

MAMMOTH TRUMPET



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PALEOINDIAN SKELETAL DATA RE-EXAMINED

Statistical Analysis Finds Link With Asia

Physical anthropologists D. Gentry Steele and Joseph F. Powell are providing a fresh view of Paleoindians in new statistical studies of North American native skeletal data.

Do 8,500- to 10,000-year-old skeletal remains of North Americans resemble more closely their presumed descendants, the historic Native Americans, or Asians of 8,500-10,000 years ago? Steele and Powell asked these questions and more. They also compared Paleoindian data with those of other human populations from areas as distant as Australia and Europe. Their analysis finds that Paleoindians had some statistical affinities with Asian populations, but do not strongly resemble modern north Asians.

Although comparisons of skeletal measurements cannot provide direct answers to questions about human migrations or genetic relationships among populations, they can suggest and support existing models. Steele and Powell are presenting their findings in two joint papers to be published later this year: "Peopling of the Americas: Paleobiological Evidence" will appear in the June issue of *Human Biology* (Mammoth Trumpet article below); and "Paleobiological Evidence of the Peopling of the Americas: A Morphometric View" will appear in *Method and Theory for Investigating the Peopling of the Americas*, a Peopling of the Americas publication by the Center for the Study of the First Americans. In addition, Powell, a doctoral candidate at Texas A & M University, where Steele is professor of anthropology, is preparing a dissertation on the odontometrics (dental analysis) of Paleoindian populations.

Skeletal features reflect the sex, age, and inherited features of individuals, and also document personal history, which covers variables such as the individual's nutrition, rate of growth, diseases or trauma, and physical activities. Interpretations of skeletal features have to allow for all these constituents.

Physical anthropologists point out that while a part



Joseph F. Powell and D. Gentry Steele review diagrams of their statistical findings of skeletal data.

of the similarity between two individuals—or between the average values of two samples—is the degree to which they are genetically related, the similarity may not be obvious in their skeletons if the two individuals or two samples have had very different life histories. Over time, descendants of a population that migrates into a new environment may not only change their physical features because of their personal life experience, but natural selection and chance factors over many generations may also alter their genetic constitution. Thus, skeletal features of the first migrants to North America might be expected to be more similar to prehistoric skeletal features common to the area from which they migrated than they are to contemporary descendants of those places.

In investigating these possibilities, Steele and Powell chose both univariate and multivariate statistical approaches, along with some subjective and non-metric observations. Their methodology is as

continued on page 3

IDAHO BURIAL SUGGESTS LIFE OF HARDSHIPS 10,675-yr-old Remains Reburied after Analysis

Idaho investigators expect to publish later this year a report on what may be one of the oldest and best-preserved Paleoindian burials yet found in North America. Their findings could alter the general assumptions that Paleoindians were relatively secure in their environment.

The remains, found in 1989 in a gravel pit near the

continued on page 2

New Focus on Peopling of Americas

The journal *Human Biology* is commemorating the quincentennial of Christopher Columbus' visits to the New World by devoting its June, 1992, issue to subjects involved with the peopling of the Americas. Editor Michael Crawford, a University of Kansas anthropologist, says the collection of nine papers is being published under the title "The Biological Anthropology of New World Populations." It follows the December, 1991 issue *Human Biology* devoted to South American Indians.

"We should not celebrate this so-called discovery of the New World," Crawford writes, "but we can

reflect on the 500th anniversary of a profound historic event." Crawford himself provides the introduction, "When Two Worlds Collide," in which he emphasizes inconsistencies that the commemorative volume's contributors find in the traditional three-wave model of a New World settlement. "I solicited contributions that examined the controversial issues of late versus early peopling of the New World and the effects of cultural contacts."

Crawford argues for a probabilistic rather than absolute approach to the scientific questions regard-

continued on page 8

INSIDE

Clovis Is Also a Book	2
Human Hair Found in Mammoth Meadow	2
Volunteers Invited	2
Contributions May Be Matched	2
Crossing Beringia	4
Paleoecologist Finds Corridor Ice-free	5
29,600-year-old Bone Projectile Found in Horse	6
Suggested Readings	6
Upcoming Conferences	6
Suggested Readings	7

Now Clovis Also Means a Big Book

25 Authorities Contribute to Volume

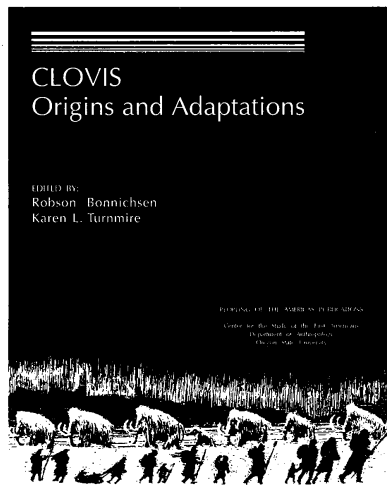
"Clovis" may refer to a Paleoindian culture, a distinctive flint projectile point, and a town in New Mexico, but now it also refers to a large blue book. The first shipment of *Clovis: Origins and Adaptations* arrived at the Center's Oregon State University office in January and the staff set to work filling orders.

The inch-thick, hardbound book of 344 approximately 8½-by-11-inch pages contains the combined

Some authors suggest a single migration, some a diffusion pattern, others that Clovis originated independently at different centers in the New World.

wisdom of 25 authoritative contributors, each of whom offers his or her own special insight to the peopling of the New World. The book's text is set in highly legible two-column format, and there are dozens of high-quality illustrations. The book has an extensive general index as well as an index of sites.

Rather than support only the Clovis or the pre-



Clovis theories of human occupation of the Americas, the book's authors present a variety of models. Some authors suggest a single migration, some suggest a diffusion pattern and still others believe that Clovis originated independently at different centers in the New World. Editor Robson Bonnicksen presents a concluding discussion of the various regional models of Clovis origin.

Clovis: Origins and Adaptations was edited by Bonnicksen and Karen L. Turnmire, and it joins the six previous titles in the *Peopling of the Americas* Publications. It is available from the **Center for the Study of the First Americans** for \$38.

Mammoth Meadow Yields Human Hair

Discoveries last summer at the Mammoth Meadow site near Dillon, in southwestern Montana, are stimulating plans for this summer's excavation. Among the interesting discoveries was a 32-cm human hair and a late Pleistocene tool assemblage composed of large blade cores, blade tools and large bifaces.

Principal investigator Robson Bonnicksen said some of the blade tools are similar to late Upper Paleolithic artifacts from Europe; they raise interesting questions about the origins of early American human populations. Charles Bolen, the project's hair expert, is analyzing the human hair as well as hair from mammoth, bison, horse, caribou and several small mammals. Bolen discovered the human hair at the lowest level of the project. It is being subjected to DNA analysis.

Although C-14 dates have yet to be made from new Mammoth Meadow cultural components, the tools are from an archaeological component above what appears to be glacial outwash gravel. Most scholars believe that glacial ice was gone from this section of the Rocky Mountains by about 14,000 years ago.

"Could we be dealing with a pre-Clovis occupation?" Bonnicksen wonders. "Only more field work will provide an answer."

