# Early Man Confirmed in America 40,000 Years Ago

Conclusive evidence that early man was present in North America at least 40,000 years ago—nearly twice the previously accepted estimate of man's entry into the New World—has been confirmed for the first time by carbon-14 dating. The find was made in a deep gully nestled in the barren "badlands" area of California's Santa Rosa Island, off Santa Barbara.

There, last summer, UCLA archaeologist and geophysicist Rainer Berger found what scientists have been combing the island for since the turn of the century: an ice-age "pit barbecue" where some form of human beings roasted and ate dwarf mammoth elephants they had hunted and killed. Berger, a specialist in radiocarbon dating methods, recently completed his analysis of four charcoal samples from the 3-meter-wide, 16-centimeter-deep hearth. He reported his findings at a symposium on archaeometry and archaeological prospection last week at the University of Pennsylvania Museum in Philadelphia.

The discovery is "significant," Berger says, because it "clinches the argument that human presence and evolution [in North America] go back much further than we thought." A relatively new dating technique called amino acid racemization (see related story) has placed some California human fossils as early as 48,000 years old. But that technique, developed by Scripps Institution of Oceanography geochemist Jeffrey L. Bada (SN: 5/18/74, p. 316) is still not fully accepted by the archaeological community.

The Santa Rosa site was found in late 1975 by John Woolley, a member of the family that owns the island, and his fiancé Charlene Haupt. However, the island has been a focal point of archaeological curiosity since the first mammoth dwarf remains were discovered there around 1900. Woolley asked Berger, who had previously dated the oldest human remains in the United States at 24,000 years, to study the newly found fire pit area.

Within the sediment-filled hearth, Berger found not only the huge, hind-leg bone of a mammoth but also what he concluded were crude chopping tools used by the ancient beings to cut up their prey.

In the past, researchers had found dwarf mammoth remains, many with their skulls smashed in, in the area of suspected roasting hearths. "But no one had ever found mammoth remains together at a fire site with either cutting tools or human remains," Berger says. It is unlikely that humans would happen to die at their eating place, Berger reasons—and indeed, no human bones have yet been found anywhere on the island. So, he and others concentrated on searching for the mammoth-fire-tools combination.

And upon excavating this latest hearth area—which over the years had been buried by sediment, then slowly uncovered by erosion—he found the remains of stone tools, most of which were hand-sized pieces of basalt and chert (a hard, clay stone). The discovery excited Berger. "We knew from the remnants of villages and cemeteries that Canalino Indians had probably existed there in prehistoric times," he says. "But we never found a definite link between man and mammoth" during the Pleistocene era, when the bull-sized elephants roamed the earth.

The archaeologist collected the tools and bones and dug out four chunks of charcoal from the pit. Laboratory analyses showed the samples had no C-14 left in them. Since it takes 40,000 years for an object to lose all its measurable C-14, Berger's findings mean the site and the people who used it were at least that old.

The hearth itself, Berger suggests, was a giant pressure cooker. After killing the elephant, the hunters placed wooden slabs at the bottom of the pit and set them on fire. Then they wrapped the meat in plant material and place it on top of the smoldering wood. They then placed more wood on top of that, set it on fire and covered the pit with soil. The meat was left to cook for 12 to 24 hours, Berger speculates, or however long it takes for elephant meat to become tender.

Because the C-14 dating method is useful only to about 40,000 years (which amino acid racemization proponents say gives the advantage to their method), Berger is not sure of the exact age of the Santa Rosa fossils. "It may be only 41,000 years old, or it may be more," he says. The C-14 technique can be "adjusted" to detect age up to 50,000 years, he adds, and that will be one of the next steps in Berger's work. Some archaeologists have speculated that many may have arrived in the new world as long as 70,000 years ago, or earlier.

