and the general public (**MT 21-2,** "Clovis in the Southeast Conference 2005"). Every year discoveries at Topper enlarge our understanding of the Clovis culture in America—and, at least as important, in the South.



▲ Shane Miller, unit supervisor of the Clovis hilltop excavation.

A fractured Clovis preform found by Miller's team in situ. The proximity of the pieces confirms there has been little activity to disturb deposited artifacts. ▶

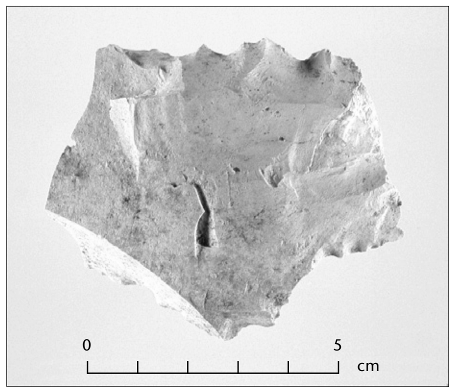
They came for the chert

"If you look on a map," Goodyear tells us, "the large chert sources go from western Allendale County, of which Topper is a member, right across the Savannah River into Burke County, Georgia, into the Brier Creek Valley." He calls it all Allendale chert, although he admits some of the Georgia people call it Brier Creek chert. Whatever you call it, it's all the same high-quality toolstone material, a fact verified by petrologic analysis done by Florida geologist Dr. Sam Upchurch, an authority on coastal plain chert.

Because Topper lies next to a chute channel of the Savannah River, the hilltop overlooking the river made a fine campsite. The river, though, didn't always flow within its present boundaries. During the Ice Age it was a broad, sluggish body of water that deposited a terrace on the floodplain. We reported (**MT 16-4,** "The Topper Site: Beyond Clovis at Allendale") how, with the end of the Last Glacial Maximum about 15,000 years ago, rainfall in the South greatly increased, creating powerful currents that scoured the river bed and dropped the elevation to its present level. Subsequent slopewash eroding off the hill gradually covered the Pleistocene terrace (and the pre-Clovis deposits that Goodyear is excavating, with the world watching over his shoulder). Clovis people were the first to see the river as it appears today. If there were earlier visitors—and Goodyear is confident there were—they saw a river of vastly different dimensions and flow.

The hilltop was the area used as a workshop and for camp-related activities, and that's where Goodyear's team are concentrating their efforts. In the 2006 season they explored two areas, the hillside and the firebreak. The hillside is a gently sloping area shaded by trees. The firebreak is so named because the Clariant Corporation, owner of the land on which Topper lies, every year for the past 30 years has plowed a swath clear of trees and brush to help firefighters contain a forest fire if one occurs. Both areas are yielding lithic artifacts in bewildering numbers. Shane Miller, a graduate student in anthropology at the University of Tennessee–Knoxville and unit supervisor of the firebreak excavation in the 2006 season, notes that they didn't start seriously digging the hillside and firebreak areas until 2004. "For years Al and company have noticed Clovis artifacts would occasionally erode out of the road above the pre-Clovis excavations, but thought the artifacts were just flukes," he recalls. "In 2004, they decided to test the areas around the road for intact deposits, and they hit the mother-lode."

Anticipating that guests attending the Clovis in the Southeast conference would be eager to visit Topper, the Topper team excavated a 4-by-4-m unit. Miller remembers that "people would come down the road and look at it, then go up to the firebreak. They were just stunned at the volume of it."



Denticulate tool. The comblike teeth of the sharp serrated edge were used to shred bark for making cordage and hafting material.

Toolstone from the quarry and river cobbles

All the chert used to make the artifacts found in the hilltop excavations was carried up the slope from the river and the quarry. Goodyear admits being slow to recognize the quarry. It lies on a fairly steep slope (about a 16-percent grade) that everyone uses as a footpath to get to the river and the pre-Clovis excavations, and at first glance it looks like common gravel. A little investigating found outcrops and boulders, and it's now apparent that what appears to be rubble is all man-made talus, the

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First Lady of the New World: Arlington Springs Woman

THE ARLINGTON SPRINGS SITE lies on Santa Rosa Island, one of the Channel Islands off the California coast. The island, already notable for being home to the enigmatic pygmy mammoth (*Mammuthus exilis*), caught the attention of the scientific world when a pair of human femora were found in general proximity to pygmy mammoth remains. The discovery was evidence of a probable co-presence of humans and mammoths at a time of critical transition, when Santa Rosa Island mammoths were on the decline and the human population was burgeoning.

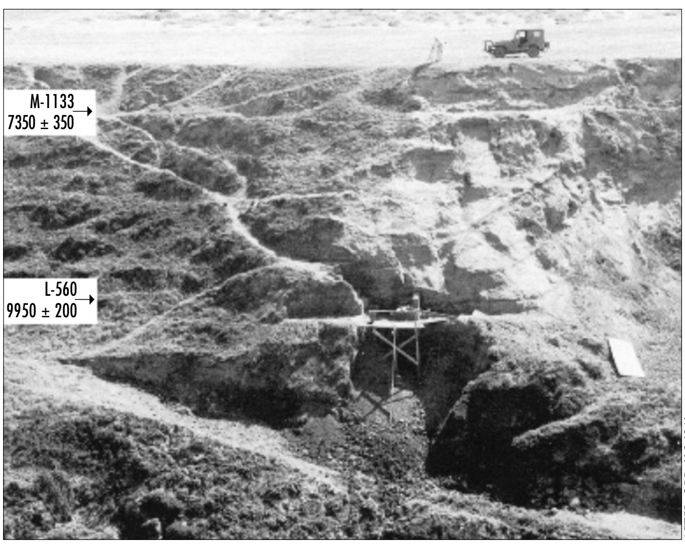
Imagine having one of the leading bone-dating experts of the day, Dr. Tom Stafford, pay a visit to your office bringing the news that the oldest known human remains in the United States are residing in your basement. Imagine . . .

That's just what happened to John Johnson, Curator of Anthropology at the Santa Barbara Museum of Natural History. What must surely have been a humbling experience for both scientists, a conversation that took place in Dr. Johnson's museum office one rainy day in January 1995, launched a series of investigations on Santa Rosa Island that continue today and are a perfect example of how archaeologists use parcels of information to assemble a snapshot in time of ancient life-ways.

An old friend revisited

We first reported the saga of Arlington Springs Woman in 1999 (**MT 14-3,** "Channel Island Woman May Be Oldest Yet"), a saga that was initiated by an accidental discovery in 1959. Phil Orr, then curator of anthropology and paleontology of the Santa Barbara Museum of Natural History, was carving a road with equipment borrowed from a nearby U.S. Naval facility in order to create easier access across Arlington Canyon to locales that were yielding interesting archaeological and paleontological data. While maneuvering a road grader down a steep incline, the equipment became mired in the mud. As Dr. Orr worked to extricate the machine from the muck, he noticed bones in the newly exposed cliff face. Upon closer inspection the bones appeared to be not animal as he supposed, but rather human. At a depth of more than 10 m from the surface, this was indeed an exciting find—evidence of human occupation on the island at what might be a very early time, possibly the earliest for the Santa Rosa Island area. Exhibiting incredible presence of mind, Orr decided *not* to excavate the bones at that time. Instead, on the advice of the Museum's Chair of the Prehistory Committee, he decided to assemble a group of eminent anthropologists and archaeologists to investigate the discovery in situ, an unorthodox methodology for the time.

With the help of Fay Cooper-Cole, the Museum's Chair of the Prehistory Committee, a Werner-Glenn grant was acquired as an umbrella for a conference convened on Santa Rosa Island. Leading U.S. archaeological scientists, whose numbers included Jesse Jennings, Emil Haury, James B. Griffin, Alex Krieger, Luther Cressman, and other experts in the fields of geology, geography, and oceanography, were enlisted to investigate Orr's discovery on site and to evaluate dark stains in nearby canyons that he believed were

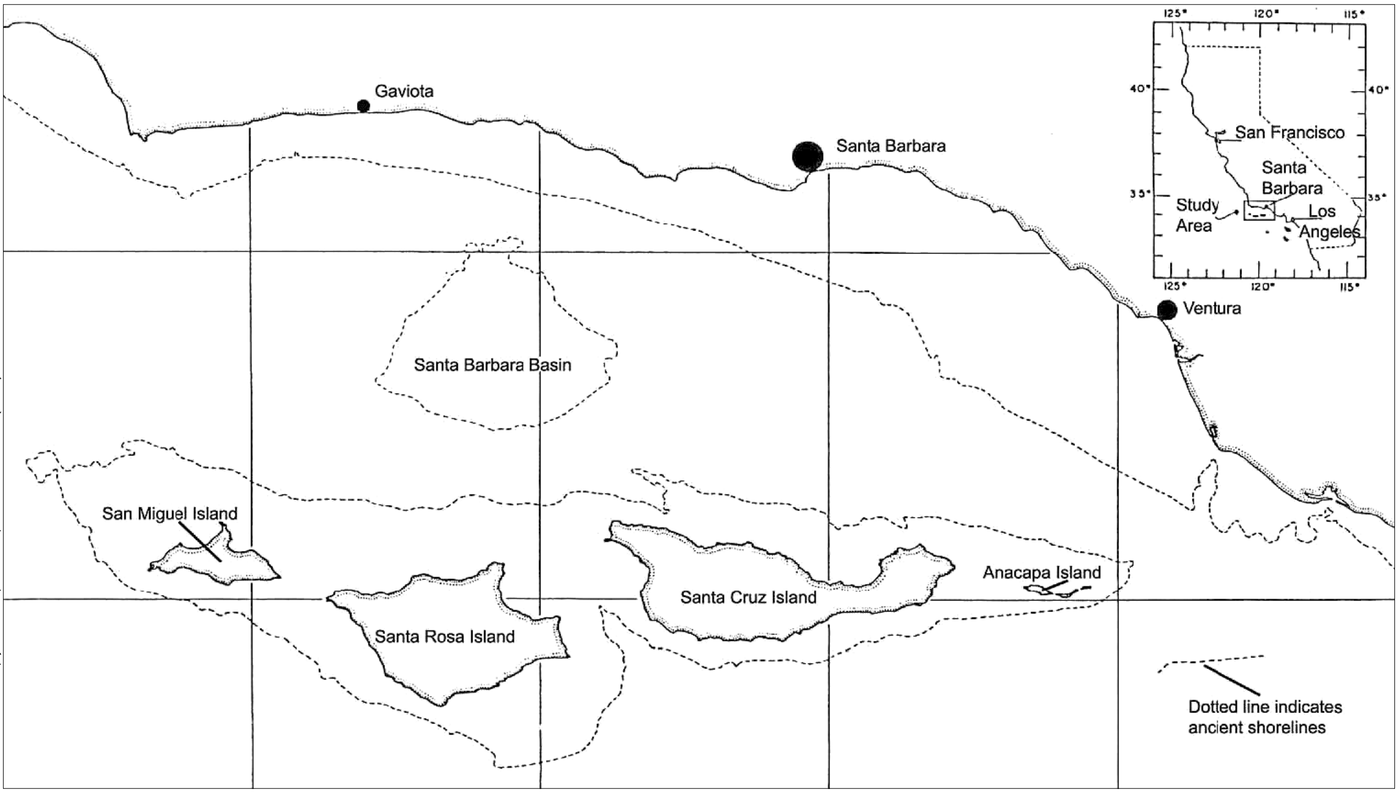


Orr's 1960 excavation. The lower arrow (9950 ± 200 radiocarbon years) is the approximate location of Pleistocene-age human bones. Johnson and Stafford's recent work at the site dates Arlington Woman's presence on the island somewhere between about 11,000 and 11,500 RCYBP.

