MAMMOTH TRUMPET

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Center for the Study of the First Americans
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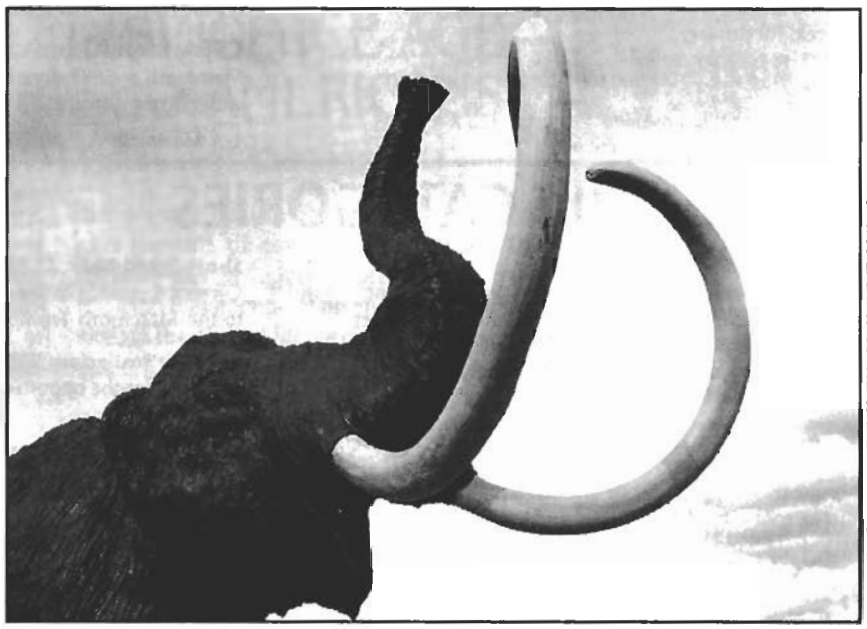
Pondering the Pleistocene

Pleistocene animals seem firmly associated with the Peopling of the Americas, but scientists are continuing to study the contexts and question the timing of correlations between humans and animals such as this mammoth, part of a display at the new Beringia Centre in Whitehorse, Yukon (article page 12). A cave in northeastern Ohio is revealing remains of many Pleistocene animals in association with artifacts (article, page 1). Meanwhile, methods of dating traces left by those mammoth hunters known as Clovis are still being debated (article, page 16).



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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 **Oregon State University,** promotes interdisciplinary scholarly dialogue among physical, biological and social scientists. The **Mammoth Trumpet,** news magazine of the **Center,** seeks to involve you in the late Pleistocene by reporting on developments in all pertinent sciences.

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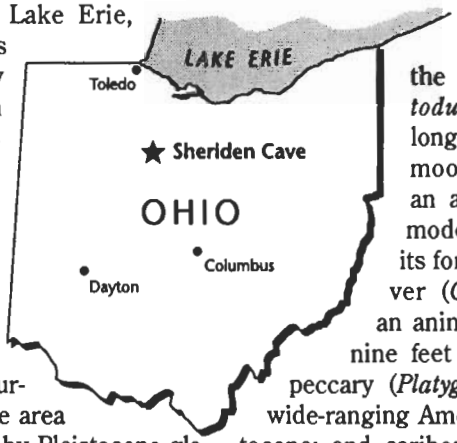
OHIO CAVE, SEALED SINCE ICE AGE, YIELDS DATA ON PALEO-AMERICANS

Absence of Evidence Proves No Evidence of Absence

From a deeply buried cave in northwest Ohio scientists have unearthed a treasure of Paleo-American artifacts and Ice Age fossils dating to almost 13,000 radiocarbon years ago. The apparent human occupation of such a cave came as a surprise to investigators.

Sheriden Cave is part of a cave system in Wyandot County that includes Hendricks Cave and Indian Trail Caverns. It is within the drainage basin of Lake Erie, which lies about 40 miles to the north. Topography is glaciated karst with numerous sinkholes and caves. The cave system was formed in a low ridge of Silurian dolomite—calcium-magnesium carbonate—a resistant reef of fossilized algae that rises about 50 feet above flat surrounding landscape. The area was repeatedly scoured by Pleistocene glaciation, and was deglaciated only about 14,100 years ago. These caves consist of a series of interconnected domes resembling "cabbage heads." The passage of Sheriden Cave is about 30 feet wide, 12 feet high and 600 feet long.



Kenneth B. Tankersley, an anthropologist at Kent State University and principal investigator for the Sheriden Cave project, says the site, discovered 30 feet below the surface, has produced more species from the late Pleistocene than most comparable sites in the United States of the Paleo-American era.

"This is an incredibly rich site," Dr. Tankersley said in a recent telephone interview. Investigators so far have identified several animals that now are either extinct or living in arctic areas. These include the short-faced bear (*Arctodus simus*), the giant, long-legged omnivore; stag-moose (*Cervalces scotti*), an animal that resembled modern moose except for its forked antlers; giant beaver (*Castoroides ohioensis*), an animal that reached up to nine feet in length; flat-headed peccary (*Platygonus compressus*), the wide-ranging American pig of the Pleistocene; and caribou (*Rangifer tarandus*). Other fauna identified include three species of vole, northern bog lemming, ermine, short-tailed mouse, pygmy shrew, porcupine, rabbit, turkey, fisher, and pine martin. There also are remains of fish, reptiles and amphibians. Overall, the fossils suggest habitats near the cave included a

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INSIDE

CSFA Honors Stanaway for Leadership

ROBSON BONNICHSEN

Anne Stanaway at the Mammoth Meadow site during the production of her "Archaeological Quest for the First Americans," available on videocassette from the **CSFA**.

Anne Stanaway, a documentary film maker with a deep interest in the peopling of the Americas, has been awarded the H. Marie Wormington Award for her tireless service to the **Center for the Study of the First Americans** over nearly a decade. The award, named in honor of Dr. Wormington, a leader in the study of earliest American prehistory, recognizes outstanding contributions to First Americans Studies.

As chair of the **Center**'s Advisory Board, Stanaway, a resident of Boulder, Colorado, worked to establish closer relations between the **CSFA** and Oregon State University and better communications between the Board and **CSFA** staff. She toured early South American sites with **CSFA** scientists in 1988 and was active in the World Summit Conference on the Peopling of the Americas in 1989. She is best known to **CSFA** members for her production "Mammoth Meadow: An Archaeological Quest for the First Americans," which is available on videocassette through the **CSFA** (See order blank).

Her personal contacts with financial supporters, scientists, administrators, and staff members have resulted in understandings and efficiencies that would not otherwise have been possible. Meeting at the University of Colorado in Boulder in October, the **CSFA** Board presented Stanaway the award stating: "By dint of her courage, her charm, her doggedness, her ability to motivate and to lead, she forged the Advisory Board into a positive force."

NGS Supported Cave Work

The article "Ancient Alaskan Bones May Help to Prove Coast Migration Theory," (**Mammoth Trumpet** 12:4) neglected to mention that work on the Tongass Cave Project by Kevin Allred, Fred Grady, and Tim Heaton was supported by a grant from the National Geographic Society.

MAMMOTH TRUMPET

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DICK REINHART

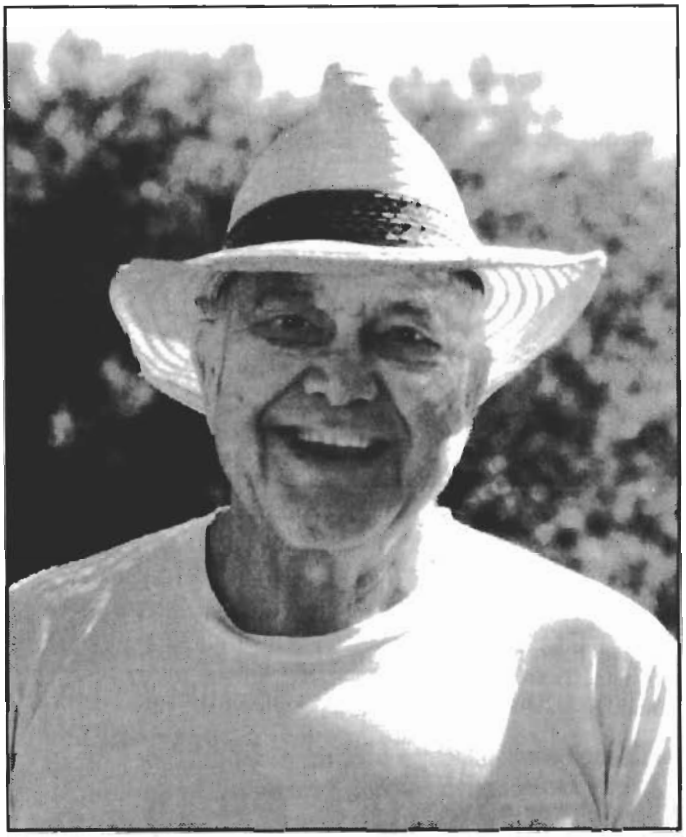
Engineer and archaeologist Richard E. Reinhart, 74, a longtime member of the **Center for the Study of the First Americans** Advisory Board, died Oct. 3 at his home in Nevada, Ohio. His passing is a major loss to all of us involved with the **Center.**

Dick was an IBM executive who did not become involved in archaeology until he took early retirement. He was among the first **CSFA** Board members who was not an academic administrator, and his practical know-how has proven invaluable to the **Center** over the years.

"Dick's real forte was in the field," says **CSFA** Director Robson Bonnichsen. "He was my chief field foreman for many years, and he always helped set up and take down camps." His extensive background in engineering and management proved ideal for field archaeology. "He provided important glue that held programs together," Dr. Bonnichsen added, noting that Dick's friendships with volunteer team members drew many people back to **CSFA** projects year after year.

Marvin T. Beatty, chair of the **CSFA** Advisory Board, agreed: "The field program of the **Center** would not have operated one-fourth so well had not Dick been there training new volunteers, organizing equipment, getting everyone going in the morning, making sure the cook was doing a good job, building new tools and equipment, and relaxing with the crew after a hot day," he said.

Dick was born in Harpster, Ohio, and graduated in 1940 from Nevada High School. Before joining the Navy in 1943, he worked for Swan Rubber Company and soon became a machine operator, supervising two employees. After serving aboard the *USS Knapp* in the South Pacific, where he took part in nine major battles, he entered Ohio Northern University in Ada, Ohio, and studied engineering. In 1950 he joined the IBM Corporation as a field engineer.