Volunteers Invited for Hard Work, Fun

The **Center for the Study of the First Americans** is seeking a few good men and women interested in two weeks of hard work and fun this summer at the Mammoth Meadow site in southwestern Montana. Robson Bonnicksen, principal investigator of the Mammoth Meadow project, has scheduled two 2-week sessions July 19-Aug. 1 and Aug. 2-Aug. 16.

For information or for a volunteer questionnaire, write to Bonnicksen at the **Center for the Study of the First Americans**, Department of Anthropology, Oregon State University, Corvallis, OR 97331.

Idaho Burial

continued from page 1

south-central Idaho city of Buhl, were dated through accelerator mass spectrometry, which produced an estimated date of 10,675 ± 95 (Beta 43055 and ETH 7729) years B.P., says Tom Green, Idaho State Archaeologist with the Idaho State Historical Society in Boise. At the request of the Shoshone-Bannock Tribes, and in accord with state law, the remains of the woman—and artifacts found with her—were reburied Dec. 20, 1991 on the Fort Hall Indian reservation, Green said in a telephone interview.

Analysis showed the woman was about 5 feet 2 inches tall and approximately 18 to 20 years old when she died. She had suffered periods of interrupted growth, apparently due to a lack of food.

"Based on X-rays of her femur and analysis of her teeth, it appears she had severe dietary deficiencies at least five to six times in her life where her growth was

interrupted," Green says. Noting that we generally think of Paleoindian people as being healthy and robust with expanding populations, he suggested that maybe we need to be a bit more cautious in assessing the Paleoindian environment. "Life may have been a little rougher than my view of it."

Green says a foreman for the Buhl Highway District saw the remains Jan. 18, 1989 in a rock crusher sorting screen at a county gravel pit. He found what turned out to be a femur in the screen. Further inspection revealed "a mandible and a couple of ribs," Green adds. Authorities were called to inspect further. They found more remains and associated artifacts nearby in what Green terms a "dry, well-drained terrace" containing very old Bonneville flood gravels from the Snake River.

Although archaeologists lost most of the lower half of the skeleton to the rock crusher, Green says they recovered an extensive amount of the upper half.

continued on page 3

Contributions before July 1 May Be Matched

Center Sets Its Sights On \$2.2 Million Endowment

Every dollar contributed before July 1 to the endowment for the **Center for the Study of the First Americans** is expected to be matched by the State of Oregon.

Oregon is in the second biennium of an effort to build endowments for state-supported universities. The state matches revenues generated by endowments for approved academic programs, and, according to the Oregon State University development office, the **Center for the Study of the First Americans** is at the top of OSU's priority list of programs being considered for the matching money.

"Our minimum goal is to develop a \$2.2 million endowment," says Robson Bonnicksen, Center director. "We fully expect that earnings from the nearly \$700,000 we have brought with us from the University of Maine will be matched for the foreseeable future," he adds. "Additional funds received before July 1 are almost certain to double their effect on the Center's work."

Its endowment is crucial to the Center's long-term stability, especially because of budget crisis looming in Oregon where voters have approved a tax-limitation plan that is gradually forcing the state to take over the financing of public schools. Drastic cuts already have occurred in state support of higher education and more are imminent. After June 1994, the director's salary, as Professor of Anthropology, will depend wholly upon endowment income.

Meanwhile, increased interest in First Americans Studies is calling for the Center to expand its work. Readers interested in helping support the research and publications work are urged to send their tax-deductible donations now while the matching program remains in effect. Further information on contribution plans through the OSU Foundation are available from the **Center for the Study of the First Americans**, Social Science 106, Oregon State University, Corvallis, OR 97331.



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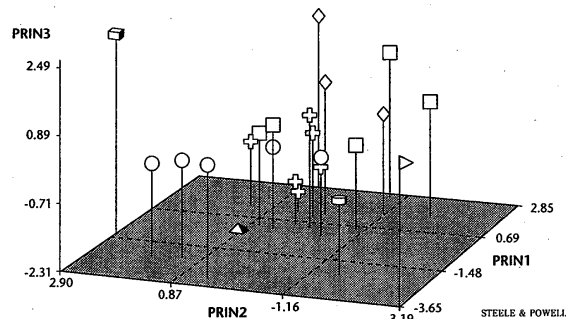
Current Research in the Pleistocene

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Table 1: Samples

Populations	Location	Age Category
European		
Armenian	Gagra and Akhalkalak, Armenia	Modern
Berg	Carinthia, Austria	Modern
Georgian	Rustavi, Georgia	Modern
Lombards	Austria, Germany, Hungary, Italy	Medieval
Norse	Oslo, Norway	Medieval
Zalavar	Zalavar, Hungary	Medieval
African		
Bushman	Kalahari Desert, South Africa	Modern
Dogos	Bandiagara Plateau, Mali	Modern
Teita	Teita, Kenya	Modern
Zulu	Wits, South Africa	Modern
Australian-Melanesian		
Andaman	Andaman Islands	Modern
Mokapu	Oahu, Hawaii	Prehistoric-Modern
Tasmania	Tasmania	Modern
Tolai	Ralum, Papua New Guinea	Modern
East Asian		
Buriats	Lake Baikal, Siberia	Modern
Chinese	Beijing, China	Modern
Chukchi	Chukchi Peninsula	Modern
Japanese (Kanto)	Japan	Modern
Jomon (Kanto)	Japan	Neolithic
Minatogawa	Okinawa	Upper Pleistocene
Ostiak	Little Ob River	Modern
Upper Cave	Zhokoudien (Beijing, China)	Upper Pleistocene
Native American		
Pre-Aleut	Aleutian Islands	Prehistoric
Aleut	Aleutian Islands	Modern
Arikara	Sully site, South Dakota	Protohistoric
Eskimo (Inugsuk)	Southeastern Greenland	Modern
Indian Knoll	Western Kentucky	Prehistoric
Northwest Coast	British Columbia	Modern
Pecos Pueblo	North-central New Mexico	Prehistoric
Peru	Huachochiri and Yauyos Provinces, Peru	Prehistoric
Texas Archaic	Oso and Palm Harbor Sites, Texas	Prehistoric
Tennessee Archaic	4 middle and west Tenn. sites	Prehistoric
Tennessee Woodland	5 east Tenn. sites	Prehistoric
Tennessee Mississippian	6 middle and east Tenn. sites	Prehistoric



This figure shows a three-dimensional plotting of the first three principal components, using the cranial measurements of female specimens. The greater the distance of symbols from each other, along each of the three axes, the more dissimilar they are. Each symbol indicates a sample; the pyramid is the Paleoindian sample; the spheres are samples from Australia or the South Pacific; the cube represents the Upper Cave (China) sample; the crosses represent modern American Indian samples; the squares represent European samples; the cylinder represents the Jomon sample (prehistoric Japan); the diamonds represent north Asians, and the flag is the 17,000-year-old Minatogawa sample from Okinawa.

A sample listed as modern is estimated at no older than 300 years; protohistoric refers to samples estimated at between 450 and 150 years B.P.; prehistoric is 450 to 10,000 years old (except for the North American specimens for which the range would be 450 to 8,500 years B.P.); Medieval refers to approximately 1,000 to 2,000 B.P. in European cultural areas; Neolithic refers to approximately 8,000 B.P. in Japan; and Upper Pleistocene refers to the category of years between 10,000 and 18,000 B.P.

