



MAMMOTH TRUMPET

Center for the Study of the First Americans
355 Weniger Hall, Oregon State University
Corvallis OR 97331-6510



WORDS & PICTURES UNLIMITED

Who Were the First Americans?

Physical anthropologists who study human morphology have been carefully analyzing the oldest human bones with the intent of helping solve this scientific mystery. Their discoveries pose still more intellectual challenges. Some results of their work are discussed beginning on page 8, and the report will continue in our next issue.

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.

MAMMOTH TRUMPET



Volume 11, Number 3
July, 1996

Center for the Study of the First Americans
Oregon State University, Corvallis, OR 97331

Department of Anthropology
ISSN 8755-6898

DISCOVERIES IN AMAZON CAVE SUGGEST CLOVIS WASN'T FIRST



©1993 BY DIEGO GOLDBERG/THE FIELD MUSEUM, CHICAGO

Anna Roosevelt at work in Brazil with a computer whose batteries are charged from portable solar panels.

Evidence from a cave near the Amazon River dating to as long as 11,200 years ago is being cited as confirmation that Clovis hunters were not the founding population of the Americas. The findings, first described in the April 19 issue of the journal *Science*, were made by an international team lead by Anna C. Roosevelt, curator of archaeology at Chicago's Field Museum and professor of anthropology at the University of Illinois in Chicago.

Though not startlingly old as early prehistoric sites in the Americas go—Clovis sites date to as early as 11,600 years ago—the Caverna da Pedra Pintada site in Amazonia has yielded evidence of people living very differently from the big-game hunters of the High Plains. The site is on the north bank of the Amazon near Monte Alegre, Brazil, in a humid, tropical environment, and Dr. Roosevelt and her colleagues say the region had a similar climate at the time of the earliest-known occupation. Then, ac-

continued on page 17

Brazilian Scientists Challenge 3-Wave Theory of Migration

After an extensive examination of early human morphology in South America, three Brazilian scientists have proposed replacing the widely accepted three-migration model for the peopling of the Americas with a four-migration model.

Walter A. Neves of the University of São Paulo described the research at the annual meeting of the American Association of Physical Anthropologists near Durham, N.C., in April. He suggested that a "first

continued on page 12

INSIDE

4 Recent advances in dating rock art

Expert describes three ways he uses to estimate antiquity of rock art

8 Who were the first Americans?

A specialist in human diversity describes her search for answers

13 Viruses may offer a new line of evidence

Scientist suggests another way to follow trail of ancient human migrations

14 Charting ancient climate with the personal computer

Climatologist steps into a domain usually abdicated to supercomputers

2 CRP: a relevant journal

3 Atlats: how accurate?

3 Coming conferences

7 University gets collection

13 Suggested readings

CRP: Every Paper Relevant to Scientists

"The really unique thing about *Current Research in the Pleistocene* is that every article in the journal is relevant to any Quaternary scientist," says editor Bradley T. Lepper. He reports that reviewers are completing work on the more than 50 papers being prepared for volume 13, the 1996 issue of the annual journal of brief papers on Quaternary research. The issue is scheduled to go into the mail to subscribers in November.

Because **Mammoth Trumpet** readers may not be familiar with it, we asked Dr. Lepper to explain the value of *Current Research in the Pleistocene*. Lepper, an archaeologist and anthropologist with the Ohio Historical Society, noted that a journal such as *Nature* or *Science* will have only one or two articles a month of direct relevance to his work. But with *CRP*, "literally, every article in the issue deals with issues or data that I am intensely interested in."

Serving as editor is truly a labor of love

for Lepper, who has been in charge of *Current Research* for three years. "When I was simply a subscriber, I would look forward to that one issue a year and sit down and devour it," he said in a recent telephone interview from his office in Columbus. "But now I don't have to wait." To this archaeologist whose research specialties include prehistory, Paleoindians of the mid-continent, lithic technology and hunter-gatherer ecology, the best thing about being editor is the opportunity to communicate directly with investigators, many of whom are leading scientists in their disciplines.

"It puts me at a focus-point of this network of research and publications, and I really like being right there where it's all happening."

One of Lepper's first actions as editor was to set up a panel of associate editors


who serve as links with other disciplines. These are Daniel Fisher of the University of Michigan's Museum of Paleontology, who represents geology and paleontology; Linda Shane of the University of Minnesota's Limnological Research Center, who represents paleobotany; Thomas Stafford of Institute of Arctic and Alpine Research at the University of Colorado-Boulder, who represents geochemistry and paleontology; and D. Gentry Steele of Texas A&M University, who represents physical anthropology. Papers in *CRP* are organized into sections of archaeology, physical anthropology, lithic studies, taphonomy, methods, and paleoenvironments, which is subdivided into sections for plants, animals, and geosciences.

"First and foremost *Current Research in the Pleistocene* is for publishing current research so that people can get timely

Class To Investigate Ice Age Environment of Mammoth Park Site

A week-long class investigating the late-Pleistocene environment of Oregon's Willamette Valley has been scheduled in August at a site where remains of many extinct animals have been discovered. Sponsored by the **Center for the Study of the First Americans** and Oregon State University Continuing Higher Education, the class will be held Aug. 12-16 at the Mammoth Park site in Woodburn, about 25 miles south of Portland.

Focus will be on the paleontology and paleoenvironment of the site, which was inundated at various times by catastrophic floods caused by failure of glacial-ice dams in Montana. The site has previously yielded bones of mammoth, ground sloth, horse, bison, mastodon, bear, and wolf.

There is a \$220 charge for the class; two college credits may be available at an additional fee of \$80. If you're interested in taking the class phone the **CSFA** office at 541-737-4595 for additional information. You may register by phone. 



The Mammoth Trumpet (ISSN 8755-6898) is published quarterly by the **Center for the Study of the First Americans**, Department of Anthropology, Oregon State University, Corvallis, OR 97331-6510. Phone 541-737-4595. Second-class postage paid at Corvallis, OR 97333.

POSTMASTER: Send address changes to:

Mammoth Trumpet

Center for the Study of the First Americans
355 Weniger Hall, Oregon State University
Corvallis, OR 97331-6510

Copyright © 1996 **Center for the Study of the First Americans**. Permission is hereby given to any non-profit or educational organization or institution to reproduce without cost any materials from the **Mammoth Trumpet** so long as they are then distributed at no more than actual cost. The **Center** further requests that notification of reproduction of materials under these conditions be sent to the **Center**. Correspondence to the editor should be addressed to **Mammoth Trumpet**, 37112 Moss Rock Dr., Corvallis OR 97330-9351, phone 541-745-5203.

Robson Bonnicksen	Director and General Editor
Don Alan Hall	Editor, Mammoth Trumpet
Bradley T. Lepper	Editor, Current Research in the Pleistocene
Alice L. Hall	Office Manager
C & C Wordsmiths	Layout and Design

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



access to exciting new results," says Lepper. "But there is a whole other series of categories of articles that we're interested in—cultural resource management research that deals with issues that might only be found in a contract report."

"It can be difficult for investigators to find the time and financial resources to publish full-length articles or monographs on the results of contract archaeology. *CRP* provides a way for short contributions that announce results and cite the regular contract report and thus get the results more widely known."

The journal is also a place where investigators can report findings that derive from long-term research projects. "Some-time projects are *never* published because there's always one more site to dig or one more reference to look up." Publishing in *Current Research in the Pleistocene* is a way scientists have to make data accessible in a preliminary format to a wide and interested audience.

Conscious of his own archaeologist's bias, Lepper is confident that the journal's associate editors are improving access to other disciplines involved in late-Quaternary research, which, of course, relates to the peopling of the Americas. He looks forward to increased submissions from physical anthropologists, geoscientists and other specialists in paleoenvironments and early prehistory. And he values the papers submitted by scientists, mostly from Latin America, for whom English is not their language of choice. *Current Research in the Pleistocene* has always strived to serve as a link between Quaternary research in various parts of the Americas.

Lepper is well known to longtime *Mammoth Trumpet* readers for his research on the mastodon found in an Ohio bog that actually preserved living intestinal bacteria (MT 6:1 "The Burning Tree Mastodon," and MT 6:4 "Evidence of Mastodon's Last Meal") and for his thoughts on where to look for Paleoindian sites in the Ohio Valley (MT 8:3 "The Search"). His bachelor's degree is from the University of New Mexico, and his master's and doctoral degrees are from Ohio State University; all are in anthropology. 📧

COMING CONFERENCES

June 22-29 Ninth International Palynologic Congress, Houston.
Contact: D. J. Nichols, U.S. Geological Survey. FAX 303-236-5690; dnichols@greenwood.cr.usgs.gov.

July 9-13 Tenth Annual Working Meeting on Soil Micromorphology, Moscow.

Contact: V. M. Safonova, Faculty of Soil Science, Moscow State University, Moscow 119899 Russia. shoba@micro.soils.msu.su.

Sept. 8-14 13th Congress of the International Union of Prehistoric and Protohistoric Sciences, Forlì, Italy. Eighteen sections include archaeometry, paleoecology, and prehistory of the Americas.

Contact: Secreteria, XIII Congresso UISPP, Via Marchesi, 12-47100 Forlì, Italy. FAX 39-543-35805.

Atlatl Maker Studies Function of Weights

An atlatl maker who has written an extensive analysis of the functions of atlatl weights wishes to contact other atlatl users and researchers to exchange information about the concept of maximum effective range of darts in hunting. Ray Strischek of Athens, Ohio, told the *Mammoth Trumpet* that he would be pleased to send copies of his 25-page paper, "Atlatl Weight Functions," to interested researchers.

Atlatls, or spear-throwers, are tools that provided ancient hunters extra leverage to propel spears or darts with increased force toward their prey (*Mammoth Trumpet* 10:1 "Hands-on Prehistory").

"I wrote about atlatl weights in particular because my experience with them . . . was slightly different from what other atlatl practitioners had written of," said Strischek. "Using atlatl weights improved my accuracy, which was more important to me than obtaining super-long throwing distances." He suggests that engineering of the atlatl-and-dart system might permit a 35-, 40-, or even 50-yard maximum effective range. Atlatl users, he said, usually describe their maximum range at between 15 and 25 yards, not far enough for solo hunting. He believes ancient hunters probably knew how to engineer their weapons for accuracy at greater distances.

Strischek begins his paper by examining seven theories regarding the use of atlatl weights, ranging from being mere good-luck charms to acting as "flexers" that helped propel darts. His own theory is that they can assist in improving accuracy or distance.

Interested readers may write to Strischek at 10810 Peach Ridge Road, Athens OH 45701. A copy of his paper is on file in the CSFA library at Oregon State University. 📧

Sept. 30-Oct. 3 Sixth International Conference on Ground Penetrating Radar, Sendai, Japan.

Contact: Motoyuki Sato, Dept. of Resources Engineering, Faculty of Engineering, Tohoku University, Sendai 980-77, Japan. 81 (22) 217-7399; FAX 81 (22) 217-7401; gpr96@earth.tohoku.ac.jp; URL: <http://www.earth.tohoku.ac.jp/gpr96.html>.

Oct. 26-29 Eastern States Archaeological Federation, Wilmington, DE

Contact: Faye L. Stocum, Delaware SHPO, No.15, the Green, Dover, DE 19901. 302-739-5685.

Oct. 28-31 Annual Meeting Geological Society of America, Denver.