AFTER ORR (1962A)

hearths. (Although the stains were ultimately dismissed by the group, Orr never wavered in his belief that the incursions of dark red earth were indeed hearths.) Articles were ultimately published in professional journals. Two of these, in *Science* and *American Antiquity,* briefly described occupational layers above the bones in question and addressed the 8000 B.C. radiocarbon age established for the bones—remember that in 1959 radiocarbon dating was still in its infancy.

human bones; but Orr was dissatisfied with the gross margin of error resulting from an insufficient sample size. Subsequently, therefore, he extracted an additional charcoal sample from the soil matrix about 1/3 m from the bones; its age was determined to be 10,000 ± 200 RCYBP (uncalibrated). No mammoth remains or cultural materials were found in direct context with the bones that could be used to refine the date of the human skeletal remains. However, pygmy mammoth skeletal material



AFTER AGENBROAD, JOHNSON, MORRIS, AND STAFFORD (2005).

Map of the Channel Islands showing current coastline and Pleistocene coastline at the last glacial maximum (dotted outline).

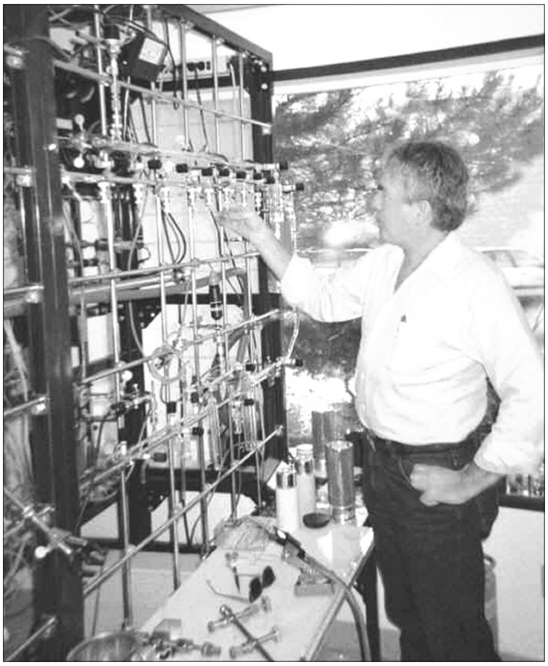
Dating the remains: Resourceful and ingenious work

Orr, a strong believer in technology, used the emerging science of carbon dating to determine the age of the Arlington Springs human remains (described by Walter Libby in his address on accepting the Nobel Prize in 1960; see "Suggested Readings"). Samples of abalone shell from a stratigraphic layer above the human bone layer and samples of charcoal from soil immediately surrounding the bones were also sent to different laboratories for carbon dating. The abalone shell, found in cultural strata about 6 m above the human bones, yielded an age of 7350 ± 350 RCYBP (uncalibrated). The charcoal bits in close proximity to the bones, at 11½ m below the surface, yielded an age of 10,400 ± 2000 RCYBP (uncalibrated). Granted, the two dates bracketed the age of the

J. JOHNSON (2006)

Johnson and Stafford's 2001 excavation. The bottom of the stadia rod (arrow) is the approximate location of present-day samples that date to the terminal Pleistocene.

had been located about 47 m from the spring and cultural materials were found eroding from the surface to a depth of about 3 m from the surface above the springs. Armed with this information and stratigraphic evidence, and bolstered by his extensive knowledge of Pleistocene faunal remains on Santa Rosa Island, Orr ascribed Arlington Springs human remains (at the time



JOHN JOHNSON, SANTA BARBARA MUSEUM OF NATURAL HISTORY

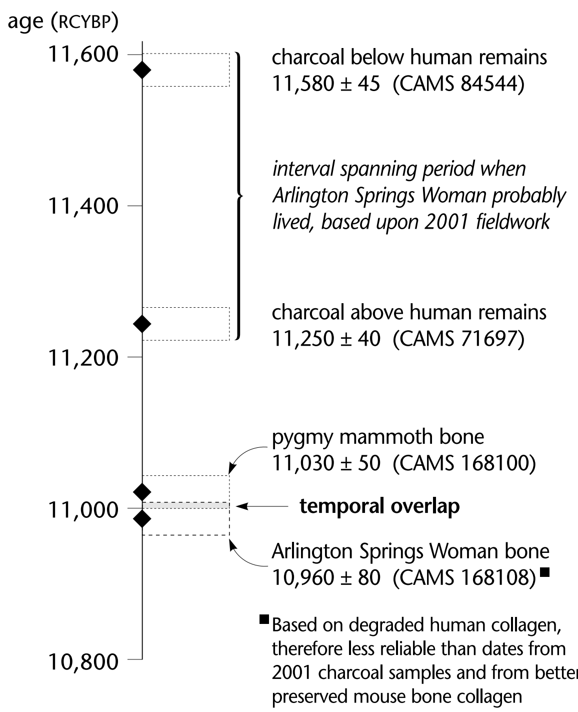
Geochronologist Tom Stafford in the lab.

referred to as Arlington Springs *Man*) to the end of the Pleistocene. Based on other evidence at the site, he proposed a gap in human occupation of several thousand years for unknown reasons prior to the start of the Holocene era.

In yet another stroke of prescience, Orr ultimately moved the bones, determined to be the femora from one individual, to the museum for safekeeping. Instead of excavating the bones from the soil matrix, however, he removed a large block of earth with the bones embedded in situ. For protection the entire block was sheathed in a plaster jacket, like that used to preserve paleontological specimens. Thus encased, the block was transported to the Santa Barbara Museum and catalogued into the Museum's collection. For the next 30 years the oldest person in the New World (still believed to be a man) reposed in relative obscurity after a brief flirt with celebrity.

Johnson, with the Santa Barbara Museum of Natural History, and Don P. Morris, an archaeologist from the Channel Islands National Park now retired, teamed up in 1987 to review the material and evidence for the Arlington Springs site. They decided to determine whether the encased fossilizing femora retained enough original matter that could yield additional information about the bones and possibly answer questions about the human individual—its ancestry, for example, and when and how its forebears arrived on Santa Rosa Island. Unfortunately, initial tests indicated that the protein within the fossilizing bone was too degraded to yield useful information, that no useful DNA remained, and that enzyme collagenase testing wasn't possible.

In 1995, Stafford, the leading U.S. specialist in extracting bone collagen for carbon dating, tested additional samples found within the block of earth in which the human bones were embedded. His task was to analyze material removed from the bones of now-extinct deer mouse (*Peromyscus nesodytes*) found embedded in the block of earth around the femora. Analysis of the mouse bone collagen returned an age of 11,490 ± 70 RCYBP. Still eager to wring usable information from the human remains, the team performed AMS osteocalcine analysis on the femora (osteocalcine, the second most abundant protein in bone after collagen, binds to both collagen and the mineral apatite, which gives bone its rigidity; osteocalcine tends to survive in fossil bone, and when present in sufficient quantity, osteocalcine amino acid protein can yield useful information about the individual including species identification and radiocarbon age) and got an age of 6610 ± 60 years; AMS dating of preserved fractions of bone collagen yielded an age of 10,960 ± 80 RCYBP. Finally, testing of a charcoal sample obtained in 1994 at the Arlington Springs Site during a geological study by Dr. Thomas Rockwell, San Diego State University, yielded a date of ca. 10,000 RCYBP. It was believed at the time that this charcoal came from the same stratum in which Orr had discovered the human bones. Since the mouse bone is far better preserved than the human bone, the scientists have greater confidence in its radiocarbon age than in that of the human bone. Thanks to *P. nesodytes,* the human remains can be dated with a high degree of confidence to at least 10,960 ± 80 RCYBP.



AFTER AGENBROAD, JOHNSON, MORRIS, AND STAFFORD (2005)

Radiocarbon ages of samples from Arlington Springs site and pygmy mammoth skeleton. Shaded area indicates probable area of overlap of pygmy mammoth and human presence.

Dr. Larry Agenbroad was invited in 1994 to examine a nearly complete pygmy mammoth skeleton found by Rockwell and Morris on Santa Rosa Island. A sample from the bones yielded an AMS radiocarbon age of 12,840 ± 419 RCYBP, which led investigators at the Arlington Springs site to infer that pygmy mammoths and humans were probably present on Santa Rosa Island within a similar time range.

Recognized at last: Ms. Arlington Springs

For over 40 years the femora originally found at the site were referred to as Arlington Springs *Man.* This was a period when, in the absence of compelling data to the contrary, it was customary to assign the male gender to human remains. The error

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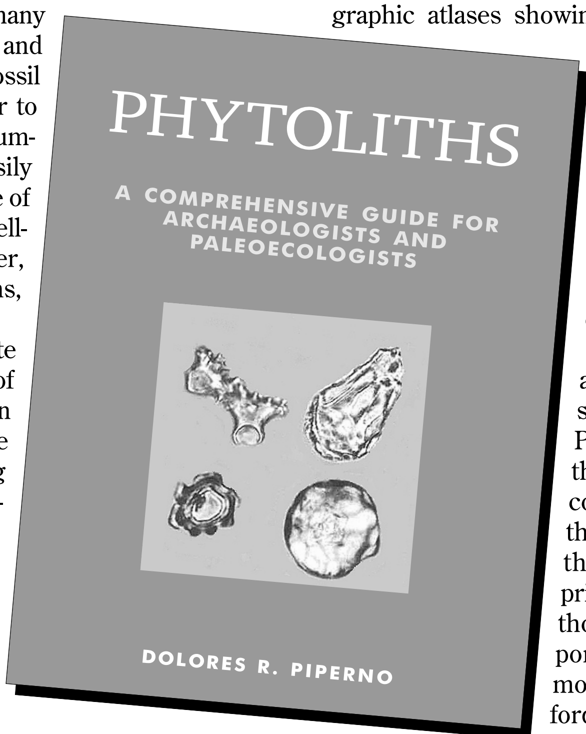
New Books

Phytoliths: A Comprehensive Guide for Archaeologists and Paleoecologists, by Dolores R. Piperno. Altamira Press (Division of Rowman & Littlefield Publishing Group, Inc.), 248 pp., illus. (B&W), tables, biblio, index, appendix, ISBN: 0-7591-0385-2. ($59.95) (paperback) 2006.