Skeletal Data

continued from page 1

significant as their choice of materials and samples for study and comparison. In a recent interview, Steele emphasized that the skeletal differences between Paleoindians, North American natives of the historic period, and populations from other parts of the world are subtle. He notes that few readily apparent differences exist among modern human populations at the skeletal level.

Steele says that in many univariate statistical tests between samples from North America and samples

from other populations, no statistically significant differences were obtained. Univariate tests compare only one measurement at a time. But when many measurements were examined simultaneously in multivariate tests and estimates of hypothetical distances between samples were prepared, Steele says subtle differences appeared. Clusters of samples were computed and displayed on graphs.

Earlier physical anthropologists such as Indiana University's Georg K. Neumann, who published studies of North American skeletal characteristics 40 years ago, did not have access to statistical and computing techniques now available to researchers. New methods, along with the equipment that makes them

practicable, have allowed researchers not only to do additional tests but to conceive of new approaches.

One of the handicaps that have faced researchers interested in the characteristics of the earliest Native Americans is the paucity of skeletal data, particularly from more than 8,500 years ago. Most North American skeletal material is much more recent, dating from the several centuries prior to Euro-American contact.

A second problem has been conceptual. Steele says the tendency of skeletal biologists who have developed comprehensive pictures of North American prehistoric peoples has been to pool all skeletal material from North America, irrespective of its antiquity. So he and Powell used a different approach. They categorized skeletal remains older than 8,500 years as Paleoindian, a single sample to be compared with more recent North American Indian samples. In their *Human Biology* paper, they list 21 specimens from 16 sites as "probable and affirmed Paleoindians," 10 of which constitute their Paleoindian sample. (A Paleoindian skeleton discovered recently near Buhl, Idaho, was not part of their sample. See "Idaho Burial" in this issue.)

To compare with the Paleoindian sample, Steele and Powell chose a large number of skeletal samples, prehistoric and historic, from all over the world. The accompanying table lists the samples, their geographic ranges, and their age category.

One of the first issues that Steele and Powell addressed was whether any of the Paleoindian skeletons exhibited characteristics of pre-modern, or archaic, *Homo sapiens* populations, such as those of the Neanderthal population of Western Europe 40,000 years ago. This is an important consideration in looking for markers that might indicate the antiquity of the migration. They found no indication of a pre-modern status for any of the Paleoindians. However, modern-appearing *Homo sapiens* are known from many parts of the world well before 40,000 years ago, so this discovery does not suggest any specific date, but it does emphasize the finding that the Paleoindian skeletons are very similar to other *Homo sapiens* samples.

For the *Human Biology* paper Steele and Powell used eight standard cranial measurements, which they analyzed singly by comparing the Paleoindian sample with other samples. They also plotted the mean values of samples on graphs, showing two variables on horizontal and vertical axes. For the *Method*

continued on page 8

Idaho Burial

continued from page 2

"We have the cranium, mandible, most of the vertebrae, the upper limbs and many ribs," he says, adding that as burials go, this one "probably is one of the oldest and most preserved ever found in North America. This is pretty spectacular preservation." Half of one humerus and a rib were destroyed in the dating process, which utilized collagen, the major organic component of bone.

Archaeologists also found with the burial a stem knife made from an obsidian-like material, a small, delicate bone needle with a drilled eye, and a badger baculine (penis) bone. "The artifacts lay right underneath her," Green says. "The knife lay right underneath her head and we suspect it was placed there purposefully." A lithics-casting laboratory in Illinois made casts of the artifacts for further analysis.

Todd Fenton, with the Arizona State Museum at the University of Arizona, Tucson, is the physical anthropologist on the project. Jim Woods and Gene Titmus of the Herrett Museum at the College of So. Idaho in Twin Falls are analyzing the artifacts. Bruce Cochran, geologist from Moscow, Idaho, is conducting geological studies at the burial locality.

Investigators would have liked more time to study the woman's remains for chemical and DNA analysis, but were pleased the Shoshone-Bannock tribes let them have the remains as long as they did, Green says.

Jeanette Wolfley, lawyer for the Shoshone-Bannock Tribes, said in a telephone interview that the tribes have no objection to the way the find was

handled, although some members wanted the remains reburied more quickly. "This is the first time the tribe had done anything like this," she says. "The procedures seemed to work just fine. We have no objection to the way it was handled. It just took longer than we anticipated it would."

Green believes he handled the process correctly, and that the results were beneficial to the quest for knowledge. "This gives us some different information than we normally get," he says. "It makes it a little

Data Are Not Buried

State laws that require reburial of Paleoindian remains need not mean loss of data on the physical attributes of ancient Americans. Remains of the Buhl, Idaho, discovery not only were dated, but analyzed by Todd Fenton, a University of Arizona physical anthropologist. Now, D. Gentry Steele and Joseph F. Powell, physical anthropologists who are conducting studies of Paleoindian remains unearthed before the Idaho find, have offered to analyze any new Paleoindian discoveries, on site if necessary, to assure that valuable data are recorded. Steele and Powell may be contacted at the Department of Anthropology, Texas A & M University, College Station, TX 77843.

more human. We are just lucky to have what we have. I don't think this will revolutionize our ideas about Paleoindian culture, but it will fill in a few things." The report on the burial probably will be published this fall through the Idaho Museum of Natural History at Idaho State University, Pocatello.

—George Wisner

CROSSING BERINGIA

Could Glaciers Have Limited Human Access?

The thought of humans migrating into North America from northern Asia frequently conjures the image of a long, adventurous trek across a wide-open landscape of tundra.

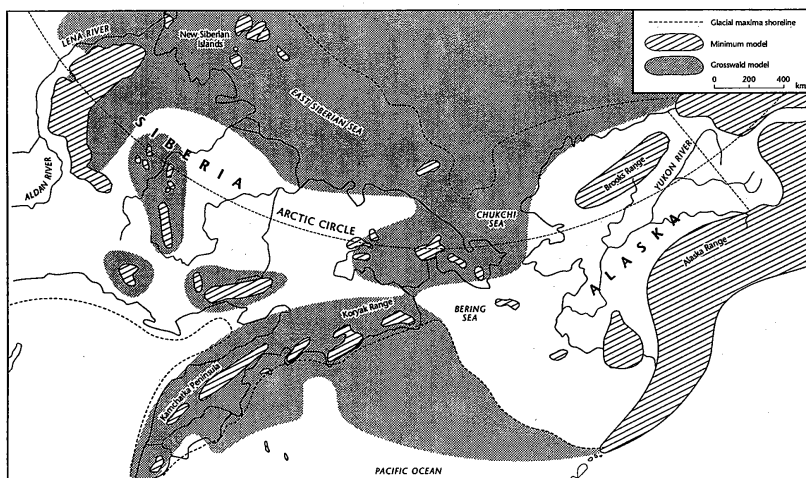
This image is the picture that paleontologists, paleoecologists, geologists and glaciologists have consistently drawn for us of Beringia. These scientists propose that during the last glacial maximum, about 18,000 years ago, a large unglaciated area existed in Yukon Territory, Alaska, and Siberia. The era's lowered sea levels reduced the source of moisture and led to restricted glaciation in mountain ranges including the Alaskan, Brooks and Mackenzie on the American side and Koryak Range on the Siberian side. Farther south and east, the coalescence of the Cordilleran and Laurentide ice sheets in what is now Alberta virtually isolated Beringia from the remainder of North America during glacial periods. Thus, Beringia was a refugium for plants, animals and possibly humans. (See "Paleoecologist Finds Corridor Ice-Free, but Forbidding," on adjoining page.)