Contact: Vanessa George, GSA, 3300 Penrose Place, Boulder, CO 80301. 303-447-2020; FAX 303-447-1133.

Nov. 20-24 Annual Meeting, American Anthropological Association, San Francisco.

Contact: AAA, 4350 North Fairfax Drive, Suite 640, Arlington, VA 22203. 703-528-1920.

April 2-6, 1997 Annual Meeting, Society for American Archaeology, Opryland, Nashville, TN.

Contact: SAA 900 Second Street NE, Suite 12, Washington, D.C. 20002. 202-789-8200. 📧



Recent Advances in Finding the Age of Rock Art

PETROGLYPHS hold a fascination for most of us no matter whether we are casual or scientific viewers. They tie us to our ancient human past and conjure up a sense of mystery within us. Were the people who made these figures really different from us? What did these shapes mean to them, and how long ago were they made?

It is only within the last 15 years that real progress has come in the development of promising dating techniques. Moving into an area of archaeology that American archaeologists have tended to ignore, scientists from allied disciplines are working to determine the exact ages of individual rock-art works.

Ronald I. Dorn studies the weathering of rock surfaces as they contribute to spatial variability in patterns of rock decay. It is an aspect of geomorphology, the study of landforms. As an Associate Professor of Geography at Arizona State University, where he teaches courses in geomorphology, Dr. Dorn has a particular interest in the study of rock coatings, to which he devotes about half of his research time.

He has developed three independent dating techniques that are applicable to petroglyphs. In the early 1980s, Dorn came up with the cation-ratio method for dating rock varnishes. He also advanced the methodology for radiocarbon dating rock varnish. More recently, he has utilized his interest in microscopy to develop a method of doing a micro-stratigraphic analysis of rock varnish layers.

In a recent telephone interview Dorn told the **Mammoth Trumpet** that he enjoys the challenge of helping archaeologists squeeze new information from rock coatings. He believes that if the goal is to develop a new methodology, one must be willing to take risks with the understanding that some approaches work

out and some don't. The intellectual challenge is to try to find all the information that is there, if you just know how to look for it—it's rather like Sherlock Holmes.

Sample Collection

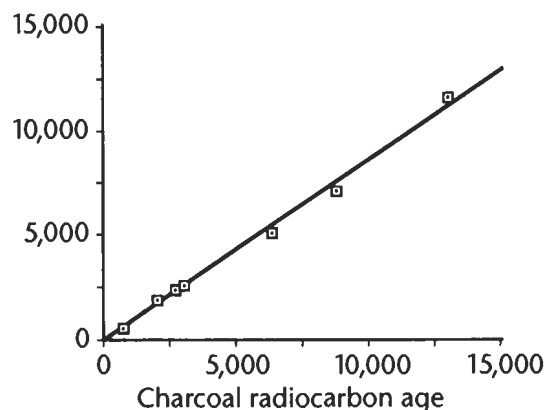
Many of the problems that occur with various dating techniques could be avoided if more rigorous attention were given to the proper collection of samples, says Dorn. But, he admits, in the end it is highly subjective and largely based upon experience.

Rock varnish is an accretion (one or more layers that build up by being added to externally). Its chemical and morphological characteristics are distinct from the underlying rock rather than being derived from it, as some people mistakenly think. Great differences exist in varnishes of varying colors and even in varnishes of the same color. Black varnishes, for example, are rich in manganese while orange varnishes are manganese poor, and dusky-brown varnishes are intermediate in manganese content.

Over the past 15 years Dorn has learned a lot about what *not* to collect. "My sample-collection philosophy has been to avoid specific varnish characteristics and microenvironments that have produced results that are inconsistent with independent age controls." For example, varnishes for dating should not be collected from varnish areas that have lichens or fungi growing on their surface, or from places where dust or organic matter tend to collect. He also avoids varnish that is in single layers rather than multiple layers, and areas where water runoff occurs.

Only tiny, millimeter-sized amounts of material are collected from different places on a petroglyph. Anyone checking to see

Varnish
radiocarbon age



RONALD I. DORN

Conventional radiocarbon dating of charcoal found underneath Hawaiian lava flows, compared with accelerator mass spectrometry analyses of weathering-rind organic matter. Note that the varnish-encapsulated radiocarbon ages are consistently younger than the control ages.



where the sample was taken from would be hard pressed to find the spot, says Dorn.

Over the past two decades he has enhanced his varnish-collecting experience by looking at surfaces of known age such as tombstones, stones faced for use in old buildings, very recent lava flows, and landforms such as old flood deposits in a sequence of ages. His experience has enabled him to gauge how rock varnish looks over time and in different environments.

When collecting samples to date, field workers often fail to describe the type of varnish they take, and the results may be the comparison of "apples and oranges" in the literature, says Dorn. Many, he says, "just want to go out and collect, by themselves, ignorantly," rather than have someone with experience show them what to collect. He likens the development of proper collection technique to cooking, wherein apprentices learn under the watchful eye of the chef.

Radiocarbon Dating

Dorn's conceptual model for the radiocarbon dating of petroglyphs is this: First, the petroglyph is made. Second, organic matter begins to accumulate on the freshly cut rock surface. Third, a layer of rock coating grows over the surface and in the process encapsulates the organic matter. Fourth, a sample of this surface is taken, the organic matter is extracted from underneath the rock coating, and the organic matter is then radiocarbon dated by accelerator mass spectrometry. The resulting radiocarbon date for the carbon underneath the rock coating should provide a minimum age for the underlying petroglyph.

For this method to work, it is essential that the petroglyph be carved deeply into the rock. The artist must have removed any prior organic matter. If the artist has left some of an earlier layer behind, it will cause the radiocarbon sample to be contaminated.

Dorn says accelerator mass spectrometry dating is the most accurate and precise method for determining the age of petroglyph varnish. "The measurement is astoundingly precise," so analytical error is not a concern when this method is employed, as it can be with other methods. The question then centers on accuracy—is it measuring the right thing? The answer depends upon a properly collected sample.

Cation-ratio Dating

Cation-ratio dating assigns relative or calibrated ages to rock varnishes. It is based on the fact that some chemicals in the rock varnish are leached away when they are exposed to water and organic weathering agents. The method, which Dorn developed in the early 1980s, attempts to measure the rate of chemical change over time. It remains experimental, says Dorn, and has been used successfully by laboratories in China, South Africa, the former Soviet Union, and the United States.

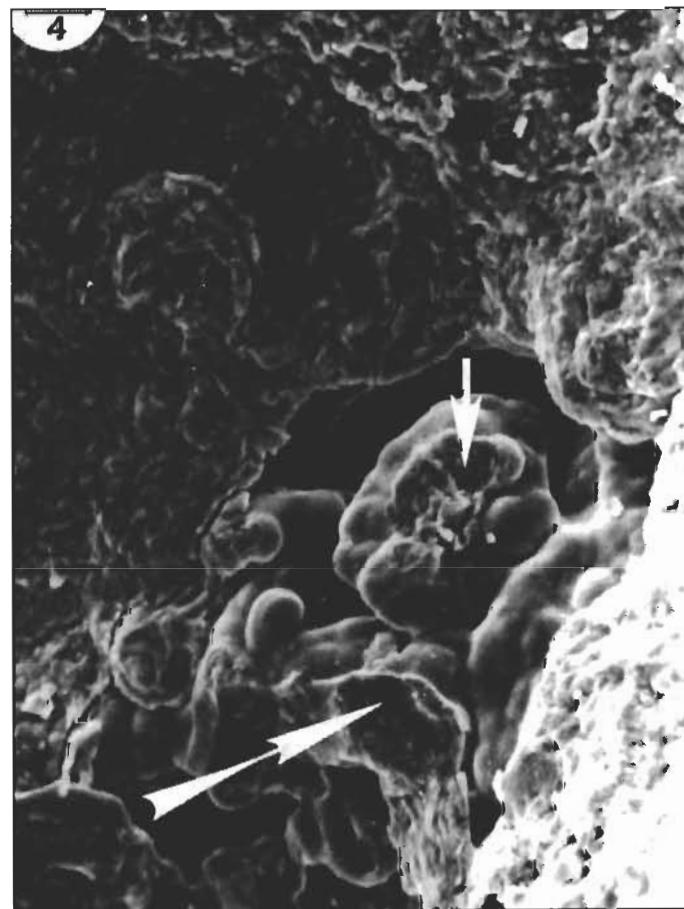
The method involves measurement of positively charged ions—cations. It is known that the ratio of cations of potassium plus calcium to titanium decreases with age. If this ratio is measured at sites with known exposure ages within a region, Dorn explained, a calibration called a cation-leaching curve can be constructed. The cation ratios in unknown samples can then be compared with this curve and a cation-ratio age is assigned.

Again, proper sample collection is crucial for this method to

yield an accurate measurement. Dorn collects only samples that are rich in manganese, are layered, and are "subaerial" in terms of their position. Subaerial means that the rock surface has always been exposed only to the atmosphere. Problems occur, says Dorn, when people collect samples that are now exposed to the atmosphere, but in the past were below the surface.

In terms of precision and accuracy, cation-ratio dating is the least preferable of his three methods, says Dorn. Yet it has great utility because it is a method that can determine the antiquity of art older than 40,000 years, the threshold of radiocarbon dating. Cation-ratio dating is much less costly than radiocarbon dating, and thus it is useful for preselecting samples for other types of more expensive dating.

Though it might not ascribe specific chronological dates to a sample, cation-ratio dating can give the archaeologist experienced in petroglyph dating some strong pointers in the right direction. By way of analogy, Dorn explains that one might compare the cation-ratio method to the analysis of non-diagnostic pottery. An archaeologist might obtain earthenware from a site that has no diagnostic motifs, yet many experienced field archaeologists would have a good sense as to what the age of this pottery might be.



RONALD I. DORN

Scanning electron microscope image of organic matter trapped under rock varnish. The smooth-textured mass (arrows) is the organic matter, encrusted in manganese-iron oxides. Arrows point to where the oxide crust has broken off. Scale bar is four microns.

Varnish-Layer Sequence Dating

Micro-stratigraphic examination of varnish layers, a third dating method that Dorn helped to develop, is used as a correlative dating technique because layers are correlated to specific time intervals.