For more than 40 years I have applied my archaeological skills to the recovery and analysis of various types of plant remains left behind in the middens, hearths, and latrine deposits of archaeological sites found both on land and on the seabed. When collecting samples from these archaeological deposits, I have often seen many different types of plant remains. The larger fragments are easy to see and collect, such as charcoal, seeds, wood, fibers, fruits, leaves, roots, and bark. Most of these are fairly easy to identify because for many there are useful taxonomic keys and good photographic atlases. Even fossil pollen, although sometimes harder to identify because of the extensive number of possible types, is fairly easily identified for many regions because of well-documented pollen keys and well-illustrated pollen atlases. However, one type of plant remains, phytoliths, is the exception to the rule.



The tiny silica and calcium oxalate crystals produced by many species of plants have always fascinated me. In some of my studies I have been able to identify a few of them as coming from specific host plants. For example, during the mid 1960s, when I first began examining the contents of ancient human coprolites (preserved feces) from sites in west Texas, I found thousands of tiny plant crystals among the debris in those coprolites, some of which were nearly 3,000 years old. After preparing reference materials from a number of the local desert plants I found matches for some of the coprolite phytoliths. Thus, I was able to say with certainty that those ancient Texans had been eating large quantities of cactus pads (*Opuntia* sp.) and the leaf bases (called quids) of agave (*Agave* sp) and sotol (*Dasylirion* sp.). Although a few of the fibers from these same plants were also present, the best confirming and most reliable evidence for the dietary use of these plants came from the thousands of undigested phytoliths that remained in their feces. Many years later, one of my doctoral students and I were trying to solve another mystery. Underwater archaeologists had found fragments of ropes that were once used on a ninth-century Byzantine merchant ship. The sunken remains suggested that the ship had run aground on a shallow reef along the west coast of Turkey and then sank. The archaeologists wanted to know details about the cargo, which we were able to reconstruct from seed and pollen remains. However, studies of the rope fragments and fibers proved inconclusive. Finally, detailed microscopic examinations of some of the rope fragments revealed palm phytoliths trapped in the cells of some of the rope's fibers. This confirmed historical reports that certain types of palm fibers were sometimes used for making ropes.

After my introduction to the study of plant phytoliths during the mid 1960s, I never found the time to study them in depth. One reason was the early absence of good reference books on how to collect and extract phytoliths from various types of matrices, the absence of books with detailed taxonomic keys to help identity unknown types, and a total lack of any photographic atlases showing pictures of some of the important phytolith types. Finally, in 1988, some of those problems were resolved when Dr. Piperno published her first textbook and guide to the discipline of phytolith studies. In the nearly two decades since that book was first published, there have been many new advances in phytolith research. Fortunately, most of them are discussed in detail in her new textbook on phytoliths.

The first thing that impressed me about Piperno's new book was its beefy size (8½ x 11) and its reasonable cost. Perhaps not everyone is concerned with the cost of books these days because it costs more to fill our cars with gasoline than it does to buy a good book! Nevertheless, I am concerned about book prices and I want to compliment the author and publisher for providing this important reference book at a price that most students and professionals can afford.

So why should an archaeologist want a copy of this book, or why should we even be concerned with phytoliths? I provided several examples of why I found phytoliths important in my own research. However, from the broader perspective the emerging discipline of phytolith studies is vital to the whole field of archaeology for a number of reasons. First, phytolith studies focus on the identity of microscopic silica elements produced by plants that are morphologically unique to the family, genus, or species level in a number of plant families. Second, these microscopic traces of the parent plants often remain preserved in sediments for thousands of years. Third, phytoliths can be recovered and separated from ancient sediments for analysis using a variety of extraction procedures. Fourth, the potential scientific value of studying both pollen and phytoliths was first noted during the 1830s by the same German scientist, Carl Ehrenberg, and later both disciplines followed a similar developmental history. Fifth, phytoliths are important for their interpretive value in a wide range of disciplines ranging from archaeology to geology and from paleoecology to forensics.

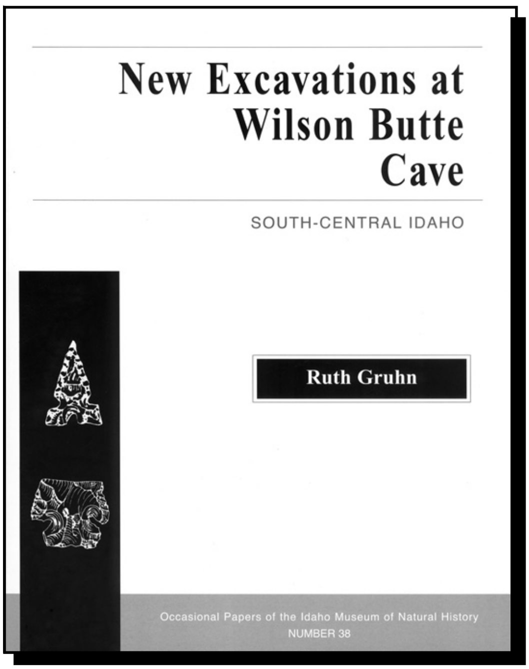
Most of the initial taxonomic studies of phytoliths were conducted between the middle 1800s and early 1900s. Then, in 1916 Lennart von Post ushered in a new era for the discipline of palynology when he reported that the statistical study of fossil pollen could be used to identify and determine cycles of past vegetational change, and hopefully might even date sediments to specific time periods. Regrettably, it would be four decades later before this same type of application would be recognized for phytolith data.

The body of ***Phytoliths: A Comprehensive Guide for Archaeologists and Paleoecologists*** is divided into eight chapters, each covering a new and important topic. For those not familiar with the development or anatomy of plants, chapter 1 will be quite helpful because it thoroughly discusses how phytoliths are formed, where they occur in plants, their chemical characteristics, how they are dispersed, what factors ensure preservation, and which major plant families have phytoliths and which do not. Chapter 2 covers the many different morphological types of phytoliths including the characteristics of ones found in monocots and how those differ from ones found in dicots or gymnosperms. Chapter 3 is one of the more important ones because it provides detailed information about many phytolith types that are found in cultigens, then discusses how those types differ from the phytoliths produced by related taxa, which are wild forms rather than cultigens. This chapter is important because during the past several decades the discovery of key phytolith taxa in ancient archaeological soils in South and Central America has provided archaeologists with the best confirmed evidence for the beginning of plant domestication in the New World. Previous to these recent phytolith discoveries, most believed that early pollen and corn cob records from archaeological deposits in central Mexico held the key to finding the origin of farming in the New World. Likewise, the search for the origins of when Polynesians first occupied many of the islands in the Pacific is becoming much better documented as a result of the discoveries of cultigen phytoliths and starch grains in early archaeological sites. Archaeologists have long realized that the Polynesians carried cultigens with them as they explored the Pacific Islands. Unfortunately, earlier searches for fossil pollen or other types of plant evidence from those early island-grown cultigens revealed no usable data owing to the high levels of microbial activity and organic oxidation in the soils.

New publications on the early site of Wilson Butte Cave, Idaho

South-Central Idaho's Wilson Butte Cave has been known as an important early archaeological site since the first report of research was published in 1961. Carbon dating on some of the materials found there suggests that it had pre-Clovis inhabitants. A wide range of dates indicates that the site was home to hunter/gatherers for more than 14,000 years, from the late Pleistocene into the late prehistoric period.

The first scientific excavations at the site, by Ruth Gruhn in 1959/60, were published in 1961; and a reprint of that report (Occasional Paper no. 6) is now available from the Idaho Museum of Natural History. As well as a description of the artifacts recovered, it provides a detailed record of the nature of the undisturbed sediments and a sequence of paleoenvironmental changes as inferred from the record of changes in frequency in small mammal and bird species; providing information supplemental to the report on new excavations carried out in 1988/89.



In a new occasional paper (Occasional Paper #38), published by the Idaho Museum of Natural History, Gruhn and her associates report the results of excavations that took place in the cave in 1988/89. Gruhn describes the excavations and the stratigraphy encountered; and Alan Bryan examines the artifacts from undisturbed deposits. There are special studies of the projectile points recovered from disturbed deposits, by Mark Druss; obsidian sources by Jeff Bailey; and Wilson Butte Cave artifact collections in private hands, by Diane Cockle. Appendices are provided by Susanne Miller, Steven Bozarth, Christopher Stevenson, and James Adovasio. In the introductory and concluding sections, Gruhn addresses two major historical problems arising from the earlier excavations: the dating of the earliest human occupations at the site, and the cultural identification of the latest prehistoric phase.

The reprint of the 1961 report (Occasional Paper #6) and the 2006 report (Occasional Paper #38) may be purchased as a set for $75 plus S&H; the volumes sold separately are priced at $40 each plus S&H. Order from the Idaho Museum of Natural History, Campus Box 8096, Pocatello, ID 83209; or telephone 208-282-3317.

Chapters 4 and 5 are important because they explore techniques for sampling and recovering phytolith records from field locations such as archaeological soils, geologic deposits, lakes, swamps, and bogs, and then discuss how to extract essential phytolith data in the lab. Chapter 4 covers field sampling and the importance of collecting modern control samples from surface soils. It also stresses the importance of understanding the complexity of the local vegetation cover and the types of phytoliths they produce. The second of these two chapters covers various methods used in extracting phytoliths from a variety of matrixes, including the calculus on teeth. Chapter 5 also examines techniques for recovering starch granules from fresh sources as well as from a variety of sediment types. The chapter also suggests ways to collect sufficient numbers of phytoliths (containing trapped carbon particles) needed for precise AMS radiocarbon dates and for use in isotope studies. The chapter ends with tips on staining phytoliths, the best types of mounting media to use, microscope photography, and the proper ways to ensure the long-term preservation of samples.

