MAMMOTH TRUMPET

Volume 8, Number 3 | Center for the Study of the First Americans | Department of Anthropology
June, 1993 | Oregon State University, Corvallis, OR 97331 | ISSN 8755-6898

MASTODONS' DROUGHT DILEMMA WAS A BOON TO PALEOINDIANS

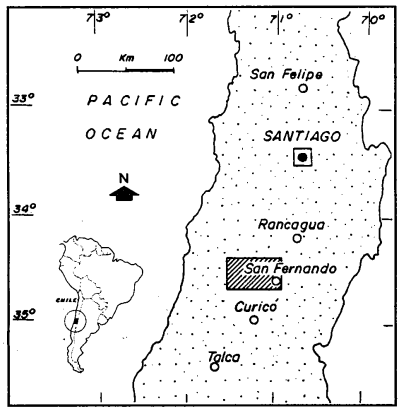
Chilean Site Discloses Human Exploitation of Resource

From a lake bed in central Chile scientists have recently uncovered evidence linking a dramatic change in climate between Pleistocene and Holocene times with development by Paleoindians of specialized hunting that exploited mastodons stressed by drought. Paleoindians not only hunted the mastodons, but they also left markings on bones and other evidence that their interaction with the now-extinct beasts was more than a casual affair.

Dr. Lautaro Núñez, archaeologist at the Institute of Archaeology and Museum at Universidad Católica del Norte, San Pedro de Atacama, Chile, led a multidisciplinary team of investigators on a series of excavations in what now is a dry lake bed called Lake Tagua Tagua. The site, about 120 km southwest of Santiago near San Fernando, is at an elevation of 200 m in the tectonic basin of Tagua Tagua between the coastal mountain range and the longitudinal depression of central Chile.

The lake's archaeological treasures first came to light more than 150 years ago. At that time, there was water in the lake, although it was in an advanced state of eutrophication and drying up. Subsequently, water was drained away, exposing some of the mastodon bones. News of the bones spread, and the scientists who came to investigate produced early paleontologic descriptions of what they found.

In his work, Núñez identifies eight distinct levels of deposits at Lake Tagua Tagua. The deposits tell a different story about the climate and vegetation existing during different times in the distant past. Today Lake Tagua Tagua has a moderate, Mediterranean-type climate with winter rains and an eight-month dry season, but Paleoindians and mastodons that lived in central Chile during the Pleistocene experienced a quite different environment. Deposits dating from 51,000 to 35,000 years ago suggest that the weather was rainy and cold. Coniferous forests thrived in the area as did other types of plant life that



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TEAM TRACES FOUR TRAILS FROM ASIA

DNA Suggests Divisions In 'First Wave' Americans

One of today's high-profile projects of Japanese science focuses on the prehistoric dispersal of Northeast Asians to the Americas and elsewhere. Satoshi Horai, of the National Institute of Genetics in Mishima, and his coworkers in other Japanese research centers have been tracing clues of this human dispersal for several years. At a recent symposium, Horai; Rumi Kondo, of the Graduate University for Advanced Studies in Mishima; Shunro Sonoda, of Kagoshima University's Faculty of Medicine; and Kazuo Tajima, of the Aichi Cancer Center Research Institute in Nagoya, reported on their findings about the prehistoric migration of Asians to the Americas. The report was based on studies of mitochondrial DNA in living Asians and American Indians.

To study mtDNA in American Indians, Horai's group collected 72 blood samples and isolated the mtDNA therein. These samples came from nine locations in Chile, four in Colombia, and one in Brazil as well as from three individual Maya persons and one Apache person. The researchers compared these mtDNAs with mtDNAs previously isolated from 91 Asians (including one New Guinean), 20 Europeans,

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Research, Outreach Occupy Attention Of CSFA's Board

Advances in research and plans for additional lines of investigation occupied much attention as the **Center for the Study of the First Americans** Advisory Board met in Corvallis, Ore., in April. Board members also reviewed all the **Center**'s outreach and development programs. Jo Ann Harris, a New York City attorney, was re-elected board chair. Anne Stanaway, a Pennsylvania media producer, was

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In CSFA's new faunal analysis lab, Dan Tupper, Oregon State University graduate student, describes computer cataloguing of discoveries from the Mammoth Meadow site for Center Advisory Board members. Visitors, from left, are Jackson Lake, Sally Malueg, David Brauner, Jo Ann Harris, David Bobb and George Cremer. Malueg is associate dean of OSU's College of Liberal Arts.

INSIDE

Volunteers Help CSFA Projects And Learn, Too

The Center for the Study of the First Americans involves scores of volunteers in many activities, mostly centered at Oregon State University. Joyce Pytkowicz, **Center** Advisory Board member and volunteer coordinator, continues to organize programs that range from classroom lectures and archival research to field projects. Last fall the **Center** presented a series of lectures at Oregon State bringing together the latest information on the peopling of the Americas. These classroom sessions involved several disciplines including climatology, geology, paleontology, anthropology and geography.

"We invited volunteers to the lectures to enhance their knowledge of archaeology and make their participation more rewarding and meaningful," Pytkowicz said.

Volunteers were instrumental in renovating the **Center**'s new laboratories and offices formerly occupied by Oregon State's agricultural chemistry department in Weniger Hall. Cleaning and renovation started in October and continued almost every weekend through the winter with volunteer participation. David Bobb, Advisory Board member from Ashland, Ore., brought his experience as a former painting contractor into play in organizing the work. Pytkowicz said that as many as 18 volunteers regularly took part in the unglamorous chores of scraping away signs of years of chemical research and moving tons of **Center** equipment into newly painted spaces.

Volunteers also helped set up the **Center**'s library and organize its extensive collection of reprints.

In December 60 persons took a trip to Cascadia Cave in the foothills of the Cascade Mountains to look at petroglyphs and other signs that may date back 8,000 years. Prior to the field trip, a classroom session gave background on the cave. **Center** Director Robson Bonnichsen led the field trip.

"From their work we have gained information about Paleoindian sites in the Willamette Valley."

Pytkowicz said volunteers are helping the **Center** in archival and library research. "From their work we have gained information about Paleoindian sites in the Willamette Valley," she added, noting that their work produced information on long-forgotten sites. Sue Van Laere, a **Center** volunteer who coordinated the project, explained that it chiefly involved scanning library microfilms of old newspapers looking for any reports of megafauna or ancient humans. She said eight volunteers have been active in the year's work. "Kristy Komar," she said, "has put in a tremendous amount of time."

In connection with the **Center**'s project to catalog Pleistocene megafauna and human sites in the Willamette Valley, 46 volunteers attended a classroom session on surveying and map reading. Later, volunteers went into the field to survey particular sites. Dan Mulligan, a graduate student in archaeology, will draw on material from the Willamette Valley project for his thesis.

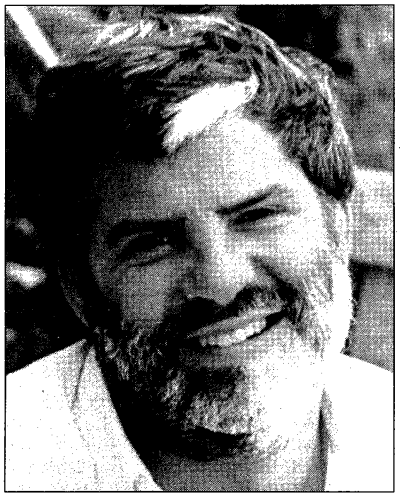
Pytkowicz is making connections with other organizations, amateur and professional, to increase the **Center**'s outreach and enhance the experience of volunteers. She said Oregon volunteers may be taking part in continuing archaeological excavations on Washington's Olympic Peninsula and that a trip is being planned to a Native American cultural center.