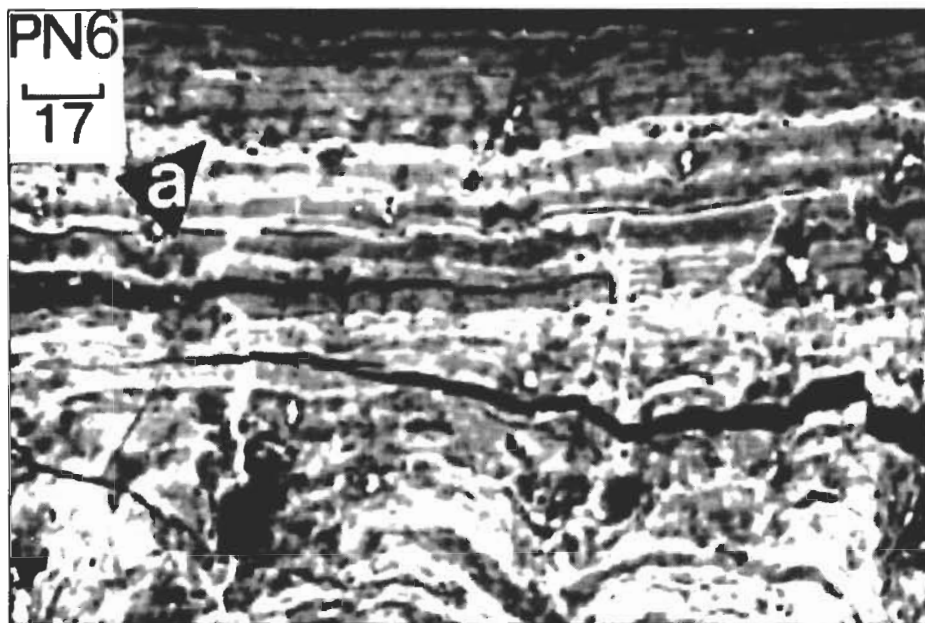
He examined the manganese-to-iron microlaminations in rock varnish and found that they are most likely caused by fluctuations in alkalinity found on rock surfaces. During periods when the environment produces alkalinity and pH levels that are high, the varnish makeup includes less manganese, resulting in its apparent orange color. Under near-neutral environmental conditions, however, the varnish takes on a black color due to its enrichment with manganese.

Dorn has found other paleoenvironmental signals in rock varnish that can be used to indicate relative time. He has discovered variations in micromorphology, stable carbon isotopes, lead, and other environment-dependent indicators.

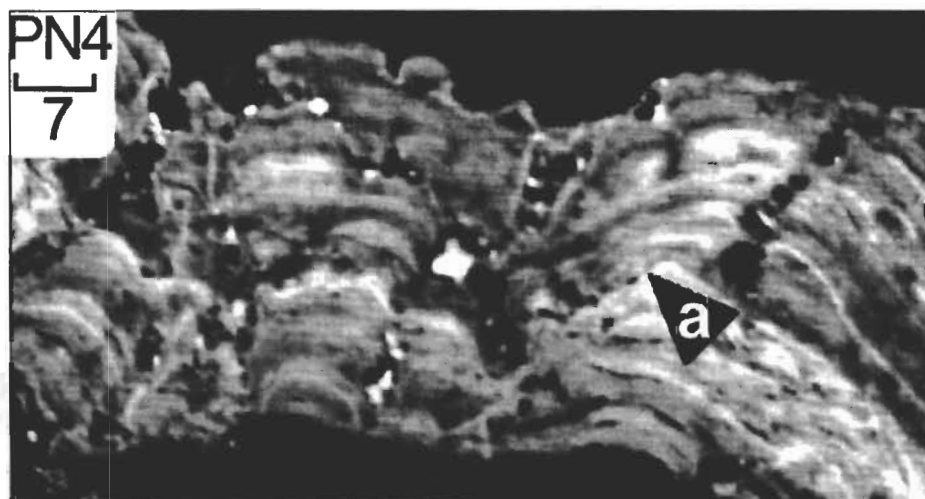
Because varnish layers can take anywhere from 1,000 to 10,000 years to grow in an arid climate, the main limitation of this technique is that it is not very useful in dating anything more recent than about 10,000 years ago in the southwestern United States; however, it has great value in its ability to provide a verification for the older dates provided by radiocarbon or cation-ratio dating. If what you are trying to analyze is in the appropriate time range, then dating by way of the micro-stratigraphic varnish layering method may be even a better choice than radiocarbon dating.

Tanzhuo Liu, a former student of Dorn's, is in the process of refining Dorn's micro-stratigraphic method. When an ultra thin-section is made of rock varnish it becomes possible to see yellow, orange, and black layers that can be linked to climatic changes.

Dr. Liu, who is now at Columbia University and the Lamont Doherty Earth Observatory, finds that the black layers can be tied to wet climatic periods. A paper on the discoveries will be coming out shortly in the *Annals of the Association of American Geographers*. Dorn says that an Italian researcher, Mauro Cremaschi, found the same thing when he looked at varnish from the Libyan Sahara Desert. Both researchers have calibrated times when wet periods occurred.



RONALD I. DORN



RONALD I. DORN

Layering in rock varnish increases in complexity with age. These two electron micro-scope images show the layering pattern of rock varnish on two different petroglyphs from South Australia. The top (PN6), taken from a curved-line petroglyph, is older than 40,000 radiocarbon years. The bottom (PN4), taken from a petroglyph of circles with a spiral, is older than about 5,600 radiocarbon years. The black arrows (a) indicate a change from a dull surface layer to a bright second layer. While the bright second layer is the bottommost layer in PN4, the varnish formed on PN6 is much more complex and much older. Scale bars indicate 17 and 7 microns.



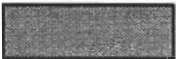
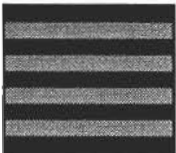
Varnish-layer sequencing is a correlation technique so that, for example, "if you get a black layer, and if that black layer occurred at 10,000 years ago, then the varnish is at least 10,000 years old and what it is on is at least 10,000 years old," Dorn explained.

"Another great joy of this approach is that you can do it with materials that you can get from a hardware store and a regular light microscope that you might find

in a high-school biology lab. It's not expensive. It just takes a lot of work in making the thin-sections. So it is manual labor as opposed to analytical cost," says Dorn.

Dorn and Liu have put together an educational slide set on varnish microlaminations that is available at cost from the Paleoclimatology Program of NOAA, The National Oceanic and Atmospheric Administration at 325 Broadway, Boulder, CO 80303-3328.

This table illustrates the generalized layering units found in the Death Valley region by Tanzhuo Liu, where age control comes from ^{14}C and uranium-series dating methods.

Layering Unit Number	Generalized Layering Unit	Characteristics of Layering Units (LU)
1		An orange or yellow upper layer in varnish that is not rich in manganese. It has formed in the last 10,000 years and represents the Holocene.
2		This layering unit (LU) occurs immediately under LU-1 and contains two black layers separated by one orange layer. The top black layer formed about 11,000 radiocarbon years ago, and the bottom black layer formed about 14,000 radiocarbon years ago.
3		LU-3 often appears as one major orange layer which separates LU-2 from LU-4. Several minor black layers within it were observed on fast-growing varnishes. It formed between about 14,000 and 21,000 radiocarbon years ago.
4		LU-4 is the most prominent layering unit in the Death Valley varnishes and often contains five black layers separated by four orange layers. The top black layer formed about 21,000 radiocarbon years ago. The second black layer formed before about 24,000 radiocarbon years ago. The older black layers lack radiocarbon age control, but the entire sequence is younger than a uranium-series age of about 70,000 years ago.


Nomenclature

The precision level for the various dating techniques is described by Dorn as "numerical" for radiocarbon, "calibrated" for cation-ratio, and "correlative" for varnish layers. This nomenclature for dating techniques is based on a 1987 article by S. M. Colman, K. L. Pierce, and P. W. Birkeland titled "Suggested Terminology for Quaternary Dating Methods" that appeared in *Quaternary Research* 28:314-319. Dorn thinks that a lot of confusion with terminology could be cleared up if more people would follow the suggestions in that paper. For example, the paper recommends that the term "absolute" be done away with in favor of the term "numerical." They also recommend that the use of "date" should be minimized in favor of "age estimate." The change in terminology would better reflect the reality that most dating methods are only able to produce an approximate age range rather than a definite date.

Dorn hopes that the recent progress in varnish dating techniques will cause more archaeologists to focus their research on petroglyphs before this "glorious cultural national treasure" evaporates.

"I really don't understand why it is so unpopular for serious archaeologists to

do rock-art research," he says. "For decades professional archaeologists have ignored this spiritual side of the discipline. . . . I feel sure that students 50 years from now will look back on today's

archaeologists and say, 'Shame on you' for sitting on the sidelines while the rock art steadily disappears forever, due to vandalism and natural erosion." 

—Carol Ann Lysek

Couple Donates Collection to Lake Superior State U.

Eugene and Priscilla Ochsner of Gaylord, Mich., have donated their extensive collection of Native American artifacts to Lake Superior State University at Sault Ste. Marie, Mich. Born in Cleveland in 1905, Eugene Ochsner's initial experience with archaeology was in 1929 after he became a member of the Ohio Historical Society. He assisted the Society in making ground surveys for sites in the Cuyahoga River Valley. Since then he has remained active in archaeological societies across the United States.

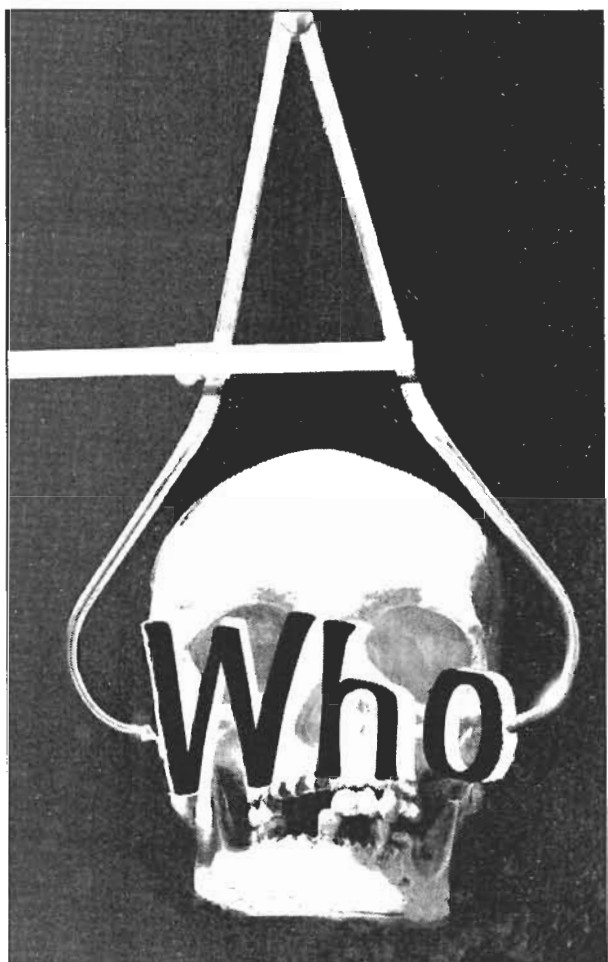
Officials of Lake Superior State University say that the collection the Ochsners have gathered over the past 67 years is of major importance to the institution's research and teaching. The collection is housed in the River of History Museum and a new wing of the university library.

Susan Schacher, museum curator, told reporters that Eugene Ochsner's extensive notes and attention to detail make the collection especially valuable. "He has all the information about everything," she said. "He wrote down names, dates, circumstances and stories associated with all of it. They're not just random objects; they're stories, with people behind each one."

The collection, which includes prehistoric and historic tools, art, and other items, represents many cultures across North America and clothing and domestic articles from the Southwest and Central America. There is also material from Western Europe and North Africa.

Ochsner is a chemist, educated in Zurich and Cleveland, who retired after

continued on page 17



*An interview with a
specialist in human diversity*

Who Were the First Americans?