Chapter 6 is another critical chapter because it first focuses on the importance of making proper identifications, then discusses how to interpret phytolith data. In the past some phytolith studies have presented their data in terms of ubiquity. Others have tried different ways to quantify the numbers and types of phytoliths found in samples. Some have tried to find ways to determine phytolith concentration values, similar to the techniques used in pollen analyses. Still others have focused on trace element and isotope variations in phytoliths. Chapter 6 of Piperno's book concludes by examining some of the best ways to report phytolith results statistically in ways that best reflect past vegetational and environmental conditions.

Grasses are prolific producers of phytoliths. Consequently, early phytolith studies of prairie soils and Holocene deposits were used mainly by botanists, soil scientists, agriculturalists, and ecologists to determine the types and expanses of early grasslands. Slowly other types of phytolith morphological studies emerged to complement those already known for many types of grasses. It was this emphasis on learning more about grass phytoliths that led to its first application in archaeology. Chapter 7 is devoted to the importance of phytolith research in the field of archaeology and chronicles a history of its use. As early as 1900, European researchers applied their knowledge of phytoliths to the search for the beginnings of wheat, barley, and millet agriculture and to trace the spread of early farming at archaeological sites in Northern Europe and Turkey. Later, these same techniques were applied to the excavations of early farming settlements discovered in the Middle East. More importantly, detailed studies of ancient and modern maize (*Zea mays*) phytoliths show that the two groups are distinctive and can be used as key indicators to trace the early domestication and spread of maize farming throughout the New World. Chapter 7 also focuses on the many other cultural clues that can be revealed from phytolith evidence at archaeological sites. Recent discoveries of phytolith scratches on human teeth and on flint artifacts provide clues to the types of plants being harvested and the diets eaten. Some ancient stone, bone, and metal cutting tools contain the dried remains of plant materials still stuck to their cutting surfaces. Careful studies of those remains have revealed trapped phytoliths from the plant materials being cut. Phytoliths recovered from archaeological sites have also played a key role in identifying the source materials used for making adobe bricks, the types of plant material used to temper pottery, the plant sources used for caulking the seams of ancient ships, and the types of fibers used for making prehistoric twine and ropes. Phytoliths found in ancient human coprolites have revealed important information about food sources in early human diets.

The final chapter examines the importance of phytolith research as a tool in the search for paleoenvironmental information. Although fossil pollen has played a significant historical role in reconstructing ancient environments and vegetational patterns, pollen is destroyed in some types of sediments by oxidation or microbial activity. Fortunately, phytoliths are often preserved in sediments that are hostile to fossil pollen preservation. Thus, in those regions the preserved phytolith chronology has often provided our only glimpse of the paleoenvironmental conditions and vegetational changes. Better still, in some regions the same sediment cores are now being used to search for both fossil pollen and phytoliths. Those types of studies are now providing more detailed information about past vegetations. For example, all grass pollen looks the same; grass phytoliths, on the other hand, can be assigned to a number of key groups, each ecologically sensitive. Chapter 8 concludes with a look to the future and speculates about the potential uses of phytolith research in the decades to come. One potential area is revealed by the discovery that phytoliths occur throughout the Tertiary in many types of sediments; in the past, however, geologists have been slow to seize upon the potential of using phytoliths in their analyses. The use of pollen and phytoliths as forensic tools is relatively new, but has great potential for the future. The recent discovery that aluminum ions in phytoliths can be used to distinguish between forested and herbaceous vegetations has great potential for future use as does the study of oxygen and hydrogen isotope signatures in phytoliths. Finally, many phytoliths trap tiny particles of carbon inside of them as they form. Perhaps DNA studies of these trapped carbon particles will help us unravel clues about plant evolution and about the paleoenvironments of the past.

So why should an archaeologist want to own a copy of this book? The bottom line is that this amazing book is well worth the cost. The original and shorter version of this book, first published in 1988, was as least as expensive as this longer, revised edition. That was 18 years ago, so in today's dollars the current edition is a real bargain. For any member of the archaeology discipline who plans to interact and work with specialists doing phytolith studies or who may need to read and comprehend data presented by paleoethnobotanists, this book is an essential purchase.

If I haven't convinced you to buy the book yet, then buy it for the beautiful photographs and the key to major phytolith types listed in the appendix. This is one of the very few available sources that illustrate many different phytolith types.

–Vaughn M. Bryant, Jr.
Texas A&M University

MAMMOTH TRUMPET

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PERU can be viewed as a microcosm of the environmental diversity of South America. Within its borders are desert, grassland, or scrub forest in the broad coastal zone and adjacent western foothills of the Andes; in the interior, high mountain ranges extending the length of the country, separated by mid-altitude intermountain valleys and basins; high-altitude grassy plateaus among the highest peaks; and to the east, a rugged forest-covered escarpment dropping down into the extensive lowland jungles of the Amazon basin. By the end of the Pleistocene, Peruvian Paleoamericans had adapted to these challenging environments and developed a remarkable cultural diversity.

Paleoamericans in Peru

An awesome sight greeted the first Paleoamericans to cross the high pass leading down into the Callejón de Huaylas. The average elevation of the Cordillera Blanca to the east is ca. 6000 m (ca. 20,000 ft).

ALAN BRYAN

Early cultural variation in the coastal zone

To modern visitors to Peru, the coastal zone at first sight appears to be totally unproductive desert. The arid conditions result from the atmospheric effects of a cold ocean current offshore, which creates extensive fog banks over the coast in the winter but inhibits rainfall directly on the coastal plain. However, the cold upwelling offshore current supports abundant marine life—fish, shellfish, sea mammals, sea birds—and Paleoamericans knew how to exploit these rich marine resources.

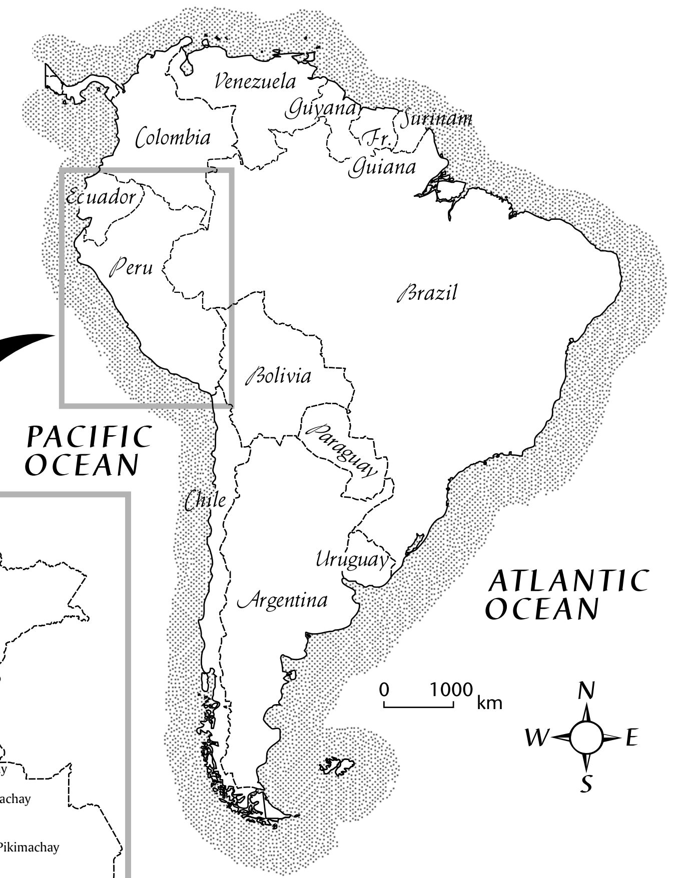
Dan Sandweiss described the early coastal site of QJ 280 near the bank of the Quebrada Jaguay for *Mammoth Trumpet* readers last year (**MT** 21-1, "Early Maritime Adaptations in Western South America"). It is located on the south coast of Peru, a strategic area for archaeologists to search for Paleoamerican sites, as, unlike the situation in most other coastal areas of the Western Hemisphere, the present coastline there is not far inland from the coastline as it existed in Pleistocene times, when the sea level was lower. While in most other regions, Pleistocene archaeological sites that were located on the coast are now under water, Paleoamerican coastal sites would be preserved in this area.

The earliest occupation zone at QJ 280 dates back to 11,105 ± 260 RCYBP. There is evidence for the construction of rectangular huts made of reed mats. The people who lived there were fully focused on the resources of the sea. They gathered shellfish, with a fondness for one species of clam; and netted near-shore fish, particularly the drum fish. The stone tools they left at the campsite were simple. There is no evidence for any hunting of land mammals, but the people did obtain prickly pear fruit from inland localities. Sandweiss believes that the site was occupied in the summer season, when there was fresh water available in the quebrada; in winter, when the stream ran dry, the people may have shifted location to a nearby river valley.

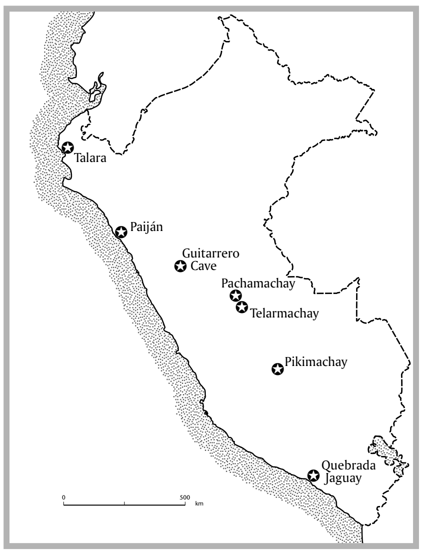
Paleoamericans in the arid coastal zone exploited the rich resources of the sea, and foraged on the coastal plain.

ALAN BRYAN

On the far north coast of Peru there is another area in which the modern shore is also close to the Pleistocene coastline, and Paleoamerican archaeological sites that indicate a littoral-based economy have been discovered. Just south of the small isolated Amotape mountain range are the Talara tar-seeps, which, like the La Brea tar pits in Los Angeles, entrapped Pleistocene animals, including mastodon, ground sloth, horse, deer, and dire wolf, a faunal suite indicating that a productive savanna-woodland then existed in what is now desert. In the late 1960s and early 1970s, James Richardson located 10 small thin Paleoamerican sites exposed on low ridges, all in sight of the tar-seeps, although no remains of the now-extinct fauna have been found on the campsites. It appears that the people who camped on the ridges maintained a foraging economy, focusing upon the collection of mollusks gathered from mangrove swamps that existed along the coastline of far northwest Peru until about 5000 RCYBP, when seasonal precipitation patterns shifted northward. A date of 11,200 ± 115 RCYBP was obtained on mangrove mollusk shell from one of the Talara campsites.