"It's been a successful year with the volunteers," Pytkowicz said, "and we hope to have even more projects next year."

Christopher Pratt, Retiring Board Leader, New Recipient of Marie Wormington Award

Christopher Pratt, president of Distribution Management Systems, Inc., Colchester, Vt., has been named recipient of the H. Marie Wormington Award for his pivotal role in reorganizing the **Center for the Study of the First Americans** and finding the **Center** a new and receptive home at Oregon State University. The **CSFA**'s Advisory Board bestowed the award at its April meeting. Pratt, who served as co-chair of the Advisory Board, resigned earlier this year, citing increasing business and family commitments. He has been an enthusiastic supporter of **Center** activities. "I would like to underscore that my personal circumstances do not reflect a diminished interest in the **Center**," Pratt said. "The fundamental pursuit of the **Center** has stirred something deep within all who become involved." The H. Marie Wormington Award was initiated by the **Center** in 1989 to recognize individual contributions to the understanding of early American prehistory, as well as to honor Dr. Wormington, curator emeritus of the Denver Museum of Natural History, long recognized as a leader in the study of America's earliest prehistory.

First recipients of the Wormington Award were George and Helen Cremer of Melville, Mont., longtime supporters of archaeological investigation on their own land and archaeological studies there and elsewhere in southwestern Montana. George Cremer is a member of the **Center**'s Advisory Board, and the Cremers provide vital logistical support to investigations of the Mammoth Meadow site southwest of Dillon.



Christopher Pratt

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–Don Alan Hall

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As a **Trumpet** reader you no doubt know that we are interested in every discipline that can offer clues to human settlement of the Americas, and it's a daunting task for us to attempt to stay abreast of the many advancements. Thus we would appreciate receiving a copy of any pertinent news item you might find, whether in a technical journal, local newsletter or newspaper. Just address them to the attention of the editor, at our address listed on on this page (see box, right). We'll look forward to hearing from you.

MAMMOTH TRUMPET

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. Second-class postage paid at Orono, ME 04473, and additional mailing offices.

POSTMASTER: Send address changes to:
Mammoth Trumpet
Center for the Study of the First Americans
Weniger Hall 355
Oregon State University
Corvallis, OR 97331-6510

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MAINE COAST MAMMOTH DIG IS UNUSUAL

Spoils Yield Parts; Age Is in Question

A team of archaeologists, vertebrate paleobiologists and geologists are at work near Maine's southeastern coast this month to recover what they hope will be the entire skeleton of a mammoth. Fragments of an animal unearthed at the site southwest of Portland are evidence of a female woolly mammoth. Initial dating of the animal has proved perplexing, even calling into question well-accepted sea-level models for the area.

First signs of the mammoth, an unusual discovery so far east, turned up back in 1959 when tree farmers were digging a pond as a source of water for their seedlings. As Bruce Bourque and Gary Hoyle of the Maine State Museum in Augusta explain, the site is in a gully. The southeast coast of Maine was covered by a sand plain, probably deltaic in origin, and the area is cut by gullies that extend down to glacial marine deposits. Where sand and clay meet there is an aquifer of angular pea gravel into which the farmers directed their backhoe in 1959.

Their excavation went as planned until somebody noticed what turned out to be the tusk of a large animal. Work stopped and geologists came to examine the site, but scientific interest faded when people began to recall a famous circus elephant that had died somewhere in that general vicinity in the 19th century. Over the years, however, a thread of interest survived; Hoyle, the museum's curator of natural history, discovered that the skeleton of the circus elephant rumored to have been buried in southeastern Maine has long been on display at the American Museum of Natural History in New York. After the Maine museum acquired the tusk in 1990, Dr. Daniel Fisher of the University of Michigan examined it and estimated that it was from a young female mammoth.

Last summer the museum, aided by the National Guard, state highway department, and other agencies and specialists, went back to the site in search of the rest of the animal's remains. Preparatory work was to include draining the pond and using a power shovel to excavate a trench nearby to reveal soil stratigraphy. Actual excavation had to wait until this summer, however, because the power shovel immediately encountered spoils from the 1959 excavation. Before a trench could be dug, material from the previous excavation had to be moved aside, and in the process the workers encountered bone that had gone unnoticed in 1959.

A vertebra found there was evidence that Fisher had been correct in his initial identification. Then a molar came to light and that clenched it—it was a young mammoth and not a mastodon.

News reporters descended onto the site, and it became difficult to secure the area from curious visitors. Before proceeding to drain the pond and dig for the remains of the animal, it would be necessary to determine what bones were in the spoils pile—a big, time-consuming project. Museum officials weighed their options and then ordered the exposed pile of spoils—more than 100 cubic yards—trucked up to Augusta for further examination. Near the museum they built a large screen and used a small tractor to scoop the spoils onto it. After the pile was screened, they had a much better idea of what happened in the 1959 excavation.

"We found about 300 fragments of bone," said Hoyle in a recent telephone interview. "Preservation of the bone is excellent," he added, noting that fragments clearly bear the marks of the power shovel from 1959.

"It looks like the backhoe clipped a few ribs, part of a vertebra and got most of the left half of the skull before anybody saw anything," Bourque explained. "When they saw the tusk they stopped."

Hoyle and Bourque are confident that the remainder of the mammoth is likely there awaiting discovery. Bourque, the museum's chief archaeologist, will be looking for any evidence of human activity in connection with the animal. So far there is "none whatsoever, but then we don't have any long bones," he said. Radar imaging of the pond was performed earlier this spring, but as of this writing, analysis of the findings had not been prepared, although radar did indicate anomalies.

Results of dating done on the recovered mammoth remains have yet to be published, but museum officials and University of Maine geologist Harold Borns say preliminary dates are in the general range

"We're going to rewrite a little geology in the course of this project."

of 10,000–12,000 years B.P. Establishing an accurate age for the animal is important even if no human connection is found because an old date would call in question accepted geological chronologies for the local area. For example, Borns, who has many dates from marine organisms in the area, is suspicious of a tentative 12,500-year date. "The dates came out to be about the same as the time when there was about 100 feet of water there," he explains. Bourque expects the investigation to refine understanding of the geology of the southern Maine coast. "We're going to rewrite a little geology in the course of this project," he said in a telephone interview. Borns believes the ultimately accepted age for the mammoth to be less than 12,000 years, although he agrees that preliminary dates suggest a curious problem.

–DAH

CSFA Research

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elected vice chair, and Joanne Turner, a Colorado geologist, was re-elected secretary.

The two-day session opened with tours of the **Center**'s newly refurbished laboratories in Oregon State University's Weniger Hall. There, graduate researchers displayed progress in the **Center**'s continuing investigation at the Mammoth Meadow site in southwestern Montana, described initial progress in the Willamette Valley Project, and illustrated the **Center**'s facilities as well as demonstrating their own research roles. In later Board sessions the **Center**'s Director Robson Bonnichsen described progress on the **Center**'s electronic laboratory, which he expects to become the means for an international data base that will standardize archaeological data that now are subject to a variety of subjective interpretations.