Marta Mirazon Lahr is the author of *The Evolution of Modern Human Diversity: A Study of Cranial Variation*, recently published by Cambridge University Press. She wrote a detailed article on the origins of Amerindians in the *Yearbook of Physical Anthropology*, 1995. Her research on the origins of modern humans has involved an extensive study of recent and prehistoric South Americans. A native of Argentina who grew up in Brazil, she earned a bachelor's degree in biology in São Paulo, and master's and doctorate degrees from Cambridge University, studying with evolutionary biologist Robert Foley, Director of Cambridge's Duckworth Laboratory. She had a research fellowship at Clare College Cambridge from 1992 to 1995. Last July she accepted a lectureship in the Department of Genetics at the University of São Paulo, where she teaches courses in evolutionary theory, medical genetics, and human evolution. Lahr is part of the King's College Human Diversity Project, which is headed by Dr. Foley. Lahr and Foley have published an article on modern human dispersals in the journal *Evolutionary Anthropology*.

Mammoth Trumpet asked physical anthropologist Roberta L. Hall to question Lahr about her research on human dispersals. Following are excerpts from their conversation.

Mammoth Trumpet Researchers such as D. Gentry Steele and Walter Neves have found differences between Paleoindians and North Asians. Is it accurate to say that the existence of greater diversity than anticipated among early Amerindians is one of the important findings of your research?

Lahr Yes, the existence of greater diversity among Paleoindians is one of



THE ANTIQUITY OF MODERN HUMANS is one of the primary research problems physical anthropologists are considering, and a second, related, concern is with the differentiation of the species into geographic subpopulations, or races. Because modern humans have been very mobile in the last 50,000 years, and because they tend to intermarry with other populations that they encounter, these subgroups are unstable—groups tend to form, dissolve, and re-form. Physical features characterizing human races at any one time may be ephemeral.

This knowledge has made many physical anthropologists reexamine relationships between Amerindians and other human groups, and it has led them to reconsider relationships among the various populations that have occupied North and South America for at least 12,000 years. These populations may have been drawn from many sources—the conventional practice of considering all Amerindians as a branch of the Mongoloid race does not reveal their origins or express their diversity.


the main findings. It is necessary to look at the problems of morphology from an evolutionary perspective. The process of population specialization (or differentiation) happens through the acquisition of new features that then become fixed at a population level by replacing the previous character of those features. This has the effect of homogenizing the new population in terms of those features, but through time, differences are again acquired and the population becomes variable again for those features.

This is a continuous process that may affect different traits at different times and rates. We only identify it as a new morphological character either because of the gaps in the fossil record that hide the intermediates, or because a group goes through a process of differentiation that affects several traits at the same time, creating a morphological complex. Such situations can occur when populations become very small (and thus either founding effects or chance can change gene frequencies relatively rapidly) or when they are under very strong selective pressures. However, in terms of diversity, once a group has specialized morphologically, it loses a previous expression of that morphology (it will soon acquire new variants of the new morphology). In terms of the Paleoindians, they show a level of diversity compatible with the unspecialized groups that inhabited eastern Asia before many typical Mongoloid traits appear. So the level of diversity—that is the variability observed in morphological features across the sample—is indeed one of the important findings.

MT Traditionally, American anthropologists have considered Native Americans as a branch of modern Asian populations. Are there now reasons *not* to look at Native Americans in this way?

Lahr We should still think of Amerindians as a branch of modern Asian populations, but understand that what we mean by modern Asian populations is not just Chinese! That was

To investigate the question of who were the first Americans, the **Mammoth Trumpet** asked a prominent scientist, Marta Mirazon Lahr, a specialist in human diversity at the University of São Paulo, for her perspective on the question. Dr. Lahr is one of a growing number of scientists who believe that skeletal remains of Amerindians can help physical anthropologists understand the diversity of modern humans. Study of these populations also can help answer questions concerning the dispersal of modern humans, including the origins of Amerindians.

Rather than confining herself to the most ancient human skeletons, Lahr has sought out skeletal remains from the most isolated populations in South America on the principle that their remoteness and isolation may have preserved morphological patterns that characterize the earliest immigrants. Her research found that these isolated populations differ from modern Mongoloid populations, being more robust and generalized. 

one of my intentions in the *Yearbook* article, to stress that Mongoloids, as a whole, form not only the most numerous group of humanity, but possibly the most varied. Amerindian variation fits within Mongoloid variation.

Talking about "lineages" in humans is very difficult because there's so much admixture going on. In a way, one could talk about lineages in a very broad sense that reflected evolutionary divergence from an ancestral human line. In that sense, one could refer probably to the Australo-Melanesians as a lineage, to the entire Mongoloid complex as a lineage, to Eurasian and Mediterranean populations as a lineage, and in Africa probably to a number of lineages. But this does not exclude gene flow at all. Eurasian populations contributed to Mongoloid variation (and vice versa) by gene flow both across the Siberian plains and the Indian subcontinent; Mongoloid populations contributed to Australo-Melanesian variation in New Guinea; and sub-Saharan African variation contributed to Eurasian differentiation numerous times in the last 50,000 years!

MT What *are* the features that morphologists such as yourself recognize as part of the Mongoloid or North Asian pattern in human skeletons, particularly in crania? Can you expand on research data and rationale that have led many researchers to think that the so-called Mongoloid morphology developed *after* the ancestors of the people who became the South American Indians had already left Asia?

Lahr The "typical Mongoloid" morphological features are pronounced facial flatness (this flatness is mainly in the coronal plane—that is, across the face from eye to eye, and not so much in terms of alveolar prognathism), broad vaults, tall faces and orbits, high cheekbones and narrow noses.

Another feature that typical Mongoloid populations have is the dental complex defined as Sinodonty by [C. G.] Turner. I



have used them as part of the same complex, although there has been no study of the association of the dental and cranial characters. I have started such study with a dental anthropologist now in Israel, Dr. Rebeca Haydenblit.

Why do I believe that the cranial data suggest that this "typical Mongoloid" pattern developed *after* the first people dispersed to the Americas? There is a point here about timing. Let's leave aside the Americas for a minute and think only in terms of the differentiation in Asia. The fossil and recent morphological data indicate that the development of a Mongoloid morphology had at least two stages. An early one, in which certain features like coronal facial flatness and broad vaults, together with a dental complex defined as Sundadonty by Turner, were developed in Southeast Asia. This could have happened as early as 40,000 years ago, and certainly by around 20,000 since it's present in fossils like the Minatogawa remains in Japan. People with this generalized morphology (which I have called "southern Mongoloids") expanded geographically, and reached North Asia up to Japan and Beijing. Accordingly, early north Asian fossils, like those from Zhoukoudian Upper Cave, have generalized traits rather than a typical Mongoloid morphology. It is only much later, possibly at the beginning of the Holocene, that a "typical Mongoloid" morphology appears within northern Asia.

Possibly during the last glacial maximum at 18,000 B.P., the population of eastern Asia broke up into smaller units, and

No simple migration model can be applied to American populations.

typical Mongoloids emerge out of this short period of relative isolation and differentiation. Then, this "typical Mongoloid" population expands markedly, occupying most of Northeastern Asia—but not all. Certain pockets of isolated populations that retained a southern Mongoloid character remained, as is shown by the Ainu of Japan even today. [Ainu are a contemporary ethnic group of Northern Japan whose ancestors are believed to have inhabited all the islands of Japan before arrival of a population from the mainland about 2,000 years ago.] These had to have been significantly isolated; otherwise they would not have retained their distinctiveness.

Now, when thinking about the origins of Amerindians, we have to start from this scenario. Although we know that "typical Mongoloids" differentiated relatively recently, after generalized Mongoloids existed in the area, who was present in Northeastern Asia 12–10,000 years ago?

And the answer is *both* populations—with the "typical" and the "generalized" Mongoloid morphology. If one considers the Ainu, they are both present there now!

So it is not necessarily true that "typical Mongoloids" evolved *after* the ancestors of Amerindians had already left Asia. That's why I stressed in the *Yearbook* article that realiz-

Some definitions

Alveolar prognathism A forward projection of the upper jaw.

Amerindian A term used here to mean the aboriginal peoples of North and South America. It usually does not include Arctic peoples known as Inuit or Eskimos. Linguists use the term to refer to a proposed grouping of languages, but in this *Mammoth Trumpet*, we use the term to refer to biological populations.

Founder effect Genetic differences between parent and daughter populations that occur when a small group breaks off from an existing population and founds a new group.

Mongoloid A term physical anthropologists have long used as a general characterization of modern north-Asian peoples. Physical features associated with these populations include prominent cheekbones, relatively gracile features of the cranium, and the prevalence of certain dental traits such as shovel-shaped incisors.

DNA Deoxyribonucleic acid, the molecular basis for heredity.

Morphology The study of biological form and structure. Anthropologists describe human morphology from a variety of observations and measurements.

PaleoIndian Generally, people of the late Pleistocene known for their distinctive stone tools, but often used to mean the earliest Americans (defined as those living prior to about 8,500 years ago), and any of the peoples in the Americas prior to cultures who made tools identified as early Archaic.

Race Geographic subpopulations within species. As used by human morphologists, "race" isn't necessarily the same as the commonly accepted usage, which has social connotations. Because humans are a relatively recent species that has been quite mobile, geographic populations have likely been transitory over the millennia, continually forming, blending with other populations, and re-forming.

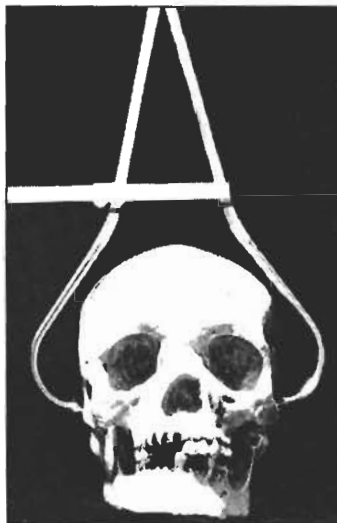
ing that the Paleoindians were not "typical Mongoloids" does not imply an earlier entry into the continent, and actually has no temporal implications whatsoever. The morphology only indicates that there must have been at least two groups of people ancestral to Amerindians (now excluding Na-Dene and Eskimo), one of a generalized Mongoloid character, and another that brought with it typical Mongoloid features—and I believe that these two later mixed within the Americas to form a really complex palimpsest.

MT Geneticists such as Emőke Szathmáry have been arguing that the model of three ethnic migrations to




the Americas is too simple and that early movements have been expansions of local populations—demes—rather than migrations as we think of them. What does a study of the morphology of ancient skeletons suggest about the possible composition of the groups that were the earliest migrants to the Americas?

Lahr I agree with Szathmary's point. No simple model of a migration can be applied to these populations. There's a lot of variation even within any group that we may identify as a unit (in this case a unit would be the generalized Mongoloids, or the typical Mongoloids), and what would have dispersed into the Americas were small subunits of these populations, each with its own genetic frequencies affected by population size and chance effects, and as the process went on, each subject to rapid or no change, depending on isolation and again, population size, and so creating a really complex picture.



WORDS & PICTURES UNLIMITED

These were human populations that certainly mixed when in contact and changed when apart, and they were all in contact with each other and apart for different periods of time and to different extents! In the case of South America, I believe that isolation by distance was an important factor in why the Fuegians [people at the southern tip of South America] maintained a more generalized morphological pattern than that observed throughout the rest of the continent, and that's why a recent group like the Fuegians represent a "relic" in many ways and are closer morphologically to Paleoindians than to other recent Amerindian groups. But the extent of admixture within South America between these possible two waves of migrant demes (one of Paleoindians, the other of more typical Mongoloids) is evidenced in several other populations. 