During periods of Pleistocene glaciation, sea levels lowered as much as 100 m to expose the floors of the Bering and Chukchi seas and create a broad link between Siberia and Alaska—a vast lowland area up to 1,000 miles wide commonly known as the Bering Land Bridge. This lowland is often depicted as a wide-open tundra or grassland. Scientists have long speculated that during periods of lowered sea levels plants, animals and humans could readily move from Siberia to America.

Most discussions of the Ice Age peopling of the Americas are based on this conception, which considers physical barriers presented by fluctuating sea levels in the Bering Strait region and positions of the American ice sheets. However, recent glacial geological studies suggest that this picture of Northeastern Siberia and the land bridge itself (central Beringia) may not be correct.

Since at least 1984, Russian glacial geologist Mikhail Grosswald has insisted that another important factor be taken into consideration. According to Grosswald, new geologic evidence of the location of the edges of the Asian ice sheets appears to indicate that a continuous ice sheet covered the entire northern outskirts of Eurasia, including the Chukchi platform, during the Late Pleistocene. This evidence includes end moraines (the ridges of accumulated glacial deposits that mark the maximum advance of a glacier) and outwash plains (the sloping sheets of sand and gravel deposited by streams of meltwater) along with evidence of the fluctuating level of ice-dammed lakes across Siberian mountain passes.

Grosswald cites additional evidence of glacio-



Map, adapted from Richard E. Morlan and Mikhail Grosswald, contrasts approximate minimum and maximum models of glaciation at height of late Pleistocene.

tectonic features (push moraines and other indications of geological structures created by glaciation) found on and around the New Siberian Islands north of Siberia. Their location has led him to conclude that the center of this ice sheet must have been off the north Siberian coast.

According to Grosswald, during the height of glaciation in the Late Pleistocene, "the true scenery of . . . ancient Beringia was not the conventional image of a wide ice-free land but rather a terrain that was heavily glacierized, partly flooded by large ice-dammed lakes, inhospitable and impenetrable for humans." This was the condition of Asian Beringia,

Migration would have occurred only when the "ice gate" and the "sea gate" were open.

and it has led Grosswald to hypothesize, in an article currently in press, that "the Bering land bridge was hardly penetrable for overland movement of plants, animals and humans during the height of glaciation."

Grosswald's latest proposed boundaries for the period of maximum glaciation on the Siberian side of Beringia are in marked contrast to the boundaries suggested in the traditional concept. Grosswald's model still allows extensive ice-free areas on the Bering continental shelf and in the intermontane basins of Alaska.

Beverly Hughes, in an unpublished 1990 research

report for the Center for the Study of the First Americans titled "Transgressions: Rethinking Beringian Glaciation," points out that Grosswald's conclusions do not preclude all possibility of human migration. Looking closely at the time-dependent processes of glaciation and deglaciation for the geology of northern Siberia, she envisions that humans, flora and fauna would have been able to pass only at certain times.

Hughes describes a critical interaction between ice-blocked mountain passes, fluctuating sea level, and the Bering Land Bridge that would have worked to prevent passage both at the height of glaciation and at the height of sea level. Migration would then have been allowed only at definable intervals, in between maximum glaciation and maximum sea level in the area, when what she terms the "ice gate" and the "sea gate" were open.

In Hughes' model, the Milankovitch cycles (see box) of fluctuating solar flux, or insolation, are divided into warm hemicycles (half cycles), when solar insolation was above average, and cold hemicycles, when solar insolation was below average. During cold hemicycles, increased glaciation would have closed the mountain passes in northeastern Siberia and prohibited access to the Beringia refugium. During warm hemicycles, deglaciation would have opened the passes but eventually also caused sea level to rise and cover the land bridge. Thus migration would have had to occur during intervals in between the hemicycle peaks, when the mountain passes were still open but sea level was sufficiently low.

Grosswald finds support for this hypothesis in evidence of the fluctuating level of lakes in intermontane valleys in northeastern Siberia during the Wisconsin glaciation. To explain the changes in water level, Grosswald hypothesizes that the lakes were controlled by what he terms "flood valves," glacial ice that served to dam a lake. A period of deglaciation would melt the ice dams, allowing water to flow out of the thawed lakes. A period of increasing glaciation would then re-dam the lake, causing its level to rise again before it froze.

Grosswald's conclusion in favor of glacial activity in western Beringia is controversial among Russian scientists. However, it has encouraged new questions about the possibility of glaciation on the Alaskan side and about the implications of northeast Asian glaciation for the peopling of the Americas.

For example, Grosswald, Beverly Hughes, glaciologist Terence Hughes, ice-sheet modeler James Fastook, and archaeologist Robson Bonnichsen have examined several questions that should be addressed if such an ice-free area did exist adjacent to northeast Siberian glaciation. They presented these questions to Quaternary scientists at the 13th INQUA Congress

continued on page 7

Milankovitch Cycles: A Basis for Theory

The belief that subtle variations in the earth's orbit have affected the growth of the ice sheets may sound a bit far-fetched. But this hypothesis has been the basis for much conventional theory on ice-sheet behavior.

Orbital variations occur over thousands of years as the tilt and precession of the earth's axis change, affecting the amount of solar flux that reaches the earth in a highly predictable pattern charted in the 1920s by M. Milankovitch.

The effect of Milankovitch cycles on insolation varies according to latitude; they predict relatively great insolation and warmer average temperatures 18,000 years ago for the northern hemisphere. The 18,000 B.P. date also coincides with a period of maximum glaciation in the late Wisconsin.

sin. Evidence of this glacial maximum has been found throughout the world in moraines and other formations, as well as in oxygen isotope levels taken from deep sea cores. Isotope levels at any given time are directly related to both ice volume and sea level.

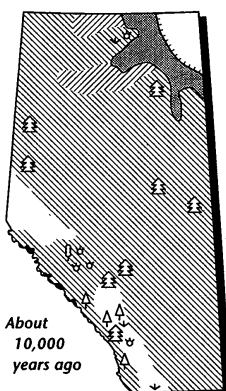
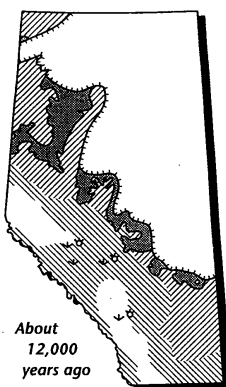
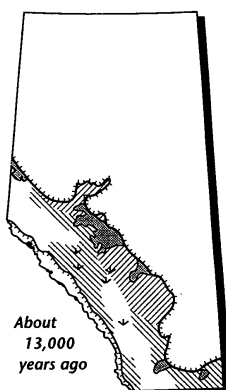
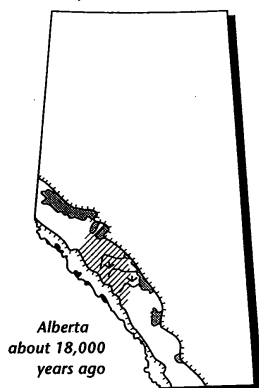
Because cycles in the isotope levels appear to correspond to the Milankovitch cycles, some scientists believe that the Milankovitch cycles were a driving factor in the occurrence of the Ice Ages.