Localities discussed in this article

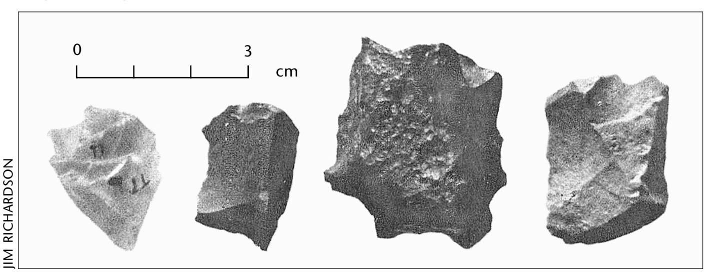


The assemblage of lithic artifacts from the early campsites near the Talara tar-seeps make up the Amotape complex. It is a unifacial industry, featuring large and small denticulated flakes; and wear patterns indicate that these tools were used to work wood or bone, or to shred fibrous plant material. It is unfortunate that none of these organic materials were preserved on these open sites. No stone projectile points were found on the early campsites, but points may have been made of wood or bone.

In contrast, a distinctive type of stone projectile point is the hallmark of the Paiján complex, which is restricted in distribution to the piedmont and adjacent coastal plain of the north-central coast of Peru. Beautifully crafted, a Paiján point cannot escape notice: it is large, with marked shoulders and an elongate stem, and features a narrow blade tapering to a fine tip often described as needle-nosed. Some archaeologists have suggested that these points served as fish spears; but as any archaeological sites directly on the coastline at the time are now under water far to the west of the present Pacific shore in this part of Peru, that hypothesis is difficult to verify. Some fish bones and marine shells are found on the inland Paiján campsites; but there are also remains of land snails, small mammals, birds, and reptiles; and occasional grinding stones left on the campsites suggest plant foods were utilized as well.

Known Paiján sites are concentrated on the piedmont, in the zone where the coastal plain meets the western foothills of the Andes. Dated archaeological sites indicate a range of ca. 10,800–9000 RCYBP for the Paiján complex; and paleoenvironmental data suggest a more humid climate in the area at this time, with extensive grasslands and low scrub forest. A major attraction in the piedmont zone was outcrops of excellent toolstone, and the Paiján people were skilled knappers indeed. Paiján lithic workshops in the area of the Cupisnique valley north of the present city of Trujillo have been well analysed and described by Claude Chauchat in the recent CSFA publication—*Projectile Point Technology and Economy: A Case Study from Paiján, North Coastal Peru* (2004).

In intensive surveys in the Jequetepeque and Zaña valleys, Tom Dillehay and his associates have found evidence for a significant shift in settlement pattern as the Paiján complex evolved over time. Early Paiján campsites, dating before 10,000 RCYBP, were apparently occupied only briefly, suggesting a pattern of high mobility in the exploitation of resources of the piedmont and coastal plain. Later, after 10,000 RCYBP, Paiján groups appear to have become localized within the more favorable areas, and at some sites circular dwellings were constructed with foundations of rings of stone and likely a hide or brush cover. In later millennia, settlements would become more permanent and more complex societies would evolve on the north-central coast of Peru, giving rise to early civilization featuring the development of impressive monumental public architecture by ca. 4500 RCYBP.



JIM RICHARDSON

Small uniface lithic tools characterize the Amotape complex of the far north coast of Peru.

ALAN BRYAN

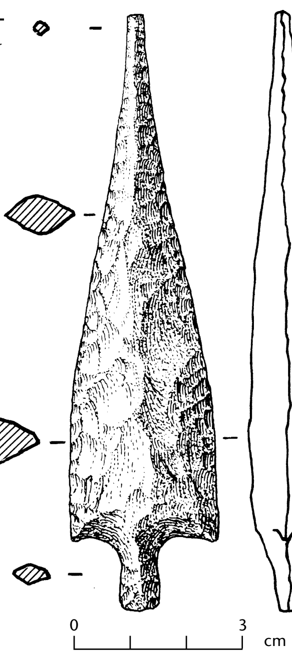
The south chamber of Pikimachay, where a Paleoamerican occupation zone has been dated between 15,000 and 13,000 radiocarbon years ago.

The middle ground: Intermontane valleys and basins

Between the high mountain ranges of interior Peru are several major valleys and basins of intermediate altitude. Because of the marked verticality of diverse ecological zones in the Andes, Paleoamerican hunter-gatherers of the intermontane valleys were able to exploit a great variety of plants and animals within close range of their campsites. Two major Paleoamerican cave sites have been known since the 1970s, Pikimachay in the Ayacucho basin of south-central Peru, and Guitarrero Cave in the Callejón de Huaylas in the north.

Pikimachay, situated in a volcanic outcrop on a hillside at an elevation of 2850 m (ca. 8500 ft), was excavated by Richard ("Scotty") MacNeish and associates in the early 1970s. In the south chamber of the cave, under a massive rock fall, remains of ground sloth, horse, and other extinct species were found with flaked lithics in a series of cemented strata. Radiocarbon dates on bone extended back to ca. 23,000 RCYBP for the earliest stratum. Archaeologists have raised serious questions about the evidence for human occupation in the lower four strata, from which MacNeish defined a Pacaicasa complex; but his subsequent Ayacucho complex, from two strata dated between ca. 15,000 and 13,000 RCYBP, includes pebble tools and many flakes of lithic materials that are exotic to the cave, and several shaped bone points. It appears that Paleoamerican hunter-gatherers were in the Ayacucho basin very early, before the extinction of Pleistocene fauna.

Guitarrero Cave, excavated by Tom Lynch in the late 1960s, is a deep rockshelter in a quartzite outcrop overlooking the Santa river valley, at the same elevation as Pikimachay, 2850 m. Unfortunately much of the site had been disturbed by looters of later prehistoric tombs. The preceramic stratigraphic zones were best preserved in the rear of the cave. A date of 12,560 ± 360 RCYBP was obtained on wood charcoal from the lowest occupation level, in association with a number of flakes, a biface knife or preform, and a rhomboid projectile point; but four other radiocarbon dates on charcoal from the same fine orange sandy silt stratum averaged about 9500 RCYBP; and to confuse the issue further, three dates from the overlying coarse grey sandy silt stratum were between 10,240 ± 110 RCYBP and 10,535 ± 290 RCYBP. More cultural material was obtained from this second stratigraphic zone; and in the front of the cave, an intact dry midden deposit that could be correlated with it produced perishable artifacts and food remains.



P. LAURENT

A typical Paiján point.

Guitarrero Cave is one of the very few early archaeological sites in the Peruvian highlands in which perishable materials have been preserved. From the early levels there are examples of cordage with simple knots; and fragments of twined baskets, and twined bags or nets. Various local plant fibers were used; and unmodified fiber plant remains, possibly gathered and stored for later use, were abundant in the early midden.

Of special interest are the remains of food plants preserved in the early midden at Guitarrero Cave. Represented are common bean, chili pepper, possibly squash, and a variety of Andean tubers and fruits. C. Earle Smith and Lawrence Kaplan, the project botanists, note that the bean and chili pepper are full domesticates; and with dates of 10,600–8000 RCYBP assigned to the stratum in which they first appeared at the site, they represent the earliest cultivars known in South America. Significantly, these plants are foreign to the valley in which Guitarrero Cave is located: the wild forms are known only from the eastern slopes of the Andes, where they must have been first brought under domestication before ca. 10,000 RCYBP. From this observation it can be inferred that, although no early archaeological sites have yet been identified east of the Peruvian Andes, there must have been Paleoamericans on the eastern escarpment and likely in the Peruvian Amazonian lowlands by 10,000 radiocarbon years ago, early hunter-gatherers who had manipulated their rainforest environment to bring plants under domestication.

High life on the *puna*

It appears that Paleoamericans entered the high-altitude grassland plateaus of the central Andes, the distinctive environmental zone known as the *puna,* just as soon as glacial ice retreated to the high peaks and vegetation cover with animal populations was reestablished—at some archaeological sites, the earliest occupation debris rests directly upon glacially derived sediments. At 4000–4500 m elevation (ca. 13,000–15,000 ft), the extensive rolling grasslands of the *puna* are perennially cold and windy; and human physiology must also adjust to the oxygen-deficient atmosphere at such high altitude. The productive *puna* grasslands, however, supported abundant herds of camelids year-round. The Paleoamericans soon adapted their hunting practices to the particular habits of the resident camelid species like vicuña, which congregate in small territorial groups.

The early hunters camped in caves and rockshelters, and

MAMMOTH TRUMPET

skillfully exploited the camelid herds within local territories. One of the best-known sites is the cave called Pachamachay, excavated by John Rick in the mid-1970s. The cave, at ca. 4300 m elevation, is situated in a rock outcrop at the head of a steep slope, overlooking a large swale of grassland.

The lowest occupation zone at Pachamachay produced a radiocarbon date of 11,800 ± 900 RCYBP. Another high *puna* cave site to the south, called Telarmachay, excavated by Danièle Lavallée, produced a comparable date of 12,040 ± 120 RCYBP from the lowest occupation level. At both sites the occupation floors that succeeded the earliest occupations were dated around 9000 RCYBP. John Rick believes that the earliest dated levels at both sites represent brief occupations by small hunting parties from lower elevations that ventured onto the *puna* only seasonally. A colder climatic episode after 12,000 RCYBP may have also delayed permanent human settlement of the *puna*. By ca. 9000 RCYBP the caves on the high *puna* were being intensively occupied as residential base camps over extended periods of time, for much cultural material—bone and stone artifacts, flaking detritus, abundant bone refuse, charcoal and ash—accumulated on the cave floors. At Pachamachay there is evidence that a low stone wall was constructed across the mouth of the cave; and hides were likely stretched across the cave mouth as well, in order to obstruct the cold winds of the *puna* zone.

The artifact assemblages recovered from the early occupation levels in Pachamachay and Telarmachay indicate the tool kit of the camelid hunters. Projectile points make up a high proportion of the stone artifact assemblages. The early projectile point styles of the Peruvian *puna* are distinctive: small, and triangular or rhomboidal with slight shoulders. Large bifacial knives were used in butchering game, and a variety of flake scrapers were employed in processing skins for warm clothing so essential in this harsh environment.