In any case, the Santa Rosa find appears to shatter the long-held belief that man first entered North America somewhere around 20,000 years ago. The Santa Rosa man would correspond to the middle of the last ice age, when a natural bridge would have connected the island to the mainland, Berger notes. "We don't know what these people looked like—we don't know if they were really Indians," the archaeologist says. Human skulls of that time would probably not have any discernible racial characteristics, he says. And while no actual human remains have been found on Santa Rosa, Berger says his findings indicate that such remains are buried there. □

## Amino acid dating: Now it has teeth

To many archaeologists, dating a fossil by any means other than the carbon-14 method borders on heresy. So, when California geochemist Jeffrey L. Bada reported in 1974 that, through a new dating method, he had placed man in North America 48,000 years ago, he immediately became the Roger Maris of archaeology—in the minds of many researchers, a qualifying asterisk was placed next to his "discovery." Since then, Bada's technique—amino acid racemization—has advanced somewhat in stature, but is still short of being universally accepted, particularly in the United States. "He [Bada] is a very serious scientist, but this is a young method in its childhood stage," says UCLA's Rainer Berger.

Ironically, Berger's announcement last week in Philadelphia that he has dated, with carbon-14, man in North America around the time of Bada's earlier estimate (see preceding story) could lend more credibility to the racemization technique, according to some observers. And at the same archaeological meeting at the University of Pennsylvania, a colleague of Bada's at the Scripps Institution of Oceanography in San Diego reported on additional findings that she says support the accuracy of racemization in dating fossils.

Biologist Patricia Helfman also reports that by measuring the racemization rate in the teeth of skeletons from a medieval cemetary in Czechoslovakia, she has been able to determine their age at the time of death. That method, if applied to other structural parts of the body, such as skin, tendon and cartilage, as well as teeth, might reveal more about how long proteins are maintained in the body and perhaps about the aging process itself, she suggests.

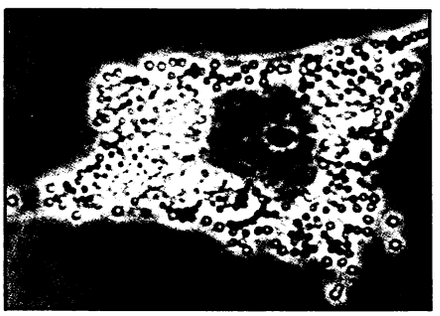
"The bulk of [aging] research has always been in intracellular functions, but 30 to 40 percent of the body protein is structural protein," she says, and that aspect has been "ignored. If such proteins are undergoing racemization [during life], that could have very serious implications" in understanding aging, she says.

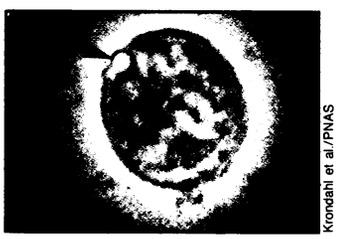
The age of a fossil in the racemization method is determined by measuring how much of its L-isomer—the left-handed amino acid found only in living things—has converted to D-isomer—the right-handed form that begins to accumulate

after death. Bada announced in 1972 that he had determined the rate of this conversion: It takes 300,000 years after death for D- and L-isomers to equalize, he said. That would make it possible to measure a fossil's age far beyond the 40,000 to 50,000 year limit of C-14.

Skeptics noted that the method was not only unproven, but it had a major drawback—racemization depends on the climate. The hotter the temperature, the faster the rate (the tooth measurements, for example, can be done only in cemeteries in cool regions). But Bada and his colleagues say they have calibrated and measured the technique's fossil-dating accuracy against known C-14 datings at various temperatures some 25 times since 1973, and the difference has averaged just 7 percent. Results of the latest tests—against known geological and anthropological information at sites in South Africa, Israel and Eastern Europe—indicate the racemization method is "accurate," Helfman reports. "Who's to say that radiocarbon dating is always accurate?" she asks. "Now, radiocarbon dating is the word of God, but the burden of proof is on those who choose to deny our dates." Bada and his colleagues have found 48,000-year-old remains at six California sites, Helfman says. □

# Artificial synthesis of cells





Krondahl et al./PNAS

*Donor nucleus (top) has 6 beads, non-donor cell 200. Beads help determine whether reconstituted cells multiply.*

Back in 1970, James Danielli of the State University of New York reported what appeared to be the first instance of artificial synthesis of a cell, that is, reconstitution of a cell using various living cell parts. He transferred nuclei from some amoebas into the cytoplasms of others, and the reconstructed one-celled animals lived most of the time (SN: 12/12/70, p. 443). Then in 1974, artificial synthesis of cells was given another boost when George Veomett and his colleagues at the University of Colorado transferred the nuclei of mouse cells into the cytoplasms of other mouse cells, and the reconstructed cells lived (SN: 6/22/74, p. 397).