Scientists have hypothesized that the minimum sea level indicated for 18,000 years ago combined with the solar insolation peak shown in the Milankovitch cycles would have exposed a land bridge between Asia and northernmost North America.

—Susan Simpson

Paleoecologist Finds Corridor **ICE-FREE** but Forbidding

Drawings:
Carole Mandryk



Popular theories for the peopling of the New World inevitably include an "ice-free corridor," which served as a route from Beringia into the North American heartland. Research has confirmed that throughout most of the Wisconsin glaciation, the great Laurentide ice sheet did not reach west to meet the ice cap blanketing mountain chains. There was, indeed, an ice-free corridor; to some it has come to symbolize a freeway that funneled Paleoindian hunters into a land of plenty.

Carole A. Mandryk, a Quaternary scientist who recently completed a doctoral dissertation on a portion of the ice-free corridor, has a more realistic view. After several years devoted to collecting and analyzing lake and pond sediments in the North Saskatchewan River basin in southwest Alberta, studying the geology of the area, and modeling ancient environments and their likely impact on human populations, Mandryk possesses as intimate a knowledge of the ice-free corridor as anyone. And things she reads about it bother her.

"Some people think that if you date when the corridor was open, then you've dated when people migrated. And those are totally different issues." Even more bothering to her is the reverse assumption, that dates of the earliest Paleoindian sites on the Plains reveal the time the corridor was open.

"The corridor could have been open and nobody could have come through it," Mandryk observed during a recent telephone interview. She is completing her doctorate at the University of Alberta while teaching anthropology at Grant MacEwan Community College in Edmonton. The title of her dissertation summarizes years of investigation: *Paleoecology as Contextual Archaeology: Human Viability of the Late Quaternary Ice-free Corridor, Alberta, Canada.*

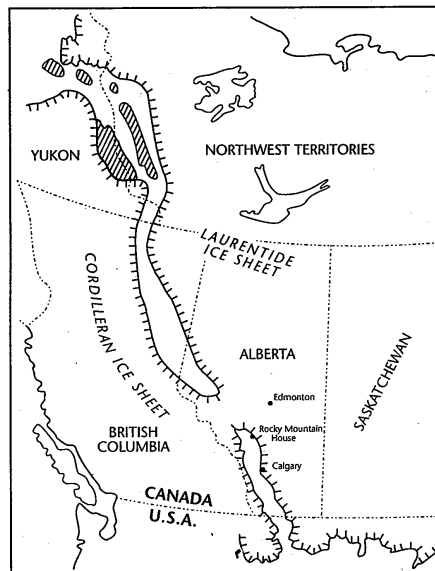
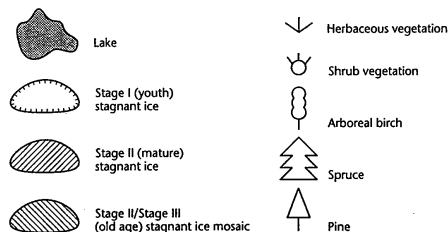
Though her findings may be seen to support arguments either for an early peopling of the Americas or the view that Clovis peoples were the original migrants, Mandryk declines to take sides. After her careful examination of what could be considered the southern third of the ice-free corridor, she found that the area was not closed by glacial ice until approximately 21,000 years ago, but that it was a non-viable environment until sometime before 12,000 years ago.

Mandryk says that in discussing her dissertation with professionals who believe that humans may have arrived in the Americas 50,000 years ago or even earlier and who think her results support early-arrival arguments, she emphasizes the specifics of her work.

"All this says is that if there were earlier people—if there are earlier sites in North and South America—then they either came through the ice-free corridor prior to 21,000 years ago or they came via some other route."

She admits that some investigators are happy to learn that she says the corridor was not closed until 21,000 years ago. "For years people have been saying that it was closed between 25,000 and 12,000." Her corridor-closure date allows room for theorists who postulate 25,000-year-old sites in Siberia linked with pre-Clovis sites in the United States such as the Meadowcroft Rockshelter in Pennsylvania, which has been dated to about 14,500 years B.P. It also leaves the door open for earlier migrations proposed by investigators such as Alan L. Bryan, a University of Alberta anthropologist and a member of Mandryk's doctoral committee.

Advocates of late entry of people into the American plains will find comfort in Mandryk's assessment of the harshness of the climate in her study area—the region around Rocky Mountain House about halfway between Calgary and Edmonton—before 12,000 years ago. It was dry and vegetation was sparse, even long after the area was deglaciated.



Possible Late Wisconsin maximum ice limits about 21,000–19,000 years ago. The ice-free corridor was blocked.

"It is considered unlikely that such a sparse vegetation in harsh climatic conditions could have supported fauna capable of sustaining viable human populations," Mandryk wrote in an early description of her work published in 1990. She was referring to the period that extended from prior to 18,000 to about 14,000 years ago, and she described a cold, semiarid steppe with precipitation of only five to 25 centimeters (about 2–10 inches) a year and grasses and sagebrush covering only 10 to 25 percent of the ground. In the range of 16,000–18,000 years ago, the landscape of her study area would have been like a rock-desert tundra where mammals and birds were rare because of the extremely low biomass. Now having completed her dissertation, she looks back on her early article as "relatively subjective."

"Now I can prove it." Her proof has come through pollen analysis and careful use of ethnographic evidence, population biology, and the most recent geological evidence, especially the work of University of Alberta graduate students who have recently completed Ph.D.s focusing on the ice-free corridor. There were long hours in the lab doing the palynology, and more hours at the computer dealing with the numbers and statistics, but the real work began on a March day in 1986 on a frozen lake a few miles south of Rocky Mountain House.

"I did a massive survey of all the possible lakes." Her lake—one of three she would use for sediment samples—was chosen as carefully as any archaeological site. She wanted a deep basin that would produce a record going as far back in time as possible. The lake had to be in a basin that had no streams that would have confused the sedimentary and pollen record with outside materials. She also had to consider the geology, and to make sure that her sampling was done within what was considered the ice-free corridor. And her lakes had to be accessible.

The methodology begins by driving a pickup load of gear onto the frozen lake and chopping a hole where she knows the water is deepest. Then there is the rig to erect and bolt together over the hole. "People who are ice fishing always come over and ask if we're drilling for oil," Mandryk says. The rig was built by Charles Schweger, her major professor at the U of A, to facilitate the use of a Livingston piston sampler. Metal casing is sunk to form a protective shaft to the lake bottom, and the corer is carefully lowered into the casing by

continued on page 6

Bone Projectile, 29,600 Years Old, Found Imbedded in Ancient Horse

What could be more exciting than a 29,600-year-old stone projectile point embedded in the equally ancient ankle bone of a horse? How about a 29,600-year-old bone projectile point driven into that ancient horse's ankle?