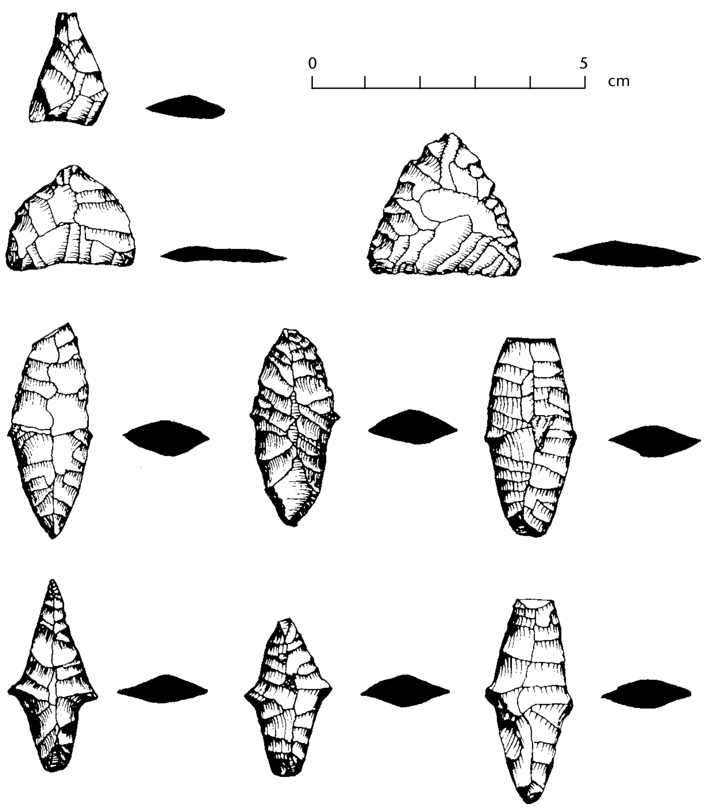
The evidence from Pachamachay and Telarmachay indicates that early peoples of the *puna* were specialized hunters who resided in the high country year-round, and exploited camelid herds within particular territories. In later millennia, beginning as early as 6000 RCYBP, camelid herds were brought under human control; and by 3500 radiocarbon years ago some species had become fully domesticated, the familiar llama and alpaca.

Pachamachay, on the high *puna,* was home to camelid hunters over 11,000 radiocarbon years ago.

What lies behind it all?

By the end of the Pleistocene, Paleoamericans had recorded their presence in all major environmental zones of Peru, and a marked cultural diversity is already evident by 11,000 RCYBP. From this observation alone, one can deduce that the very first Paleoamericans must have entered Peru substantially earlier. Indeed that deduction holds for the entire continent, for, as I have illustrated in this series of articles, every major environmental zone of South America was already occupied by well-adapted populations, maintaining diverse subsistence economies and distinctive technologies, by at least 11,000 RCYBP. In my concluding article, I shall review current evidence for a first arrival in the southern continent before 15,000 radiocarbon years ago.

–Ruth Gruhn



Projectile points from the earliest occupation levels at Pachamachay.

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Arlington Springs Woman

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was corrected in 1999 when the femora, still encased in the block of earth from Orr's excavation, were CAT scanned (computerized axial tomography). Overall measurements of the bones placed the individual's height at between 4-ft-2 and 5-ft-2. Compared with statistical data assembled by Dr. Phillip Walker, U. C. Santa Barbara, for skeletons from the Channel Islands that distinguished sex based on pelvic differences, the femoral diameter places it within the range for female skeletons. Moreover, the diameter of the femora also falls within the female range. Therefore Arlington Springs *Man* is now more appropriately referred to as Arlington Springs *Woman*.

Where we are today

What is the current state of our knowledge about Arlington Springs Woman and Santa Rosa Island?

- Based on relative and absolute data, researchers are currently confident that human and extinct mammal species coexisted on Santa Rosa Island at the end of the Pleistocene;
- the Pleistocene human remains are female;
- since the human bones were found in quite close proximity to a spring and since the bones were found at the bottom of an ancient slope, they were probably redeposited from the original location of demise.

Redeposition from the primary place of death introduces a measure of uncertainty about the stratigraphic position of Arlington Springs Woman. However, upcoming field investigations will utilize remote sensing techniques in an effort to locate likely locales for the original deposition of Arlington Springs Woman's skeletal remains. Johnson and an interdisciplinary team, including Stafford and Rockwell, returned to Arlington Springs in 2001 to study the site's chronostratigraphy. They obtained a series of dates on charcoal and sedimentary carbon in different soil layers to clarify the geological history of the site. Two dates bracket in particular Arlington Woman's age: a date of 11,580 ± 45 RCYBP from beneath the stratum in which her bones had been found, and a date of 11,250 ± 40 RCYBP from just above the soil layer that had contained her remains. Thus the date previously obtained on the well-preserved collagen in the *P. nesodytes* bone appears to be more accurate than that obtained on the badly degraded collagen in the human femur. Arlington Woman's true age thus appears to lie between about 11,200 and 11,580 RCYBP (13,200 to 13,500 CALYBP). In the 2006 field season, the research team will follow through with ground-penetrating radar investigations initiated last year.

There are many questions yet to be answered. Did humans rely on pygmy mammoths for subsistence? If so, were humans responsible for the extinction of the species?

Finding the locale where the bones were originally deposited might answer some of these questions. If the primary locale is discovered, tools or cultural evidence that might also be present can help to determine a more precise age for Arlington Springs Woman and give us insight into her lifestyle. What was the nature of her social group? Did she meet an untimely death? If she died of natural causes, did she die alone or with the assistance of her clan? Was she purposefully buried? Could the presence of a habitation site provide further evidence for a coastal adaptation or migration of humans into the New World? These are just a few of the questions begging answers about the oldest known woman in the New World.

Advances in technology give archaeologists new ways of looking at old data and thereby contribute to the arsenal of knowledge they use to fit together pieces of the puzzle. We can look forward to yet more knowledge as additional evidence is recovered from this most intriguing Early *Person* site, which Gary Haynes counts among the 20 known sites exhibiting evidence of the earliest human remains in the New World.

–Debra E. Dandridge

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Suggested Readings

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Clovis at Topper

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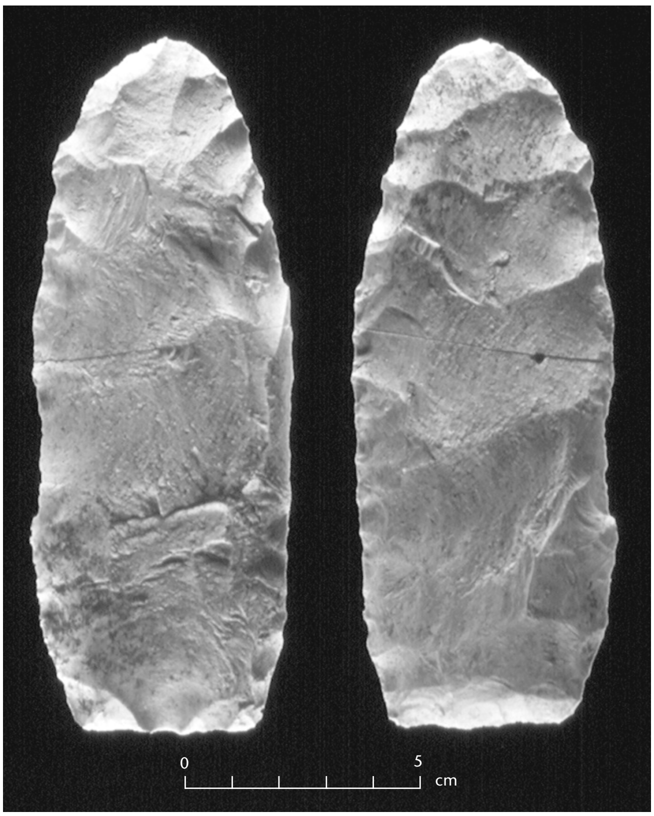
debitage from many generations of toolmakers collecting material. “Whenever it rains,” says Ashley Smallwood, a doctoral candidate from Texas A&M University and unit supervisor of the hillside unit in 2006, “you can walk and just pick up large pieces of Clovis flakes. I found a midsection that was really nice.” This is a very, very prolific site.

Cobbles from the river, polished by water action that scours off the limey cortex, have a distinctive butterscotch appearance. Shane Miller notes that river-cobble chert isn’t found in the pre-Clovis excavations. A clue to its absence may be the age of the colluvial deposits that cover the Pleistocene terrace, dated by geochronologist Steve Forman of University of Illinois–Chicago using OSL (optically stimulated luminescence) techniques at 14,000–15,000 CALYBP. (See **MT 18-3**, “Luminescence Dating of Quaternary Sediments,” for more on Dr. Forman’s dating Topper sediments.) It appears the chert outcrop became exposed just in time for Clovis toolmakers to make use of it. And use it they did, with the exuberance of children let loose in a candy store. Shane Miller concludes that “they weren’t really concerned with conserving the chert for future use.”