Now another significant advance in artificial synthesis of cells is reported in the February PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES by Ulla Krondahl and his colleagues at the Karolinska Institute in Stockholm. They have reconstituted mammalian cells that not only live, but multiply, by simple cell division. Such viable, multiplying cells can also be made from two different species.

Actually, cell division among reconstituted mammalian cells may have occurred before. But it has been difficult to demonstrate this division because intact parent cells tend to contaminate both nucleus and cytoplasm preparations. So, to show that reconstituted cells truly divide, the Swedish investigators tagged both the nuclei used in reconstitution and the intact parent cells from which they had come.

First they cultured mouse cells, then centrifuged them in the presence of a fungus by-product known as cytochalasin B to facilitate separation of the cytoplasms from the nuclei. After they obtained mouse cytoplasms, they cultured rat cells as well. But this time they did the culturing in the presence of plastic beads. This way they could determine how many plastic beads were incorporated into an intact rat cell. They found that it was around 200 beads. Now they had a marker for an intact rat cell. After that, they centrifuged the cultured rat cells in the presence of cytochalasin B to obtain separate rat cell nuclei. Then they analyzed the nuclei alone for the number of beads present. Each nucleus contained less than 20 beads, usually 5 or 6. So they now had a marker for the rat cell nucleus as well.

They were then ready to perform experiments to show that when rat cell nuclei fuse with mouse cell cytoplasms, the reconstituted cells divide and form colonies. They placed Sendai virus, which is capable of fusing a donor nucleus with a recipient cytoplasm, in the presence of rat nuclei and mouse cytoplasms. As expected, the nuclei and cytoplasms fused. And as they hoped, the reconstructed cells were also able to divide and form colonies. Evidence for division and colony formation lay in the fact that each colony contained less than 20 beads. In other words, each colony must have arisen from one rat cell nucleus. In contrast, when they put mouse cytoplasms and rat nuclei together, but without Sendai virus, no reconstituted cells formed, as they expected. However, some cell colonies did appear. And proof that these colonies came from intact cells contaminating the nuclei and cytoplasms, rather than from reconstituted cells, lay in the fact that each colony contained some 200 beads each. In other words, each colony must have originated from an intact cell rather than from a reconstituted cell.

Now that colony formation among reconstructed mammalian cells has been demonstrated, cell biologists have a means of rapidly culturing many of these cells for study purposes. Showing that nuclei and cytoplasms from two different species can fuse is also of interest. But the larger purport of these studies, as well as of those done before along these lines, is that they are giving biologists powerful tools to learn more about nuclei and cytoplasms and their roles in gene expression and other cellular actions. Artificial synthesis of cells should also help researchers learn more about diseases and aging at the cellular level. For example, Leonard Hayflick of Stanford University has already used cell reconstitution to see whether cellular aging is triggered by the nucleus or the cytoplasm. Both nucleus and cytoplasm appear to be responsible, he has found. Cell reconstruction may even eventually benefit medical diagnosis and treatment, Veomett (now at the University of Nebraska) speculates. For instance, cells might be taken from a patient with a certain inherited metabolic disease, nuclei removed from these cells and replaced with healthy nuclei. If the healthy nuclei could reprogram the cells (a feat yet to be demonstrated), then the treated cells might be reinjected into the patient and hence correct his disease. □

# NASA's Fletcher to resign May 1

The administrator of the National Aeronautics and Space Administration, James C. Fletcher, is resigning from the agency effective May 1. He was named head of NASA on April 27, 1971, near the end of the Apollo lunar-landing program, and presided throughout the Skylab project, the joint U.S.-Soviet Apollo-Soyuz mission and the beginnings of the space shuttle.

Fletcher has reportedly said that he does not expect President Carter to name a new administrator for a couple of months, but several names have been floating about in the "rumor mill" as possible candidates. Included among them are: Albert J. Kelley, dean of the School of Management at Boston College and former director of the now-closed NASA Electronics Research Center among other agency positions; Rocco Petrone, former associate administrator of NASA and now in private business; and Edgar Cortright, former director of the NASA Langley Research Center in Virginia. □