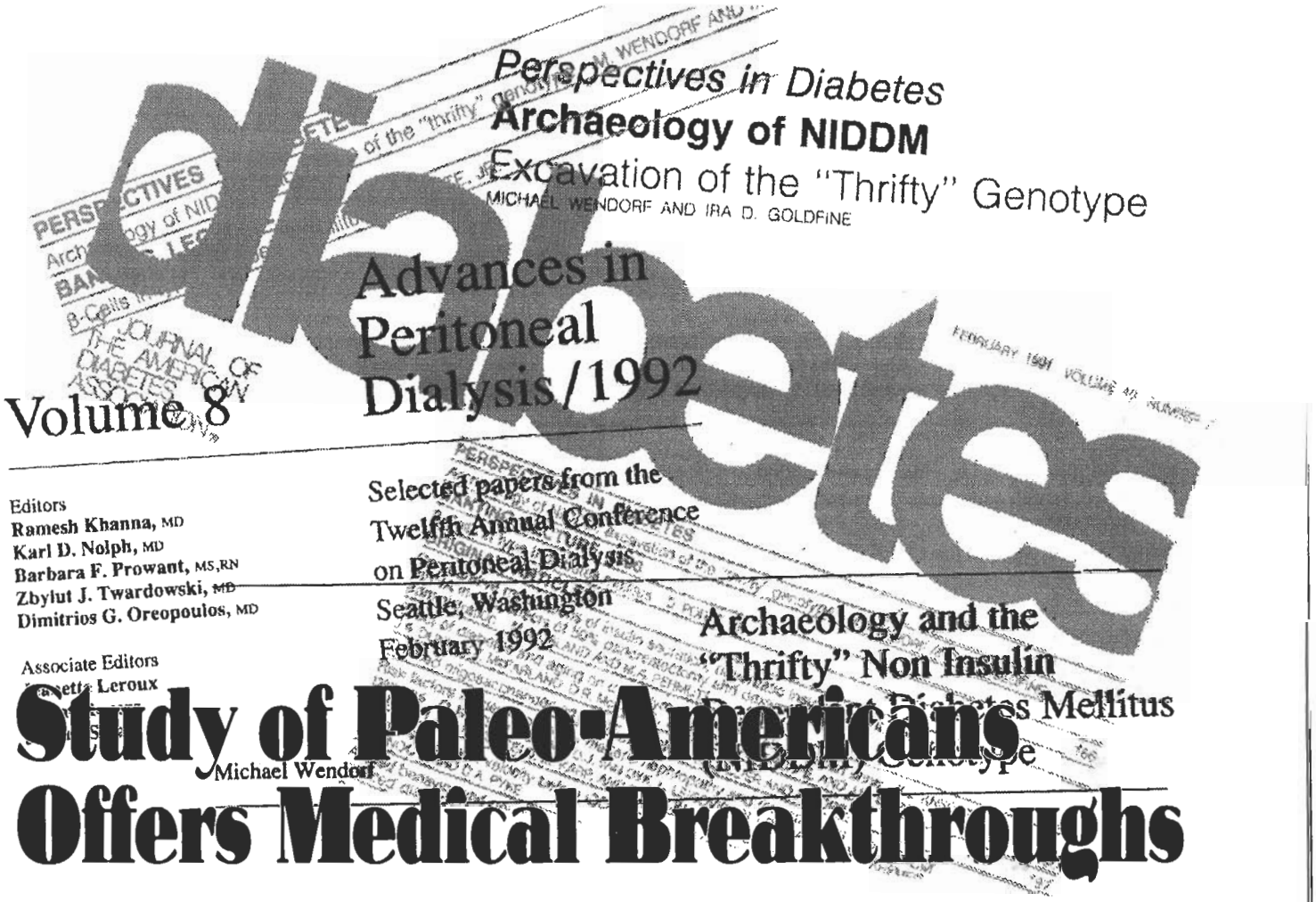
Dick Reinhart as CSFA field foreman in Montana in 1988.

In 1955 he transferred to IBM's development lab in Kingston, N.Y., working primarily in the development of large-scale computers and military units. He had secret clearance with U.S., French and British military and atomic-energy units. In 1971 he transferred to the IBM World Trade Corp in Nice, France, and in 1977 he returned to IBM USA as manager of its Electromagnetic Interference Group. Later that year he retired from the company and entered the State University of New York–New Paltz, to study archaeology and anthropology.

He participated in various digs in the Hudson Valley, and in 1980 he participated as a volunteer at Bonnichsen's Munsungun Lake project and he continued on the project until 1984. In 1981 he entered SUNY–Albany, where he received his master's degree in 1983. He was with the scientific team that chose the Mammoth Meadow site and worked with **CSFA** teams during every summer of work there. He continued to work at the **Center**'s Montana sites through the summer of 1996.

He took pride in Ohio's Paleo-American sites and would have been delighted to read our article in this issue on the Sheriden Cave site, less than 20 miles from his hometown.

"His practical enthusiasm, genial manner and long experience won't be replaceable," said Dr. Beatty, a soil scientist. "We will try to build on the base he laid."



Study of Paleo-Americans Offers Medical Breakthroughs

Michael Wendorf

Ancient Skeletons Could Hold Key to Medical Questions

SCIENTIFIC INVESTIGATION of Paleo-American skeletons has the potential to benefit the health of today's Native Americans, says a medical researcher who has been examining the ancient settlement of western North America for clues to the origin of diabetes.

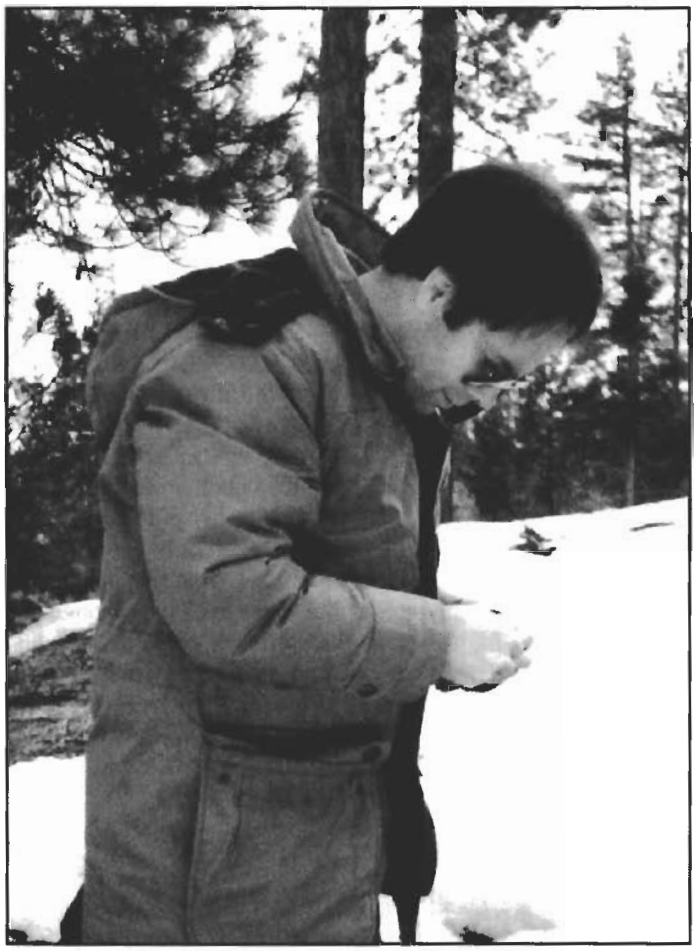
"Well-preserved Paleo-American skeletons are extremely rare," says Dr. Michael Wendorf, a researcher at Kaiser Permanente in Walnut Creek, Calif. "Data from each are priceless and could potentially benefit the health of American Indians today."

He stressed the importance of permitting tests to provide information on the diet, health, and age at death of individual skeletons such as the Buhl Woman, discovered in Idaho in 1989 and reburied in 1991, Kennewick Man, discovered in 1996 and subject to continuing controversy, and the Spirit Cave Man, discovered in Nevada in 1940 and curated at the Nevada State Museum.

"Such data could contribute to our understanding of the etiology of non-insulin-dependent diabetes mellitus, a chronic disease that has recently become a widespread health problem among American Indians," says Wendorf, who has a Ph.D. in anthropology from the University of California at Berkeley, His dissertation was on Paleo-American settlement of southern California. He says that non-insulin-dependent diabetes mellitus is a heavy health burden for Native Americans, contributing to retinopathy, kidney disease, amputation, and complications in pregnancy.

Wendorf cites statistics on a variety of diabetic complications suffered by Native groups. Non-insulin-dependent diabetes, he notes, ranks sixth as the underlying cause of death among Native Americans, and it contributes to mortality from several other causes of death including heart disease, cerebrovascular disease, pneumonia, and influenza. The age-adjusted diabetes-associated mortality rate among native groups is four times the rate for Euro-Americans. Europeans, Africans and Asians also are not as likely to have the disease as are descendants of prehistoric populations of Australia, Oceania and North America.

"Current data indicate that the presence of NIDDM [non-insulin-dependent diabetes mellitus] in American Indians is correlated with the time that their ancestors first migrated from Asia into North America," Wendorf told the **Mammoth Trumpet.** "NIDDM is most common today among American Indians who are descendants of the Amerind migration that is thought to have occurred about 12,000 years ago." For example,



Michael Wendorf doing field work near a glacier.

Wendorf said, Pima people of the Southwest, descendants of an early migration, have a much higher rate of diabetes than do NaDene peoples, who are believed to have come to the Americas much more recently.

"Variation in NIDDM rates between different Amerind tribes indicates that the susceptible genotype was actually selected in North America and is not due to a 'founder effect' in the Amerind populations." Founder effect refers to a genetic trait, possibly unusual, present in a population of people that all descended from a founding population with that particular trait.

Non-insulin-dependent diabetes was formerly known as adult-onset diabetes, because it primarily has afflicted older people. It can be triggered by a victim's diet and weight, and stress. Unlike victims of insulin-dependent diabetes, victims of NIDDM are capable of producing insulin and they may be able to control the disease by changes in diet and life-style.

Scientists have long known that non-insulin-dependent diabetes runs in families, and Wendorf notes that many researchers view the disease as a result of a "thrifty gene," which helped earlier generations through lean times. The thrifty gene hypothesis proposes that a genotype—the genetic constitution of an individual—that allowed survival during famines through efficient storage of fat, leads to obesity—and diabetes—in times of plenty.

Because populations in which non-insulin-dependent diabetes is now common inhabit different environments, Wendorf says that it appears highly unlikely that a diabetic genotype was an adaptation to any particular environment. "The NIDDM

Those Rarest of Rare Treasures

Discovered in a gravel pit near Buhl, Idaho, in January 1989, the partial remains of an individual that has come to be known as the Buhl Woman were dated by accelerator mass spectrometry (AMS) to 10,675 ± 95 (Beta 43055 and ETH 779) radiocarbon years before present. A physical anthropologist examined and measured the skeleton. In accord with Idaho state law, the Shoshone-Bannock Tribes took possession of the bones and reburied them on the Fort Hall Indian Reservation in December 1991 (**Mammoth Trumpet** 7:2 "Idaho Burial Suggests Life of Hardships").

The skeleton now known as Kennewick Man, found alongside the Columbia River in July 1996 in Kennewick, Wash., was subjected to limited analysis before it was taken into custody by the U.S. Army Corps of Engineers (**Mammoth Trumpet** 12:1 "Discovery of Ancient Skeleton Raises Trying Rights Question"). A small sample of the bone subjected to AMS assay yielded an unadjusted radiocarbon age of 8,410 ± 60 years (UCR 3478), or an adjusted age of about 9,300 years. The disposition of the skeleton remains in dispute.

Though housed at the Nevada State Museum since 1940, the skeleton now known as the Spirit Cave Man (**Mammoth Trumpet** 12:1 "A Remarkable Discovery") was not subjected to radiocarbon analysis until the mid 1990s when samples of hair unexpectedly yielded AMS dates of about 9,350 years. Another Paleo-American skeleton in the Nevada State Museum collection, known as Wizard's Beach Man, has yielded a similar date. Remains of both have been studied by some leading physical anthropologists, and Paiute tribes have asked for repatriation of the bones.

Another example of Paleo-American remains found in recent years is the Hourglass Cave Man, a partial skeleton found in a cave in the Colorado Rockies in 1988 (**Mammoth Trumpet** 12:1 "8,000-year-old Cave Explorer Challenges Research Team"). The remains were subjected to extensive examination by physical anthropologists and DNA was extracted. Uncalibrated AMS dates from samples of the bone were 8,170 ± 100 years (Beta 38554/ETH 6765) and 7,714 ± 77 years and 7,944 ± 84 years (AA-11808). The bones were reburied by the Southern Ute Tribe, and the U.S. Forest Service has declared Hourglass Cave a sacred site, closed to the public.

