



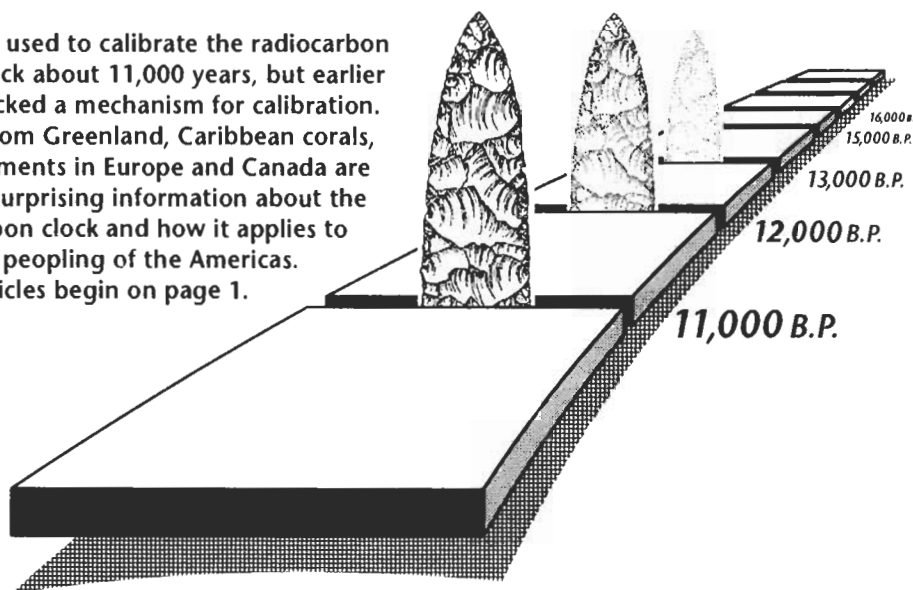
# MAMMOTH TRUMPET

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Center for the Study of the First Americans  
355 Weniger Hall, Oregon State University  
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## Radiocarbon Recalibration

Tree rings are used to calibrate the radiocarbon chronology back about 11,000 years, but earlier dates have lacked a mechanism for calibration. Now ice cores from Greenland, Caribbean corals, and lake-bed sediments in Europe and Canada are revealing some surprising information about the radiocarbon clock and how it applies to the peopling of the Americas. Articles begin on page 1.



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## CORRECTED RADIOCARBON CALENDAR CAN CLARIFY PEOPLING OF AMERICAS

Radiocarbon dating may have revolutionized archaeology more than four decades ago, but it can be difficult, even for professionals, to keep track of the implications of recent and continuing corrections to the radiocarbon calendar. Stuart J. Fiedel, archaeologist and author of *Prehistory of the Americas*, has been reminding his colleagues that newly calibrated dates can bring a wholly new understanding to events that occurred near the close of the Pleistocene.

People truly have been in the Americas longer than most people thought. Clovis, for instance, a tradition long believed to have spanned the period between 11,200 and 10,800 years ago, actually dates back to at least 13,600 years. Dr. Fiedel pointed out the revised chronology in the second edition of his book, which was published by Cambridge University Press in 1992. Earlier this year, he detailed the impact of the changes in a presentation to the Society for American Archaeology titled "Older than We Thought: Implications of Corrected Dates for Paleoindians."

Research on Greenland ice cores and uranium-thorium dating of late-Pleistocene corals off Barbados is helping scientists reset the radiocarbon calendar. Further, scientists continue to examine links between climatic periods in Europe and those

in the Americas. Evidence may not yet all be in, but a new calendar is emerging.

### Timing the Younger Dryas

Ideas about Clovis and Folsom traditions must be reconsidered in respect to the new calendar and to timing of the Younger Dryas, the profoundly cold period 1,150 to 1,300 years in duration that interrupted the warming trend at the end of the Pleistocene, and that can be recognized in sites on several continents. Folsom, Fiedel believes, belongs to the first half of the Younger Dryas, and Clovis belongs to an earlier period. Drought conditions seen at Clovis time can't be attributed to the Younger Dryas, he reasons, but must have some other climatic explanation. "It is either a strictly local phenomenon in the western United States, or more probably, is an expression of one of the global climate oscillations that preceded the Younger Dryas."

Fiedel notes that the Younger Dryas brought the return of near-glacial climate. In the American Southwest, the full glacial climate from 35,000 to 13,000 radiocarbon years ago was wet, cool, and marked by the development of lakes in the Great Basin and elsewhere. "Climate modeling suggests that wetter late-Pleistocene

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# Brazilian Rockshelter Reveals Details Dating to Pleistocene

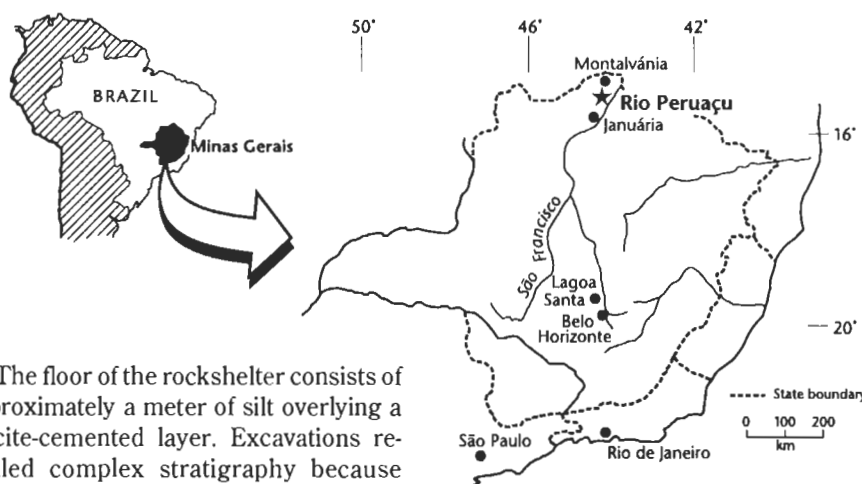
A large rockshelter in the interior of southeastern Brazil has yielded a variety of clues to human activities in the late Pleistocene and early Holocene. A French-Brazilian scientific team led by André Prous has been examining the Lapa do Boquete since 1981, recovering a rich assemblage of tools, faunal and plant materials, and several burials.

Rock art in the form of pictographs and engraved petroglyphs decorates the walls of the shelter and the cliffs on both sides of it.

Lapa do Boquete (pronounced BO-ketch) is in the valley of Rio Peruaçu, a tributary of the great São Francisco River in the north part of Minas Gerais state. The nearest town is Januária; the area is approximately 600 kilometers north of Belo Horizonte and 900 km north of Rio de Janeiro. The uplands of central Brazil are an extensive massif of dissected limestone that features a number of caves and rockshelters, many of which contain rock art. The region lies within the *cerrado* vegetation zone, a semi-arid savanna-parkland. There are gallery forests along the streams.

Canadian scientists Alan Bryan and Ruth Gruhn noted the site during a brief archaeological survey of the area in 1976. Dr. Prous and his colleagues from the Universidade Federal de Minas Gerais in Belo Horizonte later undertook an extensive survey that included test excavations in rockshelters of the region. They tested Lapa do Boquete in 1981, and followed up with an extensive excavation begun in 1988. "We have excavated now some 50 square meters in the shelter and more than 20 square meters outside in front of the cave," says Prous.

Lapa do Boquete is a level and well-lighted shelter at the mouth of a cavern that slopes sharply downward at the rear. The shelter, which has a roof about 3 meters above the present sediment level, is approximately 25 meters long and 10 meters wide. From the shelter, a talus slope drops into a thickly forested flat extending approximately 300 meters to the Rio Peruaçu.



The floor of the rockshelter consists of approximately a meter of silt overlying a calcite-cemented layer. Excavations revealed complex stratigraphy because people had used the shelter over a long



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period of time. During the historic period, domestic animals caused disturbance extending about 15 centimeters below the surface. Prehistoric people partially disturbed the upper half of the sediments, Prous said.

He and his team found that horticultural peoples of the late prehistoric time had dug a number of large storage pits extending as much as 50 centimeters into the rockshelter's compacted silt floor. Deeper sediments remained undisturbed, however. These contain records of Lapa do Boquete's earliest human occupation in a matrix of a 10-cm-thick deposit of white, yellow and dark red silts. The team described stratigraphy in *Camadas* or geomorphological units. In the deeper sediments, *Camadas* VII and VIII, Prous and his team found high levels of organic matter including much ash and charcoal. They discovered a number of hearths.

Radiocarbon analysis of charcoal *Camadas* VII and VIII yielded four dates ranging between 12,000 and 11,000 years before present.

The archaeologists found that flaked stone tools, cores, and flakes were plentiful in the site's lowest level. Chert was the most plentiful material, but the earliest inhabitants of Lapa do Boquete also used limestone and quartzite. About 30 percent of the chert specimens display evidence of thermal spalling, probably accidentally in the many hearths.

The toolmakers did almost all their flaking by direct percussion. Prous and his team recovered only a few small bifacial trimming flakes and only one bifacially worked artifact, the tip end of a projectile point. The team found that edge retouching of artifacts was done by direct percussion and that inverse flaking was rare.

The flaked stone-tool assemblage from layer (level) eight features thick, large-to-medium flakes with steep edge retouch for use as scraping tools. "Micro-use wear or polish has been seen on several tools," says Prous.

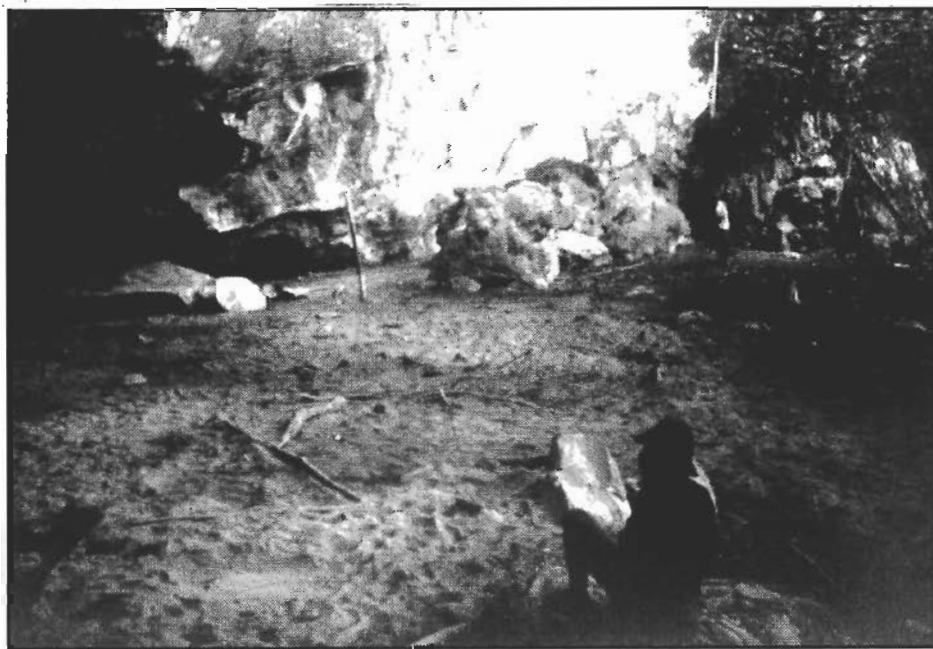
A number of *lesmas* or limaces—thick, elongate plano-convex tools with steep edge retouch—were found. Such tools are characteristic of late-Pleistocene and early-Holocene assemblages in other parts of Brazil. They have been found in the Paranaíba phase of Goiás, dating to

between 11,000 and 9,000 years B.P. according to investigations by P. I. Schmitz, and in assemblages dating to around 11,000 B.P. from Pedra Pintada in the lower Amazon basin by A. C. Roosevelt and her colleagues. Lapa do Boquete also produced a large number of small retouched or utilized chert flakes in the assemblage from the lowest level.