"We have a huge problem in American archaeology," Bonnichsen told the Board, because of the lack of standardization in typology. The **Center**'s prototype electronic lab collects digital images of lithic artifacts, for example, that are stored in computer memory. A researcher can do much more with an artifact on the computer screen than with an artifact in the hand. Its size can be measured with perfect accuracy, and its individual facets can be counted, analyzed, and singled out for close-up examination. Details such as use wear and resharpening can be readily enumerated. Moreover, when an artifact is translated into a digital computer image, it can be compared with other similar objects and shared with other researchers. With uniform standards of analysis and a data base of artifacts from South America, North America and Asia, a whole new line of investigation of the peopling of the New World will be open. Once their objects are "photographed" electronically, privately held collections can be compared alongside public and museum collections without removing any from its repository. Sacred objects, too, can be analyzed and compared without actually being handled by researchers. Ultimately, all known artifacts can become a single comparative collection against which to analyze new discoveries.

After describing and demonstrating the **Center**'s prototype system, Bonnichsen cautioned that technical as well as ethical questions about operating the image data base must be answered. He asked the Board for advice and said he also will draw on expertise from the **Center**'s Scientific Council. The goal will be to make data bases of archaeological images as accessible as possible to all who are interested without subjecting any images to exploitation or other unethical uses. A positive effect of the electronic image program, Bonnichsen pointed out, will be the increased involvement of amateurs and volunteers. Collection and analysis of data will no longer rely on expertise of a few highly skilled researchers. As a result, he said, investigators can work with actual data rather than one person's subjective inferences of what the data represent.

The system can be employed with hairs, fish scales, bones, seeds or other archaeological objects as well as lithic tools.

"We have a problem of almost unlimited opportunity," Bonnichsen told the Board after noting that the system can be employed with hairs, fish scales, bones, seeds or other archaeological objects as well as lithic tools. The **Center** hopes to work with the U.S. National Park Service and other federal agencies in planning the image system and other more conventional data bases.

Board members also received an update on Mammoth Meadow research and the Willamette Valley Project, which is gathering information on Late Pleistocene sites in western Oregon. Initial probes into a wet site in pasture near Corvallis have produced definite evidence of extinct megafauna, but a later probe produced only bones of farm animals. A survey of Willamette Valley sites is to be completed by July 1.

Other research plans discussed were the **Center**'s proposal for a three-year project focusing on the Diring site on the Lena River in Siberia (**Mammoth Trumpet** 7:3 "Siberian Site Defies Theories of Peopling"). The project calls for a field conference at the site with eight Western experts joining Russian specialists including archaeologist Yuri Mochanov, chief investigator of the Diring site, which has been dated far earlier than any previously known human habitation of the far north. The following year participants would reconvene for a conference at Oregon State University to report their findings, which would then be edited into a book.

Board discussion of the **Center**'s commitment to outreach included the schedule of new books. Bonnichsen said that four books that originated from the **CSFA**-sponsored World Summit Conference of the Peopling of the Americas held in Orono, Maine, in 1989, are in production; the first is scheduled for release this summer. A project on prehistory of northeast Asia involves three books, one of which was already in press at the time of the meeting. Bonnichsen reported that Volume 10 of *Current Research in the Pleistocene* is scheduled for distribution this summer.

The **CSFA** Advisory Board welcomed three new members to its April meeting. They are Marvin Beatty, a Wisconsin soil scientist and long-time member of the **Center**'s Scientific Council; Karl Knuchel, a Montana attorney; and Jackson Lake, a Montana Realtor. The Board scheduled its next meeting for Oct. 1–3 in Corvallis.

Powerhouse DNA

Mitochondrial DNA (mtDNA) is extremely useful for tracing the biological inheritance, or biological history, of humans. As discovered 40 years ago, DNA is the biological material of genes, the cellular determinants of our inherited traits. The bulk of DNA exists in double dose, one dose from each parent, in the cell's nucleus. MtDNA, however, resides in the mitochondria, the energy-producing powerhouses of cells' cytoplasm. And mtDNA is inherited only through the egg, making it a maternal genetic trait. It is transmitted from mother to daughter to granddaughter and on down through thousands of generations. While sons do inherit it, they do not pass it on to their offspring. Moreover, unlike the nuclear DNA that gets reshuffled every generation in forming egg and sperm cells, mtDNA is not influenced by sexual reproduction. Thus only one kind of mtDNA exists in an individual. Also, mtDNA accumulates changes (mutations) relatively fast over the generations. The result is that most humans differ from each other noticeably in their mtDNA (see Mammoth Trumpet 7:1 "Paleoindians and DNA").

DNA Trails

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and 10 Africans. The majority of the team's Asian samples were from Japanese people.

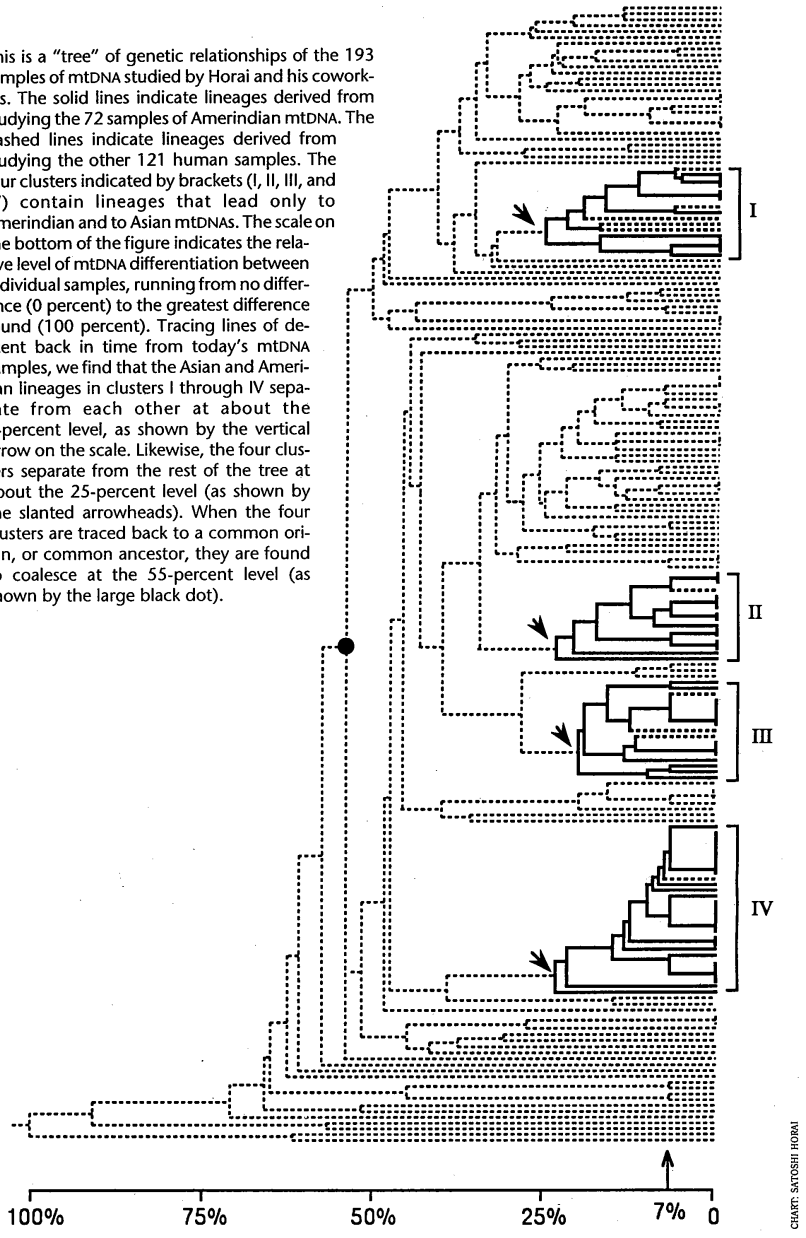
The researchers found 43 distinctive types of mtDNA among the 72 American Indians studied. Distinctive mtDNA types are analogous to the identifying bar codes on different kinds of products read by a scanner at the supermarket check-out counter. Of course, not all individuals have unique mtDNA "bar codes"; some—such as mothers and their offspring—have identical ones, unless a rare mutation has occurred.