The scientific value and the rarity of Paleo-American skeletons have been reported in a number of **Mammoth Trumpet** articles in recent years: "A Database on Humanity's Past" 12:1; "Ancient Peoples Do Not Fit into Today's Categories" 12:3; and "As Scarce as . . ." 11:3.

genotype may have been an adaptation to the process of colonizing new worlds—Australia, North America and Oceania—in prehistoric times."

Wendorf's own research has shown that a thrifty gene could have been selected for during the settlement of Australia, North America and Oceania. "In each of these colonization events, extinctions and unfamiliar foods evidently caused unusually frequent food shortages that selected the 'thrifty gene' in founding populations," he explained. "During the colonization of Australia and North America hunter-gatherer populations needed to find new food resources at a time that a significant part of the available fauna was becoming extinct. Similarly, during the settlement of Oceania by farming populations, the native food resources on each island were reduced or became extinct while introduced crops were being established to support the population. From Australia and Oceania to North America, food resources that were critical became scarce before alternative foods were available, and this led to frequent food shortages in founding populations."

The Kennewick Man skeleton could yield information about diet and life-style that might reduce the incidence of non-insulin-dependent diabetes—which ranks sixth as the underlying cause of death among Native Americans.

Wendorf says food shortages in Europe, Asia and Africa evidently were not as frequent as in Australia, the Americas and the Pacific Islands; hence there was not as strong a selection for the thrifty gene among African, European or Asian populations.

"If the 'thrifty' diabetic genotype was in fact selected long ago in several populations in different parts of the world, why has diabetes emerged only recently as a major health problem?" Wendorf asks. He suggests some likely reasons: changes in diet from foods high in fiber to calorie-dense, high-fat foods; decreases in expended energy; and a deficiency or excess of some micronutrient in the diet.

Scientists have made many studies of the effects of diet and

Reading Pathology and Genetics

Remains of ancient people offer new lines of evidence in the campaign against disease. Medical anthropologists have generally relied upon studying people of the present and making inferences about their ancestors, based on genetic features of the modern people and on what is known of their ancestors' culture and environment. This approach can tell us something about people of the past who have descendants today, but it offers little or no information about people of the past who left no descendants.

Study of pathology expressed in the bones, teeth and other tissues of ancient people is a way around this problem, and it is being supplemented, slowly, with genetic studies. Many genetic models of disease still depend to some degree upon conjecture, because the data linking genes and disease are still being discovered.

A few success stories have been reported recently, as researchers are developing techniques to identify traces of diseases left in bones or in mummified human remains. Sometimes the genetic trace is the DNA left by the infectious agent or parasite. An example is the identification of DNA from the parasite that causes Chagas' Disease in mummified tissue of people who lived in the Atacama Desert in Chile more than 4,000 years ago. This work by pathologists Marvin J. Allison of the Medical College of Virginia, Arthur C. Aufderheide of the University of Minnesota at Duluth, and others, is reported on in "Paleopathological Puzzles" in the Aug. 30, 1997 *Science News*.

Other genetic traces that are being pursued are mutations in the skeletal remains of the individual that expresses the disease. Geneticist Douglas C. Wallace explains the potential for this line of evidence in an article, "Mitochondrial DNA in Aging and Disease" in the August, 1997, issue of *Scientific American*. Dr. Wallace, director of the Center for Molecular Medicine at Emory University, says that non-insulin dependent diabetes mellitus (NIDDM) may be related in part to mutations in the mitochondrial DNA.

Physical anthropologist Emőke Szathmary, who specializes in genetics, has done long-term studies of glucose metabolism in peoples of Northern Canada. In her article "Non-Insulin Dependent Diabetes Mellitus Among Aboriginal North Americans," in the 1994 *Annual Review of Anthropology* (23:457–82), she reviewed some of the complexities of NIDDM that demonstrate why the etiology of the disease among North American Native peoples poses a significant challenge that requires looking at a number of populations in different climatic environments. Further, she notes, "no aboriginal North American population is immune from the ravages of this disease."

Diabetes is one of the disorders often referred to as "Western diseases." Populations whose life-styles have changed from active to sedentary at the same time that their daily caloric intake has increased have been dramatically affected in recent decades by NIDDM. While NIDDM poses a significant health risk to every ethnic group in the U.S. today, particularly high prevalence rates have been found in some Native American populations and some Pacific populations. Both biological and cultural factors appear to be involved in producing NIDDM, and the biological factors appear to include, but are not limited to, genes that make an individual susceptible to the disease under certain environmental conditions.

life-style on non-insulin-dependent diabetes, and Wendorf notes that it has been found that for diabetic Australian Aborigines, traditional diets and life-styles can improve metabolism of carbohydrates and lipids. Also, he says studies among Pima peoples living in remote mountains of northwestern Mexico have shown that a traditional diet and life-style protects against diabetes.

Such research, Wendorf argues, offers great promise for uncovering the causes of non-insulin-dependent diabetes, though no effective prevention of the disease has been found.

"The problem is that we know very little about the diet and life-style of Paleo-Americans and other founding populations over time. We need to know how early Paleo-Americans lived, what they ate, how diets and life-styles have changed over time, and how they have remained the same. It is possible that modern food-processing techniques are removing too much of a critical nutrient that was once part of the diet." As an example, Wendorf cites chromium picolinate, which has been found to significantly reduce the triglyceride levels in patients with NIDDM. High levels of triglycerides in the pancreas may coincide with the onset of non-insulin-dependent diabetes.

Further, he notes that grains, consumed in minimally processed forms, seem to reduce the incidence of diabetes. "What specific change in diet and life-style now triggers NIDDM?" he asks, referring to New World peoples that are suffering high rates of diabetes. "It could be a reduction in fiber, an increase in fats, a decrease in some micronutrient, or some complex interaction of life-style and a particular nutrient.

"Without more data on American Indian diets and life-styles through time, however, we can only speculate about what has changed." If Kennewick Man is truly more than 9,000 years old and if he belonged to a population that was ancestral to modern Native American peoples, Wendorf adds, "scientific analysis of this skeleton could provide data vital to diabetes research."

Wendorf says that a number of studies of Paleo-American skeletons are crucial. "The relationship to modern American Indians needs to be determined through morphometric measurements, dental characteristics and DNA analysis," he says, noting that the antiquity of an individual needs to be verified with additional radiocarbon dates. "A single radiocarbon date could be in error." Because the material is so rare and precious, Paleo-American skeletons are radiocarbon dated with great prudence and care, because even with accelerator mass spectrometry, a bit of the bone is consumed with each test.

"Studies of stable isotopes and plant phytoliths from the skeleton could tell us what the individual was eating and in what proportions." This information, he added, could be used with data from other sources to document how diets of Native American peoples have changed over time. "Perhaps we could identify one or two critical elements that were always present in the American Indian diet but were recently removed. These elements could then be tested in properly controlled intervention studies to reduce the prevalence of NIDDM in American Indians today."

Age at death and overall life-style of a Paleo-American also are of crucial interest. "How long did this person live?" Wendorf asks. "Is there any evidence of repeated dietary stress that might have selected for the 'thrifty gene' in his population?" Further questions: how active was this person? How far did he or she range each year in search of food? Did he or she engage in any repetitive activities? Answers to these questions could have important implications for understanding the causes and beginnings of non-insulin-dependent diabetes in Native American populations.

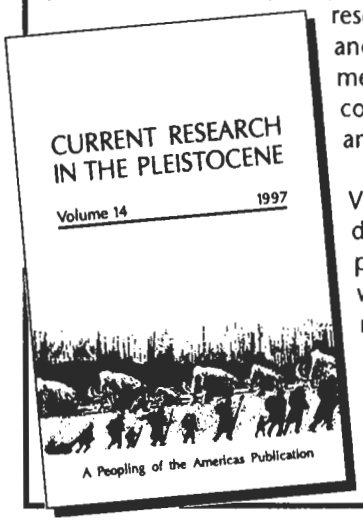
"The Kennewick Man skeleton," says Wendorf, "could yield valuable information about diet and life-style that might be used to reduce the prevalence of NIDDM in American Indians. Much like vitamin C prevents scurvy and iodine prevents goiters, there may be a critical element now missing from the diet that prevents NIDDM." He noted there might be other beneficial applications for data from the skeleton, citing autoimmune rheumatoid arthritis and autoimmune diabetes. "American Indians have a high prevalence of autoimmune rheumatoid arthritis, but virtually no autoimmune diabetes," and Wendorf suggests that skeletons of Paleo-Americans possibly could help explain why.

Even if Kennewick Man or another Paleo-American skeleton proves not to be ancestral to living Native Americans, Wendorf says the remains could be critical to diabetes research. "It would provide an opportunity to study the diets and life-styles of other early New World populations," he said, giving researchers a chance to compare the ancient person's diet and life-style with the adaptive patterns practiced by people who were the ancestors of living Native American peoples. "Were they the same or did they differ in important respects? Such comparative studies are often an important source of insights for resolving research problems. In this particular situation, successful research results could improve the life expectancy and quality of life of millions of U.S. citizens," says Wendorf.

–DAH

CRP 14 the Biggest Ever

Another volume of ***Current Research in the Pleistocene,*** the largest ever, went to the printing plant in November, and editor Bradley J. Lepper is receiving papers for the 1998 edition, Volume 15. *Current Research,* published by the **Center for the Study of the First Americans,** provides a multidisciplinary look at work in progress by researchers in late-Pleistocene and early-Holocene environments. *CRP* Volume 14 contains more than 65 papers and is 200 pages long.



To facilitate publication of Vol. 15, editors have set the deadline for submitting papers for Feb. 15. Otherwise, rules for submissions remain unchanged. Scientists on our *CRP* mailing list should have received a call for papers. If we missed you, please let us know.

Sheriden Cave

continued from page 1

marshy pond, open woodland and a grassy transitional zone.

Tankersley, a geoarchaeologist who has much experience studying Paleo-American sites and cave sites, was startled to learn that Sheriden's fossil-bearing Pleistocene deposits contained artifacts. These include wood charcoal and burned bone, chert debitage, a flaked-stone side scraper, an end scraper, a graver, and a biface.

Perhaps more exciting, the cave deposits contained a carved, incised and beveled bone point that Tankersley says is comparable to similar objects recovered from Nenana sites in Alaska and from Clovis sites in Washington, Wyoming, Arizona, New Mexico and Florida.

Although none of the artifacts was found in situ, radiocarbon dates from screened and floated material found in association with the cultural material, and documented in situ bones, range from 12,611 ± 80 years B.P. (AA-21710 on wood charcoal) to 12,973 ± 60 years B.P. (CAMS-10349 on bone collagen from a flat-headed peccary). Overall, Tankersley said, investigators have 13 radiocarbon dates on material associated with the cave, including four dates ranging from 10,065 to 11,213 radiocarbon years ago on material from an early-Holocene sediment layer, which caps the layer where the archaeological materials were found. Flooding that occurred at the beginning of the Holocene aided understanding of cave deposits.