A notable part of Lapa do Boquete's artifact assemblage are the *quebra-cocos*, tabular pieces of local limestone pocked with one or more shallow depressions. These pieces served as nutcrackers, holding palm nuts or seeds so they could

site were used for different purposes. For instance, the western area is the only one with refuse including much vegetal matter and bones. It had also many thick retouched and used tools and also material from retouching activities and some red pigments." By contrast, Prous added, "the eastern area had quite exclusively hearth, with very few other materials." Between, in the site's central part, there were no hearth, bones or vegetal matter nor any retouched tools, but there was debitage.

"Out of the sheltered area, in front of the cave, we are excavating an area with



ALAN BRYAN

A worker is silhouetted outside Lapa do Boquete during a 1976 archaeological survey.

be cracked open with a hammerstone. The researchers found many charred palm nuts in the same stratum.


Prous and his colleagues found evidence of a broad-spectrum foraging economy in the site's lower levels. Faunal remains found in *Camada* VII included fish, lizards, and small mammals. Prous believes that many of the small animals probably were dwellers of the cave. A few bones of larger animals including deer were found as were lacustrine (lake-dwelling) bivalve mollusks. In addition to the abundant remains of palm nuts, the team found evidence of a variety of other fruits.

"I believe that the main part of the subsistence refuse has not been found," says Prous.

"It is clear that the several parts of the

retouched tools of different types than those that we found inside, in the western excavation," Prous told the **Mammoth Trumpet**.

Workers found one piece of limestone stained with red pigment. Quite possibly it served as a paint palette for one of the artisans whose work graces the walls of the shelter. In part of the site they encountered a lower zone of cemented red silt containing calcite concretions. There were a few chert flakes and some bone fragments within this material.

"In the central part of the site we found a big buried block that fell between 10,000 and 9,000 years ago," says Prous. It was covered with petroglyphs made before 7,000 years ago. "Some of the lowest ones are surely as old as 9,000 years old." 

## Recalibrating Radiocarbon

*continued from page 1*

conditions in the Southwest, coeval with more arid conditions in the Northwest, were created by a change in polar-front jet-stream flow patterns," he says. He infers that the succession evident in the Greenland ice record—Oldest Dryas, cold; Bølling, warm; Older Dryas, cold; Allerød, warm; Intra-Allerød Cold Period, cold; End of Allerød, warm; and Younger Dryas, cold—should be echoed by climate indicators in the Southwest.

### The Clovis-Blackwater Context

In the Llano Estacado region where Blackwater Draw is located, the period from about 22,500 to 14,000 radiocarbon years ago has been termed the Tahoka Pluvial, and Fiedel notes that this period was followed in relatively rapid succes-

sion by several contrasting periods. There was the Crane Lake Interval, which was dry with lower water levels and increase in windblown deposits—possibly the Bølling–Older Dryas–Allerød period; the Blackwater Subpluvial—perhaps the Intra-Allerød Cold Period; the White Lake Interval marked by dwindling water sources; the Lubbock Subpluvial, a time of increased surface water, but not as wet as the Blackwater Subpluvial; and the Yellowhouse Interval, a dry period after 10,000 radiocarbon years ago when park land was replaced by herb communities.

Fiedel says the Clovis occupation at Blackwater Draw has been assigned to the Blackwater Subpluvial, the megafauna extinctions to the White Lake Interval, and the Folsom component to the Lubbock Subpluvial. If these correlations are valid, he says, the Lubbock Subpluvial should be coterminous with the Younger Dryas, from about 12,900 or

12,600 to 11,400 calendar years ago, and the Blackwater Subpluvial should date from around 13,200 to 13,000 years ago.

### The Folsom Components

Fiedel notes that if Folsom is stratigraphically and temporally associated with the Younger Dryas, there is the problem of why uncalibrated radiocarbon dates for the Folsom horizon often overlap with Clovis dates around 10,900. He says that at the original Folsom site six dates on charcoal average  $10,890 \pm 50$ , although a bone collagen sample yielded a date of  $10,260 \pm 110$  radiocarbon years ago. Dates for Folsom components at Lindenmeier, Hanson, Agate Basin, and Indian Creek fall in the broad range of 10,900 to 10,100 radiocarbon years, but the most precise dates seem to fall around 10,700.

In 1984 Edwin Wilmsen suggested that Clovis and Folsom might represent regional rather than temporal variation.

# Recalibrating the Radiocarbon Calendar

Revised radiocarbon chronologies are not simple changes of scale, but rather complex recalibrations made possible by recent research on ice cores and uranium-thorium dating studies of late-Pleistocene corals.

Radiocarbon dating is based on the premise that all living things absorb carbon; most is carbon-12, but a small percentage is radioactive carbon-14, created by cosmic radiation. At the death of a plant or animal, the carbon-14 begins to decay while the ordinary carbon—carbon-12—remains stable. Because the decay rate of carbon-14 is known, the ratio between carbon-12 and carbon-14 in a piece of wood, bone or charcoal reveals the length of time since the sample was alive.

However, the date will only be accurate if the original ratio of carbon-12 to carbon-14 in an ancient organism was the same as that observed in recent (but pre-industrial age) samples. Unfortunately, this ratio has fluctuated even in the pre-industrial past. Archaeologist

and author Stuart J. Fiedel explains that there are two principal reasons for the fluctuations: the amount of carbon-14 in the atmosphere has varied due to changes in the intensities of cosmic radiation, solar radiation, and the Earth's magnetic field; and secondly, the amount of atmospheric

### Uranium-thorium and radiocarbon dates for Barbados corals, around 14,600 to 13,200 years ago

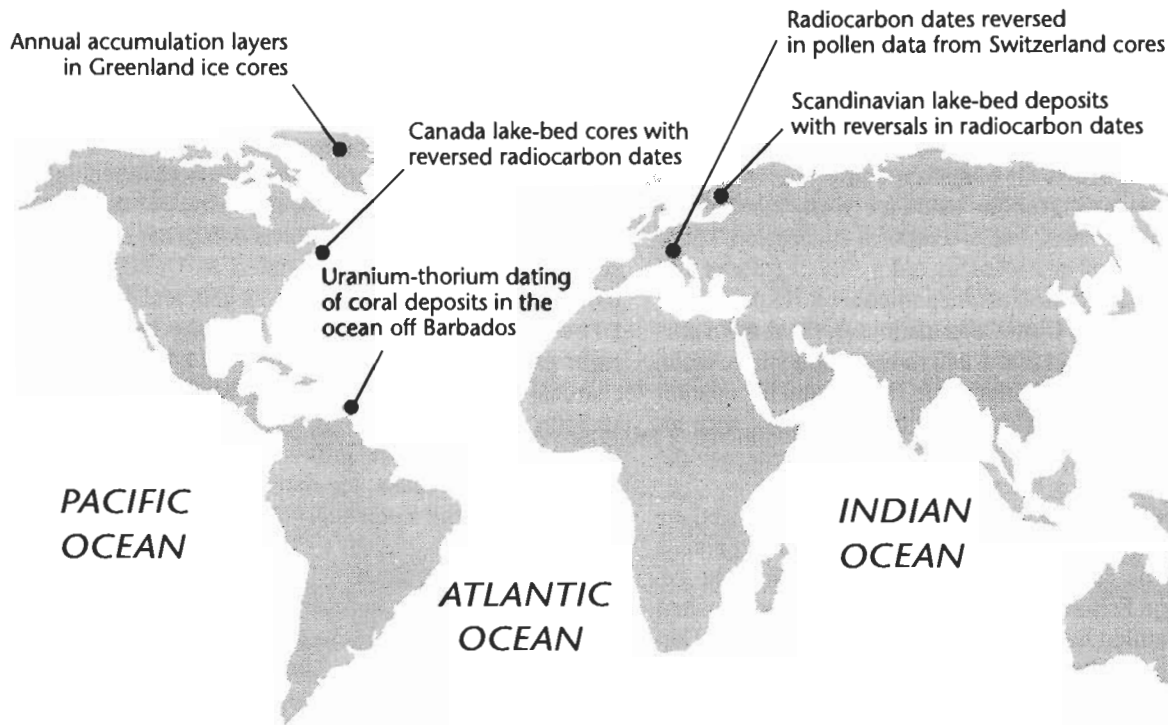
Uranium-thorium age	Radiocarbon age
$13,220 \pm 110$	$10,900 \pm 200$
$13,700 \pm 170$	$11,850 \pm 200$
$13,800 \pm 140$	$11,800 \pm 200$
$14,230 \pm 100$	$11,800 \pm 400$
$14,660 \pm 160$	$12,500 \pm 200$

carbon-12 has varied, as carbon dioxide was either absorbed from or released into the air at the ocean surface (most of Earth's carbon is stored in the ocean). The concentration of carbon dioxide rose rapidly at the end of the Ice Age, he explains, from the late-Pleistocene level of approximately 190 parts per million to about 250

parts per million. Because of industrial activities since 1850, the concentration of carbon dioxide in our modern "greenhouse" atmosphere has shot up even higher, he says, to about 360 parts per million.

Accurate calibration of the radiocarbon calendar for the Holocene, back to about 11,000 calendar years ago (10,000 radiocarbon years) has been accomplished by comparing radiocarbon dates for small pieces of ancient pine and oak trees against dates obtained by counting the annual growth rings visible in the wood samples. However, in the absence of trees of the necessary antiquity, this dendrochronological calibration has not yet been extended beyond the Holocene/Pleistocene boundary. Nevertheless, says Dr. Fiedel, an approximate calibration of earlier dates is now possible on the basis of two parallel dating methods applicable to the late Pleistocene: counting of annual accumulation layers in cores driven into the Greenland ice sheet, and uranium-thorium dating of coral deposits in the ocean off Barbados in the West Indies. The same coral samples can also be dated by the carbon-14 method. Comparison of the uranium-thorium and carbon-14 ages





shows that carbon-14 underestimates the age of the late-Pleistocene corals by about 2,000 years.

No organic materials suitable for radiocarbon dating are present in the Greenland ice. However, Fiedel describes an intermediate step that allows the ice cores to be used in carbon-14 calibration. A sharp change in oxygen-isotope ratios in the ice at about  $12,940 \pm 260$  years—indicating a sudden, steep drop in temperature—signals the onset of the Younger Dryas episode. For the next 1,300 years, a nearly glacial climate prevailed in the Northern Hemisphere. "The vegetation in northern and central Europe and North America responded rapidly to this change, and this response is clearly visible in the form of altered percentages of pollens, seen in lake-bed cores," he says. Those lake beds also contain a variety of well-stratified organic materials that can be carbon-14 dated, and the dates obtained for the Younger Dryas onset fall in the range of 10,600 to 10,900 B.P.—again, some 2,000 years later than the date based on the ice cores.

Another point of correlation of these records, says Fiedel, is the onset of the sharp initial postglacial warming epi-

sode called the Bølling period. Ice cores date this event at about 14,700 B.P., but

**AMS radiocarbon dates from lowest sediments (below Younger Dryas boundary) in Scandinavian lake (from Björck et al. 1996)**

Depth (cm)	Radiocarbon date
831–832.5	$10,625 \pm 70$
832.5–835	$10,995 \pm 75$
835–845	$10,820 \pm 85$ ; $11,065 \pm 150$
845–855	$10,750 \pm 100$
875–885	$11,630 \pm 190$
885–895	$11,470 \pm 135$

radiocarbon dates from Swiss lake-bed cores fall around 12,500 B.P.