Before we examine the principal results obtained by Horai and his coworkers, it is important to take into consideration that their study included only one person from the Na-Dene language family (the Apache subject), and none of the northern peoples commonly known as Aleuts and Eskimos. As **Mammoth Trumpet** readers may recall, some theorists have suggested that migration from Asia across Beringia occurred in three waves, with the ancestors of so-called Amerindians arriving in the Americas first, followed later by speakers of Na-Dene languages and still later by ancestors of Aleut-Eskimos. Horai and his colleagues did not involve themselves with this three-wave theory because they studied only its "first wave." However, they did consider the question of "waves" within this category, as have other investigators recently (see **Suggested Readings**).

Now for some results of Horai's group. Among the 72 American Indians studied, they identified four ancestrally related mtDNA clusters—four genetic trails from Asia to the Americas. Every cluster contained mtDNA from at least two widely separated local populations; for example, each of the four clusters contained individuals from Chile and Colombia.

When the investigators compared the mtDNA findings on their 72 American subjects with those on their 121 other samples, they found that the four American clusters were intermingled among other lines of descent, as depicted in the accompanying diagram. That is, the four American clusters did not clump together; they were scattered among the rest of the sampled population.

A diagram such as this is called a phylogenetic tree, even though it is not shaped like a tree but is lopsided. It is composed of hypothesized lines of descent over many generations, running from left to right. The tree helps us see the deep-time pattern of clustering that gave rise to the many kinds of mtDNA studied by Horai's group. To construct such a tree, the degree of difference is computed for all possible pairs of mtDNAs in the sample. The maximum difference found is, in this case, set at 100 percent, on the scale shown at the bottom of the figure. Identical mtDNAs are set at 0 percent. Similar mtDNAs are paired together to form forked twigs of the tree. Such twigs are then joined to other pairs, or to other singleton mtDNAs, that are most like the average value of the twig in question. In this way twigs are combined to form branches, and branches are combined to form main limbs. By convention, the leftmost line in the tree is called the root, rather than the trunk.

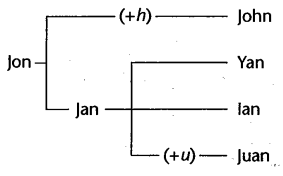


This is a "tree" of genetic relationships of the 193 samples of mtDNA studied by Horai and his coworkers. The solid lines indicate lineages derived from studying the 72 samples of Amerindian mtDNA. The dashed lines indicate lineages derived from studying the other 121 human samples. The four clusters indicated by brackets (I, II, III, and IV) contain lineages that lead only to Amerindian and to Asian mtDNAs. The scale on the bottom of the figure indicates the relative level of mtDNA differentiation between individual samples, running from no difference (0 percent) to the greatest difference found (100 percent). Tracing lines of descent back in time from today's mtDNA samples, we find that the Asian and American lineages in clusters I through IV separate from each other at about the 7-percent level, as shown by the vertical arrow on the scale. Likewise, the four clusters separate from the rest of the tree at about the 25-percent level (as shown by the slanted arrowheads). When the four clusters are traced back to a common origin, or common ancestor, they are found to coalesce at the 55-percent level (as shown by the large black dot).

On a more detailed level, each of the four American clusters identified by Horai and his coworkers was found to contain mtDNAs of Asians, even though no Asian and American mtDNA types were the same. (Horai said the one Apache subject fell into the fourth cluster of the phylogenetic tree, intermingled with the natives of Chile and Colombia.) On the assumption that American ancestors were Asians, the maternal ancestor of each of these four clusters must have had some descendants who "left home," that is, immigrated to the New World, and some descendants who stayed behind in Asia.

Perhaps the most interesting aspect of this study is the finding of separation of the four Asian-American Indian clusters on a worldwide basis. Horai's group suggests that the ancestors of the four clusters were isolated from each other for a long period of time and that each cluster represents a subpopulation that migrated independently of the others to the New World, leaving behind a few Asian "cousins." These migrations required many generations, during which time individuals in each cluster differentiated genetically from each other in terms of their mtDNA bar codes.

These incidental changes in the ancestral type can be illustrated by the following hypothetical tree, or "John cluster," shown below, in which we pretend to reconstruct the history of some John-like names.



As this example shows, most of the incidental changes are letter substitutions (3 of 5), but

additions—or deletions—of letters may also occur. Likewise, in incidental mtDNA changes, the majority are substitutions of molecular information in the DNA, although gain or loss of DNA information occasionally occurs.

Horai and his coworkers interpret the finding that each of their four American Indian clusters has representatives from different locations in the Americas as reflecting that "a considerable degree of migration occurred between populations" after initial colonization. That is, while the four mothers of the clusters were probably strangers, their American descendants were not "strangers in a strange land." By groups moving about, and by group-level fusion and fission, these various descendants sometimes became cultural brothers and sisters—in the same location. This intra-group diversity is a microcosm of the broader global human diversity revealed by numerous mtDNA studies. In a way, mtDNA studies are not only a narrative about the past, they are also a metaphor to reflect on our universally diverse humanity.

To put their findings in a time perspective, Horai's group tried to determine when the four America-colonizing clusters left Asia. Based on the results of a variety of previous studies, they assumed that modern humans have been around for 200,000

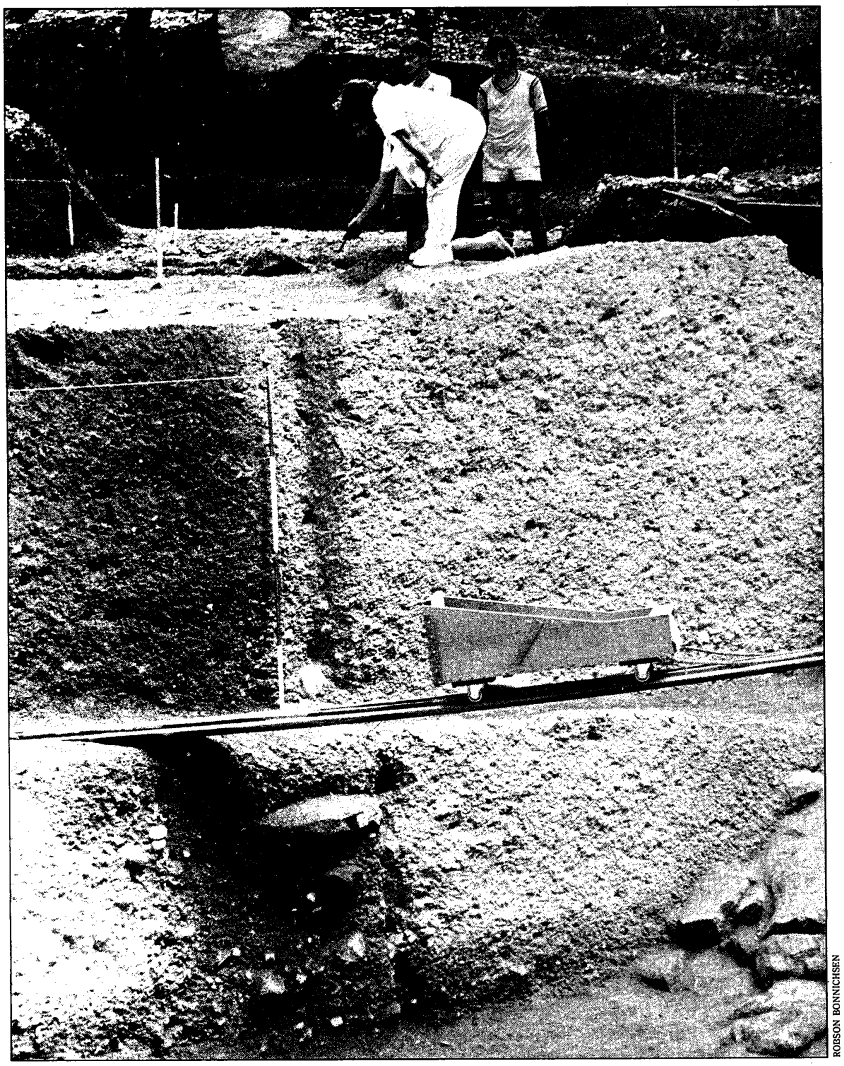
The maternal ancestor of each of these four clusters must have had some descendants who "left home," that is, immigrated to the New World, and some descendants who stayed behind in Asia.