ALL PHOTOS: KENNETH B. TANKERSLEY

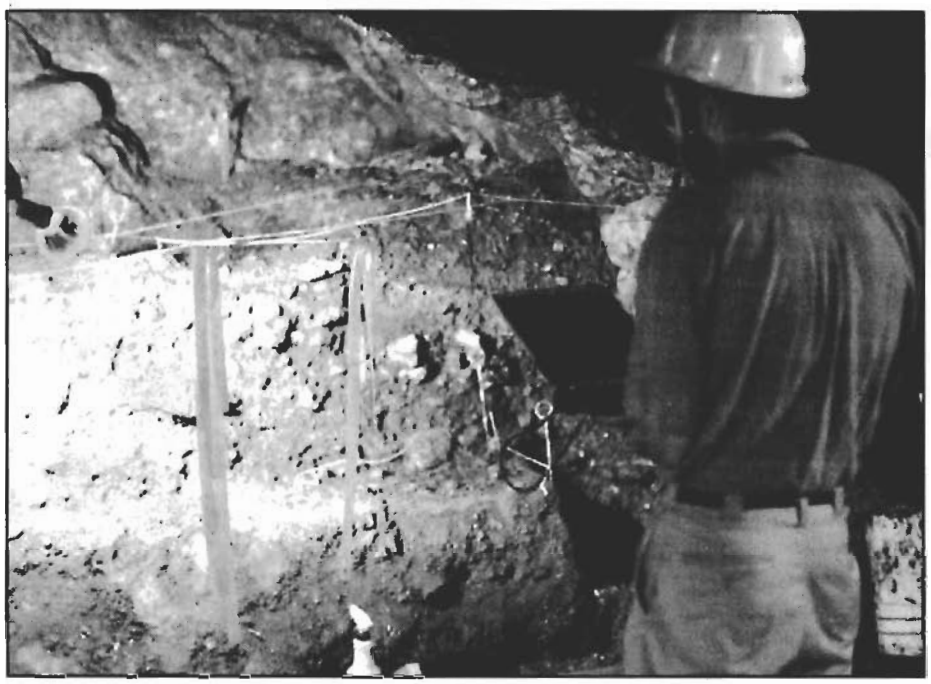
Principal investigator Kenneth B. Tankersley, right, is pictured in the Sheriden Cave passage with Barbara Barrish of the Cleveland Museum of Natural History. Electric floodlights allow team members to see what they are doing.

"After artifacts were deposited, the cave was flooded and sealed," says Tankersley. "Therefore we know it was occupied prior to those dates." He notes that the tight sediment seal also left bone material well preserved. Investigators have recovered sediment samples stratigraphically linked to the artifacts, and these samples contain hair that Tankersley hopes will provide a DNA link with bone material in the cave.

The unexpected discoveries began in 1990 when landowner Richard Hendricks sought to expand an existing commercial cave system. Initially the entrance of Sheriden Cave had appeared as a sinkhole, an extensive, shallow circular depression about 12 yards away from the commercial entrance to Indian Trail Caverns. In July 1990, Hendricks hired a crane to excavate unconsolidated deposits from the depression. The deposits proved to be cave-ponded sediments—yellowish silt—rather than glacial drift. At about 10 meters below the surface, the excavation broke through a cave passage on the sinkhole's west side.

Excavators lowered a small bulldozer into the hole to open the passage, which was partially filled with sediments. The bulldozer soon encountered layers of dark, organically rich cave deposits. Workers, who found concentrations of charcoal and bone in cave walls and

On a wooden platform over the Pleistocene deposits, Carol Landefeld of Kent State University lies on her side under the sloping cave ceiling to excavate.



Robert Brackenridge of Dartmouth College uses a notebook computer as he studies the cave's sedimentology. Floodlights illuminate the profile of late-Pleistocene sediments (above).

backdirt, reported their discovery to the Ohio Historical Society, which notified H. Gregory McDonald, then curator of vertebrate paleontology at the Cincinnati Museum of Natural History. McDonald conducted a paleontological investigation until 1992. Under Kenneth M. Ford's direction, the museum continued to dig there through 1995.

A volunteer found what appeared to be a side scraper in 1990, but Tankersley felt confident that the cave could not have harbored human occupation. "I argued that there was just no precedent for this type of site," Tankersley said. "But I was wrong. There are a number of Florida sites that set a precedent."

In 1995, Ford, now a doctoral student in paleontology at Michigan State University, discovered the carved bone tool in material from about 30 feet below the surface. Tankersley visited the site and saw chert debitage from a source 140 kilometers away. He applied for and received a grant from the National Science Foundation for salvage archaeology on the site during the 1996 field season.

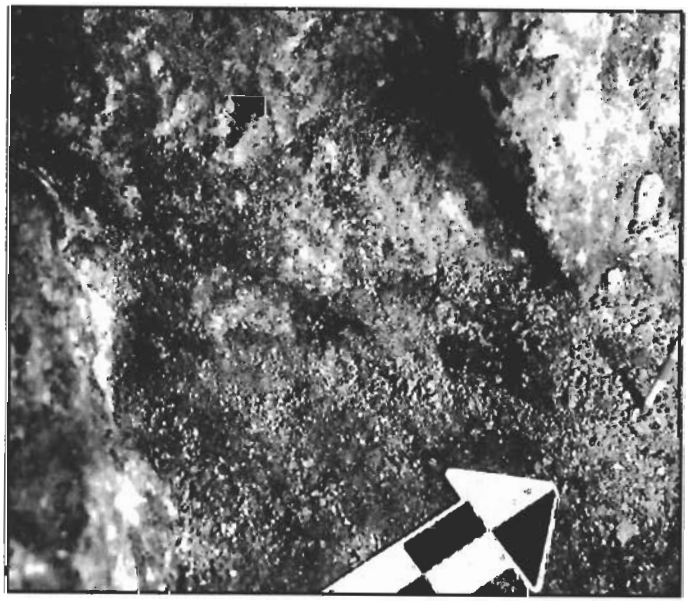
Existence of Paleo-American material in the deeply buried cave has prompted Tankersley to readjust his thinking on human use of caves and the depth at which they might be found,

Collection and analysis is a slow process—and tricky: during spring and fall baseball-sized rocks rain down.

particularly in eastern states. Tankersley said that, like many of his colleagues, he previously saw no evidence that humans had used these sorts of caves. He had spent much of his professional life looking without success for human occupation in other similar caves.

"It finally hit me that people have been right when they were saying that the archaeology for early peopling of the Americas is deeply buried, particularly in the East." How many archaeologists would be willing to dig through 30 feet of sterile sediment to find such an occupation, he asks, and what funding source would back such a project?

"This has been a sobering reminder that the absence of evidence is not evidence of absence, and that we can't assume that if we don't have any surface manifestation of human occupa-



An intriguing carbon concentration. Were carbonized plant materials burned here, or did the carbon migrate in from the surface? Arrow indicates where bone point was discovered.

tion that it doesn't exist," Tankersley said. "We have to look at this deeply buried context and we have to begin some systematic work to find these ancient deposits, particularly in the East. This cave is telling me that there are a lot of things that we don't know. This site has given us a new place to look for evidence of peopling of the New World that we had pretty much written off."

Tankersley believes Sheriden Cave is not a one-of-a-kind site. It is highly possible that other such sites exist, and researchers should begin a concentrated effort to find them. Deep sites such as Sheriden Cave also harbor a wealth of well-preserved environmental information capable of showing the environmental problems to which early people had to adapt. A better understanding of that early environment also leads to a more complete understanding of the cultures operating within it, Tankersley suggests.

Crew members Carl Syfranski and Mike Kagelmacher work from a wooden platform over cave deposits.

In a joint project with the Cleveland Museum of Natural History, Tankersley undertook a systematic examination of the cave the bulldozer had opened. Now, although the antiquity of the site is firmly established, investigators still have much to do to flesh out the Sheriden Cave story in coming field seasons.

Tankersley says the interdisciplinary research team intends to focus on establishing a temporal and environmental framework for the archaeological record, more closely distinguishing between natural and biological process and those resulting from human behavior, and more clearly determining what human behaviors left artifacts behind at the site.

Tankersley also seeks a more complete analysis of bone and hair recovered from the site. "The genetic possibilities offered by this site are exciting," he says. More geochemical analysis remains to be done on sediment samples to pinpoint, for example, the location for burning of carbonized plant materials—to determine if it was burned where it was found or migrated to that layer from the surface. He also plans to examine the suspected hearth in more detail to firmly establish its identity and significance.

As part of continued analysis, scientists will study the taphonomic process of material movement to determine how the buried artifacts and material may have moved around within the sediment.

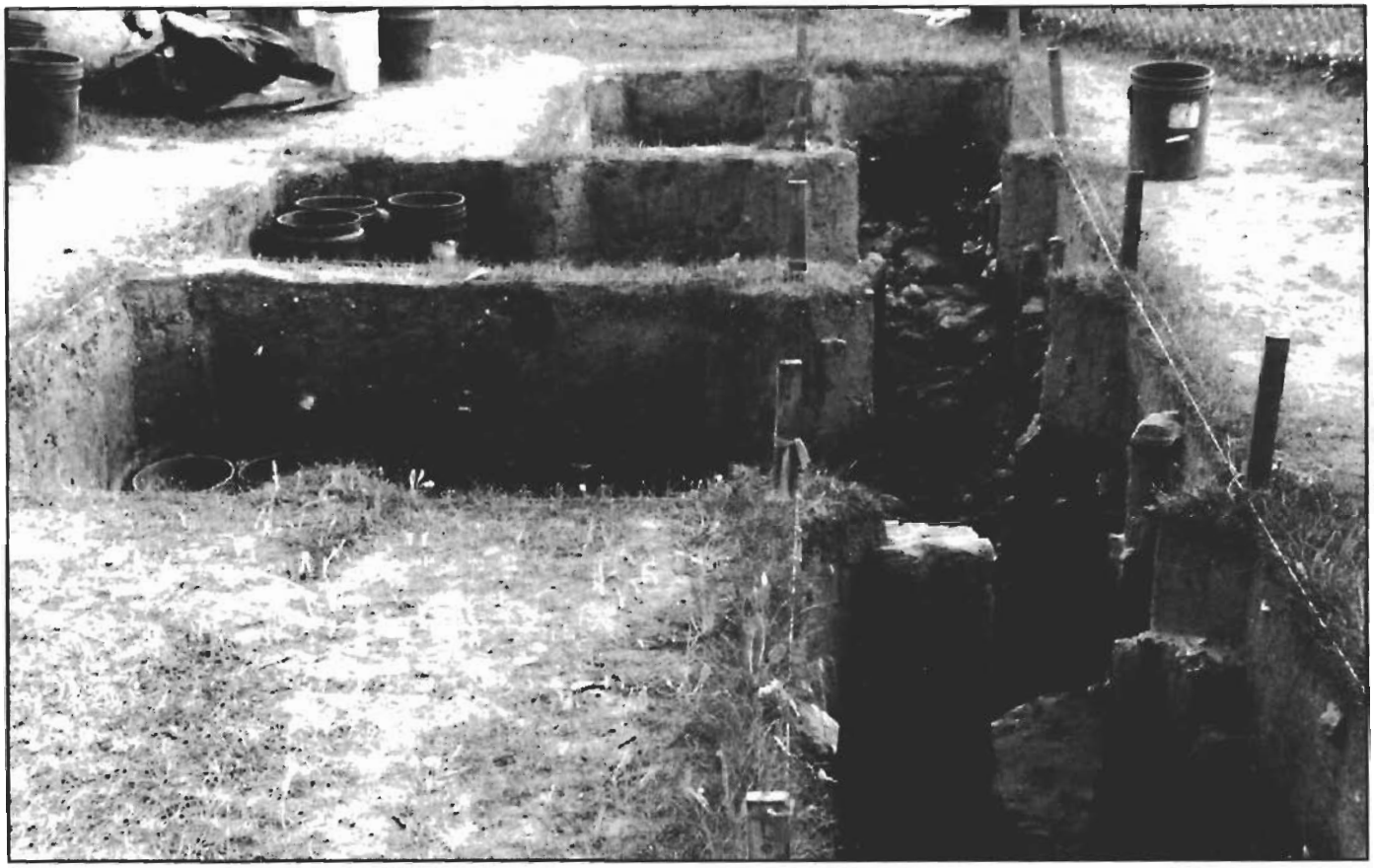
"We know for a fact that the 12,611 B.P. date goes with the cultural occupation," Tankersley said. "But we want to know if it is possible some of the artifacts are trickling down to deeper levels with some of the older dates."