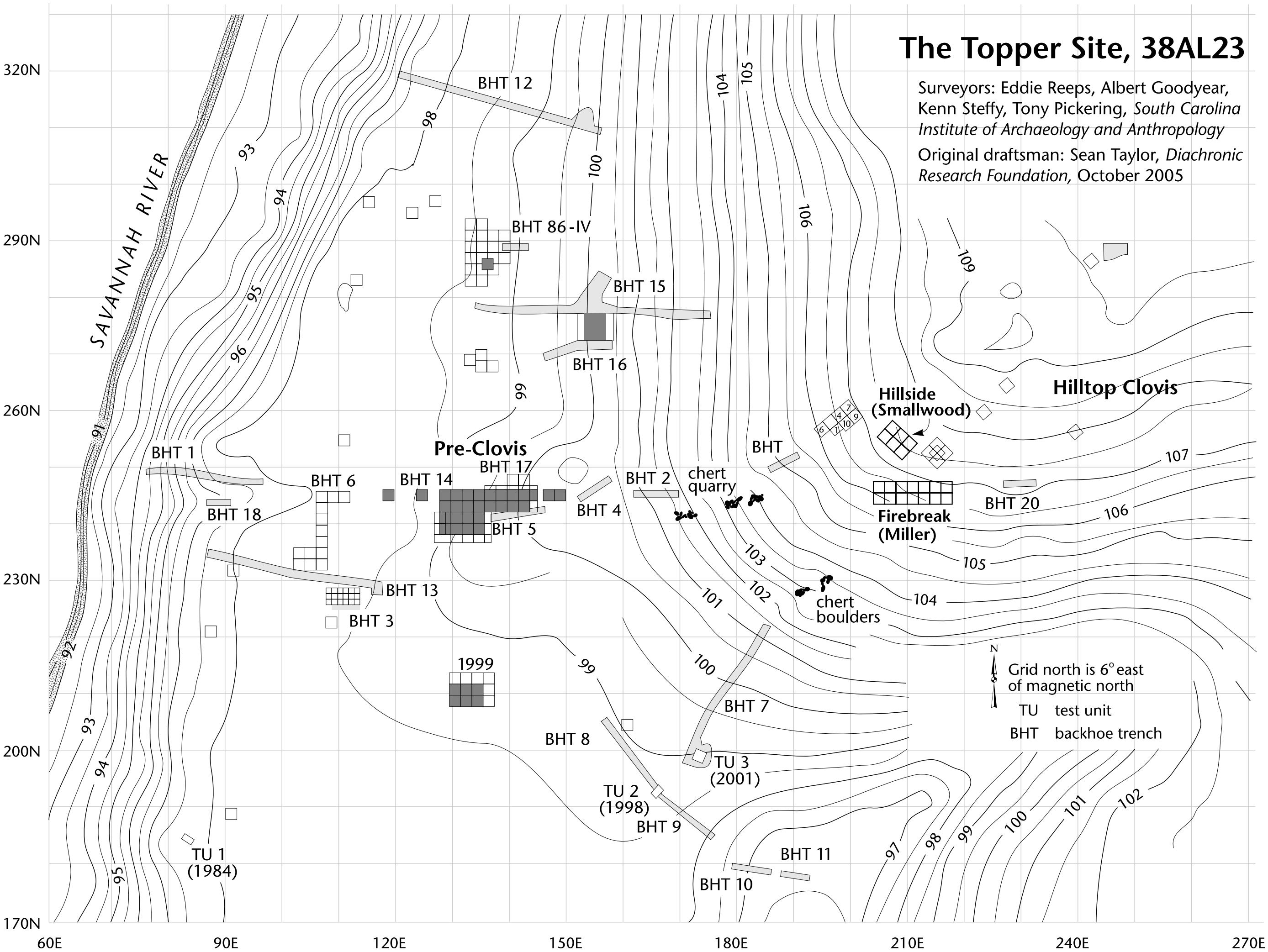
A site with a special quality

Probably the most important factor that sets Topper apart from other Southern Clovis sites is its rich quarry of Allendale chert. Goodyear doesn’t know of any major chert sources on the South Carolina coastal plain east or north of the Allendale sites. This means that Clovis people came here from quite a distance (an artifact of green rhyolitic tuff proves they came from as far away as North Carolina) just to work at quarry-related activities. Consequently, most of the artifacts found at Topper are production failures, typically broken preforms. A *completed* projectile point went into someone’s pouch or was hafted onto a foreshaft and was carried off, possibly eventually becoming a Clovis point turned up by a farmer’s plow in some distant field many millennia later.

This magnificent preform, nearly 6 inches long, is called “Alaina’s Sword” in honor of unit supervisor Alaina Williams, who found it. The broken preform was well on its way to being a finished spear point. The pieces refit beautifully—but probably not the heart of the knapper who broke it.

Although there is no evidence of long-term occupation at Topper (they have yet to find a hearth), people stayed there long enough to organize themselves, to set aside areas for different activities and to engage in camp activities. The camp tools we are finding—utilized flakes, for example, and scrapers and expedient tools—tell us they stayed there longer than just to complete quarrying activities. "We want to find out how these tools are distributed across the hilltop and down on the terrace," says Goodyear, because from this information it's possible to infer how they spatially organized themselves. In order to gather those data, you need to excavate large areas. "The 64-square-meter block Shane now has is our first step," Goodyear declares, and he has plans for even more ambitious excavations in the future.

Its geographical location flavored the kinds of camp tools we're finding at Topper. In Clovis times Topper was perched on an ecotone. To the north was a now-extinct cool, mesic, late-glacial hardwood forest extending from latitude 37 to 33, encompassing the classic mid-South. South of Topper, at latitude 33, down through northern Florida the environment was oak-hickory-pine forest, similar to what we see today. Warm summers and mild winters meant the occupants may have had little use for fur clothing, consequently no need of hafted endscrapers to prepare hides. Instead, diggers at Topper are finding denticulate tools probably used to work bark and fiber. "The advantage of working in a Clovis quarry," according to Goodyear, "is that you can reconstruct how all the bifaces were designed and made, *including* projectile points. There may be other biface types in there that don't lead to projectile points we don't know about. Hopefully, Ashley is going to find this out."

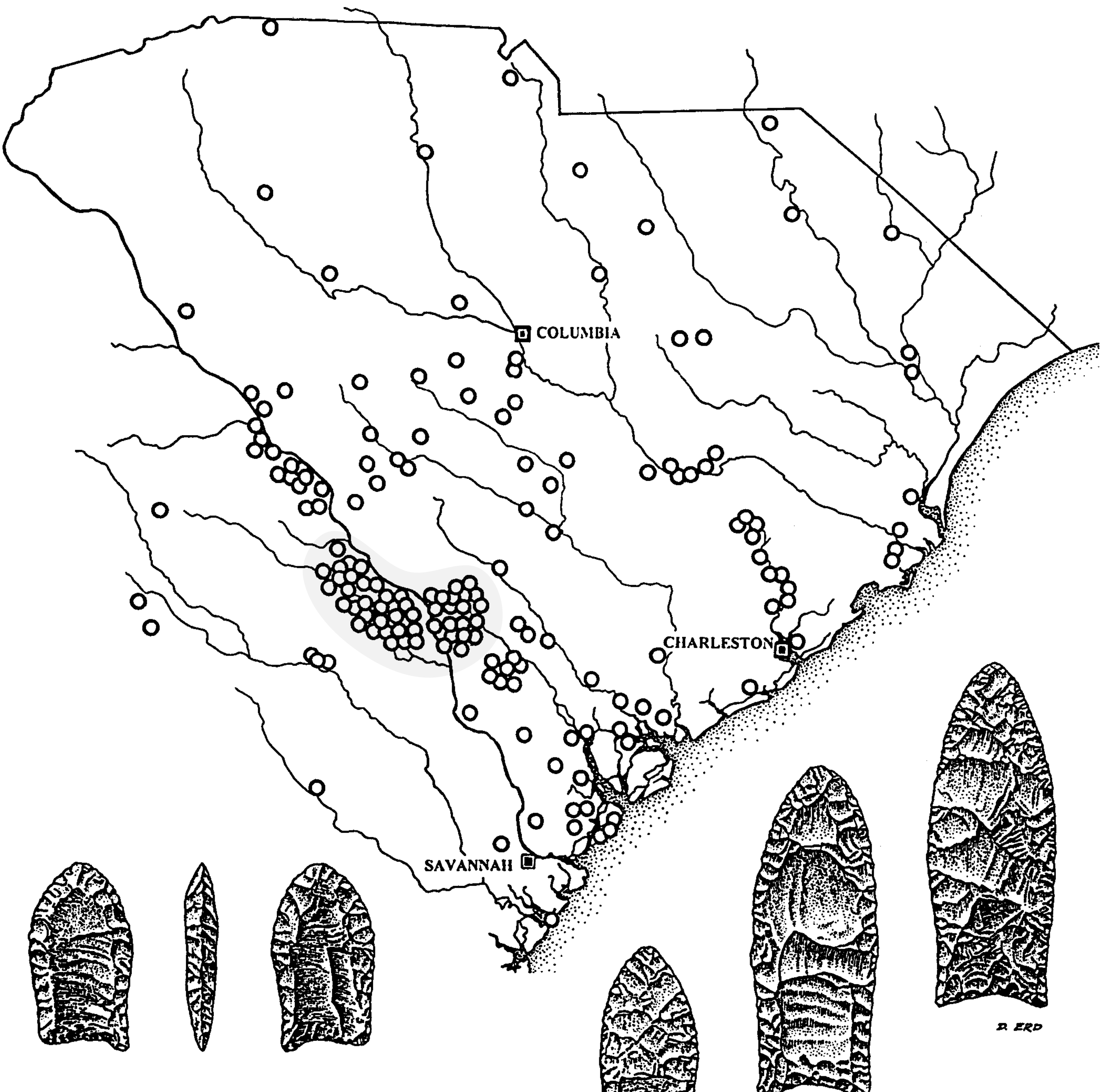


A unique classroom

We last ran into Ashley Smallwood at the Gault site in central Texas, where she was analyzing use wear on Clovis bifaces in preparation for her master's thesis (**MT 20-1,** "Assault on Gault"). At Topper, a quarry-related site, she is working under a different charter: to define Clovis bifacial technology.

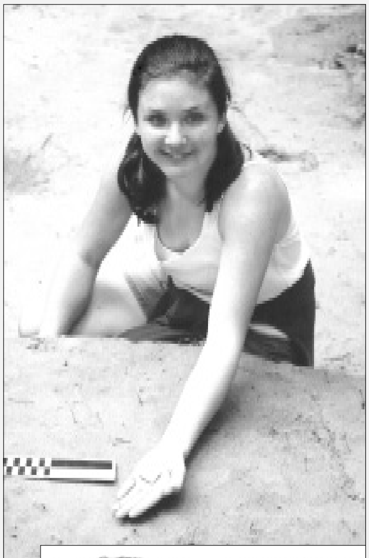
Goodyear describes her task well: "When you see a Clovis point, what you don't see because it's finished, whether in a plowed field or in a mammoth skeleton, is what it looked like *before* it got to that point. You've just got to go to a quarry, where you have examples of every stage, failure at different stages. They're all going to be rejects or failures or you aren't going to get them."

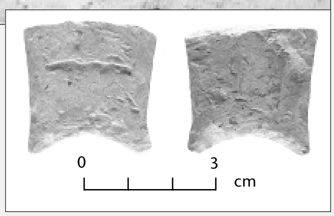
THE ALLENDALE-BRIER CREEK CLOVIS COMPLEX



This artwork, seen on many a T-shirt on the University of South Carolina campus, is more than an eye-catching graphic. Each dot is a Clovis point made of Allendale chert from the network of quarries shaded in gray that straddle the South Carolina–Georgia border. Most of the points are isolated finds owned by private collectors, painstakingly catalogued by Goodyear and his colleagues over the past 40 years. Their database, the South Carolina Paleo Point Survey, shown graphically in this artwork, now comprises 495 specimens.

The School of Hard Knocks



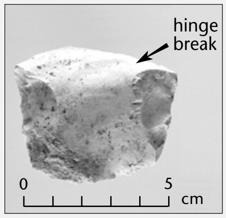


Ashley Smallwood, Texas A&M University graduate student, shows us here the base of a finished Clovis point (inset) recovered from the hillside excavation at Topper.