"Just as most climatologists see a link between increasing carbon dioxide and rising temperatures in our present-day environment, they suspect that colder episodes such as the Younger Dryas were related in some way to decreased levels of carbon dioxide," says Fiedel. The probable mechanism, he adds, is increasing absorption of carbon dioxide (called "ventilation") by cold water at the ocean surface. "Such periods of cold climate should in theory be accompanied by lowered carbon dioxide and a relative increase of car-

bon-14, which will make radiocarbon ages appear too young. This has, in fact, been observed in the Younger Dryas; the result is a compression of radiocarbon dates." Fiedel notes that a period of about 1,300 years (12,500 to 11,200 B.P.) corresponds to only about 400 radiocarbon years (10,500–10,100 B.P.).

"Given the typical standard error, this means that radiocarbon-dated samples of 12,500 to 11,200 in real age will appear virtually contemporaneous, producing dates of around 10,500 to 10,100 radiocarbon years." Carbon fluctuations, or "wiggles," perhaps associated with brief climatic episodes, can also create apparent reversals in chronology. For example, an organic sample derived from a period of abnormally high carbon-14 to carbon-12 ratios could well appear younger than a later sample, stratified above the first, but containing a smaller original "dose" of radioactive carbon.

Archaeologists must consider such problems when evaluating the stratigraphy of sites that date to the late Pleistocene. The chronological revision, Fiedel emphasizes, has important implications for models of Paleoindian colonization, expansion and genetic and linguistic divergence.



He cited the statistically indistinguishable dates from Lindenmeier and Clovis sites as evidence that Folsom and Clovis were at least partly contemporaneous. Fiedel notes that Clovis and Folsom points were originally believed to have been contemporaneous functional variants—Clovis for mammoth hunting and Folsom for bison hunting.

"However, the stratigraphic evidence from Blackwater Draw compels us to recognize a temporal succession," says Fiedel, noting that an erosional inconformity separates the Clovis assemblage from the Folsom component. He points out that three dates for the Clovis occupation, derived from carbonized plants, average  $11,300 \pm 240$  radiocarbon years, while four dates from carbonized plants from the Folsom occupation range from 10,200 to 10,700 radiocarbon years ago, with an average age of  $10,380 \pm 140$  years. A bone collagen sample yielded a date of  $10,260 \pm 110$  years.

"Now it appears that a cultural horizon characterized by unfluted Plainview or Goshen points may have to be squeezed in between Clovis and Folsom," says Fiedel, citing the research of George Frison and Bruce Bradley. He says Goshen points were stratified below Folsom assemblages at Hell Gap and the Carter-Kerr-McGee site. Five dates at the Mill Iron site in Montana put the Goshen complex at roughly 11,400 years (uncalibrated), but four other dates average about 10,850.

### More Clovis Questions

"Since Clovis is demonstrably earlier than Folsom and probably older than or contemporaneous with Goshen, it is disturbing that a number of western Clovis dates have come in around

Vance Haynes, he adds, suspects that dates on collagen or collagen-derived amino acids may be less reliable than charcoal or wood dates, although Fiedel notes that Haynes leans toward accepting a collagen date for the Folsom type site instead of six charcoal dates which are some 600 years older. Fiedel says that the accuracy of amino acid-based dates is cast into some doubt by results for the Anzick child burial.

Fiedel argues that these Clovis dates that seem late cannot be attributed only to sample materials. Uncalibrated dates of  $10,770 \pm 140$ ,  $10,620 \pm 300$ ,  $10,700 \pm 150$ , and  $10,710 \pm 90$  years B.P. were obtained on charcoal from the Lehner site, where eight earlier dates (one as early as  $11,470 \pm 110$ ) were also charcoal-derived. Murray Springs, he adds, yielded a date of  $10,710 \pm 160$  on charcoal (seven others ranged from  $10,840 \pm 140$  to  $11,190 \pm 180$ ).

So why, Fiedel asks, are dates of 11,100–11,400 and 10,700 turning up for the same short-duration Clovis occupations?

### Clues from Lake Beds

Studies of layered deposits laid down by lakes provide confirmation of irregularities in the chronological record. Fiedel cites studies of a Scandinavian lake-bed sequence, where a date reversal occurs in the deposits lying just beneath deposits indicating the onset of Younger Dryas. A radiocarbon date of  $10,750 \pm 100$  years B.P. occurs 16 centimeters *below* a date of  $10,995 \pm 75$ . That 16 cm is possibly equivalent to about 500 years of deposition according to the lake-bed research. Fiedel says the 10,750 date is sandwiched between dates of  $11,065 \pm 150$  and  $11,630 \pm 190$  radiocarbon years.

This research by Svante Björck of the University of Copenhagen and colleagues on lake-bed deposits in Scandinavia revealed large jumps in radiocarbon age from around 11,400 to 10,900 years ago. Swedish lake-bed sediments dated by accelerator mass spectrometer and coeval German tree ring data revealed that after 11,000 to 10,900 radiocarbon years ago, radiocarbon dates suddenly leaped to 10,600 (Folsom-age). Further, Björck and colleagues reported that before a radiocarbon dip at around 12,600 years ago, there appears to have been an increased ratio of carbon-14, itself preceded by another dip that began about 13,200 years ago.

Carbon-14 dates for pollen-bearing strata at Rotsee, Switzerland, show a comparable pattern. Fiedel reports that the stratigraphic sequence from the Swiss core reveals the following reversal in the column: at 795 cm, approximately 11,600 and 11,200 radiocarbon years; at 790 cm, 11,350 years; at 780 cm, 10,600 years; at 770 cm, 11,000 years; and at 760 cm (just after onset of the Younger Dryas), 10,400 years. He notes that similar reversals of AMS radiocarbon dates between 10,660 and 10,900 years ago have been reported in Atlantic Canada lake-bed cores, for example at Splan Pond, where a radiocarbon date of  $10,970 \pm 90$  overlies a date of  $10,690 \pm 80$ .

### Did Climate Force Migrations?

Ice-core data place the onset of the Younger Dryas at  $12,940 \pm 260$  years ago, or just about the end of the Clovis era in Western North America.

Fiedel says the abrupt jump in radiocarbon chronology from 11,400 to 10,900 uncalibrated years probably was related

## JO BEN WHEAT

Archaeologist

1916–1997

**J**O BEN WHEAT, an authority on the weaving of peoples of the American Southwest, died June 12 in Denver after a brief illness. He was 81. He was widely known for his analysis of dyes and materials used by Navajo and Pueblo weavers, and for his archaeological excavations, undertaken from the 1940s through the 1960s in the Southwest.

Dr. Wheat, who had retired in 1987 after 34 years on the University of Colorado faculty, also researched the early peoples of the High Plains and was known for publications on bone technology at Paleoindian sites. He had been curator of anthropology at the U of C museum in Boulder. He served as president of the Society for American Archaeology in 1966 and 1967.

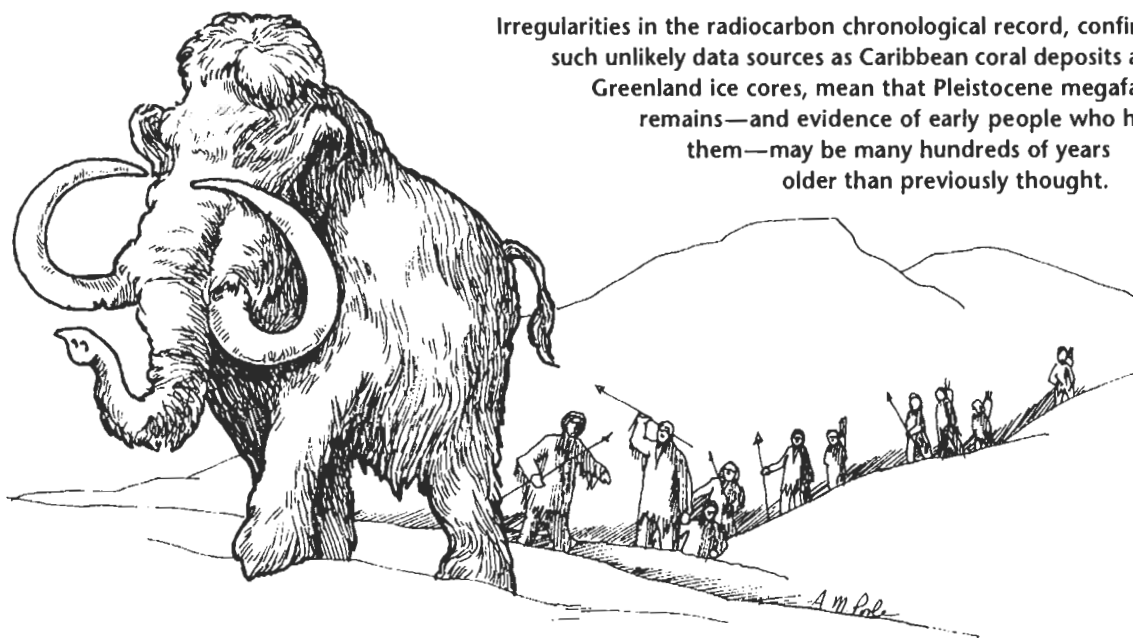
10,700 radiocarbon years," says Fiedel, referring to uncalibrated dates. Those include Anzick in Montana, Lange-Ferguson in South Dakota, Dent in Colorado, and Murray Springs and Lehner in Arizona. He suggests that these late dates may be attributable to the nature of the samples. C.

to this cooling episode. "The Clovis drought in the Southwest may be tentatively identified as a regional manifestation of the 200-year warm interval between the Intra-Allerød Cold Period and the Younger Dryas," he says, adding that the interval is marked by a methane "spike" in ice-core records that indicates increased temperatures and possibly also changes in the global hydrologic cycle.

"Perhaps, we might attribute Clovis emigration from Beringia to climatic stress during the Intra-Allerød Cold Period. However, in view of new dates from North and South American sites, it now appears that the initial southward move-

proposed time frames, whether they be based on changes in dental morphology, mitochondrial or nuclear DNA, or linguistic differentiation," says Fiedel. "It may or not be a coincidence that [Christy] Turner's 'dentochronological' estimate for North Asian-American divergence is about 14,000 to 13,500 years."

Focusing on the language question, Fiedel notes that linguist Joseph H. Greenberg has suggested that all "Amerind" languages except Athapaskan and Eskimoan-Aleutian belong to a single phylum with a common ancestor, probably represented archaeologically by Clovis. However, he says, 11,000 years has seemed a rather brief time for the development of so



Irregularities in the radiocarbon chronological record, confirmed by such unlikely data sources as Caribbean coral deposits and Greenland ice cores, mean that Pleistocene megafauna remains—and evidence of early people who hunted them—may be many hundreds of years older than previously thought.

ment of the Paleoindians must have occurred at least 600 calendar years before the Intra-Allerød Cold Period."


Fiedel notes that early North American radiocarbon dates include an  $11,820 \pm 200$  date for the Nenana complex at Walker Road, Alaska; the Aubrey, Texas, Clovis dates of  $11,540 \pm 110$  and  $11,540 \pm 90$ ; the  $11,570 \pm 170$  date for the Goshen complex at Mill Iron, Montana; and the  $11,840 \pm 130$ ,  $11,700 \pm 95$ , and  $11,450 \pm 110$  dates for the ill-defined "pre-Folsom" level at Agate Basin, Wyoming. He says that although much earlier radiocarbon dates of around 13,000 at Meadowcroft Rockshelter in Pennsylvania may result from contamination by coal or old charcoal, there is mounting evidence of a small-blade and blade-core industry associated with, or perhaps immediately preceding, early Clovis components in the Southeast. Findings at sites such as Cactus Hill in Virginia and Big Pine Tree in South Carolina, says Fiedel, suggest that the Meadowcroft evidence should be reevaluated.