Tankersley also wants to see more detailed analysis of the flora, fauna and artifactual material to see how it all fits together so that consistencies and inconsistencies can be identified. Specialists also will prepare a three-dimensional map illustrating how the cave filled in.

Continued collection and analysis will be a slow process. Work at the site is complicated by the fact that the cave, closed since the last Ice Age, is rapidly deteriorating now that it has been exposed. Tankersley says that it is unsafe to be in there during spring and fall, because baseball-sized rocks rain down from the cave walls and ceilings.

Until scientists collect and analyze

Ladder provides access to the platform over cave deposits.



Tankersley's team did a considerable excavation in front of the cave to analyze surface deposits.

more data from the cave, Tankersley says it isn't possible to fully explain why and how early people were using the cave. But he trusts the scientific team to secure the answers. The team includes Brian Redmond and Francis King from the Cleveland Museum of Natural History; Robert Brackenridge from Dartmouth College, who is doing the sedimentology; Donald Steirman from the University of Toledo, who is doing remote sensing; paleontologist Greg McDonald, now with the National Park Service; and Lucinda McWheeney from Yale University, who is performing the paleo-environmental analysis.

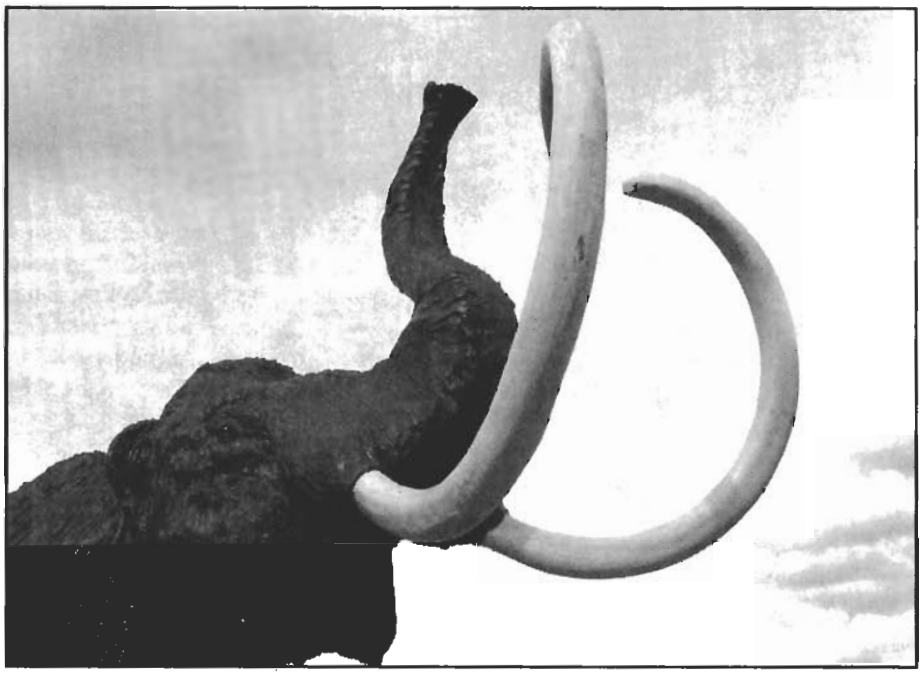
Although the reason for artifacts in the cave is still uncertain, Tankersley suggests several possibilities.

From existing environmental and geologic information, scientists know that the time period of occupation was a dry, karst environment, with available water being underground and not at the surface. Maybe they were in the caves seeking water—as were other animals. Or perhaps the cave could have been an overnight stopping spot on a hunting or foraging expedition, or maybe it was used to escape bad weather. Could it be that all the artifacts washed in from the surface?

Because the cave apparently was enticing to animals and served as natural traps or dens for them, humans may also have entered to scavenge or hunt animals trapped, denning, or dying there.

Tankersley says Sheriden Cave serves to remind him that archaeologists should remain open-minded. "George Frison [retired University of Wyoming archaeologist] told me many times that we still do not have all the answers, and he is right. We still don't have all the answers."

–George Wisner



YUKON BERINGIA INTERPRETIVE CENTRE, GOVERNMENT OF YUKON

The Yukon Beringia Centre's bull mammoth was modeled from the Hebior Mammoth, found butchered in Wisconsin.

Ontario Specialists Re-create Mammoths

A FAMILY of woolly mammoths was sighted this past summer in the Yukon Territory near milepost 915 just outside the town of Whitehorse. Excited Alaska Highway motorists have observed the stolid creatures standing patiently in front of the newly opened Yukon Beringia Interpretive Centre.

Made of fiberglass and resin, the three life-size castings depict a mama, papa, and baby mammoth, and are based upon actual Ice Age mammoths recovered by paleontologists and archaeologists. In its first four months after installation, the outdoor family diorama drew in more than 45,000 people to see the new museum's exhibits, says Rob Conrad, Coordinator of the Beringia Centre.

"The mammoths are a big hit," says Jeff Hunston, director of the Heritage Branch of Tourism Yukon. "That was a wise stroke of genius to stick them out on our lawn because kids are drawn to them."

The mammoths were created by Research Casting International, of Oakville, Ontario, one of the few companies in the world specializing in reproductions of prehistoric animals. Owner Peter May explains that 90 percent of the work of their 11-person company involves fossil skeletal mounts, while the other 10 percent focuses on casts of the entire specimen, which was done with the Beringia Centre mammoths. May believes his company has mounted more *Tyrannosaurus rex* specimens than any other company in the world.

With an art degree in sculpture from Ontario's University of Guelph, May had originally planned on being a sculptor working in clay. Twenty years ago, after obtaining his art degree, he was working in a steel plant and saw a classified ad seeking someone who knew how to make molds and casts, enjoyed camping and field work, and was mechanically inclined. The ad was for a paleo-technician at the Royal Ontario Museum. May got the job.

Over the years, as he became more experienced, he began to receive commissions to do dinosaur mounts that he initially worked on in his garage. This gradually evolved into his present-day multi-person business that has taken him all over the world.

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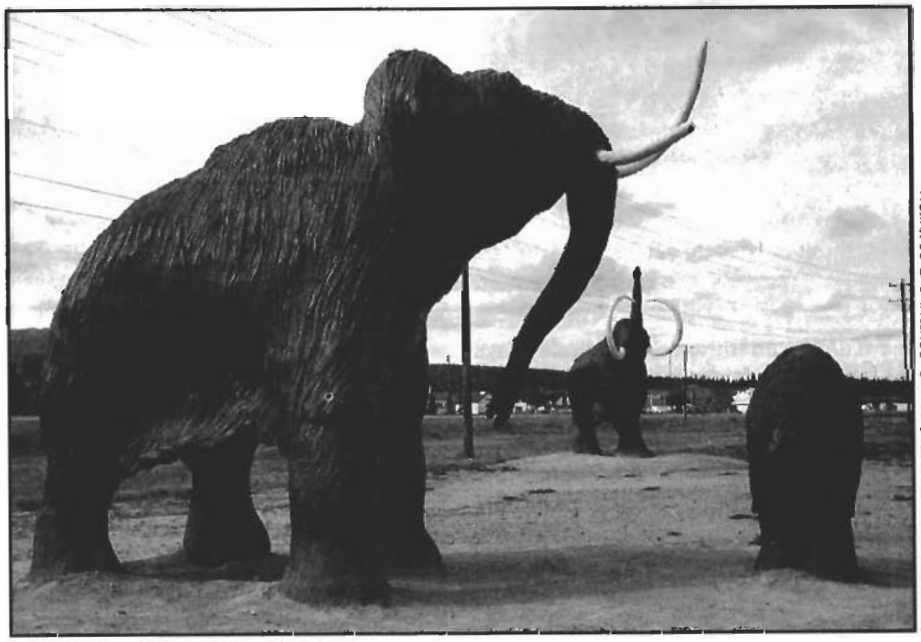

YUKON BERINGIA INTERPRETIVE CENTRE, GOVERNMENT OF YUKON

Mother mammoth is a Yukon specimen, complete with a broken tusk. The baby is modeled on Dima, a celebrated Siberian discovery.

Colorful magazine a flagship for archaeological conservancy

AS A LOBBYIST for the Society of American Archaeology during the 1970s, Mark Michel gained a keen interest in protecting and preserving the rapidly vanishing cultural heritage of the Americas. He also realized there was no organization mobilized to support archaeology the way groups such as the Nature Conservancy, the Sierra Club, or the Audubon Society support the environment—often by acquiring important or threatened natural areas.

Concerned about that void, Michel launched the Archaeological Conservancy in 1980. As 1997 draws to a close, he also stands at the helm of *American Archaeology*, the quarterly general-interest magazine of archaeology in the Americas. It serves as a flagship for Conservancy programs and accomplishments, which have been considerable.

Backed by membership dues and corporate and private donations of land and money, the Albuquerque-based organization has so far identified and acquired approximately 150 archaeological sites as research preserves. The sites range from Colorado's Lamb Springs Pleistocene bone bed near Denver to the 18th-century settlement of Old Mobile, the first capital of French Louisiana, Michel explained in a telephone interview. The Conservancy raised about $200,000 to acquire the Lamb Springs site; the DuPont company donated 31 acres for the Old Mobile project.

Both sites have been featured in the fledgling magazine *American Archaeology*, which Editor Rob Crisell says is devoted to the ambitious task of "showing the scope and breadth of American archaeology from Central America north t0 Canada" while illuminating Conservancy efforts to save America's cultural heritage.

Modeled after *National Geographic* magazine for editorial content, readability and colorful graphics, the magazine seeks a balance between a writing style understandable by the layman and content designed to inform and educate readers with a minimum knowledge of, but substantial interest in, archaeological subjects. Readers of initial issues, for example, got sprightly yet informative stories on topics ranging from excavations at Old Mobile (Spring, 1997), through the continuing search for the First Americans, and a history of maize farming in the Americas (Summer, 1997) to an introduction to Maya archaeology through exploration of the rise and fall of Xunantunich (Shoo-NAN-too-NEECH), an ancient Maya city in Belize (Fall, 1997).

Michel concedes the magazine is an expensive venture, costing about $25,000 an issue to publish. But private donors have guaranteed payment of publishing costs for five years, he added, at which time the magazine is expected to be a break-even proposition.

Less than one year old, the 32-page magazine, an outgrowth of a smaller and less polished Conservancy newsletter, has exceeded expectations, Crisell said in a telephone interview. Beginning with an initial circulation of 13,000 to Conservancy members, the circulation after only three issues has increased by 70 percent to 22,000, according to Michel.

"I'm thrilled beyond my hopes," he said of the magazine's progress. With a sale price of $2.95, the magazine is now being test marketed to the general public in a variety of bookstores and museums.

"We hope that it will soon be easily accessible and that people can pick up a copy anywhere across the United States," said Crisell, who expects the magazine soon will jump to 40 pages, and be published six times a year. Although excited with his start-up effort as editor, Crisell is moving up within the organization to become senior editor and one of five regional directors for the Conservancy. The new position makes him responsible for saving sites in the Conservancy's Eastern region, which stretches northward from North Carolina.

James Burroughs, formerly editor of an Atlanta–based magazine, is assuming Crisell's duties as *American Archaeology* editor. Although the magazine operates with largely a one-person editorial staff, the Conservancy's nine staff members, including Michel, write and help produce it.

Michel says the system has its good and bad points.

"What's nice is that we are not primarily a magazine publisher and we are not pretending to be," said Michel. "We are an organization that happens to publish a magazine. The bad part is that we only do it four times a year." But that limitation is offset by the magazine's financial subsidy for the first five years—smoothing out the financial instability faced by most magazine startup ventures relying for survival on advertising—while sustaining a top-quality editorial product.