*In the next issue Lahr discusses **Migration Models and Specific Populations of South America.***

As scarce as...

SCIENTISTS SEEKING KNOWLEDGE of the earliest Americans would be tempted to say "hen's teeth," if the subject is Paleoindian skeletal data.

Descriptions of shape and size of human bones provide one of physical anthropologists' principal lines of evidence in the search for understanding of the first Americans. Another line of evidence is genetics, the study of genetic material, usually from living people. Experienced human morphologists can tell a great deal about a person simply by looking at his or her bones. They can determine much more with the aid of careful measurements and sophisticated statistical analysis. High-technology scanning devices developed for medical applications make a vast array of new measurements available to scientists with sufficient financial support; they allow bones to be measured inside and out, and in any number of cross sections.


But physical anthropologists must have bones to study if they're to illuminate the scientific questions surrounding the peopling of the Americas, and precious few are available. The actual number of North American human skeletons confidently dated to beyond 10,000 years B.P. might be tallied on the fingers of one hand. Possibly there are just a few more from South America.

An exact tally of Paleoindian remains is difficult to make. Chronology from old sites is often disputed, and remains from several sites are fragmentary, which means compara-

tive data on them exist only for available bones. Because human remains are regarded with respect, even small samples of human bone often are not used for radiocarbon dating, since the process would destroy the sample. Fortunately, in some cases, associated material is available for dating.

And even the specimens that have been found and dated are not readily available for morphologists to analyze. In the United States, the Native American Graves Protection and Repatriation Act presumably makes all remains subject to repatriation and reburial by the tribal groups nearest the site where the remains were found. Those not yet repatriated may for various logistical reasons be difficult for researchers to analyze. South American specimens, some of which are stored in the archives of European museums, also are difficult to access.

In his analyses of North American humans confidently dated to at least 8,500 years of age, D. Gentry Steele of Texas A&M University has had data available from only about 10 relatively whole individuals. In their South America studies, Walter A. Neves of São Paulo University, and Héctor M. Pucciarelli of National University of La Plata, included 19 individuals with absolute or estimated dates ranging from 12,000 to 6,000 years B.P.

In spite of the scarcity of material and all the analytical challenges that scarcity causes, morphologists have investigated these precious materials. They have come up with intriguing tentative conclusions—conclusions that may challenge conventional theories of human dispersal into the New World—and they have posed interesting questions for further study of the earliest Americans. 

—DAH



Brazilian Scientists

continued from page 1

migration" of humans to South America was composed of people who looked quite unlike today's typical northeastern Asians, whose ancestors have been assumed to constitute the founding populations of the Americas.

The three-migration model for the peopling of the Americas was first suggested in 1983 by Christy G. Turner, an Arizona State University anthropologist who analyzes the morphology of teeth. The three-migration model was later supported by the genetics research of R. C. Williams and others, and in 1987 the analysis of linguistic evidence by J. H. Greenberg added further support. The model proposes peopling of the Americas after 12,000 years ago by a first wave who soon populated both continents, a second wave who mostly settled along the north Pacific coast, and a third wave composed of Arctic peoples commonly referred to as Eskimos.

Dr. Neves noted that the three-wave hypothesis implies that only the first wave, the Paleoindians, gave rise to all later populations in most of the Western Hemisphere. "This implies, among other things, that all native morphological variability of prehistoric and historic times in South America should be considered the product of differentiation from a single source," he told a conference audience.

"Under this assumption, cranial diversity in South America should vary around one cranial pattern," he said. Neves's co-authors were Danusa Munford and Maria do Carmo Zanini, also of the University of São Paulo's Laboratory of Human Evolutionary Studies. Their paper continues: "If one demonstrates, for instance, that two very different cranial morphologies were present in continental Americas in ancient times, this will force a re-evaluation of the nature of Paleoindian migration."

Employing a variety of sophisticated statistical methods, Neves and his colleagues analyzed 13 different measurements of the skulls of 502 individuals from eight sets of South American data. Two of the eight sets were Paleoindian, representing prehistoric populations dating from 12,000 to 8,000 years ago, and



WORDS & PICTURES UNLIMITED

later populations demonstrated to be their direct descendants. The other six sets of data included prehistoric Archaic and horticultural peoples as well as ethnographic groups extending into the nineteenth and twentieth centuries.

"We attempted to bring together the maximum possible number of prehistoric and historic cranial samples studied so far in South America in terms of cranial metric variation," said Neves. He stressed that the paper presented to the AAPA rests on several earlier papers including a detailed one published in the *Journal of Human Evolution* (**Suggested Readings**). It analyzes craniometric data on prehistoric Brazilian populations that Neves has collected during the past 15 years, some of which have not yet been published. He said all the research is being carried out in cooperation with Hec-


tor Pucciarelli of the National University of La Plata, Argentina.

"This is to our knowledge the most comprehensive study undertaken about native morphological variation in South America since the typological works of Imbeloni [around 50 years ago], if space, time and number of individuals covered are considered," say the Brazilian scientists. They subjected the data to univariate, bivariate, and multivariate analyses.

"It is obvious that the detected pattern of morphological variability among native South Americans cannot be properly explained under the assumption of a single . . . founding population, as wished by Turner," they conclude. "Seen from South America, at least two waves of migrants departed from north Asia. . . . The first one would correspond to a very generalized *Homo sapiens sapiens*, whose roots are to be found in Africa, and the second one to a specialized *Homo sapiens sapiens*, of Mongoloid nature, whose roots are to be found in Siberia."

The researchers further conclude that the first group arrived in South America by about 12,000 years ago, while the so-called Mongoloid people entered at the time of the early Archaic, about 9,000 or 8,000 years ago.

Their statistical analyses grouped the cranial morphologies of the Paleoindians closer to those of Australians or Africans than to the Archaic South Americans.


Neves cautioned that these findings do not necessarily support an early peopling of the Americas. He said, however, "They certainly suggest that the occupation of the Americas was much more complex in terms of biological founding populations than dental analysis has led us to believe." 

—Don Alan Hall

CSFA Information on World Wide Web

Electronic text versions of 1995 and 1996 editions of the *Mammoth Trumpet* are available on the World Wide Web. You can find these and other information about the Center for the Study for the First Americans at the CSFA World Wide Web site at <http://www.peak.org/csfa/csfa.html>. Our web site, parts of which are still being developed, is the creation of CSFA volunteer Craig Skin-

ner, a professional archaeologist and obsidian researcher.

Besides recent issues of the *Trumpet*, the web site has information on CSFA books, *Current Research in the Pleistocene*, and Oregon State University programs. Further, Internet users can contact the CSFA at the electronic-mail address: halla@cla.orst.edu. 

VIRUSES MAY OFFER NEW LINE OF EVIDENCE

Several presentations at the annual meetings of the American Association of Physical Anthropology (AAPA) in April dealt with genetic evidence of human dispersals. Continuing analysis of DNA, both from mitochondria and nuclei of human cells, is producing an increasing body of evidence about where living people's descendants came from. A Yale University researcher offered an additional line of evidence—human T lymphotropic viruses, which integrate with DNA.

These viruses are not found everywhere and cannot be a universal tool, says the researcher, F. L. Black of the Yale School of Medicine, but because they mutate more than mitochondria, they offer an independent basis for confirming data from more conventional DNA research. Variations in the virus, known as HTLV, suggest differences and similarities among peoples. For example, one type of the virus exists in people living along the Pacific coast of the Americas, he told scientists attending a session on genetic research. Its presence suggests the possibility "that the original settlement of the Americas might have been along an area that is now flooded,


and that American Indians moved into both continents simultaneously—or even South America first."

Black said that populations of eastern Siberia do not have the virus, "so they must have come in after the migration to the Americas." Further, he said, the variations of the virus suggest that the three-wave theory of aboriginal settlement of the Americas is not an adequate explanation.

Theodore G. Schurr of Emory University reported on studies of mitochondrial DNA that indicate similarities and differences among various groups living in northeast Asia. The studies are providing baseline data on intergroup genetic variation in the subarctic and Arctic, data that should be useful in testing hypotheses on expansion of Asians into the New World. Schurr and his team have been doing genetic analysis on the origins of Native Americans for several years.

The ultimate human-dispersal problem for physical anthropologists involves the origin of modern humans. Anthropologists hotly debate whether they originated from ancestral hominids at different centers in Asia and Africa, or

whether our species simply migrated out of Africa. New genetic data presented at the meetings by various researchers, including K. K. Kidd of Yale, continue to favor the "out of Africa" side of the argument. L. L. Cavalli-Sforza of Stanford University placed the time of the original migration from Africa at $116,000 \pm 20,000$ years ago.

But genetics alone cannot answer all questions of human origins—nor of the peopling of the Americas. A plenary session of the Human Biology Association, meeting in connection with the AAPA, heard an argument for the study of the paleontology of human ancestors. Robert Foley of the University of Cambridge said in a presentation delivered by a colleague that genetics can only tell us about past populations that left descendants. Genetics, he noted, reveal nothing about peoples that died out. Applied to the study of early populations of the Americas, for example, Foley's message implies that the range of variation in past populations could be quite different than the range of variation now observed among living Native American populations. 

—DAH

SUGGESTED READINGS

ON Rock Art

Dorn, R. I., P. B. Clarkson, M. F. Nobbs, L. L. Loendorf, and D. S. Whitley 1992 A New Approach to the Radiocarbon Dating of Rock Varnish, With Examples From Drylands. *Annals of the Association of American Geographers* 82:136–151.

Francis, J. E., L. L. Loendorf, and R. I. Dorn 1993 AMS Radiocarbon and Cation-Ratio Dating of Rock Art in the Bighorn Basin of Wyoming and Montana. *American Antiquity* 58:711–737.

Liu, T., and R. I. Dorn 1996 Understanding Spatial Variability in Environmental Changes in Drylands With Rock Varnish Microlaminations.

Annals of the Association of American Geographers 86: in press.

Whitley, D. S. and L. Loendorf (editors) 1994 *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*. UCLA Institute of Archaeology, Monograph 399.

ON Human Morphology

Lahr, M. M. 1996 *The Evolution of Modern Human Diversity: A Study of Cranial Variation*. Cambridge University Press

Lahr, M. M. 1995 Patterns of Modern Human Diversification: Implications for Amerindian Origins. *Yearbook of Physical Anthropology* 38:163–198.

Lahr, M. M. and Robert Foley 1994 Multiple Dispersals and Modern Human Origins. *Evolutionary Anthropology* 3(2):48–60.

Neves, W. A. and H. M. Pucciarelli 1991 Morphological Affinities of the First Americans: An Exploratory Analysis Based on Early South American Human Remains. *Journal of Human Evolution* 21:261–273.


Steele, D. G. and J. F. Powell 1994 Paleobiological Evidence of the Peopling of the Americas: A Morphometric View. In *Method and Theory for Investigating the Peopling of the Americas*, edited by Robson Bonnichsen and D. G. Steele, pp 141–164. Center for the Study of the First Americans, Corvallis.

Steele, D. G. and J. F. Powell 1993 Paleobiology of the First Americans. *Evolutionary Anthropology* 2(4):138–146.

ON Amazon Discoveries

Roosevelt, A. C. and others 1996 Paleoindian Cave Dwellers in the Amazon: The Peopling of the Americas. *Science* 272:373–384.