to 300,000 years. They observed that their future Americans separated from their Asian cousins—presumably by the former heading for Beringia—at the 7-percent level of mtDNA differentiation (see diagram), representing the last 7 percent of human evolution. The Beringia crossing was thus estimated at .07 times 200,000 or 300,000 years—14,000 to 21,000 years ago. This window of time coincides, as they point out, with the last glacial period during which the Bering platform was above sea level. Whether their four clusters represent four asynchronous "waves" of immigrants to the Americas, as Horai's group maintains, or represents one wave—composed of four different clusters funneled together—cannot be resolved on the basis of their data. Workers in this field are still debating "the wave question" (**Suggested Readings**). In any event, it seems clear that four major genetic trails, or trajectories, characterize today's American Indians.

So far, so good. But how strong is the evidence of Horai and his coworkers for their estimate of 14,000 to 21,000 years for the time of the Beringia crossing? Only further work will tell, since Horai's group did not study Siberians or various other Asians who might have split off from the future American Indians at less that the 7-percent level of differentiation. For example, if the average were 5 percent, the minimum estimate for a Beringia crossing would be 10,000 years ago—that is, post-Clovis in the archaeological vernacular. Moreover, no one knows the relationship between the calculated 7 percent differentiation level and the actual time when subgroups split off for the Beringia trek; descendants of different maternal ancestors may have lived together in the same river valley or on the same coastline for generations before a split in the group occurred.

The effort to visualize the past using mtDNA is not over yet. Horai and coworkers plan to continue to probe the prehistoric Asian connection to the Americas, judiciously sampling individuals on both sides of the Bering Straits.

–Dee Baer



ROLSON BONNICHSEN

Niède Guidon examines an artifact pointed out by a member of her crew during excavation at Pedra Furada in March, 1987.

PEDRA FURADA DOCTORAL THESIS CONVINCES COMMITTEE SKEPTICS

Data from eight years of research and analysis on Pedra Furada, the renowned sandstone rockshelter in northeastern Brazil, became public earlier this year when Fabio Parenti, co-excavator with Niède Guidon, presented his doctoral thesis to an academic committee in Paris. Paleoanthropologist Yves Coppens presided over the six-member committee, which included a paleontologist expert in Brazilian sites, an expert on Paleolithic rockshelters and stone-tool industries of southwest France, an expert on archaic stone tools, a specialist on Andean pre-history, and Guidon herself.

"There is now solid archaeological evidence for a human presence in the New World tens of thousand of years ago."

Parenti convinced all six, some of whom had earlier voiced strong doubts about Pedra Furada. In reporting on the successful thesis defense in the journal *Nature*, the British archaeology writer Paul Bahn predicted "the opening of a new era of investigation into the 'first Americans.' No site had yet met all criteria necessary to convince skeptics that humans had been present in the New World so far back in the Pleistocene," Bahn wrote.

The goal of Parenti's dissertation was to distinguish between human and natural agencies involved with the site's contents. Of more than 6,000 pieces definitely considered tools, about 900 came from Pleistocene-age strata. Parenti presented 595 tools considered assuredly human by even the most stringent criteria. The site has 54 radiocarbon dates, in a coherent series, ranging from 5,000 to 50,000 years B.P.

Nature reported that skeptical members of the thesis committee had also voiced skepticism about other controversial New World sites such as Calico in California, Pendejo Cave in New Mexico and Old Crow in Yukon—all of which have been reported on in the **Mammoth Trumpet**. "Regardless of the lack of early sites in North America, there is now solid archaeological evidence for a human presence in the New World tens of thousand of years ago," Bahn wrote. "All other issues . . . become secondary to that."

Guidon and Parenti have invited a number of the skeptics, among others, to an international meeting in Brazil in December.

THE SEARCH

Why haven't more Paleoindian and other Pleistocene-age sites been excavated in the Ohio Valley? Perhaps it's because archaeologists haven't been looking carefully.

THE OHIO VALLEY has proven rich in archaeological resources, but there has been a scarcity of data in this region from the Paleoindian period and even less evidence of the cultural and technological transition from the late Paleoindian to the early Archaic.

Dr. Bradley T. Lepper, an Ohio Historical Society archaeologist at the Newark Earthworks State Memorials, believes the lack of Paleoindian sites is an indication that researchers haven't made the fullest use of available scientific resources. In part, he says, they've been unable to do so because of the nature of conservation archaeology, which generally is inadequately funded and too quickly completed to allow the multidisciplinary efforts Lepper says are critical to successful identification and recovery of the earliest sites. But he also suggests that standard archaeological strategies for locating and excavating later prehistoric sites don't work well for the sort of ephemeral sites that he believes are typical of the earliest Paleoindian and Archaic periods of the Ohio Valley.

In a recent telephone interview, Lepper explained the important lessons he learned from a site on a high flood terrace above the Ohio River in southwestern Ohio. The Manning site almost escaped detection during testing done as part of a Cultural Resource Management survey. The Manning site owes its discovery to development of the William H. Zimmer Generating Station, originally planned as a nuclear power station but converted in the mid-1980s to a coal-fired plant. Before construction began, American Power Electric Company contracted with a cultural resource management company to undertake archaeological testing. In excavations completed in 1986, the archaeologists determined there were at least four potentially significant occupations that would be impacted by the planned construction. Testing suggested extensive Archaic occupations, with a possible single Paleoindian occupation in a deeply buried component.

Lepper's work began in the following year at the Manning site's supposed single Paleoindian occupation. Working with archaeologist Donna Roper and a research team that included a geomorphologist, their excavations revealed not one but three possible occupations, spanning the important period from late Pleistocene to the early Holocene. Because of the complexity and size of the site, the utility company altered construction plans to reduce impact.

The earliest evidence for occupation came from a large, shallow, elongate basin containing highly oxidized red sediment and scattered charcoal. Two carbon samples from this feature yielded dates of 9,840 and 9,890 years B.P. The single bifacial resharpening flake identified from this feature was not closely enough associated with the carbon samples to clearly identify it as a cultural feature.