### Other Proposed Time Frames

"In my opinion, we should now take 14,000 to 13,500 B.P. as a firm date for the first successful human colonization of the Americas. This is the date that should be used in any future attempts to calibrate the archaeological record against other

many distinct families, so most linguists reject Greenberg's Amerind macrophylum. In contrast, linguist Johanna Nichols has contended that the process of linguistic divergence in the Americas must have taken from 35,000 to 50,000 years, a time insupportable on archaeological grounds. "It is therefore convenient to have an additional two to three millennia tacked on to the span of human occupation," says Fiedel.

He acknowledges that the technological uniformity of Clovis need not also imply linguistic or ethnic uniformity. "Late-Pleistocene Beringia might have contained populations derived from several different language stocks and cultural traditions, such as Nenana and Mesa complexes, that adopted Clovis technology much as diverse tribes took up the accoutrements of the Plains bison-hunting lifeway in the 18th century."

Referring to genetic evidence, Fiedel notes that the widespread occurrence of four mitochondrial DNA lineages in modern and prehistoric Native American populations suggests that all four are descended from a single, somewhat diverse group of immigrants from Beringia. "Geneticists would now prefer a date of about 20,000 to 25,000 years for this migration, but I think they should accept the 14,000 to 13,500 year estimate as a working assumption," says Fiedel. 

—Don Alan Hall



# Ancient Alaskan Bones May Help to Prove Coast Migration Theory

**H**UMAN BONES excavated in a remote southeastern Alaska cave in 1996 date to around 9,800 radiocarbon years ago, making them the oldest reliably dated human remains found thus far in Alaska or Canada. The antiquity of these bones of a young man, and their location on Prince of Wales Island, lend support to the theory that early people migrated to North America along the Pacific Coast. In addition, a series of accelerator mass spectrometry (AMS) radiocarbon dates from Paleontological specimens from the cave span the past 40,000 years, indicating the presence of ice-free refugia during the late Pleistocene.

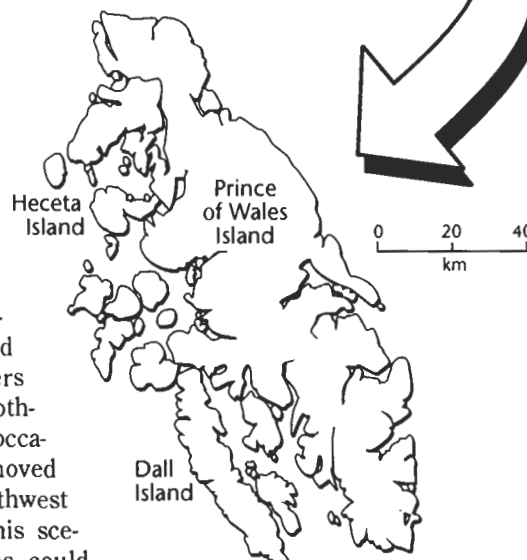
The Tongass Cave Project, a joint effort of the United States Forest Service and the National Speleological Society, began in 1990 a systematic survey and mapping of the caves of the Tongass National Forest on the islands of coastal Alaska.

E. James Dixon, Curator of Archaeology at the Denver Museum of Natural

History, says these caves are ideally suited for evaluating the coastal-migration theory. Not only was the area free of ice during the late Pleistocene, the caves were a center of human activity, and they contain organic remains that can be dated.

an inland or a coastal route. Scientists favoring the inland route hypothesize that human hunters followed large animals such as mammoths southward when there was an ice-free corridor between the great Laurentian ice sheet on the east and the Cordilleran glaciers that flowed from the mountains. Others propose an alternative hypothesis suggesting that people, occasionally using watercraft, moved southeastward along the northwest coast of North America. This scenario explains how humans could have reached South America before the melting of the continental glaciers. Proponents note that several early archaeological sites in North and South America lend support to the coastal theory.

The interior-migration model suggests a lifestyle based upon the hunting



in a project that pulls together scientists whose expertise includes glaciation, geology, archaeology, paleontology, and climate history. In a telephone interview with the **Mammoth Trumpet** he noted that the origins and development of Northwest coastal culture are not well known because the heavily forested environment makes excavation difficult and the acidic soils result in poor organic preservation.

By focusing on the region's caves, however, typical research problems—such as excavating through massive root systems, sites overlain by uprooted trees and branches, disturbance of the soil layers caused by fallen trees, and the high acidity of forest soils—are eliminated. So the Tongass project focused on the region's karst topography, which forms in areas underlain by limestone and is exemplified by underground drainage and caves.

## Parts of the area were ice-free during the late Pleistocene

History, says these caves are ideally suited for evaluating the coastal-migration theory. Not only was the area free of ice during the late Pleistocene, the caves were a center of human activity, and they contain organic remains that can be dated.

Archaeologists postulate that people could have entered North America by way of the Bering Land Bridge either by

of land mammals and freshwater fishing. The coastal-migration model suggests a livelihood based upon the hunting of marine mammals, saltwater fishing, and shellfish gathering facilitated by the use of various types of watercraft.

Dr. Dixon, who received his undergraduate and part of his graduate education in Alaska and his Ph.D. at Brown University, is the principal archaeologist



Tim Heaton, paleontologist from the University of South Dakota, is pictured near the entrance of site 49-PET-408. Behind him, the cave squeezes down into two smaller passages, each no larger than one meter high and two meters wide.

TERRY FIFIELD

The karst region of southern southeast Alaska contains numerous coastal caves that were carved out by the sea. Though sea level increased after the melting of Ice Age glaciers, many of these caves have undergone geologic uplift so they are above modern sea level. The caves preserve beach deposits that contain shells, driftwood and other organic materials that can be radiocarbon dated.

This karst region is part of the temperate coastal rain forest that extends along the west coast of North America from northern California through coastal Oregon, Washington and British Columbia northward to Alaska's Kodiak Island. The Alaska portion of this region is characterized by hundreds of islands, heavy rainfall, and steep, thickly forested terrain that makes field research difficult.

The excavation of a cave designated

49-PET-408 located in the northern part of Prince of Wales Island in the Alexander Archipelago yielded human remains. Scientists found the mandible (broken into two parts) of an adult male who was probably in his early 20s. "The mandible contains all the teeth, except the four incisors," said Dixon. "Three human vertebrae and a partial right pelvis were found in the same chamber as the mandible, about 10 meters from the cave entrance. Based on the similar degree of staining, size, and estimates of age and gender, all the human bones appear to be from the same individual."

Dixon's team submitted two small samples of the bone to AMS radiometric tests. A sample extracted from the mandible dated  $9,730 \pm 60$  years B.P. (CAMS-29873). Another sample taken from the pelvis dated  $9,880 \pm 50$  years B.P. (CAMS-



Kevin Allred uses a transit while mapping site 49-PET-408. Founder and current board member of the Tongass Cave Project, Allred was one of the first to recognize the significance the site. He guided Heaton, his longtime friend, to the site in 1994. This year Allred spent two weeks at the site assisting with archaeological and paleontological investigations as well as mapping.

TERRY FIFIELD

# TRIBAL GOVERNMENTS MAKE DECISIONS

As soon as human remains were found at the 49-PET-408 site in 1996 all excavation ceased and the archaeologists began a process of consultation with the tribal groups involved pursuant to the Native American Graves Protection and Repatriation Act (NAGPRA). Terry Fifield, archaeologist with the U.S. Forest Service's Craig and Thorne Bay Ranger Districts in Craig, Alaska, contacted the local tribal governments of Klawock, Craig, Hydaburg, and Kake.

Fifield said the human remains were discovered on July 4, 1996, and that he was informed July 5. By the following day, Fifield had informed the presidents of all the tribal governments concerned. "There was very little time lapse and we were talking to each other well within all the prescribed time limits."

The Kake and Hydaburg tribal governments deferred to the Klawock Cooperative Association and the Craig Community Association. The Klawock and Craig tribal governments represent related Tlingit tribal lineages; it is in their ancestral territory that the human remains were found.

On first learning of the discovery, both Craig and Klawock Tribal Councils had reservations about further study and excavation.

Millie Stevens, president of the Craig Community Association, said that at a subsequent meeting, there was a lengthy discussion among the 10 Craig board members. She says that one of the biggest concerns of tribal members is that they do not want the name or the location of the cave to be made known because they fear grave robbers might desecrate it as has happened at burial sites in other parts of Alaska.

Stevens told the *Mammoth Trumpet* that she was able to persuade board

members to permit radiocarbon dating of the bones for scientific and archaeological reasons. Also, she says, "it would give us a better idea as to how long people had been in this area. We really believe that the Tlingits were the first people in this area. The Haida and Tsimshian people migrated from Canada and have been in this area a long time, but not as long as the Tlingits have been here."

Roseann Demmert, president of the



**Sabrina Demmert, daughter of Roseann Demmert, the president of the Klawock Cooperative Association, was one of four interns who worked on the project in 1997. A recent graduate of Klawock High School, she is entering Fort Lewis College this fall.**

Klawock Cooperative Association in Klawock, Alaska, said that both tribal associations agreed to allow the skeleton to be dated with the understanding that the bones would be reburied at the same site

later. The tribal councils also have an understanding with the Forest Service that all decisions regarding the skeleton will be discussed with them every step of the way. In addition, she said, the tribal councils are to have prior review of any new information that is to be published regarding the skeleton.

Fifield said he attended six tribal meetings over the course of last winter and also exchanged dozens of phone calls and some letters with the tribal governments.

Two years prior to the discovery, Forest Service officials had convened a general meeting in Ketchikan and invited all community and tribal representatives to begin a government-to-government relationship, required under executive order, says Fifield. "There was meaning in what they said," he added. "We took it to heart, and did it the way we were supposed to do it, and it has worked out real well."

Fifield believes that the government-to-government approach is encouraged by the island's small-community environment. "My children go to school in the same school that most of the council members' children in Klawock go to. We're active on all the same committees. I see everybody in the grocery store. They know me. People trust me to some extent, and I'm personally accountable for the things that I say in public. There isn't the amount of distrust that can develop in a more urban context."

Regarding the current research season, Fifield says that researchers were able to fund two native student internships with their National Science Foundation grant to the Denver Museum of Natural History. The internships have been shared among four individuals selected by the Klawock and Craig Tribal Councils. Recipients Sabrina Demmert, Aubery Gambel, Tarz Snook, and Yarrow Varra have contributed to every aspect of the project and promise to provide lasting links between the researchers and the tribes.

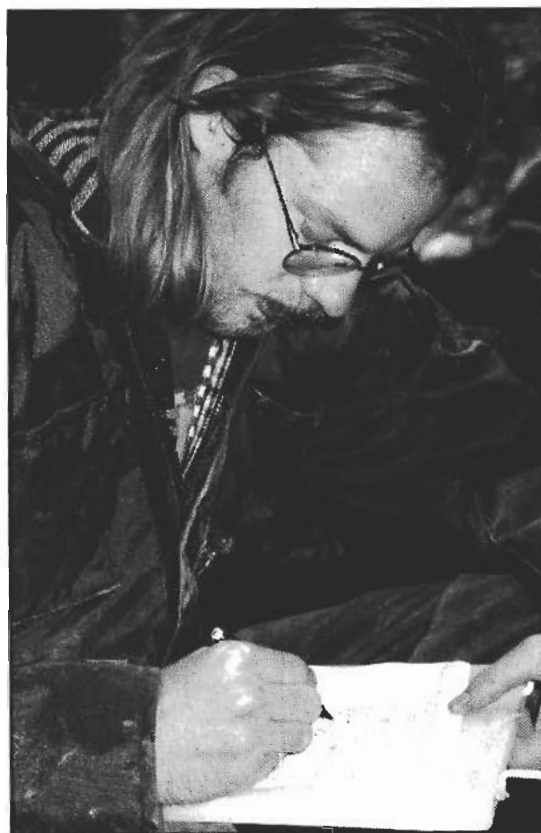
—Carol Ann Lysek

3238). The human bones are being kept in a climate-controlled environment at the Denver Museum of Natural History.