The horse bone and embedded projectile were excavated at Dr. Richard MacNeish's site, Pendejo Cave, near Orogrande, N.M., in a stratigraphic zone that dates to 29,600 years B.P. (see *Mammoth Trumpet* 7:1 "Pre-Clovis Human Prints Found in Clay"). At first, testing of the bone was problematical because it was fragile. But MacNeish says a friend who is an orthopedic surgeon had a suggestion: "Why don't we do a CAT scan?"

The CAT scan (computerized axial tomography) provided a cross-section picture of the entire length of the ankle bone at one-millimeter intervals and provided a picture of the projectile buried inside it.

"At the edge of the bone," MacNeish says, "what is sticking in there is something roughly triangular, black and about 12 millimeters by 12 millimeters. It looks the same for five or six pictures and then it begins to get rounder at about one to two centimeters deep in the bone. Suddenly at about the third centimeter, this thing starts to get much, much smaller with three to four deep grooves on the side. It looks like a pencil that has been whittled to a point."

The point extends a full four centimeters into the

ankle bone, and MacNeish says at least 40 pounds of thrust would have been required to force a point four centimeters into bone.

MacNeish says the projectile point is made from the femur of a relatively small animal like a fox. He says it looks like a burned bone point that was the projectile point for a spear or dart. MacNeish says he initially believed the point was made of black flint, but the X-ray examination showed that it was bone. He

**MacNeish says the point
is made from the femur
of a small animal like a fox.**

says the bone point possibly is an awl rather than a projectile point and suggests that it could have been used to split the bone to extract the marrow. The cave has other pieces of split bone with scratches suggesting marrow extraction.

Whether projectile point or awl, MacNeish notes with satisfaction, it is further indication of human occupation nearly 30,000 years ago. "Either way, somebody stuck it in there."

—Nancy Allison

SUGGESTED READINGS

ON Ice-Free Corridor

Mandryk, Carole 1990 Could Humans Survive the Ice-Free Corridor? Late Glacial Vegetation and Climate in West Central Alberta. In *MegaFauna and Man: Discovery of America's Heartland*, edited by L. D. Agenbroad, J. I. Mead and L. W. Nelson. pp. 67-79. The Mammoth Site of Hot Springs, South Dakota, Inc. Scientific Papers, Vol. 1. Hot Springs, S.D.

Catto, Norm and Carole Mandryk 1990 Geology of the Postulated Ice-Free Corridor. In *MegaFauna and Man: Discovery of America's Heartland*, edited by L. D. Agenbroad, J. I. Mead and L. W. Nelson. pp. 80-85. The Mammoth Site of Hot Springs, South Dakota, Inc. Scientific Papers, Vol. 1. Hot Springs, S.D.

UPCOMING CONFERENCES

March 31-April 1 Human Biology Council, Hotel Riviera, Las Vegas, Nev.

April 1-4 American Association of Physical Anthropologists, Hotel Riviera Las Vegas, Nev.

April 10-12 World Atlatl Association Atlatl Contest, Valley of Fire State Park, 55 miles northeast of Las Vegas, Nev.

Competition for beginners, children, women and men on targets at 15 m, 40 m, 60 m and 100 m. Contact: World Atlatl Association, P.O. Box 56, Ocotillo, CA 92259.

April 8-12 57th Annual Meeting of the Society for American Archaeology, The Pittsburgh Hilton & Towers, Pittsburgh, Pa.

April 16-18 45th Annual Northwest Anthropological Conference, Simon Fraser University, Burnaby, British Columbia.

Plenary sessions April 17 will feature speakers from the academy of Science, Yakutsk, Siberia, Yuri A. Mochanov on "Early Paleolithic in Northeast Asia" and Svetlana Fedoseeva on "Neolithic Cultures of Yakutia." Papers will include all aspects of anthropology. There will be a special exhibit on contemporary native art in British Columbia. Contact: NWAC Steering Committee, Department of Archaeology, Simon Fraser University, Burnaby, B.C., Canada V5A 1S6 (604) 291-3135.

ON Crossing Beringia

Grosswald, M. G. 1988 An Antarctic-Style Ice Sheet in the Northern Hemisphere: Toward a New Global Glacial Theory. *Polar Geography and Geology* 12:239-267.

Morlan, R. E. 1987 The Pleistocene Archaeology of Beringia. In *The Evolution of Human Hunting* edited by M. H. Nitecki and D. V. Nitecki pp. 267-307. Plenum Press, New York.

ON Paleoindian Skeletal Data

Harper, Albert B. and William S. Laughlin 1982 Inquiries into the Peopling of the New World: Development of Ideas and Recent Advances, in *A History of American Physical Anthropology 1930-1980*, Edited by Frank Spencer, pp. 281-304. Academic Press, New York.

ON Idaho Burial

Ubelaker, Douglas H., and Lauryn Guttentplan Grant 1989 Human Skeletal Remains: Preservation or Reburial? *Yearbook of Physical Anthropology*, 1989 32:249-287.

April 23-26 Annual Meeting, Southern Anthropological Society, St. Augustine, Fla.

May 6-10 25th Annual Meetings of the Canadian Archaeological Association, London Centre Radisson Hotel, London, Ontario.
Contact: Neal Ferris, 55 Centre St., London, Ontario N6J 1T4 (519) 433-8401 FAX (515) 439-1696.

June 18-21 America Before Columbus Conference, Providence, R.I.

Lectures, poster papers and discussions. Scheduled speakers include George Carter, Alice Kehoe, David Kelly, Cyrus Gordon, Mary Ritchie Key, Stephen Jett, Carl Johannessen, Mary LeCron Foster, Nancy Yaw Davis and Betty Meggers. Contact: Suzanne Carlson, 2 Oxford Place, Worcester, MA 01609 (508) 752-3490; FAX (401) 949-5342

Oct. 8-10 23rd Biennial Great Basin Anthropological Conference, Boise, Idaho.

Contact: Max Pavesic, Idaho State Historical Society, 210 Main St, Boise, ID 83702 (208) 334-3847.

Nov. 12-15 25th Annual Chacmool Conference, Calgary, Alberta.

Contact: Programme Committee, Department of Archaeology, University of Calgary, 2500 University Drive N.W., Calgary, Alberta T2N 1N4. Deadline for receiving proposals, May 15.

Nov. 13-16 49th Annual Plains Anthropological Conference, Lawrence, Kan.

Contact: William Lees, Kansas State Historical Society, 120 West 10th, Topeka, KS 66612 (913) 296-2625.

Ice-free Corridor

continued from page 5

adding sections of connective pipe like miniature sections of an oil rig's drill stem. At the surface of the lake-bed sediment, the corer's sampling sleeve is opened and pushed down exactly one meter, and then carefully hauled to the surface with its one-meter column of sediment. The sample is extruded onto protective plastic and then rolled in corrugated cardboard for transport to the lab. Then the process is repeated to retrieve another meter-thick sample immediately below the previous sample. The topmost samples are the delicate, Jell-O-like organic substance palynologists call gyttja. Sediments come out like a giant squirt of toothpaste.