A part of the Archaeological Conservancy for little more than one year, Crisell, a Yale graduate in religion and philosophy and former science editor

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Communication

Clovis Clarification: A Follow-up

by A. C. Roosevelt

The July 1996 issue of **Mammoth Trumpet** paraphrased our April 1996 article in *Science*, that "most dates for Clovis sites, by contrast [to the dates on palm fruit pits from the earliest culture in the cave at Monte Alegre, Brazil, Roosevelt et al. 1996], have come from tests of combined wood charcoal samples." In the October issue of the **Trumpet**, a correspondent wrote to suggest that most North American Clovis sites were dated using tusk or bone, not charcoal, and asked which Clovis sites were dated by charcoal. Clovis sites that he thought had been dated by tusk or bone were Clovis (Blackwater Draw Locality 1), Rawlins, Dent, and Stolles.

However, the majority of dated samples from components of the High Plains Clovis culture were indeed charcoal, not bone or tusk, as the accompanying table of Clovis dates shows (sidebar). Of the 35 Clovis samples dated, 21

*A. C. **Roosevelt**, Field Museum of Natural History, Chicago, and University of Illinois, Chicago; coauthors are **Matthew O'Donnell**, Field Museum; **Ellen Quinn** and **Judy Kemp**, University of Illinois; **Christiane Lopes Machado**, Field Museum; **Maura Imazio da Silveira**, Universidade de São Paulo; and **Marcondes Lima da Costa**, Universidade Federal do Para Belem.*

Famous Clovis Sites Neglected?

Three decades after initial discoveries at Arizona's best-known Clovis sites, tight federal budgets have caused the sites to fall into neglect. Scientists, including the University of Arizona's Paul Martin, have criticized the U.S. Bureau of Land Management for allowing the Lehner and Murray Springs sites to be eroded by wind and water. The former, on the ranch of Ed Lehner, yielded the first Clovis radiocarbon dates. Murray Springs is perhaps even better known for having yielded an undisturbed Clovis hunting camp in stratigraphic context that was described in detail by its principal investigator, C. Vance Haynes, University of Arizona geo-archaeologist.

Both Lehner and Murray Springs sites have been incorporated into the San Pedro Riparian National Conservation Area more information about the late Pleistocene. Dr. Martin decried the situation to a Tucson reporter who wrote about the controversy for the journal *Science*. "These sites are some of the most sacred in the New World, but they're being left to the wind. They're washing away in the rain." It's a matter of origins, mammoth kills, and "critical knowledge about earliest America," Martin is quoted in the Aug. 15 *Science* article, "BLM Accused of Neglecting Clovis Sites."

Visitors to the Murray Springs site do find a path and two wooden bridges over Curry Draw, a dry wash. And the BLM intends to install an interpretative kiosk and signs.

Visitors to the Murray Springs site east of Sierra Vista, Ariz., see the eroding banks of a dry wash. Scientists have urged federal land managers to divert water from desert cloudbursts away from the site. Excavations here from 1966 to 1971 revealed three major areas of Clovis activity including a mammoth kill and an associated campsite.

BOTH PHOTOS: WORDS & PICTURES UNLIMITED

A path circles the vicinity of the Murray Springs site where archaeologists have recovered an assemblage of 85 stone tools and more than 12,000 pieces of debitage. The site probably still holds information about Clovis people.

were charcoal; only 8 were bone or tusk. Lehner and Murray Springs are the best-known Clovis sites dated by charcoal. Lehner's 12 charcoal dates average 10,930 B.P. (uncalibrated weighted mean), and the 8 from Murray Springs average 10,900. The dates from these sites were on samples pooled from scattered charcoal flecks because no single pieces were large enough to date by conventional means.

Samples from pooled small charcoal flecks have dating problems for several reasons. Small carbon samples have much larger standard errors and are more vulnerable to contamination than large samples, which can be cleaned more rigorously and counted longer (Taylor 1987; Bowman 1990). Because pooled flecks come from a wider area than discrete samples, they may include both pre- and post-occupation materials. Also, wood charcoal is known to have inherent age that predates its use by humans (Bowman 1990:15, 51). A tree is used for firewood many years after it begins to grow, and the interior parts of logs, with the oldest rings, tend to carbonize more readily than the younger, outer parts, which tend to ash. Only the outer sap wood gives accurate dates for the time of cutting, and it is rarely preserved. Jack Hofman of the University of Kansas has shown that charcoal from late-prehistoric plains sites can be around 300 years older than associated dates on well-preserved bone (Hofman 1995). Dry temperate areas tend to have longer-lived trees than moist, humid areas, where trees may survive only about 50 years (Mozeto et al. 1988).

Realistically, then, the dates on charcoal from Clovis sites will overestimate the sites' ages to some degree, but Clovis charcoal dates usually are quoted without any adjustment for inherent age. Short-lived parts of food plants, such as fruits, nuts, or tubers, will, in contrast, date close to the time they were eaten but, unfortunately, are usually not recovered from High Plains Clovis sites.

In theory, bones of animals used for food by Clovis people should be good sources of carbon for dating, but in practice, Clovis bone dating has been difficult because of poor preservation of the organic fractions. The mineral, or hydroxy apatite, fraction can take in geological carbonate from the ground, and degraded organic fractions can combine with extraneous organic material, too (Taylor 1987; Bowman 1990). Dates on bone mineral and undifferentiated bone organic material have been very variable and have very large errors, a major disappointment to Clovis archaeologists (Haynes 1992). Individual amino acids in well-preserved bone are thought to provide contamination-free carbon, but they yield small cleaned carbon samples, and thus, large errors even when AMS-dated.

As a result, in contrast to the many dated charcoal samples, only eight bone or tusk samples from High Plains Clovis components have yielded Clovis-age dates. These, from Domebo, Colby, Lange-Ferguson, Anzick, and Union Pacific Mammoth, gave widely varying dates on the different bone components (Table A). Anzick's amino acid dates average 10,680 ± 50, and Dent's average 10,750 ± 40. Lange-Ferguson's one bone date is 10,730 ± 530, compared with its charcoal date of 11,140 ± 140. Colby's mammoth-bone samples gave three dates—11,200 ± 220, 10,864 ± 141, and 8,719 ± 392—so disparate that they cannot be weight-averaged (averaged so that the dates with smaller errors are given more weight than those with larger errors). A single date of 11,280 ± 350 on tusk came from the UP mammoth, whose cultural origin is questioned.

Only two mammoth-bone samples from Domebo were dated. All had large standard errors from 420 to 600, due to small sample size. Both samples were saturated with water

Table A Radiocarbon Dates from High Plains Clovis Components

Anzick site, Montana
weighted average of 5 amino acids from human bone: 10,680 ± 50 (AA-2978 AA-2982)

Sheaman site, Agate Basin Locality, Wyoming
bison bone 10,030 ± 280 (RL-1263)

Clovis site, Blackwater Draw Locality 1, New Mexico
mammoth rib: 6,370 ± 160 (A-536)
humic acid and lignin from naturally carbonized pond plants

11,630 ± 400 (A-491)	11,040 ± 500 (A-490)
11,170 ± 360 (A-481)	weighted average: 11,300 ± 240

Lehner site, Arizona
pooled wood charcoal fragments

11,470 ± 110 (SMU-308)	10,860 ± 280 (SMU-164)
11,170 ± 200 (SMU-264)	10,770 ± 140 (SMU-168)
11,080 ± 230 (SMU-196)	10,710 ± 90 (SMU-340)
11,080 ± 200 (SMU-181)	10,700 ± 150 (SMU-297)
10,950 ± 110 (SMU-194)	10,620 ± 300 (SMU-347)
10,950 ± 90 (SMU-290)	weighted average: 10,950 ± 40
10,940 ± 100 (A-378)	

Murray Springs site, Arizona
pooled wood charcoal flecks

11,190 ± 180 (SMU18)	10,840 ± 140 (SMU-42)
11,150 ± 450 (A-805)	10,840 ± 70 (SMU-41)
11,080 ± 180 (Tx-1413)	10,710 ± 160 (Tx-1459)
10,930 ± 170 (Tx-1462)	weighted average: 10,880 ± 50
10,890 ± 180 (SMU-27)	

Colby site, Wyoming
collagen from mammoth bone: 11,200 ± 220 (RL-392)
apatite from mammoth bone: 10,864 ± 141 (SMU-254)
collagen from mammoth bone: 8,719 ± 392 (SMU-278)

Domebo site, Oklahoma
organic acids and humic acids from mammoth Bone A
weighted average: 11,210 ± 390 (SI-172, SI-175)
XAD purified, pro-hydro, XAD hydrolysate from mammoth bone:
weighted average of 3: 11,040 ± 250 (AA-825, AA-811, AA-805)

Dent site, Colorado
organic acids from mammoth bone: 11,200 ± 500 (I-622)
weighted average of 6 amino acids from a mammoth bone: 10,810 ± 40 (AA-2941, AA-2942, AA-2943, AA-2945, AA-2946, AA-2947)

Lange-Ferguson site, South Dakota
pooled wood charcoal flecks: 11,140 ± 140 (AA-905)
organic acids from mammoth bone: 10,730 ± 530 (I-13104)

U.P. Mammoth site, Wyoming
organic acids from mammoth tusk: 11,280 ± 350 (I-449)

Sources: Damon and Long 1962; Damon et al. 1964; Frison and Stanford 1982:178–180; Haynes 1987, 1992; Haynes et al. 1966, 1967; Taylor et al. 1996; Leonhardy 1966; Hester et al. 1972:174–176; Stafford et al. 1987. Weighted averages were calculated by Linda Brown, Department of Anthropology, University of Montana, using the program EXCELL.

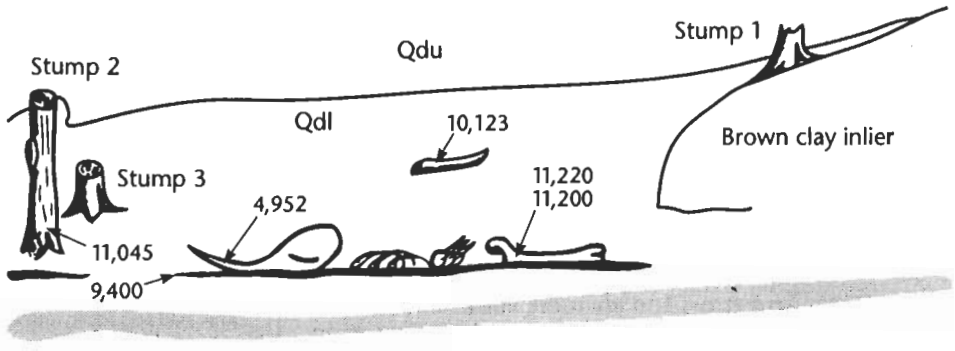

Figure A. Stratigraphic section drawing of the Domebo site with location of dated samples. (After Leonhardy 1996, fig. 24. Schematic representation; not to scale.)

draining geological carbon sources, such as petroleum[1], but the small sample size precluded rigorous cleaning. The five Domebo dates run on the bone samples averaged 11,210 ± 390 (on two unpurified extracts of bone) and 11,040 ± 250 (on three purified amino acid extracts). Two Clovis-range dates with large errors came from an elm stump in the vicinity of the archaeological site, but the tree was not associated with the archaeological deposit (Leonhardy 1966:11–26; Taylor et al. 1996: 517, note f of Table 1). (See Figure A.) The many trees preserved in the Domebo geological formation had a wide range of dates; that one happened to date close to Clovis is not actually evidence for the age of Clovis.