However, the second occupation, 40 cm above the possibly questionable one, contained a number of bifacial and unifacial chipped stone tools as well as one pitted stone. Although the scatter of tools did not include diagnostic artifacts, the feature is confidently identified as a Paleoindian occupation. With a date of 9,720 years B.P., Lepper notes that with the exception of the Paleo Crossing site near Akron, (**Mammoth Trumpet** 7:4 "Investigations at Ohio Site Push Back Dates for Clovis") and another less-clearly dated occupation at the Epply Rockshelter, Coshocton County, Ohio, this in situ occupation offers the earliest radiocarbon dates for Ohio. "This demonstrates such sites are there. Now we must figure out how to find them." A surprise from this occupational level was the presence of spruce in the charcoal sample, suggesting the mixed arboreal/deciduous environment associated with the Late Pleistocene may have persisted for as much as 2,000 years longer than scientists previously thought.

The third occupation, from 10 to 12 cm above the second, yielded a much larger number of bifacial and unifacial chipped and ground stone tools, as well as two early-Archaic Kirk corner-notched points. Lepper isn't certain whether the increased amount and variety of lithic materials suggests a number of occupations over a period of time or a single, larger residential occupation.

Lepper says sites such as the Manning provide an opportunity to learn more about the transition between the Paleoindian period, with what some argue was an almost exclusive emphasis on the exploitation of megafauna, and the more complex exploitative strategies of the Archaic period. "The sequence of occupations at Manning gave us an opportunity to look closely at the cultural changes across this critical slice of time." Therefore, Lepper says, it is all the more unfortunate that sites like the Manning site are being lost or only cursorily examined by researchers looking for highly visible cultural deposits and features.

Sites may be lost or only cursorily examined by researchers looking for highly visible cultural deposits and features.

The Manning site is now under a peninsula in a settling pond, preserved at least partially for the next 75 years. He believes there were considerably more data to be obtained from the site, but work ended when the utility company decided to alter its planned construction once the extent of the site and the cost to mitigate it became more apparent.

Lepper is confident there are other similar sites in the area; the Ferris site, excavated by Kent Vickery of the University of Cincinnati, lies only 5 miles downriver from the Manning site and is located on the same terrace. Future work by Vickery and others certainly will add to our understanding of these occupations. Lepper suggests it is not just the destructive actions of development that cause valuable information to be lost.

He argues that current archaeological methods in use in the Ohio Valley region may be inadequate for systematically discovering early occupations. Principal problems he sees are the lack of interdisciplinary strategies and the failure to systematically utilize test pits of sufficient quantity, depth, and size to allow for the identification of late-Pleistocene/early-Holocene sites. "Occupation 2," he notes, "was only 10 square meters in extent. Trying to find that in a field of many acres with random testing is clearly a problem."

He recommends exploring potentially productive landforms in stages, with the first stage involving systematic coring with the assistance of a geomorphologist who can clarify the stratigraphy and evaluate the likelihood of late-Pleistocene land surfaces. Such information would allow the archaeologist with limited resources to focus on what are likely to be the most productive areas. "Of course," Lepper quickly adds, "the geomorphologist can't solve the archaeological problems. He can't determine how far apart the deep tests should be to locate occupations." In the second stage, Lepper continues, backhoe trenches should be excavated with both a geomorphologist and an archaeologist present and the trenches should be long enough to bisect the geomorphological features.

Lepper says when the backhoe trenches have been exposed, some predetermined proportion of the sediments should be removed and screened in the third stage of exploration. The original test trench at the Manning site yielded a single feature. A backhoe was used the following year to remove what was presumed to be the sterile overburden from above the identified feature. As excavation proceeded, flakes were noted in the trench wall above the feature and further scraping was terminated some 40 cm above it. Lepper now believes that portions of a higher occupation or occupations may have been missed and inadvertently removed because of the assumption that there was only one component to the site.

More than a year after the initial phase of testing, Lepper says, an examination of the weathered back dirt of virtually every deep test across the Manning site yielded some lithic artifacts. He cautions that the ephemeral nature of the earliest sites may result in features without lithic debris and debris without the presence of obvious features, as would be expected of short-term occupations of small and highly mobile populations.

Asked what other surprises the excavations held for him, Lepper remarks on the nearly total absence in all the excavations undertaken by the contractor of any data on the middle-Archaic period. "There is extensive data from the late Archaic at Longworth-Gick (Kentucky), at the Patriot site (Indiana) and from our sites in Ohio, and substantive evidence for the early Archaic at all these sites, but almost no evidence at all for the middle Archaic." Lepper says he hasn't drawn any conclusions about this intriguing lack of information yet, but suggested "either people in the middle Archaic are living a very different lifestyle, or some geomorphological factors have erased the evidence for their occupation, or there was a massive depopulation of the area at that time."

The only way to resolve this problem, Lepper concludes, is to utilize a variety of research strategies involving professionals from several disciplines.

–Kathryn Ross

Alaska Site Called Earliest Evidence Of Human Activity

The Mesa site on Alaska's North Slope is the focus of continued attention as Paleoindian experts prepare to examine evidence from what was widely reported as the oldest well-documented evidence of human activity in North America. Michael Kunz, a Bureau of Land Management archaeologist, recently announced results of years of investigation of the site, which he discovered in 1978 during a routine survey in connection with oil and gas exploration on the National Petroleum Reserve.

In announcing the discovery at a Washington, D.C., press conference in March, Kunz and Richard Reanier, anthropologist at the University of Washington, stressed the 11,700-year date and the fact that Mesa-site tools are more like Paleoindian tools found in various places in the Lower 48 states than any previously known in Alaska. Although fluted projectiles have been found at various sites in Alaska, archaeologists have long been puzzled by a general lack of indications that the creators of Clovis points ever passed through Alaska. The 11,700 date is enough earlier than well-established Paleoindian sites in New Mexico, Wyoming, Montana and elsewhere that the discovery was welcomed by many professionals. Kunz later reported on the site at the Society of American Archaeology conference in St. Louis.

Among those to be examining the site this month are George Frison of the University of Wyoming and C. Vance Haynes of the University of Arizona. Frison, who was shown the artifacts several weeks ago, told a reporter for the journal *Science* that they do "appear close" to tools from the Agate Basin complex of eastern Wyoming. Some who have seen the artifacts stress that they're not precisely Clovis in form.

The Mesa site is near the northern slopes of the Brooks Range about 200 miles south of Point Barrow on a 200-foot-high mesa. The high vantage point with commanding view of surrounding plains makes it consistent with the locations of Paleoindian hunting camps studied in the Lower 48. Radiocarbon dates done in the 1970s yielded dates in the 7,000–8,000-year age range, but more recent dating by accelerator mass spectrometer produced what Kunz told reporters was the "bulletproof" dates he wanted.

WRANGEL'S DWARF MAMMOTHS OUTLIVED PLEISTOCENE EPOCH

The startling discovery that dwarf mammoths survived into the time of Egypt's pharaohs on an island off Siberia may increase our understanding of the extinction of Pleistocene fauna worldwide. The discovery by Russian scientists may energize arguments about whether human hunters drove mammoths to extinction, but it does not settle it. The find, announced in the March 23 issue of *Nature*, is sufficient revelation in itself. One biologist likened the Wrangel Island mammoths to the discovery of the first living coelacanth, that leggy living-fossil fish hauled up from oceanic depths off east Africa earlier this century.