They have been dried so that the moisture content is optimal for preservation, and casts have been made, said Terry

Fifield, archaeologist with the Craig and Thorne Bay Ranger Districts.

In addition to being studied by Dr.



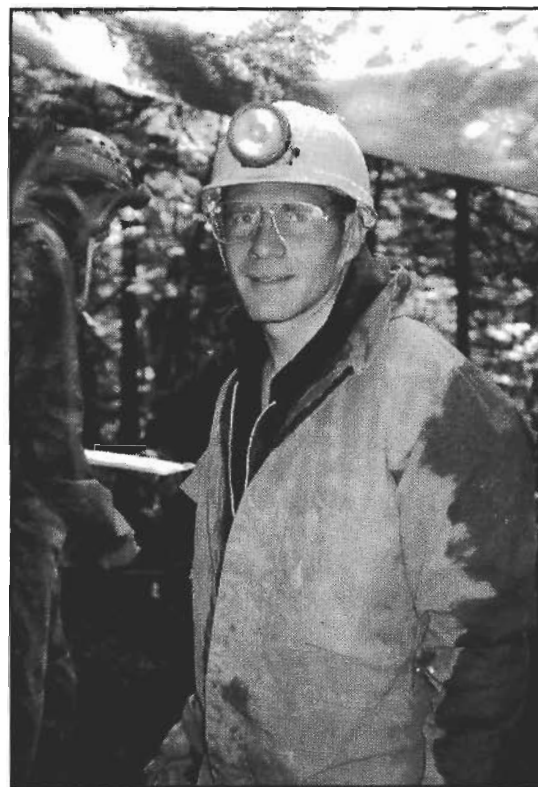
Fred Grady, above, preparator for the Smithsonian Institution, washes cave sediments. Sediment from paleontological context is bagged by provenience unit, and washed in fine-mesh bags to remove fines. The coarse fraction is then dried, sorted and studied. Eric Parrish, above right, technical illustrator with the Denver Museum of Natural History, at work on Prince of Wales Island. Parrish documented the setting and developed stratigraphic profiles. Paleontologist Tim Heaton, right, has been studying the Quaternary mammals of Prince of Wales Island since his work at El Capitan Cave in 1992.

Dixon, the bones have been examined by Robert Pickering, a physical anthropologist at the Denver Museum of Natural History. Physical anthropologist Christy G. Turner of Arizona State University plans to study the individual's dentition, and Douglas Owsley, head of physical anthropology at the Smithsonian Institution, will also be examining the bones from 49-PET-408.

In addition to the human bones, scientists discovered three artifacts while excavating 49-PET-408. They found a piece of marine mammal bone, possibly a large mammal, that had been modified into what was probably a flint flaker. This artifact and the human remains exhibit similar staining and preservation qualities and it appears that they were associated, says Dixon.

Near the rear of the cave the team found the medial fragment of a large barbed bone projectile point. The fragment, which appears to have been manufactured from the rib of a marine mammal, is not stained dark brown like the human remains and the flint flaker.

The only lithic artifact researchers found is a bifacially thinned chert tool encrusted with calcium carbonate. This biface was recovered from a cham-



ALL PHOTOS: TERRY FIELD

ber near the cave entrance. Dixon says calcium carbonate encrustations characteristically form on the underside of artifacts in cave deposits, and the fact that these encrustations occur on both faces of





the artifact indicates that it was turned over some time after it was originally deposited in the cave.

Perhaps more exciting than the artifacts, however, are animal bones from the cave dating back more than 40,000 years, establishing for the first time the existence of a glacial refugium

*continued on page 20*




TERRY FIFIELD

Dave Love and Jennifer Griffin pose at the Tongass Cave site. Love spent two weeks this summer assisting with archaeological and paleontological excavations.

## New Books

***Paleoindian Geoarchaeology of the Southern High Plains***, by Vance T. Holliday. University of Texas Press, 1997. 312 6 x 9-inch pages, 31 photographs, 71 maps and drawings, 33 tables. \$50 (hardcover) \$24.95 (softcover).

Holliday, a University of Wisconsin geographer, has extensive experience studying well-known archaeological sites on the southern High Plains including Lubbock Lake, Plainview, Clovis and Midland. This book, covering 20 sites, presents a synthesis of data from decades of earlier research on the region's geoarchaeology as well as Dr. Holliday's own recent research. He integrates new and old data on geomorphology, stratigraphy, soils, geochronology and paleoenvironments. He also compares the sites with other sites across the Great Plains. This new book is considered a key source on the early geoarchaeology of the region. 

## COMING CONFERENCES

**Oct. 20-23 Annual Meeting, Geological Society of America, Salt Lake City, UT.**

Contact: Vanessa George, Geological Society of America, 330 Pentrose Place, Boulder CO 80301. 303-447-2020. Fax 303-447-1133.

**Nov. 7-9 Eastern States Archaeological Federation Meeting, Travelodge Conference Center, Mt. Laurel, NJ.**

Contact: Debra Martin, 302-832-0653

**Nov. 13-16 30th Annual Chacmool Conference, Calgary, ALB.**

Contact: Nancy Saxberg, Conference Committee, Dept. of Archaeology, University of Calgary, 2500 University Dr. NW, Calgary AB T2N 1N4. 403-220-5227.

e-mail: 13041@ucdasm1.admin.ucalgary.ca

**Nov. 19-23 96th Annual Meeting, American Anthropological Association, Washington, D.C.**

Contact: AAA Meetings Dept. 4350 N Fairfax Dr. Ste. 640, Arlington VA 22203. 703-528-1902 ext. 2.

e-mail: liz@aaa.mhs.compuServe.com.

**Dec. 1-5 Annual Conference of the Australasian Society for Human Biology and the IUAES Commission on Human Ecology, and the 5th World Academic Conference on Human Ecology, Adelaide, South Australia.**

Contact: ASHB/5th WACHE, Dept. of Anatomy and Histology, University of Adelaide Medical School, Adelaide, SA 505, Australia. Fax 61-8-83034398.

**March 25-29, 1998 63rd Annual Meeting, Society for American Archaeology, Seattle Convention Center, WA.**

Contact: SAA, 900 Second Street NE No. 12, Washington DC 20002-3557. 202-789-8200. Fax 202-789-0284.

e-mail: meetings@saa.org.

**March 31-April 1, 1998 Annual Meeting, Human Biology Association, Hilton Hotel, Salt Lake City, UT.**

Contact: Michael Crawford, Department of Anthropology, University of Kansas, Lawrence KS 66045-2110.

e-mail: crawford@kuhub.cc.ukans.edu

**April 1-4, 1998 Annual American Association of Physical Anthropologists, Hilton Hotel, Salt Lake City, UT.**


Contact: Clark Spencer Larsen, Research Laboratories of Anthropology, Alumni Building, CB# 3120, The University of North Carolina, Chapel Hill, NC 27599-3120.

**May 5-10, 1998 31st Annual Meeting, Canadian Archaeological Association, Harbour Towers Hotel, Victoria, BC.**

Contact: Bjorn Simonson, 250-715-1566.

**August 23-29, 1998 Eighth International Congress of the International Council for Archaeozoology (ICAZ '98), University of Victoria, Victoria, BC.**

Contact: Conference Management, Division of Continuing Studies, PO Box 3030, Victoria, BC, V8W 3N6.

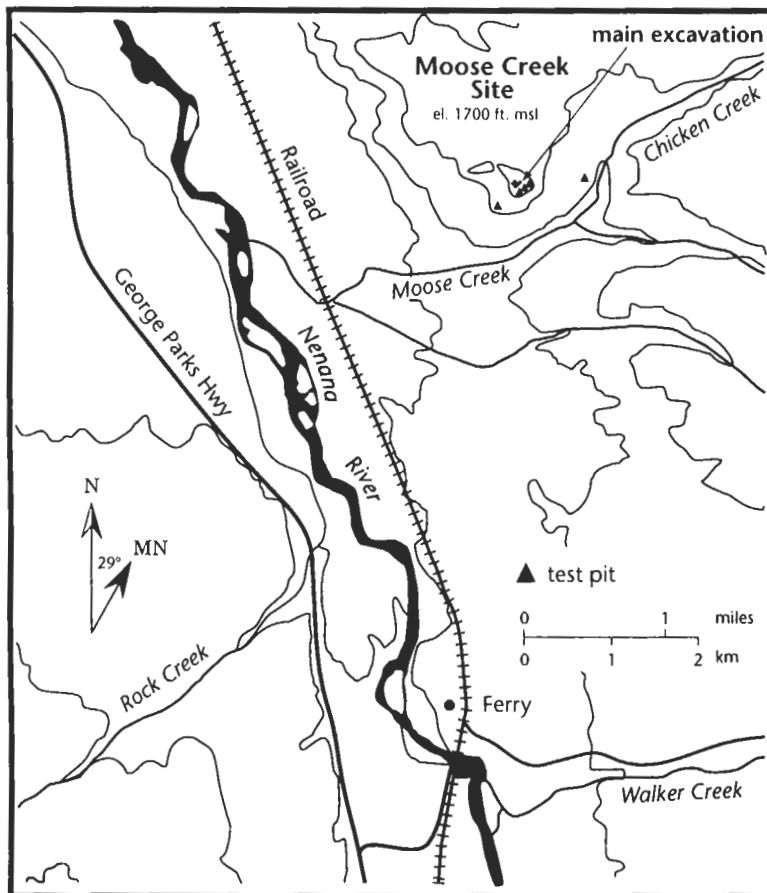
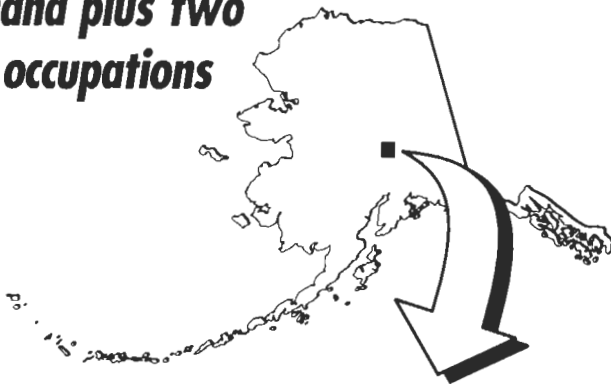
e-mail: morourke@uvic.ca; <http://www.uvcs.uvic.ca/conference/admin.htm> 

*Send conference notices to Mammoth Trumpet, 355 Weniger Hall, Oregon State University, Corvallis, OR 97331-6510.*



# Expedition Affirms Significance of Moose Creek Site

*Remote Alaskan hilltop yields evidence of Nenana plus two Denali occupations*



**N**EW EXCAVATIONS confirm that Alaska's Moose Creek site was first occupied by people of the Nenana tradition. The 1996 field work also revealed two hitherto unknown Denali occupations in higher levels of the remote site. Initially excavated in the 1970s and 1980s, Moose Creek had previously had an ambiguous cultural affiliation and questionable age, but a larger University of Alaska-Fairbanks excavation in 1996 headed by Georges A. Pearson of the University of Kansas has affirmed the status and significance of this Alaskan site.

Located in the northern foothills of the Alaska Range about 100 kilometers southwest of Fairbanks, the site is approximately two miles from the confluence of Moose Creek with the Nenana River and four miles from the town of Ferry. It is on the highest terrace of the Nenana Valley on a hilltop carved from glacial outwash by the Nenana River and Moose Creek.