No bone or tusk samples from the Clovis site gave Clovis-age dates (Blackwater Draw Locality 1). The only bone date from the Clovis component was 6,370 ± 160 (A-536), on a mammoth rib. Nearly 5,000 years younger than the expected Clovis range, it was rejected (Haynes et al. 1967).

The site's only Clovis-age dates are three on naturally carbonized water plants from the pond strata into which the Clovis artifacts intruded (Table 1; Damon et al. 1966:100–101; Haynes and Agogino 1966; Hester et al. 1972: 176, 225, Fig. 130). The plant samples were small, so the errors are large: 360 to 500 years. Since the pond plants were not culturally utilized carbon, they do not actually date human activities, especially at Clovis, where numerous artesian springs mixed materials vertically[2]. Possibly because of this mixture, the dates, vertically separated from each other by several feet, were in reverse order, with the oldest being the one highest up in the stratigraphy (Figure B). Water plants in the Southern High Plains today incorporate older, geological carbon into their tissues (Damon et al. 1964: 93–98; see also Bowman 1990:26), so dates on water plants tend to overestimate the plant's age. According to the reports on the Clovis site, prehuman fossil bone and caliche as old as 15,000 radiocarbon years B.P. were mixed with Clovis cultural materials. Thus, prehuman carbon was abundantly available for uptake by the pond plants at the time.

In any case, the radiocarbon samples from Clovis had no relation to the human activities at the site but were merely plants that had grown in the pond into which the Clovis tools dropped. Not surprisingly, their dates average about 500 years earlier than the earliest dates on cultural carbon from Clovis sites.

The Rawlins and Stolles sites, cited in the **Mammoth Trumpet** as Clovis sites dated by bone or tusk, are not actually considered Clovis occupation sites. Rawlins, for example, had an adult male mammoth skeleton without cultural remains: "The Rawlins Mammoth (McGrew 1981) in southern Wyoming . . . [is] of the right age but there is a question of human association" (Frison 1991:159).

The Clovis cultural component at the Agate Basin locality, the Sheaman site in Wyoming, lacks Clovis-age radiocarbon dates entirely. The only date from that component was a bone that yielded a post-Folsom age estimate of 10,030 ± 280 (RL-1263).

Because charcoal dates associated with bone are often several hundred years earlier than the bone, it has been said that Clovis bone dates are usually "too young" (Haynes

[1] The bones from Domebo were saturated with water draining a petroleum oil field and from an aquifer in earlier geological strata (Leonhardy 1966: 3–9).

[2] Only A-481 of the Clovis dates was from a feature that contained Clovis artifacts, and that feature was in disturbed strata at an artesian spring conduit (Haynes and Agogino 1966).

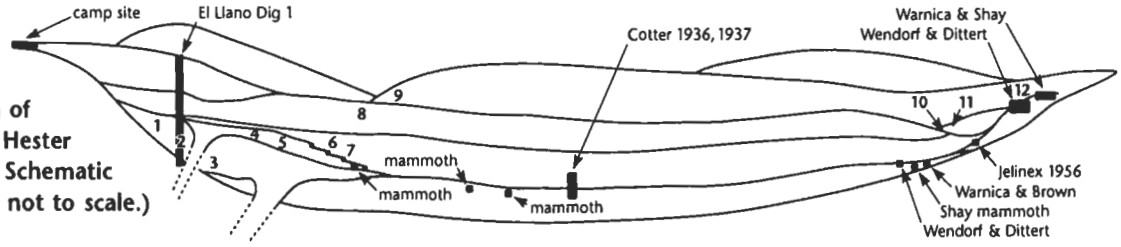

Figure B. Stratigraphic section drawing of the Clovis site with location of dated samples. (After Hester et al. 1972: fig. 130. Schematic representation; not to scale.)

1. 11,630 ± 400 (A 491)
2. 11,170 ± 360 (A 481)
3. 11,040 ± 500 (A 490)
4. 10,170 ± 250 (A 488)
5. 10,490 ± 200 (A 492)
6. 10,250 ± 320 (A 379–A 380)
7. 10,490 ± 900 (A 386)
8. 9,890 ± 290 (A 489)
9. 8,470 ± 350 (A 512)
10. 0–169 6,300 ± 150 B.P.
11. 0–170 6,230 ± 150 B.P.
12. 0–157 4,950 ± 150 B.P. (prob. too young—Haynes 1966 p.26)

1992). However, subtracting a hundred or so years for charcoal's inherent age usually brings the charcoal dates in line with the amino acid bone dates.

Even before adjustment for inherent age, the majority of the 48 Clovis radiocarbon dates fall later than 11,000. Only eight were 11,200 or earlier, and only three were earlier than 11,200. Significantly, all Clovis dates 11,000 and earlier were on the doubtful materials: carbon with inherent age, non-cultural carbon, and/or small carbon samples with large errors of 450 to 600 years. Of the nine sites that have documented proveniences for dated samples[3], only three—Domebo, Clovis, and Lehner—have samples dated 11,000 B.P. or earlier, and these earlier dates all have very large errors and/or probable old-carbon effects. Thus, at present it is difficult to make a strong case for dating the culture much before 11,000 years ago.

Since High Plains Clovis components have so many dates in the same range as Folsom components, a common procedure has been to drop the later Clovis dates and the earlier Folsom dates to eliminate the overlap. However, it's long been pointed out by radiocarbon specialists that individual radiocarbon assays are ranges, not points in time, so overlap is expected of the dates of successive cultural occupations (Bowman 1990). Also, plateaus in carbon isotope ratios are a possible cause for the extensive overlap of the dates of High Plains Paleoindian cultures. Along with the problems of small samples and large standard errors, these plateaus prevent statistical separation of the age of Clovis and Folsom (Taylor et al. 1996). Although the transition from Clovis to Folsom might have occurred within a period of 100 years or less, the most recent definitive conclusion is, "In our view, the existing corpus of Clovis and Folsom radiocarbon age-estimates does not have the precision required to test this assertion" (Taylor et al. 1996:524).

The problems of precisely dating Clovis are relevant to cross-regional relationships of Paleoindian cultures (Roosevelt et al. 1997; Roosevelt and Morrow nd). Comparisons with other regions are usually made on the basis of the defined Clovis range of 11,200–10,900 (Haynes 1992) or even on a Clovis age as early as 11,500 (Haynes 1987; Gibbons 1996). However, these ranges are based on questionable dates run early in the history of radiocarbon dating, The fact that no Clovis date series with documented cultural provenience averages earlier than 11,000 usually is not taken into consideration in comparisons with other regions. Using a defined age range of Clovis for Clovis rather than the means of actual Clovis date series exaggerates the age of Clovis in comparison with more recently discovered cultures that have large suites of dates with small standard errors, run on large samples of short-lived materials from localized cultural features. The geographic directions of cultural diffusion or migration thus become confused. As Vance Haynes has written, "Large standard deviations, inherent ages in wood charcoal dates, and a notoriously poor record for bone dating at most [North American] sites make attempts to construct isochrons of geographic movements (time-space relationships) for a particular cultural complex highly questionable" (1992:96).

The dating problems of the Clovis High Plains culture have inspired truly innovative research in the past and presumably will inspire more in the future. R. E. Taylor and colleagues at UC–Riverside and Thomas Stafford and his team are working on improving the accuracy of dates on small samples, and standards of collection and recording of dates are improving, also. For now, however, the actual age of Clovis needs to be taken into account in comparative research on the peopling of the Americas[4].

[3] The Aubrey site (Humphrey and Ferring 1994; Mammoth Trumpet January 1996), like Domebo and Clovis, has a wide range of late Pleistocene dates: from c. 14,000 to 10,000. The specific excavation context and lithic association of two dates at about 11,500 B.P. on carbon from Trench B have not been documented.

[4] Clovis in Context: New Light on the Peopling of the Americas (organized by A. C. Roosevelt and J. Morrow), a session of 1997 SAA meetings in Nashville, explored these questions Thursday afternoon, April 3.

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COMING CONFERENCES

March 25–29 63rd Annual Meeting, Society for American Archaeology, Seattle Convention Center.
Contact: SAA, 900 Second Street NE No. 12, Washington, D.C. 20002-3557. 202-789-8200. Fax 202-789-0284.
e-mail: meetings@saa.org.

March 26–28 Annual Meeting, Southern Anthropological Society, Wilmington, NC.
Contact: Jim Sabella, University of North Carolina-Wilmington.
e-mail: sabellaj@uncwil.edu.

March 31–April 1 Annual Meeting, Human Biology Association, Hilton Hotel, Salt Lake City.
Contact: Michael Crawford, Department of Anthropology, University of Kansas, Lawrence KS 66045-2110.
e-mail: crawford@kuhub.cc.ukans.edu

April 1–4 Annual Meeting, American Association of Physical Anthropologists, Hilton Hotel, Salt Lake City.
Contact: Clark Spencer Larsen, Research Laboratories of Anthropology, Alumni Building, CB# 3120, The University of North Carolina, Chapel Hill, NC 27599-3120.

April 16–18 51st Annual Northwest Anthropological Conference, Holiday Inn, Missoula-Parkside, MT.
Contact: Thomas A. Foor, Dept. of Anthropology, University of Montana, Missoula MT 59812.

May 5–10 31st Annual Meeting of the Canadian Archaeological Association, Harbour Towers Hotel, Victoria, British Columbia.
Contact: Bjorn Simonson, 250-715-1566.

Aug. 23–29 Eighth International Congress of the International Council for Archaezoology (ICAZ '98), University of Victoria, Victoria, British Columbia.
Contact: Conference Management, Division of Continuing Studies, PO Box 3030, Victoria, BC, V8W 3N6.
e-mail: morourke@uvic.ca
http://www.uvcs.uvic.ca/conferce/admin.htm

Sept. 3–6 Alta Conference on Rock Art II. Alta, North Norway.
Contact: Knut Helskog, Tromso Museum, Tromso U, 9037 Tromso Norway. e-mail: knut@imv.uit.no.

Send conference notices to Mammoth Trumpet, 620 Northwest Witham Drive, Corvallis, OR 97330.

Magazine

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and writer for John Muir Publications and *Highlights for Children* magazine, has an abiding interest in the importance of the conservancy's magazine mission.

Admittedly, Crisell said, *American Archaeology's* mission of covering the breadth of archaeology in the Americas is "a big task when we only have three main features each issue to do it." And "we want to have great reading, lots of style, and at the same time have lots of substance and be an authoritative word on the subject without being academic. In short, we want to be a respected magazine but we don't want to be a respected academic journal—a magazine for the layman that archaeologists also can respect and enjoy."

To help achieve that tall order, the magazine has an impressive 22-member editorial board of archaeologists and other specialists that includes James Dixon, of the Denver Museum of Natural History, and Brian Fagan, the archaeologist and author. Board members, according to their specialty, review and edit the magazine's articles for accuracy before publication. Fagan, for example, even writes for the magazine ("Maize: The Staff of Life," Summer, 1997).

Crisell and Michel hope the magazine will become a leader in the popular archaeology field, particularly on archaeology of the Americas.

"We want people to understand that we live in this country that has a great amount of archaeology and exciting digs going on every single day," Michel said. "Maybe some of it isn't as exciting as what's happening elsewhere in the world, but it is more pertinent to the people living in the Americas."

So far readers have reacted positively to the magazine, says Crisell. "We expected to get some pretty negative reactions from archaeologists, but we really didn't get any. Archaeologists always talk about the need to educate the public on archaeology, something to get them interested in saving sites and funding research. That's what we are doing." Conservancy members also are pleased with the fact that the magazine represents the organization's interests and efforts, he added.