Extinction of mammals like the mammoth is the threshold that scientists have used to separate the Holocene and the Pleistocene, the two most recent periods of geologic time. The great beasts were thought to have completely disappeared by 9,000 years ago after having faded from most of their range in North America and Eurasia about 12,000 years ago. Mammoths have been dated to less than 10,000 years in Siberia, but evidence that they held on for another 6,000 years on an arctic island was astonishing.

Thirty radiocarbon dates have been produced from tusk and bone samples of mammoths collected on Wrangel Island by researcher Dr. S. L. Vartanyan of the Wrangel Island State Reserve. Of those, 29 were dated from 3,730 to 7,620 years B.P. When Vartanyan collected mammoth teeth on Wrangel in 1991, he found that they consisted of two obvious size classes. A few were relatively large, but most were very small, although they were from adult animals. The small teeth were 20 to 25 percent smaller than those of late-Quaternary mammoths that had been found in northeast Siberia.

When the teeth were dated, all the small ones were of Holocene age while the large ones were late Pleistocene. Though there were no limb bones from which to calculate the exact size of the small-toothed mammoths, Vartanyan and his colleagues, Dr. V. E. Garutt of the Zoological Institute of the Russian Academy of Sciences in St. Petersburg, and Dr. Andrei V. Sher of the Severtsov Institute of Evolutionary Animal Morphology and Ecology in Moscow, studied other known dwarfed forms of Pleistocene elephants. Dwarfing of island-isolated mammals is a well-known phenomenon. The researchers concluded that while it is not possible to reconstruct the body size of Wrangel Island animals with the small teeth, dwarfed elephants tended to have proportionately larger teeth than bodies.

A British biologist, Dr. Adrian M. Lister of University College, London, agrees. In accompanying commentary in the same issue of *Nature*, Lister suggests that the late-surviving Wrangel mammoths were only 180 cm high (about 5 feet 10 inches) and weighed 2 metric tons compared with 320 cm (more than 10 feet) and 6 metric tons for a full-sized *Mammuthus primigenius*.

"The Wrangel mammoths are bound to fuel the already vigorous debate about the causes of Late Pleistocene extinction," said Lister, adding that "proponents of the 'human overkill' model are likely to regard them as consistent with hunting to extinction on the mainland." He notes that on Wrangel Island there is no evidence of human occupation until after the time of the last mammoths. However, the Russian scientists suggest that environmental change was responsible for the disappearance of the mammoth. "The period 9,500–8,000 B.P. is considered as the Holocene 'optimum' for this region, marked by increased temperature and humidity and related turnover in plant communities. By 9,500 B.P., mammoth had vanished totally from the mainland and most of the arctic islands, and it is likely that this time was also critical for the Wrangel Island mammoth," they wrote in the *Nature* article.

Wrangel Island was connected to the mainland for several thousand years during the last glacial maximum, perhaps as late as 13,000 B.P., but the rising sea isolated it by 12,000 B.P. However, the island apparently continued to be a refuge for Pleistocene plants. "Unlike the other islands in the Arctic Tundra subzone, Wrangel retains a much higher diversity of herb species, steppe plants in particular," the Russians report. "It is likely that the island provided a relict of tundra-steppe habitat in the early Holocene too, but that is still to be proved."

The earliest evidence of humans on the island is about 3,000 years ago, but people are known to have hunted on other islands north of Siberia as early as 7,000 to 8,000 B.P.

SUGGESTED READINGS

ON Four Genetic Trails

Gibbons, Ann 1993 Geneticists Trace the DNA Trail of the First Americans, *Science* 259:312–313.

Horai, Satoshi, Rumi Kondo, Shunro Sonoda, and Kazuo Tajima (in press) The First Americans: Different Waves of Migration to the New World Inferred from Mitochondrian DNA Sequence Polymorphisms, in *Prehistoric Dispersal of Mongoloids*, edited by Takeru Akazawa, Oxford University Press, New York.

ON Dwarf Mammoths

Vartanyan, S. L., V. E. Garutt, and A. V. Sher 1993 Holocene Dwarf Mammoths From Wrangel Island in the Siberian Arctic, *Nature*, 362:337–340.

Lister, A. M. 1993 Mammoths in Miniature, *Nature*, 362:288–289.

ON Mastodons' Drought Dilemma

Darwin, Charles 1882 *Naturalist's Voyage Around the World*, John Murray, London.

Haynes, G. 1991 *Mammoths, Mastodons, and Elephants: Biology, Behavior and Fossil Record*, Cambridge University Press, Cambridge.

Heusser, C. J. 1983 Quaternary Pollen Record from Laguna Tagua Tagua, Chile, *Science* 219:1429–1432.

Martin, P. S., and R. G. Klein (editors) 1984 *Quaternary Extinction: A Prehistoric Revolution*, University of Arizona Press, Tucson.

Montane, J. 1968 Paleoindian Remains from Laguna Tagua Tagua, Central Chile *Science* 161:1137–1138.

ON The Search

Lepper, B. T., and D. J. Meltzer 1991 Late Pleistocene Human Occupation of the Eastern United States in *Clovis: Origins and Adaptations*, edited by Robson Bonnichsen and Karen L. Turnmire, Center for the Study of the First Americans, Corvallis.

Symposium Planned

An international symposium on the Pleistocene/Holocene boundary and human occupations in South America is being planned for November, 1994, in Mendoza, Argentina. It is being organized by the Facultad de Filosofía y Letras, Universidad Nacional de Cuyo. For information contact Marcelo Zárate, International Symposium The Pleistocene/Holocene Boundary, Centro de Geología de Costas y del Cuaternario-UNMP, Castilla de Correo 722-Correo Central, 7600 Mar del Plata, Argentina.

UPCOMING CONFERENCES

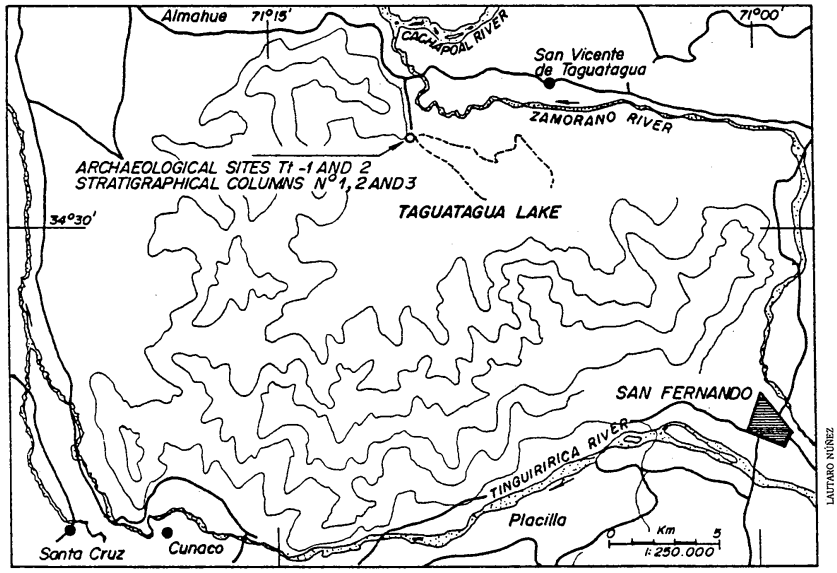
Aug. 17–23—Seventh International Conference on Hunting & Gathering Societies, Moscow, Russia.
Contact: Linda Ellana, Department of Anthropology, University of Alaska, Fairbanks, AK 99775. (907) 474-6751 Fax: (907) 474-5817.