At her first lake the water was about 14 feet deep, but at another lake the corer had to be lowered and raised repeatedly through 40 feet of water. To make sure she had continuous sequences of sediments, she took three columns from each lake, starting at different levels so contacts between samples overlapped. The deeper the sampler was pushed, the firmer the sediments it encountered. "In this area it gets less and less organic and more and more mineral as you go down," Mandryk says. Eventually it became impossible to push the corer down; in some lakes of the area glacial till can be encountered, but Mandryk says compacted clay defined the bottom of her sample columns.

Back in the lab, the cores were stored and Mandryk removed samples for analysis. Since she was studying the ice-free corridor, she didn't bother with the upper samples. Mazama ash, deposited by the explosion and collapse of Mount Mazama to create Oregon's Crater Lake 6,800 years ago, made a convenient upper horizon. She started there and worked down taking uniform samples at five-centimeter intervals. Her analysis not only reveals the types of vegetation growing at various times in the past, but also reveals the density of plants.

"One of the really neat things about pollen is that it is so incredibly abundant that you can use statistical analysis. You only need to count 500 grains in order to have a statistically valid sample." Introduction of a known number of exotic pollen grains facilitates the count of local pollen and allows for measurement of pollen influx. "In terms of trying to figure out how

**"Some people think that
if you date when the corridor
was open, then you've dated
when people migrated."**

much vegetation there is in an environment, you have to know the influx because that tells you how much pollen is actually falling on the ground."

She found the pollen influx quite abundant in layers representing times back to more than 11,000 years ago, but then it decreased until eventually it was down to zero. "So there's a point that the pollen influx is as low as, for instance, a polar desert."

Dating the pollen record is also important. Several dates, besides those established by volcanic ash, were required to determine the sedimentation rates. Radiocarbon dating of sediments in the ice-free corridor can be problematic because the region is underlain by carbonaceous bedrock. Coal-rich sediments and organic material from older deposits can produce misleading results. Mandryk got dates from carefully chosen macrofossils unlikely to have been affected by contamination. Dating was done by accelerator mass spectrometry at the University of Toronto's Isotrace Laboratory and Beta Analytic in Boca Raton, Fla.

Then it came time to consider the human element. Mandryk turned to evidence from population biology, genetics, and computer modeling indicating that a biologically viable population of humans must contain a minimum of 175 people able to contact each other during their lifetimes in order to assure that everyone has a mate. While a range in minimum population size from 175 to 500 is usually quoted, the

upper level is more commonly seen in the ethnographic record. It was considered more effective to test the smallest biologically viable population, Mandryk explained, adding that individual living groups could be smaller—15 to 25 people. Using ethnographic evidence, she argues that the thinnest people ever spread themselves is about 15 people in 2,500 square kilometers.

"That's the thinnest population density that had been reported for any hunter-gatherer group. Even in the most marginal areas, people just don't spread themselves any thinner than that." So was the North Saskatchewan basin portion of the ice-free corridor able to sustain viable human populations?

*"Maybe the corridor was open
and nobody came through it."*

Mandryk's dissertation suggests two ways to approach that question. The qualitative approach is to look at all other places in the world and see if people lived in similar environments. "I do an all-around-the-world survey at high latitudes and show that nobody lived in an environment like that at the height of the last glacial. We have the myth that people did, but in reality nobody did. They lived there before the coldest time and after the coldest time, but nobody lived there in the coldest time. So why should we expect anybody to here?" Her quantitative approach is more complicated.

First, she considers the adaptations available to hunter-gatherers in a marginal environment. One by one, the arguments in her dissertation eliminate every adaptation except mobility. Then, adding the assumption that people couldn't spread themselves any thinner than 15 individuals for every 2,500 square kilometers, she reconstructs the vegetation of her area. From vegetation it is possible to extrapolate possible animal biomass. Then she translates animal biomass in terms of calories that would have been available for her hypothetical minimum but typical human population of 175 individuals.

"Then I simply show that there would not be enough calories to feed these people," she says, referring to the period after the glacial ice retreated about 18,000 to 13,000 years ago. What about before 21,000 years ago—before the Cordilleran glacier coalesced with the Laurentide ice? Mandryk's lake sediments simply don't contain the data.

In her own portion of the ice-free corridor, Mandryk sees ice from Cordilleran and Laurentide glaciers coalescing around 21,000 years ago and beginning its retreat by 18,000 years ago. "So you only have a closure for 3,000 years."

Why, then, was the environment so inhospitable until almost 12,000 years ago? The answer is a complex one, but a key element of it is that the ice didn't simply disappear one sunny afternoon, nor did it back away like a bulldozer in reverse. It lay there stagnant, wrapped in its own insulating debris. But it wasn't stagnant ice that created a forbidding environment, the ice merely confused the evidence, Mandryk says. The stagnant ice was nothing like an Arctic ice sheet, although even when enough soil accumulated on top of the stagnant ice to support vegetation, seeds were still far away. The environment was harsh in part because of the lack of vegetation; until 14,000 or 13,000 years B.P. the climate was cold, dry and windy.

"A lot of the renewal of vegetation has to do with the distance that things have to travel," Mandryk says. "My lake was deglaciated 18,000 years ago and where were the sources of trees 18,000 years ago? They were several thousand kilometers to the north and south." It took many centuries for the spruce forest to regenerate on the stagnant ice. It was after 12,000 years ago—a warmer time than the present—that trees imprinted her pollen samples.

While Carole Mandryk can provide details of paleoenvironments of the southern third of the ice-free corridor, don't ask her to speculate on how her research will affect broad theories on the peopling of the Americas. "It doesn't matter to me if Clovis turns out to be the earliest or not," she says. "I just want people to argue logically."

—Don Alan Hall

Crossing Beringia

continued from page 4

in Beijing in August 1991, and included preliminary ice-sheet modeling results to illustrate the possibilities. One major concern has been what an ice build-up on the Siberian side, such as Grosswald postulates, would have meant for the Alaskan side.

Although Grosswald makes no claims for glaciation in western Alaska, Beverly Hughes argues that a lobe of Grosswald's marine ice sheet in the East Siberian and Chukchi seas may have extended southward through the Bering Strait and dammed Alaskan rivers flowing into the Bering Sea. Then there would have been a river-fed lake beyond the frontal margin of the ice lobe. The lobe would calve into this lake, and the lake would require an outlet for the overflow.

"Where is the evidence for this?" Hughes asks. "Was the spillway on the Bering Sea continental shelf, and is it now buried under marine sediments?"

Hughes has found these and other issues problematic enough to convince her that, if Grosswald's hypothesis for the Siberian side is correct, central Beringia might have been completely covered by an ice sheet during maximum glaciation in the late Wisconsin. "For the most part I am in agreement with [Grosswald] about the Siberian glaciation which occurred during the late Wisconsin," Hughes says. "I propose that there was no ice-free corridor in central Beringia during the late Wisconsin maximum, but instead the area was covered by an extension of Grosswald's east Siberian marine ice sheet." After examining the data that do exist for the Alaskan side, Hughes suggests: "The ice sheet covered the continental shelf between northeastern Siberia and western Alaska."

Hughes cautions that she has not personally collected data in support of her hypothesis but she is making a new interpretation of data reported by others from central Alaska, the Aleutian Islands, and elsewhere to raise the issue for discussion. At this time Quaternary scientists working in central Alaska seem confident that there was no glaciation there or in central Beringia. However, Hughes points out that there are few data available specific to the region in the Bering Sea that is most critical to her proposal.