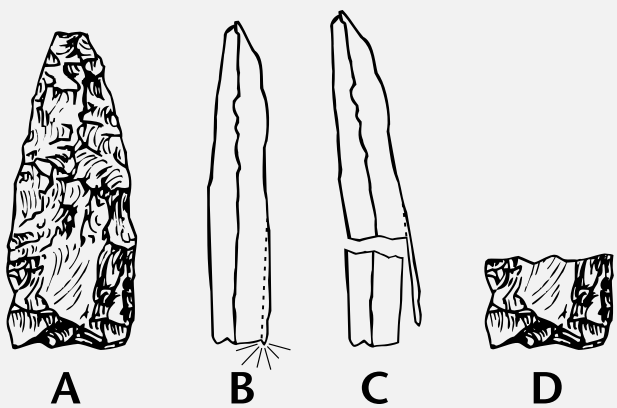
A principal goal of her dissertation is to describe general patterns of production failure, and the broken preform shown at far right is an excellent example of a common knapper's mistake. "I've pulled out six or seven of these just on the hillside," she says.

Clovis knappers reduced a large bifacial core to a late-stage preform by bifacial reduction. "In bifacial reduction," she explains, "they thin on the sides—lateral thinning—then on the ends, reducing the piece with that mechanism. They may alternate the actions; they're trying to maintain a sturdy width while narrowing and reducing the piece."

While reducing a preform similar to **A** below, the knapper attempted to thin the end with a hit from a hard hammer (**B**). But the thinning flake, instead of breaking away cleanly, plunged, or reversed inward (**C**), creating a hinge break that severed the distal end, leaving only the base section (**D**).



"This is a continual pattern I'm seeing," Smallwood explains, "and what is even more interesting to me is that, on the hillside at least, I'm not seeing those distal ends." She suspects that the frustrated knapper, hating to waste the time already spent on the piece, decided to rework the distal end into a usable tool.



Ashley Smallwood (*front*) and the volunteers who helped to dig the hillside excavation, May 2006: (*sitting*) Jonathan Pearson; (*standing, left–right*) April Gordon, Jim Way, Connie White, Ernie Plummer, Don Gordon, Joan Plummer, and Martha Christy. In all, nearly 100 volunteers helped out over a 5-week period in the 2006 dig on the Clovis and pre-Clovis excavations.

What Smallwood hopes to accomplish is to define the sequence of processes Clovis toolmakers used to reduce chunks of chert to bifacial tools and projectile points—what Claude Chauchat, principal investigator of the Paiján culture of coastal Peru, calls the *chaîne opératoire* approach to defining lithic technology. "I'm going to know their mistakes," she declares assuredly, "I'm going to know how upset they were, and I'm going to have a handle on all the problems and mistakes, and also all the clever maneuvers they used to remove and thin and end-thin and trim. I hope to get a good understanding of every aspect of it."

After learning the ins and outs of Topper bifacial technology, she wants to examine isolated point finds (those dots on the T-shirt map pictured on the previous page) to see how they became the end product of what she's finding at Topper. After all, if it weren't for private collections, she notes, all we would have is a quarry without end products.

Finally, she wants to look at the lifeways of Clovis people at latitude 33. What is their bifacial technology? Why is it important? How does it differ from that of Clovis people at higher latitudes?

If these plans weren't ambitious enough, Smallwood also intends to return to Topper next year. In 2006 her team dug four 2-by-2-m units in the hillside area. Next year she plans to excavate a 32-square-meter unit.

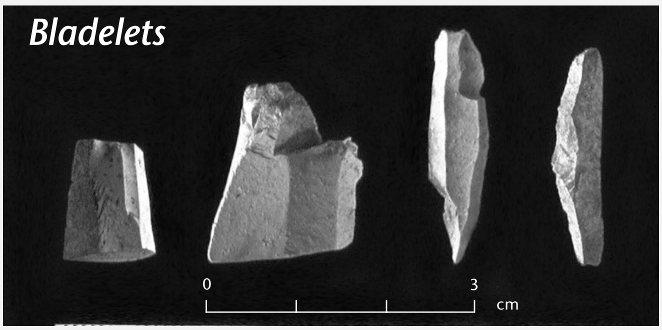
God bless enlightened patrons!

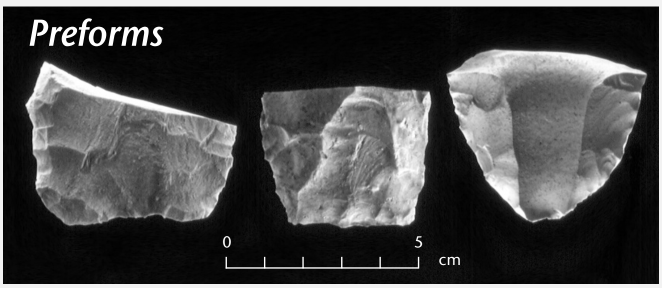
"It's an archaeologist's heaven," says Goodyear of the Topper site. He gives credit for his good fortune to the Clariant Corporation, a chemical manufacturer that owns 2,000 acres in Allendale County—which includes most of the Allendale chert quarries in South Carolina. For years they have been generous benefactors of Goodyear's Allendale Paleoindian Expedition. Not only do they protect Topper against vandals and pot hunters, they provide wonderful facilities on site for use by Goodyear, staff, and volunteers that include a kitchen and barbecue, showers, even a lab.

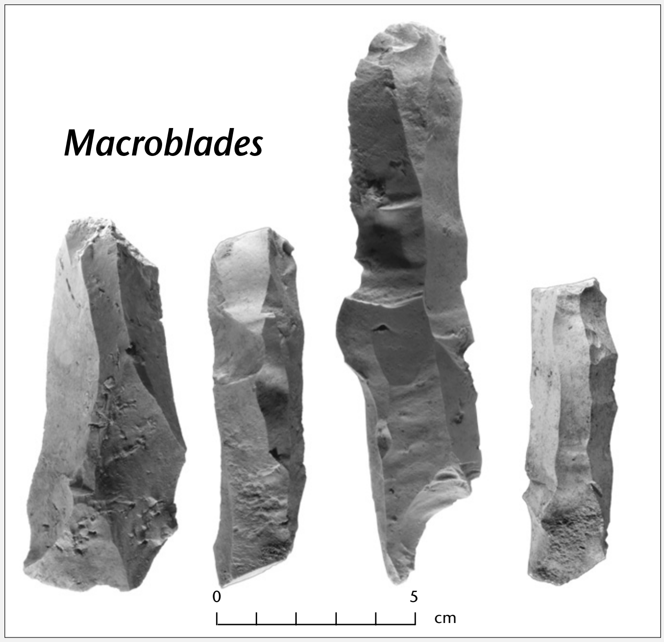
Apparently the satisfaction of knowing good science is practiced on their land is sufficient payment for Clariant. It matters little that the company is wholly Swiss-owned. Shane Miller observes that "when foreign owners of Clariant get over here for meetings, they want to run down and see what's happening." For his part, Goodyear reflects gratefully, "We have a major footprint on Clariant land. I'm becoming more aware of just how much we owe them."

Bona Fides of a Clovis Site

Here is a representative sample of lithic artifacts taken from the Topper site over the years. Goodyear had tray after tray of artifacts on display to dazzle visitors to the Clovis in the Southeast conference. Says Shane Miller of the hilltop excavations, "They are so rich, they're self-defining."







The future shape of Clovis

In September 2003 we published an interview with Michael Faught, then an assistant professor at Florida State University (**MT 18-4,** "Rethinking Clovis Origins: A Conversation with Michael Faught). His study of the distribution of fluted points convinced Dr. Faught that although the first Americans may have come from Northeast Asia, Clovis has its origins in the New World. "Given the abundance of Clovis materials found in the Southeast," interviewer Ariane Pinson writes, "Faught thinks the continental shelf off the western coast of Florida is a good place to start looking for early Clovis."

Goodyear considers Faught's theory that Clovis originated in the Southeast "a very viable idea, simply based on the great concentration of [fluted points] in the mid-South. From Kentucky to Alabama we see an extraordinary number of Clovis

Base camp at Topper for staff and volunteers includes kitchen and bathing facilities, all courtesy of the Clariant Corporation.

points." He is keeping an open mind to the possibility that Clovis people, equipped with their distinctive lithic technology, suddenly intruded upon the continent nearly 14,000 years ago; the theory is supported, he allows, by radiocarbon dates, all grouped within 400 or 500 years.

"On the other hand," he counterargues, "I don't think we can now rule out the existence of even low density levels of human beings in North America prior to Clovis." The question to be resolved, as he sees it, is, Was this a continental cultural intrusion (the traditional Clovis-first model), "or are you simply looking at a demographic threshold that was reached in North America—and as far as I'm concerned, maybe in the mid-South area—where humans that were here in small far-flung groups somehow coalesced into something we call *Clovis*?"

With the talent Al Goodyear has for infecting volunteers and young scientists with his energy and enthusiasm, it appears that Clovis secrets don't stand much chance of remaining secret.

–*JMC*

▲ The pre-Clovis excavation at Topper. The roofed structure was built with money from individuals, volunteers, and banks, together with a sizable contribution from Clariant Corporation. Thanks to the generosity of Clariant, the facility will soon boast a viewing platform spacious enough to accommodate 30 visitors and elegant signs that will identify significant features to viewers. On 21 October 2006 Goodyear will host a tour and dedication of the Topper Pavilion for donors, volunteers, and Clariant officials.

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Clovis in the Southeast Conference
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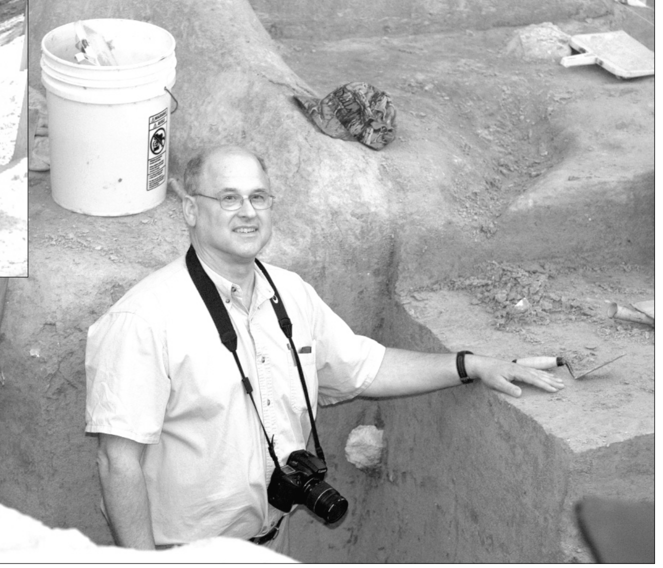
For information on how to become a volunteer at Topper
Web site: www.allendale-expedition.net



Al Goodyear in the pre-Clovis excavation. ▶