John F. Hoffecker and C. F. Waythomas identified the site in 1978 while assessing the extent of late-Pleistocene human occupation of the Nenana Valley during the North Alaska Range Early Man Project. Archaeologists had previously found that human presence at the nearby Dry Creek site went back

*The daily climb up to the site took 40 minutes; 12-gauge shotguns provided protection against bears.*

more than 11,000 radiocarbon years. At Moose Creek, Hoffecker and Waythomas tentatively assigned cultural material to the Nenana complex, an early tradition characterized by the presence of triangular and teardrop-shaped points and endscrapers, and the absence of microblades and fluted points. However, their excavations did not yield unequivocal Nenana affiliations, and antiquity of the cultural material had to be inferred from a 3,500-year range of radiocarbon dates from samples of organic material in buried paleosols. Hoffecker and colleagues found that Moose Creek possessed at least two cultural components, but both of them lacked diagnostic tools; thus, the site remained something of an enigma.

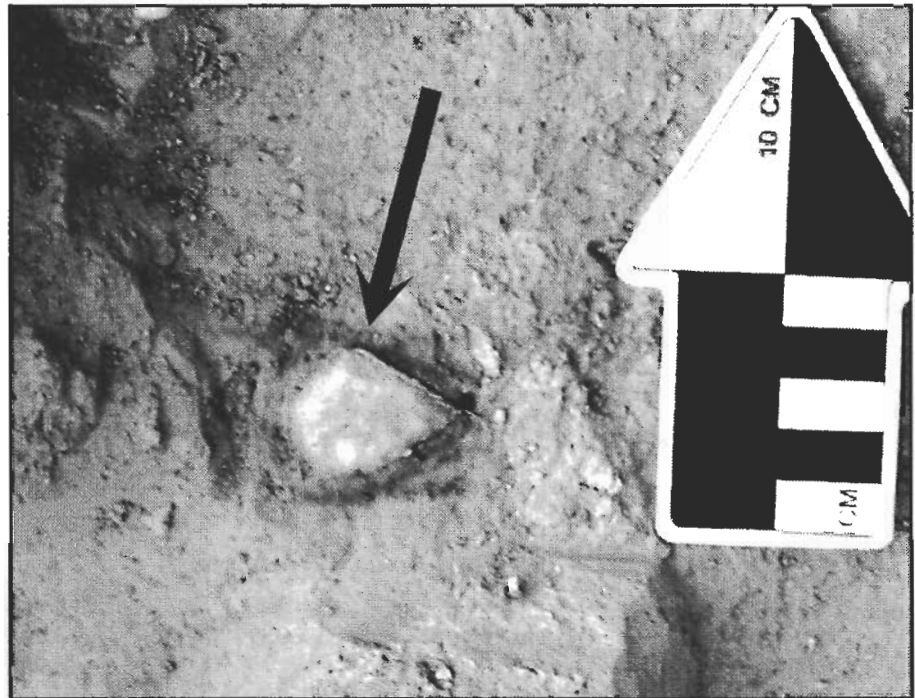
Analysis of the 1996 findings is still in progress, but this latest expedition has clarified the significance of the remote site. "The principal aim of last summer's re-excavation," says Pearson, "was to liberate the Moose Creek site from an unfortunate state of



limbo." It succeeded in finding two distinct Denali occupations above unequivocal Nenana material. Denali complex, sometimes referred to as American Paleoarctic or Beringian tradition, is characterized by microblades and wedge-shaped core technology that are regarded as closely related to artifacts found in Siberia.

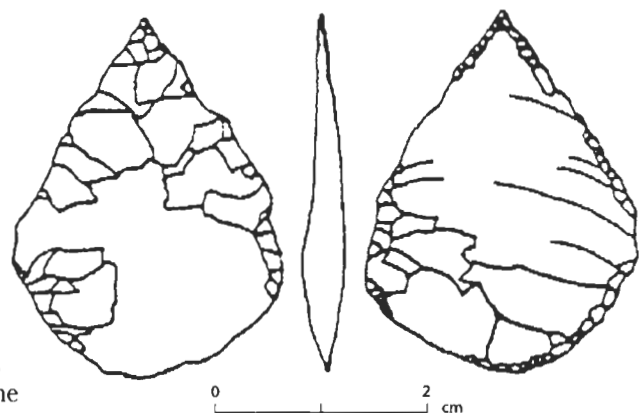
The 1996 field work so far has produced one radiocarbon date,  $11,190 \pm 60$  years B.P. (Beta-96627), from an accelerator mass spectrometer (AMS) assay of hearth charcoal. Pearson says budget restrictions have delayed further radiocarbon analysis of 1996 Moose Creek discoveries. The radiocarbon dates previously obtained from Moose Creek paleosols ranged from 8,160 to 11,730 years B.P.

The one new date compares closely with radiocarbon dates from nearby Nenana sites, Walker Road and Dry Creek. Differences are, in fact, statistically insignificant. Three Walker Road AMS



GEORGES A. PEARSON

At the Nenana level at Moose Creek the 1996 excavation discovered a diagnostic Chindadn point (right), pictured in situ above.



GEORGES A. PEARSON

dates range from about 11,010 to 11,300; Dry Creek has a date of 11,120 years. The data indicate that the Nenana Valley was first occupied around 11,200 radiocarbon years ago.

The solid evidence of Nenana occupation at Moose Creek came from the discovery of a Chindadn point in the site's deepest cultural component. The new radiocarbon date came from a hearth in this same component. The two Denali-complex occupations were separated by more than 20 centimeters of sand. "These data demonstrate that previous assemblages were composed of mixed artifacts from the Denali and Nenana complex levels," says Pearson. "The sequence of archaeological components at Moose Creek is similar to those observed at Dry Creek, Walker Road and Panguingue Creek." Those nearby sites are all south of Moose Creek.

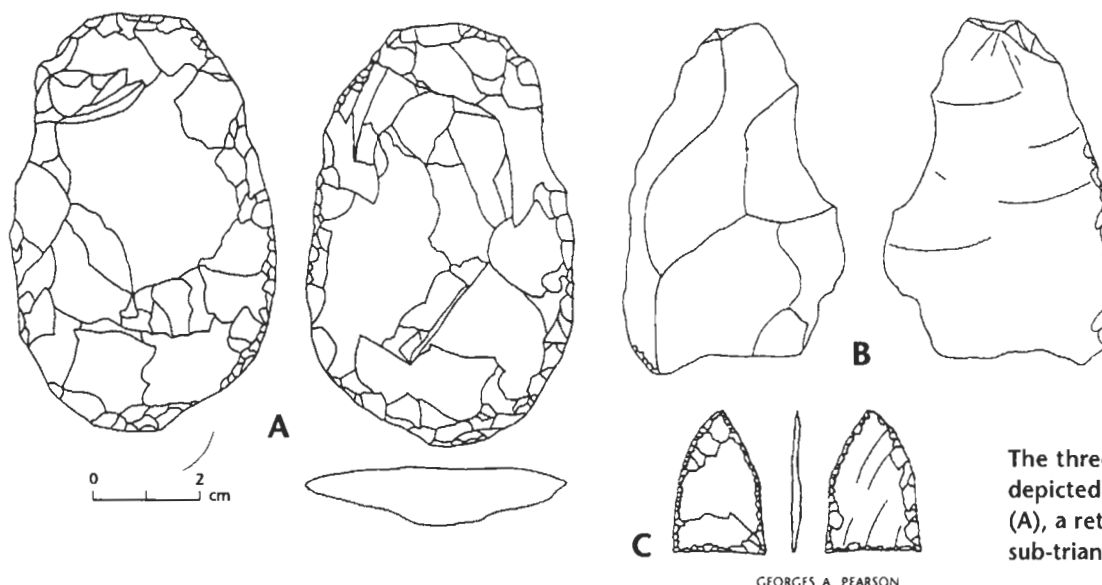
Setting out to locate hearths and diag-

nostic tools, Pearson decided that the 1996 Moose Creek expedition should excavate more than twice as much surface as had the previous investigations. The project was part of the University of Alaska Fairbanks Summer Session's archaeological field school, which provided the energy of 15 students who came from all parts of the United states, and Robert A. Beckwith, the crew chief. Their excavation units surrounded those that had been put in by Dr. Hoffecker, and followed the same grid system so that all features could be plotted on a single map. Pearson's crew excavated more than 45 square meters, in spite of the difficulties imposed by the remote site.

"It was by far the most extreme kind

## EASTERN STATES MEETING

The Archaeological Society of New Jersey will be the host for the 1997 meeting of the Eastern States Archaeological Federation, which represents 20 states and provinces. The three-day conference will be Nov. 7-9 in Mt. Laurel, NJ, at the Travelodge Hotel Conference Center, New Jersey Turnpike Exit 4, 1111 Route. 73. There will be presentations on research as well as displays of artifacts and publications. David Orr of the National Park Service will speak at the Saturday banquet on research at Gettysburg and other Civil War sites. Sunday morning's session will focus on New Jersey archaeology. For registration information contact Debra Martin, arrangements chair, at 302-832-0653 or Herbert C. Kraft, program chair, at 201-761-9543 or e-mail at [krafther@lanmail.shu.edu](mailto:krafther@lanmail.shu.edu).



The three Nenana-complex tools depicted here include a biface (A), a retouched flake (B), and a sub-triangular point (C).

GEORGES A. PEARSON

of archaeology I've had the pleasure to be involved with," Pearson told the **Mammoth Trumpet**. The expedition's base camp was set up far below the site on a lower terrace of the Nenana River. The area's abundant bears—black bears

and Alaska brown bears—were a constant threat in the thickly wooded area. "We had to cut our own path through the forest to bring our equipment to the site," said Pearson. University of Alaska archaeologist W. Roger Powers pro-

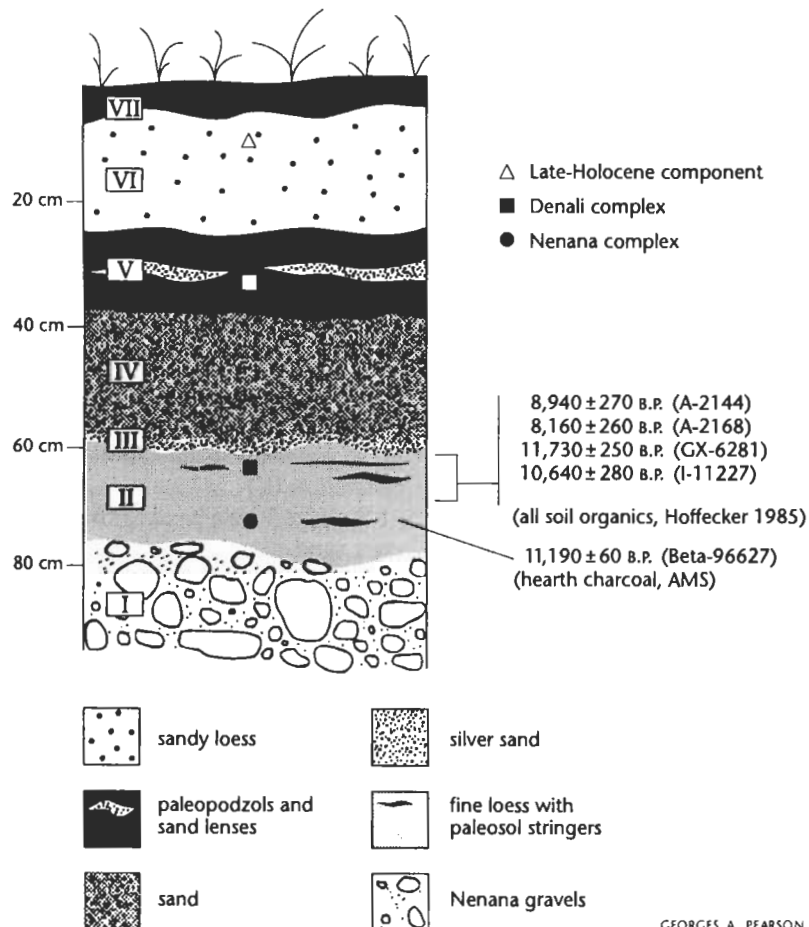
vided an all-terrain vehicle to help move equipment to the camp. The crew carried in some of their equipment.