Hughes' suggestions elaborate on, rather than diverge from, Grosswald's picture by specifying the timing of migration through Beringia. For archaeologists, an on-again, off-again migration of humans, flora and fauna that is tied to Beringian glaciation could be significant in several ways.

It could offer more precise dates to be tested against the field data. Bonnicksen suggests that the views of Grosswald and Hughes might support dates for migration during the mid-Wisconsin 50,000 to 30,000 years ago and the early Late Wisconsin period 30,000 to 24,000 years ago. Ice over Siberian mountains would have blocked movement during full Wisconsin times (24,000 to 14,000 years B.P.) and may explain why the oldest site in western Beringia, the Uski Lake site on the Kamchatka Peninsula, is slightly older than 14,000 years B.P. while microlithic industries along the Lena and Aldan Rivers in Siberia date back to 30,000 years B.P. Similar technologies do not appear in Alaska until about 10,700 years ago. In computer simulations of Beringian glaciation, Fastook produced advances and retreats of a marine ice sheet with these periodicities in central Beringia.

Certainly the concept of a migratory valve controlling the passage through Beringia is intriguing enough to warrant further examination and debate.

—Susan Simpson

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Skeletal Data

continued from page 3

and Theory book, they increased the number of measurements to 14 and used two multivariate techniques, principal-components analysis and canonical discriminant-function analysis. The accompanying three-dimensional graph illustrates results of only one of many of their analyses, a principal components analysis involving the female samples. Principal-components incorporates all the measurement data and constructs a number of lines that indicate differences among samples in several dimensions of hypothetical space. The graph positions a symbol for each of the samples within those three dimensions: the horizontal and vertical axes of the graph, plus the third dimension, the position above the surface.

In this chart the Paleoindian sample occupies a relatively central position, not very close to any of the other groups, particularly along the third principal component (identified as PRIN3 on the chart). On components 1 (PRIN1) and 2 (PRIN2), however, it is relatively close to the Native American samples, the 18,000-year-old Upper Cave (Zhoukoudien) sample, some southern Pacific/Australian samples, some European samples, and the Jomon sample.

Although each of the multivariate analyses produced slightly different results and should not be considered alone, Steele says that several trends are evident. According to the totality of multivariate tests, the Paleoindian sample appears most similar to more recent North Americans and to the South Asian/South Pacific sample, to historic North Americans, and somewhat less similar to the contemporary northern Asians; some proximity to European samples also is shown in the analysis.

Proximity to European samples may be the most

surprising, although similarity with the southern Asian and Pacific populations may puzzle some scholars of Paleoindian origins. Steele and Powell say that the relatively small, narrow face, and relatively long cranial length of Paleoindians and southern Asians are specific features that their metric analysis identifies; and these features also are shared to some extent with European and southern Asian samples. By contrast, contemporary North Asians and North Americans are linked, and in the multivariate analysis are separated from the other groups, by their broader, larger facial measurements and more rounded heads. The prehistoric North Asian Upper Cave skulls more closely approximated the Paleoindian and South Asian-Pacific samples than contemporary northern Asians.

Steele says this suggests that the northern Asian population of the late Pleistocene probably was more generalized than the modern people of the area, and much closer biologically to the early migrants into North America. Fossils such as those from the Upper Cave have been interpreted and re-interpreted many times since their original discovery. Because they represent some of the oldest fossils from the *Homo sapiens sapiens* population, investigators have hoped that they will contribute to an understanding of relationships among diverse groups of modern peoples, but so far there has been little consensus. Part of the reason for this may be that these very old fossils possess similarities to many modern populations because they lie close to the time of dispersal of human populations worldwide. In this interpretation, all later populations have retained some of the characteristics of earlier people. While studies of Paleoindian remains have not shown definite affiliations with any one founder population, they have suggested that the specific characteristics of modern American Indians have developed after the migrations of their forebears.

-DAH

Human Biology

continued from page 1

ing the peopling of the New World. He challenges investigators to be open minded. "It is our obligation as scientists to examine the evidence dispassionately before concluding which explanation is the most likely. As additional data surface, we should be willing to change our minds and accept the dictates of the evidence," the editor writes. "Colleagues who continue to argue their personal positions, despite the evidence, retard scientific progress."

The journal's first three contributions examine pre-contact populations in North America. Crawford says the initial article, "How the Door Opened: The Peopling of the New World," by archaeologist Richard Rogers, biological anthropologist Laurie Rogers and paleontologist Larry Martin, "provides a relatively balanced evaluation of theories concerning the early versus late entry of Siberians into the New World and their probable pathways of entry. This Kansas University team has brought together evidence from linguistics, pre-Pleistocene ecology, and archaeology.

"They conclude that a pre-Clovis occupation occurred in the Western Hemisphere," Crawford writes. "On the basis of linguistic and ecological data, they contend that the coastal route of entry into the New World was the most significant." The Kansas team argues against the theory of a late, three-wave migration from Siberia suggested by J. H. Greenberg and others.

The next article, "The Peopling of the Americas: Paleo-biological Evidence," by Texas A & M anthropologists D. Gentry Steele and Joseph F. Powell is reported on in this *Mammoth Trumpet*. Another paper, "New Approaches to the Study of Disease in Archaeological New World Populations" is by a Smithsonian Institution team, Donald Ortner, Noreen Tuross and Agness Stix. It applies molecular, genetic and immunologic methods to the examination of the role of disease in the evolution of American Indian populations.

Douglas Ubelaker, another Smithsonian Institution anthropologist, provides a transition between pre-contact and contact populations with his article titled "Patterns of Demographic Change in the Americas" in which he examines changes that occurred immediately before and after the arrival of Europeans in North America.

The four concluding articles involve genetic and morphological variation in native North American populations: "Immunoglobulin Allotypes GM and KM Indicate Multiple Founding Populations of Native Americans: Evidence of at Least Four Migrations to the New World," by Moses Schanfield, director of the Genetic Analytic Laboratory in Denver; "American Indian Prehistory Written in Mitochondrial DNA: A Review," by Douglas Wallace and Antonio Torroni, geneticists from the Emory University School of Medicine; "Patterns of Genetic Variation in Native Americans" by Dennis O'Rourke and Ann Mobarry, University of Utah anthropologists, and Brian Suarez of the Washington University School of Medicine; and "Variation Among North Amerindians: Analysis of Boaz's Anthropometric Data," by Richard L. Jantz, University of Tennessee anthropologist; David R. Hunt, Smithsonian anthropologist; Anthony B. Falsetti, of the Ecology and Evolution Department at SUNY Stony Brook; and Patrick J. Key, of Key Company, Williston, N.D. The latter paper reports on the first multivariate analysis made of the extensive anthropometric data carefully collected by anthropologist Franz Boaz a century ago for the World's Columbian Exposition that marked the quarter-century of Columbus' first visit to the New World.

The special issue of *Human Biology* is not Crawford's only involvement in commemorating the 500th Columbus anniversary. A Spanish group, the MAPFRE Foundation, has commissioned him to produce book on the physical anthropology of American Indians. *Biological Anthropology of American Indians* is scheduled to be published (in Spanish) in July. Crawford hopes an English-language version will be available later.

-DAH

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