Roosevelt, A. C. and others 1991 Eighth Millennium Pottery from a Prehistoric Shell Midden in the Brazilian Amazon. *Science* 254:1621–1642

Wilford, J. N. 1996 Sharp and To the Point in Amazonia. *The New York Times*, April 23:B7. 



CLIMATE undoubtedly was a critical factor in the peopling of the Americas. People don't migrate into new areas unless they have successfully populated the old places and unless suitable habitat exists in the new. Deserts or ice fields don't qualify, so climatological factors such as temperature and precipitation are crucial.

Prehistorians studying early sites often find evidence that ancient climates differed radically from that of the present, but until recently there was no way to chart past climates except by careful analysis of proxy paleoenvironmental evidence. Reid A. Bryson, a veteran climatologist, has a different idea—climatic models designed for specific archaeological sites almost anywhere on earth. He can provide estimates of monthly mean temperature and precipitation at a site for 200-year averages back to 14,000 years B.P., and 500-year averages from 14,000 to 40,000 years B.P.

Dr. Bryson, Professor Emeritus of Atmospheric Science and Geography and Director Emeritus of the Institute for Environmental Studies and the Center for Climatic Research at the University of Wisconsin—Madison, has modeled past climates for more than a hundred archaeological sites. And he continues to work on new sites, eagerly testing and adjusting his system, which runs on ordinary personal computers.

How can a model of something as complex as thousands of years of climate fluctuations be run on a personal computer when the largest and most powerful supercomputers seem to disagree on temperature trends in this century? In a recent telephone interview from his office in Madison, Bryson explained—and, in a sense, defined the difference between meteorology and climatology.

"Meteorologists say that climate is just average weather," said Bryson. He emphatically added: "It isn't!"

"Weather is what the climate will allow. Summer climate is different from winter climate. Summer weather systems are different from winter weather systems. Summer and winter weather are

different because the *climate* is different, not the other way around." Rather than simply being "typical weather," Bryson argues that climate is more accurately the status of the interaction of forces of heat and moisture along known global boundaries that determines concurrent weather patterns.

So whereas meteorologists analyze the atmosphere, climatologists analyze the prevailing set of global conditions. Meteorologists have created weather models by simulating the kinematic

Climatologist's Model Gives ICE AGE Forecasts

physics—the study of motion—of small parcels of air. When powerful computers made it possible, they extended their weather models into climate models. Through repeated computer processing—iteration—these microphysical models combine calculations on small segments of the atmosphere at grid points on the Earth's surface into a global model. Extending such a model thousands of years into the past requires the largest and fastest computers.

Bryson's macrophysical model takes the opposite approach, starting with known global parameters and working down to their effects on specific sites. His model is no less complicated, but it can run in seconds on a personal computer.

The Brysons may be contacted by writing to Archaeoclimatology Consultants, P.O. Box 2084, Davis, CA 95617, or by electronic mail at rubryson@mother.com.

By starting with the premise that weather is what the climate will allow, and the certainty that the sun controls climate, Bryson built his model of paleoclimates. The sun's energy varies with the transparency of the atmosphere, and its effects are altered by the amount of energy reflected back into the atmosphere due to Earth's albedo. First Bryson constructed a model of the volume of glaciers over time so he could to calculate an estimated ice albedo effect. "That turned out to be pretty simple," he says. But then to estimate the transparency of the atmosphere, he had to build a data base of volcanic eruptions, which he calibrated against the modern record of transparency versus volcanic activity. "That took a hell of a lot of work."

Armed with the amount of incoming energy, Bryson factored in known climatological features. "Years ago before we had computers, we used something called synoptic climatology." He explained that by knowing about large-scale features—the subtropical anticyclones, semipermanent high-pressure areas responsible for many of Earth's deserts; the intertropical convergence in the equatorial area between them; and the jet stream, the high-altitude westerly winds that snake across middle and upper latitudes—one can understand local climate.

Bryson has something of an affinity for the jet stream, because during World War II he was one of its discoverers. "We predicted that the 20th Air Force would run into strong high-altitude westerlies, and sure enough, they did." These high-altitude winds later came to be known as the jet stream. Scientists have found that the jet stream flows near the outer (equatorial) edge of Earth's circumpolar vortices, or swirls of westerly winds. Hydrodynamic computations developed in the 1960s make it possible to calculate the latitudes where westerly wind patterns break off from the circumpolar vortex and produce subtropical anticyclones.

Because today's local climate is related to all these factors, it seems logical to assume that the same principles apply to the past because the physics remains

the same. So Bryson calculates all the global factors and from them reconstructs local climates of the past.

"And, by golly, it seems to work."

To model the peak flood of the Nile River for geoarchaeologist Fekri A. Hassan, Bryson modeled rainfall on headwaters of the White and Blue Niles and scheduled it downstream to Aswan. Bryson says that Dr. Hassan was absolutely delighted. The model fit his field data so well that Hassan jokingly told Bryson his first reaction was, "How did you manage to steal my field data?"

Only about a dozen of the more than 100 site-specific models have been verified with field data, and Bryson is eager to work with more archaeologists. "I don't sell the software. I only sell knowledge—how to—because I want you to know the weaknesses as well as the strengths, and you can only get that by sitting down and doing it *with* me."

Bryson says he enjoys working with archaeologists because they don't hesitate to ask experts in other disciplines for advice. "If you find some corn, you ask the expert on corn 'what kind is it?' If you run into a climate problem—maybe it got dry or something—you ask a climate expert. So I get lots of inquiries about climate."

He traces his interest in archaeology back to boyhood when he read an article by Earl Morris in *National Geographic* on the excavation of Cañon del Muerto—Canyon of Death—a side canyon of Canyon de Chelly in Arizona. The extensively illustrated article held young Bryson spellbound. "I wanted to know all about those people and their environment."

Destiny, however, took its time to get him into the study of prehistory. He studied geology, and then World War II came along "and made a meteorologist out of me." After the war, Bryson, with a doctorate from the University of Chicago, became an assistant professor of meteorology and geology at the University of Wisconsin. There he founded the meteorology department, which expanded and gave rise to the Center for Climatic Research; only after Bryson retired 10 years ago was he able to fully devote himself to his interest in archaeological sites and ancient environments.

Working with archaeologists, however, was nothing new for him. In the

1960s, he found himself chairman of a meteorological investigation of past climates. The conference on climate of the 12th and 16th centuries, which for some reason was sponsored by the Air Force, chanced to introduce Bryson to David Baerreis, who was then the president of the Society for American Archaeology. "Dave and I worked together for years after that on archaeological-climatological problems."

Some definitions

Albedo Reflective power; the percentage of solar radiation that is reflected by a surface such as ice or bare soil.

Anticyclone Winds that rotate around high atmospheric pressure, clockwise in the northern hemisphere and counter-clockwise in the southern.

Intertropical convergence The equatorial area where the easterly winds from northern and southern hemispheres converge; a line of low pressure that fosters storms in subtropical areas.

Jet stream The narrow band of westerly winds at 30,000 to 40,000 feet that in winter may reach 200 or even 300 miles an hour.

Synoptic Providing a general view of the whole.

Bryson's studies in the Arctic, working with archaeologist William N. Irving, brought great changes in how archaeologists came to understand human presence in the far north.


Later, Bryson gained a family connection with archaeology; one of his sons, Robert U. Bryson, became an archaeologist. Now, father and son collaborate in their company, Archaeoclimatology Consultants, on projects all over the world. "We've given workshops in Berlin and Sweden, and Bob's going to Israel in July." They have projected climates of Jerusalem, Naples, Tashkent, Yakutsk, Yulin, Lake Victoria, Merida, La Paz, and Guam into the past, as well as a number of sites in 11 states.

At the Plains Conference in Laramie last fall the Brysons gave a paper in honor of George C. Frison that presented past climates of several sites important to Dr. Frison's career, including Hell Gap and Agate Basin. "He was a little startled," Bryson said of Frison. "I said, 'George, you used to ask me questions about the climate that I couldn't answer. Well, here's a first shot at the answers.'" Since then, the Brysons have modeled climates for other Paleoindian sites including Milliron and Mammoth Meadow in Montana, Lubbock Lake in Texas, Lake Ila in North Dakota, and others.

Bryson is eager to involve more archaeologists in the work. "The more people that use it, the more we find out what the weaknesses are and we get some new ideas." Mean seasonal temperatures and precipitation are by no means all the Brysons can model. Hassan, for example, asked about minimum temperatures for a site west of the Nile in Egypt. The model indicated one period when nighttime temperatures would have dipped regularly to below freezing, and Hassan said the time exactly matched the time that he had found frost damage to the site's artifacts.

The Brysons have modeled evaporation from Lake Titicaca, and they've also modeled vapor pressure. "What I want to get is a better estimate of the evaporation, the evaporative stress, at any place," he said. That tells what kind of pressure the resource base of a place was under at any particular time."

Regarding the question of late-Pleistocene extinctions, Bryson is not ambivalent: "I don't believe for a minute that it was over-hunting," he said. Nor is he ambiguous about his opinion of the microphysical climatological models created by meteorologists. "A million iterations at thousands of points with lots of complicated equations, none of which is perfect, give you something you really have to ask questions about," he says, noting that an error rate of only a tenth of a percent will result in a 100 percent error rate after a million iterations.

"I don't have to iterate a million times. I don't even have to iterate twice. I'm trying to produce a product that's useful to archaeologists and other field scientists." 

—Don Alan Hall

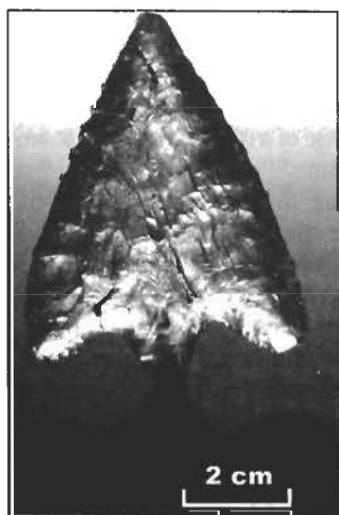


Anna Roosevelt Makes Headlines

Anna Roosevelt's long-awaited report on Caverna da Pedra Pintada made headlines; besides being the cover article in *Science*, it was front-page news in *The New York Times*, the *International Herald Tribune*, and other newspapers, and it was featured on network news broadcasts.

Dr. Roosevelt's agreement with *Science* gave that journal the initial scoop; *Science* embargoed the information until its publication date, but specialists in South American archaeology had long suspected that Roosevelt was on to something interesting. She and her team had done the field excavations in 1991 and 1992, but analysis of the material took the scientists years to complete to the satisfaction of Roosevelt, who well knew she would be criticized. Contacted by the **Mammoth Trumpet** early in 1993, Roosevelt explained her agreement with *Science*; later that year she sharpened our curiosity when she faxed us, without explanation, intriguing drawings of Pedra Pintada lithics and stratigraphy. *The New York Times* science reporter John Noble Wilford visited her at the site in 1992; he sat on his story for almost four years.

Seeking to put Roosevelt's discoveries into context, reporters called on other scientists—especially those known to favor the now-challenged Clovis-first theory of the peopling of the Americas. These scientists voiced caution about Roosevelt's earliest dates and discussed the merits of averaging several dates taken from an archaeological stratum versus Roosevelt's preferred method of dating individual samples—mostly carbonized seeds.