The daily climb up to the site took 40 minutes, and always Pearson or Beckwith escorted the crew with 12-gauge shotguns for protection against the bears. It took 25 minutes to climb back down to camp.

No refrigeration was available, and food was brought in weekly. Water had to be brought in daily from Ferry. "This research would not have been possible without the help of the people of Ferry," said Pearson, "especially De Vere Pieschl, who let us use his well."

Because earlier archaeological investigations at the Moose Creek site had found only a few flakes in the upper layers, Pearson had his crew excavate them by arbitrary 10-centimeter levels using a "skim shovel" technique. They sifted these upper-level materials through a combination of eighth- and quarter-inch screens and recorded artifacts either by a three-point system to locate each precisely within the site's three-dimensional grid, or simply within quads of 50 square centimeters, 10 cm in depth.

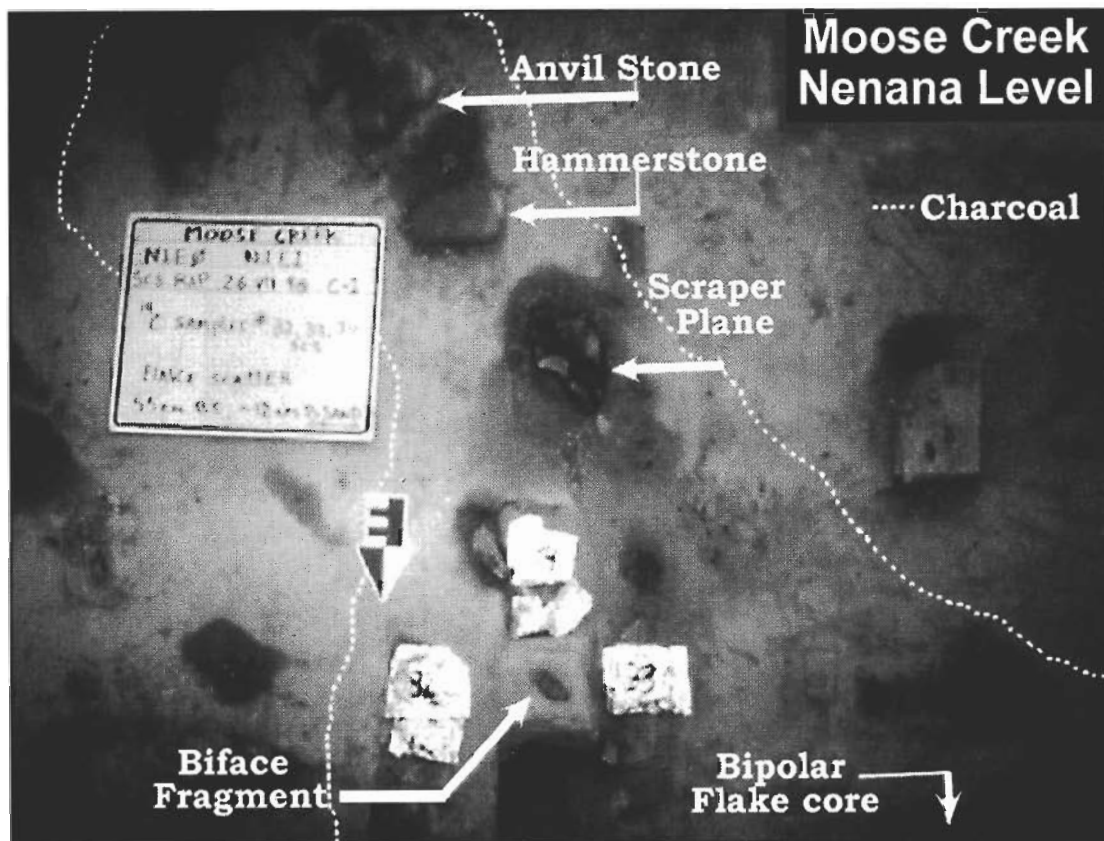
Upon reaching the site's lower levels, the crew employed more precise methodology. Workers excavated in five-centimeter levels with trowels, and sifted all material through eighth-inch screens. They recorded provenience of artifacts by the three-point system and employed three separate depth measurements—



GEORGES A. PEARSON



Plan-view photo depicts Nenana complex hearth and flake scatter plus some of the tools recovered at Moose Creek in 1996.



distance below surface, below datum, and below sand layer. Pearson says the below-sand measurement standardized their depth measurements and maximized the resolution of the five-centimeter levels. "This allowed us to compare more readily and accurately the relative depth of objects across the site," he explained.

Though archaeological materials

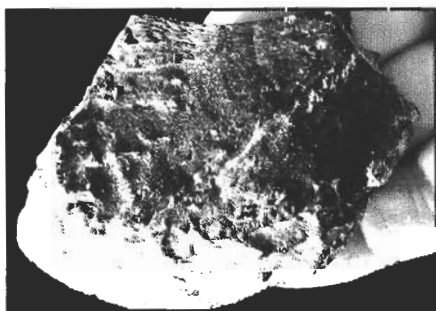
come chiefly from four strata, Moose Creek site has seven distinct strata that become compressed near the edge of the bluff. The lowest, stratum I, consists of archaeologically sterile outwash gravels—an unsorted mix of pebbles, cobbles and sand of various kinds of rock. Above this layer is stratum II, approximately 25 centimeters of fine, windblown silt. This loess with discon-

tinuous paleosols yielded both Nenana and the early Denali cultural materials. Its paleosols are more evident away from the bluff than they are near the bluff. Nenana-complex material including the Chindadn point was found near the bottom of stratum II, and the oldest Denali-complex material was found near the upper horizon of the stratum, underlying a conspicuous layer of silver sand—stratum III—approximately five centimeters thick. Previous Moose Creek dates that ranged from 8,160 to 11,730 radiocarbon years came from organic materials in soils in the upper half of stratum II.

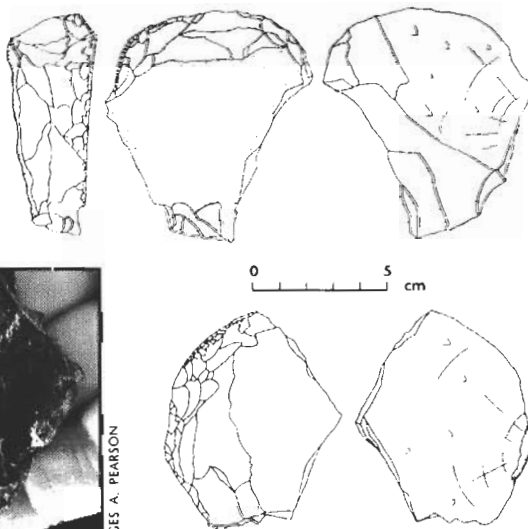
Stratum IV is a layer of coarse, weathered sand approximately 25 centimeters in thickness, and above that, stratum V is a complex of buried podzols, dark brown in color, mixed with lighter layers of sandy loam. On top are strata VI and VII, a modern B horizon of poorly weathered sandy loam topped by about seven centimeters of humus and surface litter.

The archaeologically important layers, strata II and V, are the two buried soil complexes. Pearson said permafrost conditions have not caused major alterations to the stratigraphy, though some

Nenana complex side scraper shown in both photograph and drawing below. At the right are three views of a Nenana scraper plane.



GEORGES A. PEARSON

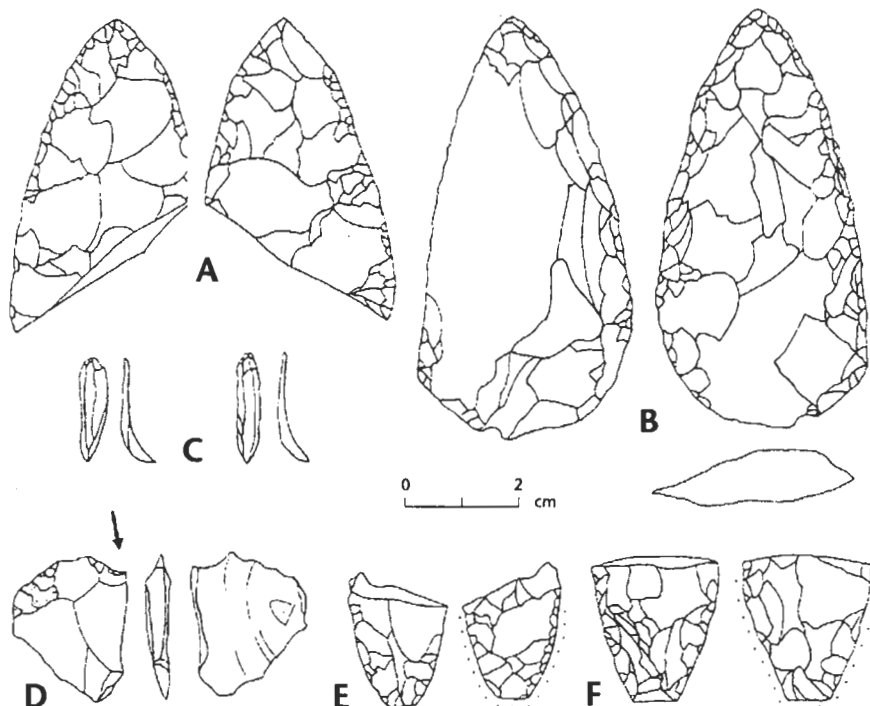


GEORGES A. PEARSON



GEORGES A. PEARSON

Above, Nenana complex scraper plane from Moose Creek. Right, some of the artifacts found at the Denali complex I level at the Moose Creek site: A & B, bifaces; C, microblade overshots; D, Donnelly burin; E & F, point bases.



GEORGES A. PEARSON

evidence of permafrost was found at the site.

Hoffecker had designated two cultural components at the Moose Creek site, but Pearson says the 1996 excavation indicates these each could be subdivided stratigraphically, making four distinct cultural components. The oldest, of course, is the Nenana material low in the second stratigraphic unit. Diagnostic Nenana material, in addition to the Chindadn point, included a sub-triangular point and a large scraper plane. The Chindadn point was found 15 centimeters below the lowest part of the site's microblade component, and it was associated with the hearth dated at 11,190 radiocarbon years. Dave McMahan of the Alaska Department of Natural Resources identified charcoal from the hearth as willow.

Associated material included three large "hearth stones," a bifacially flaked tool, a sidescraper, a bipolar flake core, a sub-triangular point, and a scatter of flakes. "The majority of these artifacts were manufactured from a single large basalt cobble taken from the underlying Nenana gravels," says Pearson, who adds that pitting on the large hearth stones suggests that the basalt cobble

was reduced using a bipolar technique with the large stones as hammers and anvils.

Pearson's component two consists of the upper portion of the second stratigraphic unit and is associated with a paleosol immediately under the silver-sand layer (stratum III). Diagnostic material includes 27 microblades and a Donnelly burin. The 1996 workers found


all of this level's microblades in a tight cluster, suggesting that they are all by-products of microblade production.

This Denali-I component is likely associated with a hearth Pearson's crew found nine centimeters below the silver sand horizon. Because of budget restrictions, the hearth has not yet been dated, but Pearson has tentatively assigned the Denali-I component a radiocarbon age

## Peopling of Americas Subject of SAA Session

Peopling of the Americas is the subject of a session being planned for the annual meeting of the Society for American Archaeology in Seattle next March. Organizers Georges A. Pearson of the University of Kansas and David R. Yesner of the University of Alaska-Anchorage have titled the session "Late Pleistocene-Early Holocene Population Movements in the Americas: The Peopling of a Continent."