Those efforts, he said, are largely aimed at recruiting supporters of archaeological resource preservation, which he sees as a vital enterprise.

"Archaeology is often the only clue to the people who came before us," Michel said. "Unless we preserve these real sensitive sites they will be lost forever under malls or looted completely so all the clues they can give us about past cultures will be lost."

He suggests that we in the 20th century are not necessarily that unique. Perhaps we can better understand the similarities with past cultures—if we save, and study, the remaining evidence of their passing.

"We have much in common, more than we want to believe, with people who may have lived 10,000 years ago and it is important for us to save all the sites that can give us more and more of that hidden knowledge," says Crisell. "Many people just don't realize that taking away a single artifact, an arrowhead for example, can be detrimental. It's like taking away a part from a puzzle."

That's why educating the public to the rich cultural diversity of the Americas—and drumming up support to save it—will remain the central goal for *American Archaeology*, Crisell and Michel emphasized.

–George Wisner

Mammoths

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How to Make a Mammoth

As May explained to the **Mammoth Trumpet**, the casting process begins with the mold. Research Casting has entered into agreements with a number of North American museums that allow the company to use molds that the paleontology departments of these museums have made from fossil material.

In the case of the Beringia Centre mammoths, the molds came from the Canadian Museum of Nature in Ottawa, which exhibits a similar grouping of cast mammoths on the grounds of the museum. The Beringia Centre mammoths are reproductions of those already at the Canadian Museum of Nature.

The cast for each mammoth is made by spraying layers of a mixture of ultraviolet-resistant polyester resin mixed with a catalyst and chopped fiberglass into each mold. The resin has a built-in expansion and contraction factor that enables it to cope with temperatures from -80 to 200 degrees F. May says it's the same kind of resin used to build yachts and sailboats.

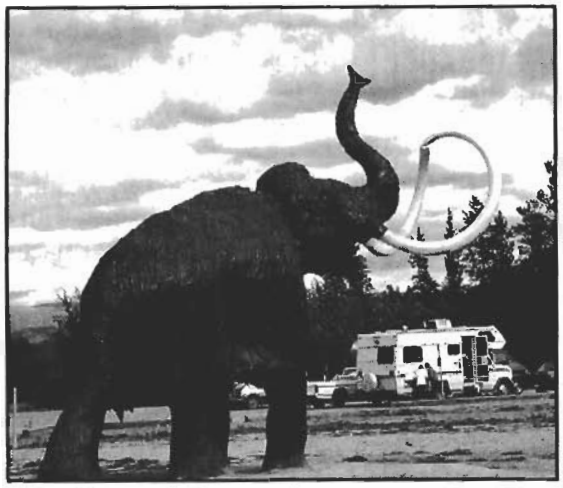
Separate castings are made of the tusks and attached to the main body. Two ¾-inch layers of the resin-fiberglass mixture usually provide sufficient thickness. The hollow castings are supported by an inner steel-pipe superstructure that extends down the legs.

Steel base plates are anchored into the ground, and then concrete pads are poured around them. The steel pipes coming out of the legs are then welded to the steel base plates. Upon completion, none of the steel is visible because topsoil and a lawn provide a landscaped grass setting. The larger mammoths weigh 800 to 1,000 pounds each, says May.

The castings were made at the Research Casting facility in Ontario and trucked to the Yukon. When the male mammoth was found to be too big to fit in the truck, the front legs were cut off and hauled separately. The legs were reattached at the site by technicians wearing hoods and air-supplied respirators, who crawled inside the belly of the mammoth. Once the seams were complete, they had to exit down through the legs. May says this was the hardest and most dangerous part of the job.

The Installation

Passersby found the installation process at the Beringia Centre quite interesting, said Conrad. He noted that some Yukon residents base their own business on mammoth ivory that they have recovered themselves. Several folks bragged to Peter May that they had mammoth tusks bigger than the ones on the mammoth replicas.



YUKON BERINGIA INTERPRETIVE CENTRE, GOVERNMENT OF YUKON

Appearing ready to trample parked tourist vehicles, this bull mammoth could not find much steppe vegetation for grazing around Whitehorse.

Research Casting, a 10-year-old company, has done commissions for the British Museum of Natural History in London, the National Museum in Tokyo, Universal Studios and Walt Disney Imagineering in California and many other museums worldwide.

May speaks with pride of the display they did for the American Museum of Natural History in New York. A rearing, five-story tall *Barosaurus* is defending its youngster from an attacking *Allosaurus*. He says the display represents the tallest free-standing dinosaur mount in the world. In regards to cost, $1,000 per foot is a good ballpark figure, says May.

Asked if he thought of his work as art, May says that when he was in art school he was told that art is 95 percent technical and only 5 percent art, meaning that you couldn't create anything unless you knew how to do it (had the technical expertise). The models that they make involve a great deal of technical expertise. As for the art, he thinks that is there too, in the animals they build.

May says his favorite part of the whole process is the installation. That's where the public gets to see what they've done. He said the installation often draws a crowd of hundreds, and when they're all done the crowd applauds. He likes to think of how these technical models become something very special in the eyes of the children who see them in a museum after they leave his shop.

Each member of the Beringia Interpretive Centre woolly mammoth family is based upon a specific historic specimen. The large male was modeled on the Hebior Mammoth from a site near Kenosha, Wis. (**Mammoth Trumpet** 10:2 "Ice-Age Wisconsin People Left Unique Cultural Record"). It is known to date to about 12,500 radiocarbon years ago, and is considered the largest such specimen ever recovered, measuring four meters at the shoulder. It was found in association with three stone tools attributed to Chesrow-complex people. Visitors have the unusual opportunity of seeing a full-body cast of this animal standing in front of the museum and a skeletal version of the same specimen inside the museum building. (Other replicas of the Hebior Mammoth have been on display at museums in the United States.)

The female mammoth, which has a realistic broken tusk, is based on the Whitestone Mammoth from the Old Crow area, northern Yukon. The fossil bones are dated at about 30,000 years old.

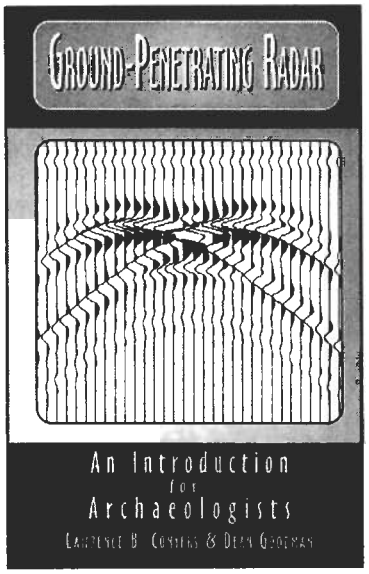
The baby woolly mammoth was found preserved in the permafrost on a tributary of the Kolyma River in northeastern Siberia in 1977. Given the name Dima, the live animal weighed about 100 kilograms and had chestnut-colored hair. Dima died about 40,000 years ago. Its internal organs are very similar to those of living elephants, but its ears are only one-tenth the size of those of an African elephant of similar age (7 to 8 months), according to Dr. C. R. Harington, Curator of Quaternary Paleobiology at the Canadian Museum of Nature.

–Carol Ann Lysek

New Books

Ground-Penetrating Radar: An Introduction for Archaeologists, by Lawrence B. Conyers and Dean Goodman. AltaMira Press, 1997. 240 6 x 9-inch pages, 15 color plates. $54 (hardcover) $26.95 (softcover).

Here is a comprehensive guide to one method of non-invasive archaeological exploration. The book is tailored to archaeologists who are wary of using high-tech instruments. The authors describe the system and the methods of using it. Ground-penetrating radar, they explain, "involves the transmission of high-frequency electromagnetic radio (radar) pulses into the earth and measuring the time elapsed between transmission, reflection off a buried discontinuity, and reception back at a surface radar antenna." Reflections occur where there are changes in electrical properties in the soil, variations in water content, lithologic changes, changes in bulk density, at interfaces between archaeological features and surrounding sediment, and void spaces.



The book explains practical technicalities such as differences between systems with low-frequency antennas, which can penetrate deeply, and high-frequency antennas, which have much higher resolution. It covers practicalities including data collection, data processing, synthetic modeling, time-depth analyses, and mapping buried surfaces.

Gender in Archaeology, by Sarah Milledge Nelson. AltaMira Press, 1997. 240 6 x 9-inch pages. $46 (hardcover) $19.95 (softcover).

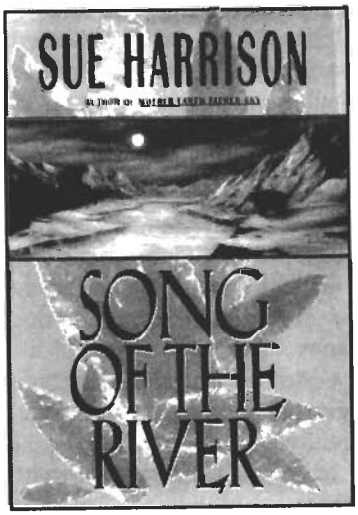
Subtitled "Analyzing Power and Prestige," this book presents a synthesis of a great deal of archaeological work on gender. Anyone who thinks gender in archaeology simply refers to both sexes being involved in field work is only a couple of decades behind the times. "In this book," Nelson begins, "I argue that a gendered archaeology is an *improved* archaeology, one that helps expose the ways in which an emphasis on power and prestige has obscured gender in the past and one that makes possible a less distorted view. I also suggest that gendered power imbalances in the present among living archaeologists still contribute to obscuring parts of the archaeological record." After exploring "power and prestige" issues, Nelson goes on to examine the interpretation of gender in the past, studies of human origins, and the analyses of division of labor, families, and communities. "Gendered archaeology," the author concludes, "is a more nuanced one, asking new questions, finding new data, and partitioning the old data in new ways."

Tennessee's Prehistoric Vertebrates, by James X. Corgan and Emanuel Breitburg. Tennessee Division of Geology, 1997. 170 8½ x 11-inch pages. $8.75 (softcover).

This book describes 161 sites where the soils and rocks of Tennessee yield the bones of ancient animals—at least 245 species of them ranging in age from 380 million to 10,000 years ago. It reflects a continuing effort, which began in the 1820s, to assess vertebrate populations that at one time or another were tied to the topography of Tennessee. It is a concise history of vertebrate paleontology of Tennessee, discusses ancient geography and illustrates distribution of fossils through time and topography. The book is available through the Division of Geology, 401 Church Street 13th Floor, Nashville TN 37243-0445. Checks should be made to the Tennessee Dept. of Environment and Conservation.

Song of the River, by Sue Harrison. Avon Books, 1997. 484 9¼ x 5¾-inch pages, with map, glossary of Native American words, and pharmacognosia. $24 (hardcover).

Novelist Sue Harrison (**Mammoth Trumpet** 10:2 "The Novel Approach") puts readers into the hearts and souls of early Holocene people on the coast of Alaska. She vividly illustrates gender issues in a Paleo-American setting because she creates complex family lives with strict customs, pride, jealousy, revenge and many other emotions within her characters. This novel follows her first series of stories "Ivory Carver Trilogy," consisting of *Mother Earth Father Sky, My Sister the Moon,* and *Brother Wind.* All are set on Aleutian Islands or nearby coastal Alaska and make use of much archaeological and ethnographic data. Though life more than 8,000 years ago was harsh and often brutal, Harrison believes ancient humans were as multi-faceted and thoughtful as we are today.



Many authors, including Jean Auel and Elizabeth Marshall Thomas, have built on archaeological and anthropological data to produce novels set in the distant past, and none brings artifacts to life any more vividly than Sue Harrison. It's impossible for a reader not to empathize with her protagonists, or not to appreciate how human genes may have flowed at the fringes of the New World.

–DAH