These spear points, the left made of quartz crystal and the right of chalcedony, are among several found along Brazil's Tapajós River southwest of Monte Alegre. Similar stone points were found in Caverna da Pedra Pintada in strata with the charred remains of tropical tree fruits, pigment and fauna. Paleoindians may have used points like this to hunt the large fish whose rare bones were found in the cave along with the remains of smaller fish, shellfish, reptiles, amphibians, birds, and larger animals.




Speaking of the Amazon cave dwellers, C. Vance Haynes, the respected geoarchaeologist from the University of Arizona, told reporter Ann Gibbons of *Science*: "My bias is that they are descendants of Clovis." However, Dr. Haynes told *The New York Times* that it would not surprise him to learn that there were people in the Americas before Clovis. Another prominent scientist noted that if the Pedra Pintada people were actually descendants of Clovis people, it would have required a migration rate of seven miles a year, double the rate of Haynes's own model for Clovis migration.

Geoarchaeologist Ken Tankersley of Kent State University told reporters that Roosevelt's interpretations of the cave's antiquity might be too liberal; however, he said that Pedra Pintada is a further indication that Clovis-culture peoples were not the only Paleoindians. "You could have had an earlier wave of people," he told *Science*. Dr. Tankersley said that differences

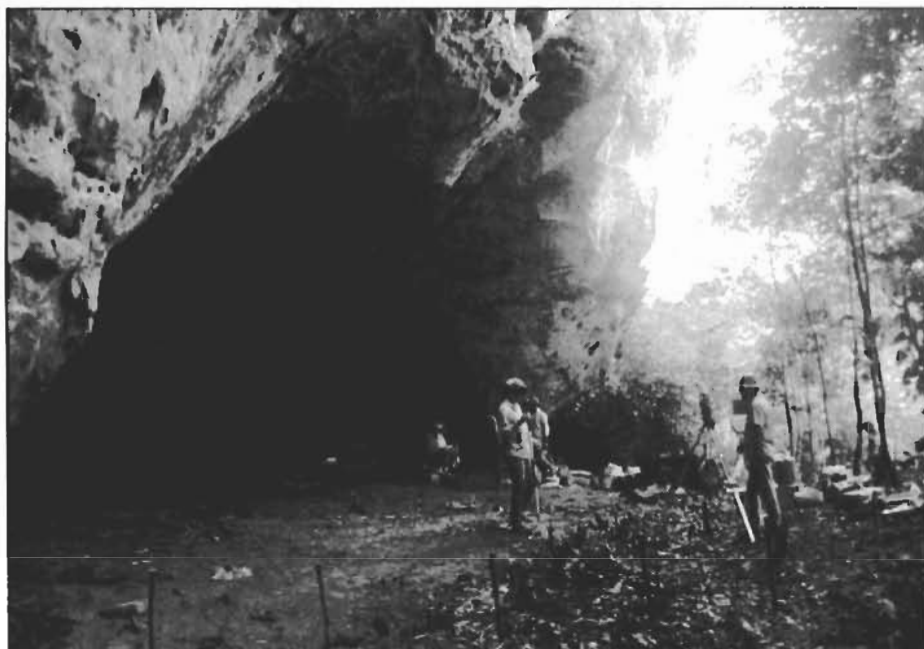
Other scientists voiced caution about Roosevelt's earliest dates.

between Clovis tools and those found in sites such as Hell Gap, Wyoming, and Mill Iron, Montana, further suggest that there was more than one group of Paleoindians.

Stanford University anthropologist John Rick told *The New York Times* that Roosevelt's dates seemed well founded and constituted good evidence of early hunter-gather occupation of the Amazon. But he said it is too early to totally revise New World archaeology. Roosevelt's findings, he said, "open the door but don't tell you exactly what is on the other side."

Archaeologist Tom Dillehay, the University of Kentucky's expert on early South American peoples, told the Associated Press that Caverna da Pedra Pintada "is another candidate site that puts pressure on our ability and need to understand the Clovis theory." Roosevelt's conclusions, he said, "could be very important for the understanding of the South American culture." 

-DAH



©1993 BY A.C. ROOSEVELT/THE FIELD MUSEUM, CHICAGO

When Anna Roosevelt was first shown Caverna da Pedra Pintada on the north bank of the Amazon near the town of Monte Alegre, Brazil, she saw that it looked light, airy and dry. The cave had been visited by Brazilian archaeologists and speleologists, but it had never been excavated until Roosevelt's Field Museum team arrived. After examining a dozen auger holes, they concentrated on the area near the right side of the entrance where they put in 11 contiguous meter-square excavation units.

Amazon Cave

continued from page 1

cording to environmental clues found at the site, the area was more thickly forested than today's landscape, which has been cleared for cattle ranching and agriculture.

Despite some evidence suggesting the presence of early human foragers in subtropical areas of South America, the common assumption has been that game animals and plant food were too scarce in this tropical environment to support humans who had not yet developed slash-and-burn agriculture. But discoveries from Caverna da Pedra Pintada indicate Paleoindians lived there from 11,200 to 10,000 years ago, foraging food from the forest and river, crafting distinctive spear points and woodworking tools made from stone, and decorating rocks with red and yellow images. The rock art includes hand prints of both adults and children.

Noting that the culture of Pedra Pintada Paleoindians appears very different from that of their Clovis contemporaries in North America, Roosevelt says that the site presents a further challenge to the

traditional view that the Clovis tradition was the "donor culture of early South American societies." Large animals were not important to the subsistence of the Pedra Pintada people, who made use of a wide variety of animals and plants.

"It seems Paleoindians were able to adapt to a broader range of habitats than

has been thought," says Roosevelt. "Amazonia, far from a dead end, fostered a dynamic cultural trajectory over thousands of years." Early foraging bands, she says, eventually gave way to fishing villages where pottery making developed. Pottery fragments in Caverna da Pedra Pintada and nine other previously reported sites nearby date to between 7,500 and 5,000 years B.P., making it the oldest-known pottery in the Americas.

Some archaeologists, especially those who believe the people who made Clovis-type tools were the first humans to enter the Americas, expressed skepticism about the significance of the Amazonian discoveries. Replying to reporters' questions soon after publication of the *Science* article, some noted that a more conservative interpretation of the dates reported by Roosevelt and her colleagues would place the earliest occupation at about 10,500 years ago. Other proponents of the late-entry theory of the peopling of the Americas conceded that the Pedra Pintada discoveries might mean that Clovis hunters weren't the first Americans.

The *Science* article notes that critics of the late-entry theory have suggested that "foragers with simpler tools and more generalized subsistence based on plants, smaller game and fish spread throughout the Americas long before specialized big-game hunters did so." After reviewing evidence for pre-Clovis South American


Couple Donates Collection

continued from page 7

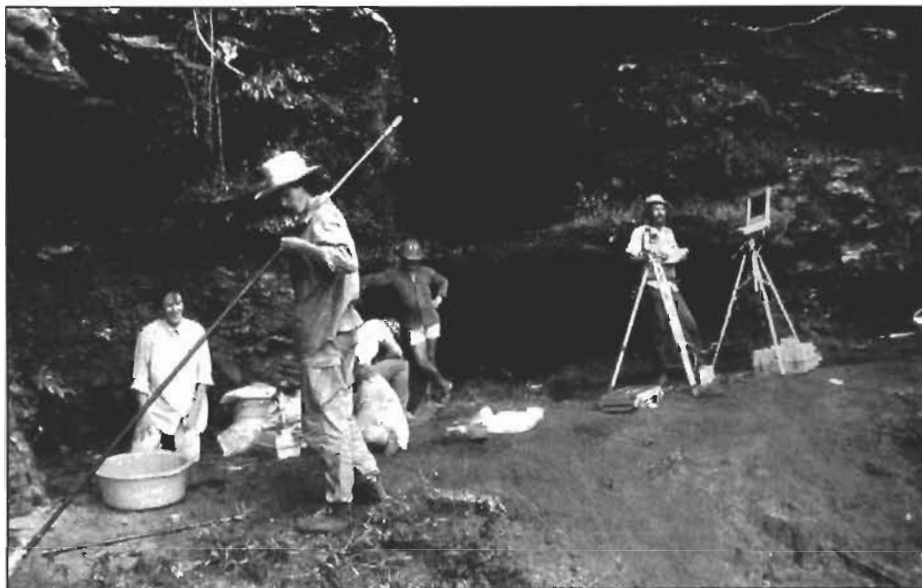
41 years with the Grasselli Chemical Co., which merged with DuPont Corp. His profession included supervising or managing chemical plants in Michigan, New Jersey, Texas, and Kentucky, and wherever he went he was active in amateur archaeological societies. Explaining his decision to present the collection to LSSU, he noted that it is a growing university at a historic and prehistoric crossroads. For example, prehistoric items made of Lake Superior native copper have been found as far south as Alabama. Many native cultures were concentrated around Sault Ste. Marie, he said, "and it seemed appropriate that their history

should be there, as well." Approximately 350 reference books and 8,000 slides accompanied the collection.

"It took a lot of time to collect all of this," Ochsner explained to a local newspaper. "I didn't want it stolen, or all split up and auctioned off." He said that the collection is much more valuable as a whole than in separate pieces, and noted that artifact robbers often prey on the homes of collectors.

LSSU's Schacher said that it is evident that the Ochsners became friends with people in various cultures wherever they went. "Because they spend time and appreciate different cultures, they have things given to them that are not even in museums, because they are so treasured. They are very generous, very special people." 

The Field Museum archaeological team does coring and mapping at the entrance to Gruta de Itatupaoca, one of more than a dozen caves, rockshelters and rock-art sites in a small upland about 10 kilometers west of the town of Monte Alegre, Brazil. The upland, only about 5 by 10 kilometers in diameter, rises about 250 meters above the Amazon flood plain. At this site, the elevation is approximately 250 m; Caverna da Pedra Pintada, only 4 km away, is at 135 m elevation.



©1993 BY A.C. ROOSEVELT/THE FIELD MUSEUM, CHICAGO

people, Roosevelt and her colleagues write: "The open questions about the peopling of the Americas have implications for research strategies. Zones thought uninhabitable by Paleoindians need to be investigated, as well as presumed occupation zones." They say that both cultural and natural remains should be collected from "sealed stratigraphic contexts" and dated.

Earlier archaeologists raised the possibility of Pleistocene colonization of the Amazon, they report, "either by foragers from Asia or incipient farmers from tropical Africa, but early sites were expected to be invisible because of poor preservation and lack of rock for lithics." Bifacial lithic tools that had been found on the lower Amazon lacked stratigraphic context and had been assumed to be Holocene or Archaic in age.

Caverna da Pedra Pintada is one of several caves in the area long known for their rock paintings. Brazilian archaeologists and speleologists had visited the cave but it had never before been excavated. When surveying the area as part of

the Lower Amazon project several years ago, Roosevelt and her team looked at 21 caves, rockshelters and open sites. Nelsi Neif Sadek, a high-school ecology teacher who is now Monte Alegre's Secretary of Culture, took Roosevelt to Caverna da Pedra Pintada (literally "Painted Rock Cave"). "I could see right away that it was a good bet," she says. "It looked very livable—light, airy and dry."