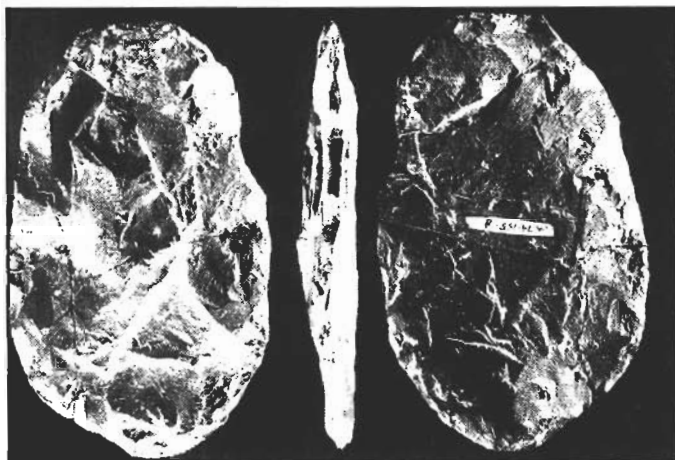
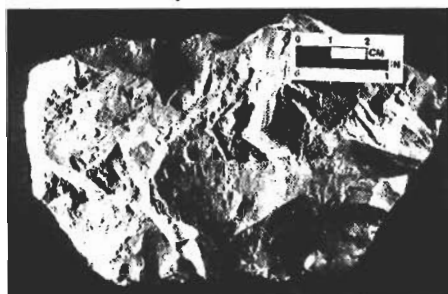
The session is to address important questions related to the initial dispersal

and settling of humans across North, Central and South America, say the organizers. Papers are being sought from researchers in physical anthropology, human genetics and linguistics as well as those in archaeology. Pearson and Yesner say possible topics include technological diffusion versus human migrations, coastal versus interior entry and dispersal routes; late Paleoindian origins and expansions; periglacial refugia and "backwash" movements; migration waves revisited, and others. 





Two Nenana artifacts discovered at Moose Creek in 1996: right, complex bipolar flake core; below, three views of a complex biface.



BOTH PHOTOS: GEORGES A. PEARSON

of 10,600 years based on AMS dates from the Dry Creek site. This component at Moose Creek is associated with the material that previously had been dated at 8,160–11,730 radiocarbon years.

Cultural component three was found approximately 30 to 40 centimeters below the surface in the fifth stratigraphic unit. Diagnostic material included microblades and a microblade core rejuvenation tablet. Pearson said this second microblade component—Denali II—was found in a buried podzol and could be as old as 8,500 radiocarbon years, judging from similar materials that Ted Goebel and Nancy Bigelow found at the Panguingue site a few miles to the southwest of Moose Creek. Charcoal samples from the Denali II component have not yet been sent to a laboratory for dating.

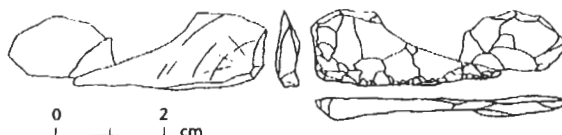
Pearson's component four consists mostly of manufacturing detritus 10–15 centimeters below the surface that is made of milky white rhyolite. The team found a small concentration of calcined bone fragments in that most-shallow component, but it was not possible to identify them.

The team found no faunal material at all in either the Nenana or Denali occupations. "We must assume that taphonomic processes are responsible for the scarcity of bone in these components," says Pearson.

Though the 1996 excavation at Moose Creek confirmed that the site is similar to others in the Nenana Valley, Pearson notes a significant dissimilarity related to geography. Moose Creek is higher than the others—more than 200 meters above the valley floor. It offered Denali and Nenana hunters unobstructed views of the entire southern half of the Nenana Valley, as well as the Chicken Creek drainage to the east. It would have allowed hunters to spot animals and watch their movements.



Denali complex II at Moose Creek yielded microblade tools—microblades (top) and a microblade core rejuvenation tablet.



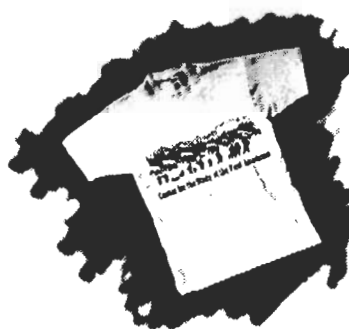
GEORGES A. PEARSON

Unlike all related Nenana Valley sites, the Moose Creek site faces southwest, not south, but that may not always have been so. Pearson's team put in several test pits around the periphery of the site to look for other signs of occupation and to determine the extent of the site. Little cultural material was found, and Pearson speculates that the site may have been more extensive and included a south-facing slope that has been removed by erosion. Evidence of Pleistocene-Holocene occupations that likely occurred on the south side of the Moose Creek hilltop would have been lost to erosion.

Pearson believes the absence in the site's assemblage of processing implements such as endscrapers is significant. "Moose Creek may have been a satellite lookout point to a larger occupation situated on a lower terrace nearby," he says.

—DAH

## And for Christmas...

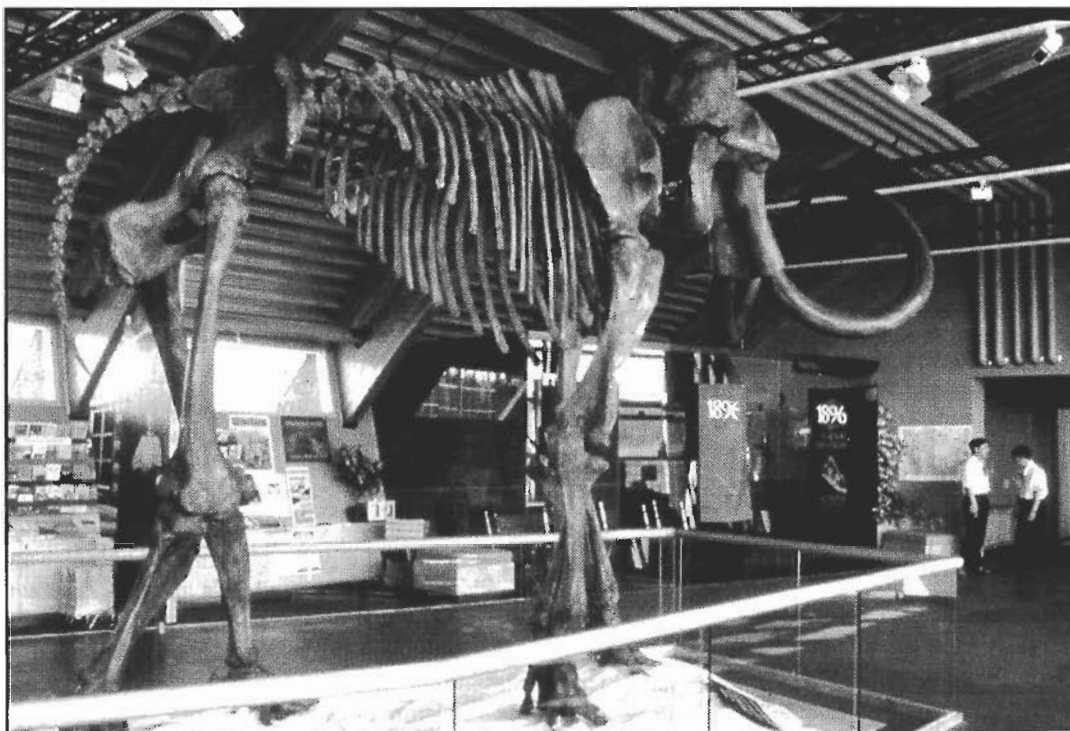


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This skeleton of a woolly mammoth is one of dozens of displays at the Beringia Interpretive Centre, which opened this summer in Whitehorse, Yukon Territory.

## Ice Age Beringia the Focus of New Museum in Whitehorse

The Yukon Beringia Interpretive Centre in Whitehorse, featuring more than a dozen exhibits and displays designed to take visitors into Yukon's Ice Age past, opened to the public this summer.

Major exhibits include a replica of the Bluefish Cave, one of the most significant archaeological sites in North America. Broken mammoth bones and stone tools found there in 1985 indicate humans found shelter in the cave. An adjacent exhibit tells the story of scientific research in the area.

The Exhibit Gallery contains thematic displays and dioramas as well as educational programming. Computer kiosks connect visitors to interactive displays and the center's web site, Beringia.com. Among the exhibits in the Great Hall is a diorama of a First Nations winter camp and a cast of the largest woolly mammoth ever recovered. The mammoth was the most abundant of all of the animals found in Beringia.

Yukon First Nations heritage is highlighted through a variety of displays and commissioned works of art. Traditional


First Nations stories depict the transition from the Ice Age to a world of new beginnings for First Peoples. At the opening ceremony Old Crow elder Charlie Peter Charlie offered prayers and Yukon musician Jerry Alfred provided entertainment.

Scientific advisors include Richard E. Morlan, Donald Clark, and Jacques Cinq-Mars, Canadian Museum of Civilization; C. R. Harington, Canadian Museum of Nature; Dale Guthrie, Institute of Arctic Biology, University of Alaska; Charles E. Schweger, University of Alberta; John E. Storer and Ruth M. Gotthardt, Yukon Heritage Branch; and C. E. Scott Smith, Agriculture Canada.

"This unique facility will provide an informative glimpse into the life of North America's first peoples and the prehistoric animals who occupied Yukon's landscape more than 10,000 years ago," said Tourism Minister Dave Keenan in opening the Centre. Keenan, who is also responsible for heritage and the arts, congratulated the artists and contractors involved in the project and the members of the advisory team, which comprises

First Nation elders, academics, and designers who guided the Centre's development. Keenan said that First Nations, particularly the Vuntut Gwitchin of Old Crow, have been instrumental in helping scientists locate Beringian evidence in the northern Yukon.

Keenan also praised the cooperation of placer miners. "Donations of ancient animal remains found on placer claims are invaluable for education and research. This support has led us to a much truer picture of the animals who roamed this land during the Beringia period."

Beringia is the name given to the area between Siberia and the Mackenzie River that remained ice-free during the Ice Age. Low sea levels caused by glaciation created a land connection between the continents by way of the exposed floor of the Bering Sea. A vast grassy tundra, known as the Mammoth Steppe, supported herds of woolly mammoth, caribou, and steppe bison. Also present were the giant ground sloth, the giant beaver, and the North American horse and camel. Predators, including the giant short-faced bear, the scimitar cat, and the American lion, followed the great herds. Evidence shows the First Peoples of North America also hunted these ice age mammals and arrived in Beringia at least 24,000 years ago. 

# SUGGESTED READINGS

## On Radiocarbon Dating


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## Ancient Alaskan Bones

*continued from page 12*

on Prince of Wales Island. Bones of a brown bear (*Ursus arctos*) yielded a radiocarbon date of  $35,365 \pm 800$  years B.P. (AA15227). Radiocarbon assay of black bear (*Ursus americanus*) yielded a date of  $41,600 \pm 1,500$  years (AA16831). It had been thought that brown (or grizzly) bears had never inhabited the island, but it now appears they have lived there through the last glacial maximum, probably living on fish. Marmot and seal bones of Pleistocene times also have been found in caves in the area.

Dixon says PET-408 still contains much undisturbed sediment including some near the entrance of the cave that appears to be several meters thick and probably spans the past 40,000 years. He thinks it is quite possible that other and possibly earlier archaeological evidence is waiting to be found. The interdisciplinary team plans to continue excavating PET-408, and to survey other caves in the region. Team members also are working to define late-Quaternary sea levels and the limits and timing of late-Pleistocene glaciation.

The project is undertaken through the professional and financial resources of the U.S. Forest Service, Tongass Cave Project, Denver Museum of Natural History, University of South Dakota, and the National Science Foundation. 

—Carol Ann Lysek

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