Aug. 23–31—International Symposium on the Origins and Evolution of Ethnocultural Processes in Asia, Novosibirsk, Russia.
Contact: Academician Anatoly Panteleevich Derevyanko, Institute of Archaeology & Ethnography SD RAS, Acad. Lavrent'yev Avenue, 17, Novosibirsk-90, 630090, Russia (RF) USS. Fax: 007-383-235-7791.

Sept. 19–24—Sixth Nordic Conference on the Application of Scientific Methods in Archaeology, Esbjerg, Denmark.
Contact: Vagn Mejdahl, The Nordic Laboratory for Luminescence Dating, Riso National Laboratory, DK-4000, Roskilde, Denmark, 15(2)1.

Nov. 7–11—Annual Meetings, Social Science Society of America, Cincinnati. Featuring one-day symposium: Pedological Perspectives in Archaeological Research.

Nov. 12–15—25th Annual Chacmool Conference, Calgary, Alberta.
Plenary speakers: Alice Kehoe, David Kelley, Robert Janes and Jeremy Sabloff.
Contact: Department of Archaeology, University of Calgary, Calgary, Alberta TN2 1N4. (403) 220-5227 Fax: (403) 282-9567.



Map depicts site at the northern edge of the Tagua Tagua lake bed.

them to different locations. Further, his finds suggest that Paleoindians were selective hunters. Excavations have revealed groupings of mastodons of a particular age or size, indicating that the hunters were selecting for certain traits. Núñez's research suggests that the early hunters preferred mastodons of middle age and middle size, although groupings of bones from infant, young and older mastodons were uncovered at Tagua Tagua.

Núñez concludes that by the advent of the Holocene, Paleoindians of south-central Chile were living in close association with the mastodon. And, by learning to exploit the mastodon in a specialized habitat such as a lacustrine zone, the hunters developed an awareness that gave them a measure of control over their environment. Working with Núñez were Juan Varela, geologist at Universidad de Chile in Santiago; Rodolfo Casamiquela, Río Negro Study Center, Viedma, Argentina; Virgilio Schiappacasse and Hans Niemeyer, Chilean Archaeological Society, Santiago; and Carolina Villagrán, biologist at Universidad de Chile in Santiago.

–Thomas Weller

Tagua Tagua

continued from page 1

mastodons, ***Cuvieronius humboldti***, favored. Thus, the animals were able to forage widely.

As the Pleistocene was drawing to a close, mastodons frequented the lakes in central Chile. They were there, Núñez believes, because the lake environment provided them with abundant vegetation, aquatic resources and salt—in short, everything the large mammals needed.

Pollen analysis performed on deposits laid down during the Holocene, however, reveals a dramatic change in vegetation, reflecting a shift toward a drier and warmer climate. Sub-Antarctic grasses and plants disappeared and were replaced by herbs and grasses diagnostic of an arid environment.

As drought lingered, many mastodons died. Those that survived were forced to restrict their range and rely more on the lakes, where water, plant life and other resources could be found. Núñez theorizes that human hunters became specialized in killing mastodons concentrated in such lacustrine zones.

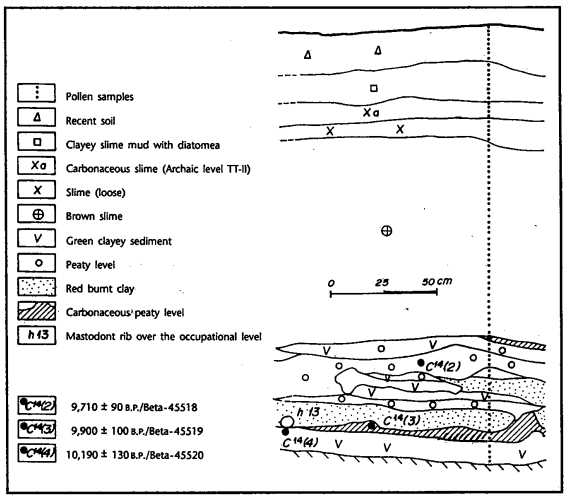
By the end of the Pleistocene, it appears that mastodon herds in the Tagua Tagua area were separated by sex. When they came together in the spring to mate, there were great concentrations of mammals on the beaches of Lake Tagua Tagua. Paleoindian hunters would have found these gatherings an excellent hunting opportunity. Armed with this knowledge, Núñez and his team excavated an area that had been thought to be an ancient kill site.

Their investigations found that Paleoindians used a variety of techniques for utilizing the Tagua Tagua mastodons, including trapping and scavenging the dead and dying. Núñez also uncovered evidence that Paleoindians killed using Fell or "fish-tail" projectile points. At two Lake Tagua Tagua sites, he found the bones of 15 mastodons associated with Fell points. The projectiles had been made from obsidian, opal, quartz crystal, basalt and agate mined from the nearby mountains. Artifacts made of mastodon bones also were found.

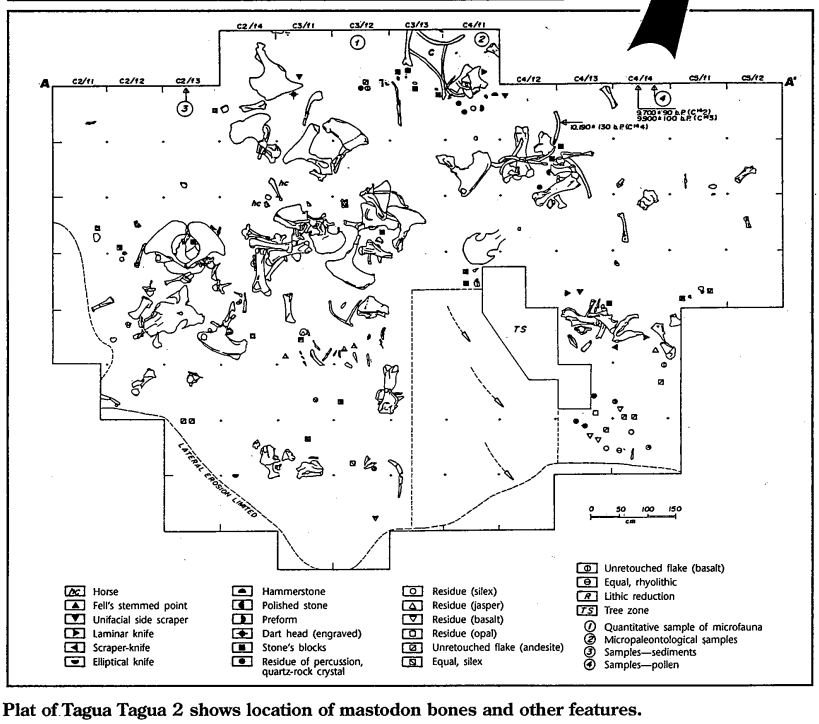
While some of the tools were knives and scrapers, Núñez and his team believe most of the thin Fell points found at Tagua Tagua were projectiles used to hunt mastodons.

Other cultural evidence discovered at the kill site includes mastodon bones with certain markings on them. Femurs, for example, had scars left by knife cuts, and other bones displayed evidence of blows by blunt objects. Additionally, all the craniums of the mastodons were sunken, with fractures in the superior and inferior parts of the cranium. Núñez infers that the fractures were inflicted during the killing or afterwards, to allow brains to be extracted.

Núñez also suggests that Paleoindians stripped flesh from the mastodon pelvic bones, craniums and femurs in one location and at some later time moved



Stratigraphic profile of area C4/f4.



Plat of Tagua Tagua 2 shows location of mastodon bones and other features.