The main chamber, six and a half meters high, measures 15 meters from north to south and 10 meters from east to west. Though moisture drips from the center of the cave's Paleozoic sandstone during the rainy season, it is dry during the remainder of the year. Local climate is classified as humid tropical monsoon (type "Am" by the Köppen system), and annual rainfall amounts to about 80 inches. There is a perennial spring nearby, and Amazon floodplain lakes and streams are about three kilometers away and less than 150 meters lower in elevation. The main channel of the Amazon is about 10 kilometers away. Roosevelt reports that in the late Pleistocene, river

levels were lower and floodplains less extensive.

Roosevelt brought in her team, and after auger cores inside and outside the cave exposed promising-looking middens, they began to peel back well-preserved layers representing thousands of years of intermittent human occupation. Near the bottom, where Roosevelt hoped to find evidence of Paleoindian life, they encountered culturally sterile soil. "I thought, 'Well, that's it. I wonder where else we can look in the area?' But we dug a little farther and suddenly something snapped up into my face. It turned out to be a spear-point flake. Then the soil turned black." She had hit a midden black with dateable charcoal from campfires—the biological and cultural remains of a society that by conventional wisdom should not have existed.

In one contiguous excavation, the team took 11 meter-square blocks down to bedrock at a depth of about two and a quarter meters. Workers identified 20 archaeological strata. The Paleoindian midden consisted of two strata roughly 30 cm in total thickness resting above about 50 cm of sterile sand and boulders, and below about 30 cm of sterile soil.

In the *Science* article, Roosevelt and her colleagues describe the Paleoindian strata as one of gray sand from 5 to 20 cm thick and the blackish sand layer 10 to 25 cm thick. They found shallow hearths and numerous carbonized seeds. They say they identified four different Paleoindian periods, and in these strata they

Roosevelt's co-authors of the *Science* article were Marcondes Lima Costa, Federal University of Para, Brazil; Cristiane Lopes Machado, Linhares Forest Reserve, Linhares, Brazil; M. Michab, CERN, France; N. Mercier, CERN, France; Helene Valladas, CERN, France; James Feathers, University of Washington, Seattle; William Barnett, American Museum of Natural History, New York; Maura Imazio da Silveira, Goeldi Museum, Belem, Brazil, University of Sao Paulo, Brazil; Andrew Henderson, New York Botanical Garden, New York; Jane Sliva, Center for Desert Archeology, Tucson, Arizona; David Reese, The Field Museum, Chicago; Barry Chernoff, The Field Museum, Chicago; Alan Holman, Michigan State Museum, East Lansing. Funding was provided by the John D. and Catherine T. MacArthur Foundation, the National Endowment for the Humanities, and the National Science Foundation.

counted more than 30,000 lithic flakes and 24 formal tools. The tools included four triangular, stemmed bifacial points, and two preforms; among the other tools were a stemmed graver and four limaces—slug-shaped unifaces. The most common lithic material was chalcedonic rock, but the earliest artifacts were made of quartz crystal.

Roosevelt reports that the stemmed points and limaces were found only in the early stratum. She speculates that the bifacial points could have been knives, or points for spears, darts or harpoons, while the unifaces seemed suitable for woodworking, cutting, digging or hide-working. Contemporary Amazonian harpoon points, she says, are usually socket-hafted and barbed, like some of the archaeological discoveries.

In the Paleoindian strata, Roosevelt and her team found thousands of carbonized seeds and wood fragments from trees common in tropical forests. For example, Brazil nut was among those found at several levels. *Jutai*, a leguminous tree still valued for flour made from the coating of its seeds, *achuá*, a rain-forest tree that bears starchy fruits, and *pitomba*, a fruit tree, were found at all Paleoindian levels. Evidence was also found of *sacuri*, *tacuma*, and *curuá*, palms common to the area that provide food and raw materials.

Paleoindians evidently harvested plants that can still be found in the region's relict tropical forests. Roosevelt says no examples were found of crop plants or of plants adapted to cool climates or to dry tropical climates. She told the **Mammoth Trumpet** that the stable carbon isotopes of the plant remains were in the ranges typical of closed-canopy tropical rain forest.

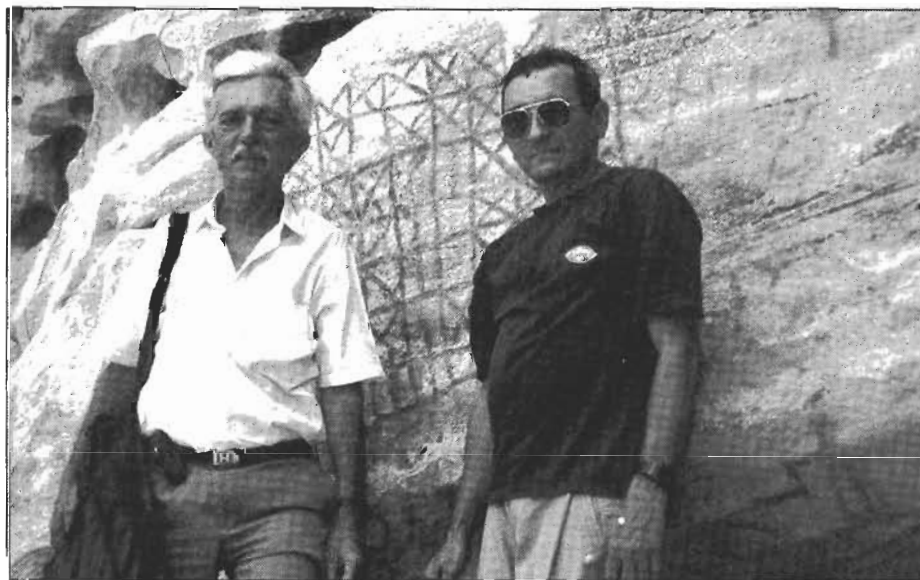
The team used 56 carbonized specimens of plants for radiocarbon dating of the Paleoindian strata—49 by accelerator mass spectrometry and seven by conventional dating.

Dates received from the different dating labs were consistent with the stratigraphy. To assure the most precise results, they dated mostly single specimens of fruits. Roosevelt noted that most dates for Clovis sites, by contrast, have come from tests of combined wood charcoal samples. She argues that combining samples can result in indistinct dates, and notes that wood samples from the inner



©1993 BY A.C. ROOSEVELT/THE FIELD MUSEUM, CHICAGO

The Paineiro do Pilao (painted pillar) site, less than a kilometer south of Caverna da Pedra Pintada, has a variety of rock paintings. The work above depicts a bird and hand prints. Standing beneath this rock painting (*below*) are Helcio Amaral, left, the historian of the town of Santarem, and Nelsi Neif Sadek, an ecology teacher and Secretary of Culture for Monte Alegre, Brazil, both of whom participated in Anna Roosevelt's Lower Amazon research project. It was Sadek who led Roosevelt to Caverna da Pedra Pintada. Behind them is rock painting of geometric design.



©1993 BY A.C. ROOSEVELT/THE FIELD MUSEUM, CHICAGO

parts of large trees may yield dates several hundred years too old.

To further validate the radiocarbon results, the team tested three sediment samples by optically stimulated luminescence and tested 10 burned lithic artifacts by thermoluminescence. The scientists conducting these tests had no knowledge of the radiocarbon dates, and results were generally consistent with the radiocarbon dating although the range was

greater: these 13 age estimates ranged from $9,530 \pm 780$ to $16,190 \pm 930$ years B.P.

Faunal remains were poorly preserved in Caverna da Pedra Pintada, but they represented a wide variety of animals: very large and small fishes, rodents, bats, molluscs, tortoises, turtles, snakes, amphibians, birds and large land mammals. Most of the remains were small fragments, many of which were carbonized.



©1993 BY A.C. ROOSEVELT/THE FIELD MUSEUM, CHICAGO


This rock painting at the Serra da Lua (mountain of the moon) site, about five kilometers west of Caverna da Pedra Pintada, depicts concentric circles and an inverted figure with a rayed head. Monte Alegre paintings portray animals, humans and composite creatures along with geometric and possibly astronomical designs. The Monte Alegre rock art apparently dates to the Paleoindian era.

Roosevelt and her team also analyzed the cave's paintings and pigments. They report that many of the cave paintings were made during the Paleoindian period. Pigment occurred abundantly only in the oldest strata of the cave. Painting also could be from the late prehistoric period, because there was one specimen of pigment in those strata, too; however, they found no evidence of pigment in early-Holocene strata.

The cave was evidently vacant for a period after the Paleoindian occupation, during which time the sterile layer accumulated. Roosevelt and her colleagues have dated the subsequent reoccupation to the period from 7,580 to 6,625 years B.P. in a culture that possessed pottery. In 1991, Roosevelt described the discovery of the Western Hemisphere's earliest-known ceramics—8,000-year-old pottery found in a shell midden near Santarém less than 90 km southwest of Caverna da Pedra Pintada on the south side of the Amazon.

In a *Science* article reporting that find, Roosevelt wrote that archaeology has shown that Amazon floodplains were intensively exploited for thousands of years. She called for protection of Indians' cultural and territorial integrity as

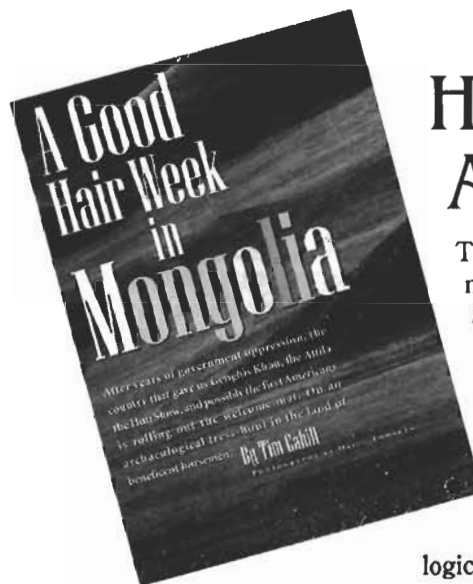
well as for protection of ancient occupation sites. She said Amazonian people hold unassailable ancestral rights to the land and indispensable knowledge about effective, long-term management of tropical resources.

"Lowland archaeology is important untapped evidence relevant to evolutionary ecology, conservation, and planning." She might have added that it held untapped evidence regarding the initial peopling of the Americas. 

Some Lessons from the Tropical Forest

"Much recent research in the Amazon shows that so-called 'virgin' tropical forests were in fact settled and cultivated for many thousands of years," says Anna Roosevelt. "They are actually anthropogenic forests. Look at the diversity patterns we see today, like the clustering of cashews, Brazil nuts, certain palms—species with great economic importance. Some of these patterns came about precisely because prehistoric human activities altered the topography and the soil and changed the vegetation."

This tells us, Roosevelt argues, that it doesn't make sense to move native people out of the forest to make a nature reserve. People on a small scale, she says, have long been part of the landscape, an integral component of the ecological processes we value. "It's only when outsiders subsidize exploitative activities on a large scale that we see the type of destruction that's eradicating tropical forest in some areas today," she says. "Native people and their ancient occupation sites hold a great deal of knowledge about tropical ecosystems. Their continued presence on the land is critical for the survival of the habitat."



Hair-Raising Adventure

This article in the April edition of *Outside* magazine by adventure writer Tim Cahill, a member of the CSFA Advisory Board, describes a trip across Mongolia's vast outback. Cahill, editor-at-large for *Outside*, collected hair from Mongolian people for analysis by scientists at Oregon State University who are studying the morphology and DNA of naturally shed hair found in archaeological sites in the Americas. 