Headier days. The hunt proved more rewarding than the trophy for scientific coordinator Dick Mol.

specimens unearthed on future expeditions.

Sponsored by the Discovery Channel, a team led by Bernard Buigues, a Paris-based North Pole tour operator, chiseled the 23-ton block from the Taimyr Peninsula in October 1999 and airlifted it by helicopter more than 300 kilometers to the northern Siberian town of Khatanga. The previous year, Buigues had excavated the skull of the 20,380-year-old male mammoth, nicknamed "Jarkov" after the family of indigenous Dolgans who had found its tusks sticking out of the snow. Ground-penetrating radar readings hinted that substantial portions of the carcass remained underground. But after inspecting the block, a Russian project scientist argued that it was unlikely to harbor mammoth remains (*Science*, 29 October 1999, p. 876).

After moving the block into a tunnel in Khatanga used to store reindeer meat and fish, Buigues and company began thawing it with hair dryers last October. Near the top of the block they found three thoracic vertebrae, two of which lay in anatomical position, and a pair of ribs lying haphazardly, like crossbones. But the bones were devoid of flesh. Indeed, the only flesh uncovered during the season's final thawing session, witnessed by *Science*, was a 10-centimeter-long strip of tissue that looked like beef jerky. "I was expecting a lot and got a little," Buigues said at the time.

The denouement comes as no surprise to many. But the revelation that the block does not contain a whole mammoth has drawn ridicule from some quarters. An editorial in the 6 January edition of *The Times* of London even suggested that the whole episode was a hoax. "Prehistoric hoaxes offer very good sport, as our dalliances with Piltdown man have long proven," *The Times* said.

However, Discovery Channel officials and project scientists reject that characterization. "Nobody ever said Jarkov was going to be Sue," says Ross MacPhee, curator of mammals at the American Museum of Natural History in New York City, referring to the nearly complete *Tyrannosaurus rex* skeleton.

Buigues's team takes some consolation from having succeeded in airlifting the remains, still frozen in place, to an environment where they could be thawed under controlled conditions. "Whether or not this mammoth is the epitome of frozen mammoths is immaterial," says Larry Agenbroad, a geologist at Northern Arizona University in Flagstaff. "We can now go out and get more." –RICHARD STONE

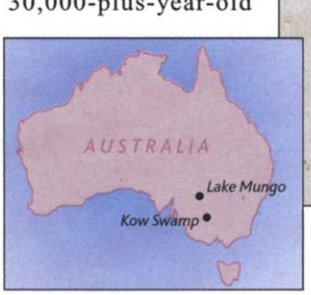
PALEOANTHROPOLOGY

Oldest Human DNA Reveals Aussie Oddity

Australian scientists say they have successfully extracted an extinct genetic sequence from an anatomically modern man who died on the shores of an Australian lake about 60,000 years ago. The sequence is so primitive that it raises questions about the leading model of human origins, the "Out of Africa" theory, which holds that our ancestors first arose in Africa, then spread throughout the world perhaps 100,000 years ago.

DNA studies from living populations have repeatedly pointed to such a recent African origin. But the new data, published in the 16 January 2001 *Proceedings of the National Academy of Sciences*, present a "serious challenge" to a "simplistic" Out of Africa scenario, says co-author Alan Thorne, an anthropologist at Australian National University in Canberra. Thorne argues that the results better fit a model known as multiregionalism, favored by a determined minority of anthropologists, in which people coming from Africa interbred with earlier humans already living in various parts of the Old World.

The researchers say they extracted mitochondrial DNA (mtDNA) from the remains of 10 ancient humans—a striking feat, as other scientists had extracted ancient human DNA from only a handful of subjects (including the 5300-year-old Alpine "Ice Man" and three 30,000-plus-year-old Neandertals). The 10 fossils—four from Lake Mungo in New South Wales, Australia, and six from Kow Swamp in nearby Victoria—range from 2000 to 15,000 years old, except for a Lake Mungo man known as LM3, who has been dated by three separate methods at more than 60,000 years old (*Science*, 21 May 1999, p. 1243). LM3 is "the oldest individual dated accurately and possibly the oldest human from which DNA has been recovered," Thorne says.



Far out. Mungo man bore a now-vanished sequence of mitochondrial DNA.

The key finding, Thorne says, is a sequence in LM3's mtDNA that differs both from that of the other fossils and from that of modern people. Now extinct in modern human mtDNA, it exists only as a remnant, or "insert," on chromosome 11 in the modern nuclear genome. Scientists have long suspected this sequence to be a copy of old mtDNA that found its way into the cell nucleus, as other sequences are known to have done.

Thorne says the data undermine studies that support the Out of Africa scenario with genetic evidence from living populations. By analyzing variations in modern DNA sequences and tracing their "roots" backward in time, scientists have concluded that everybody now alive stems from African ancestors who replaced earlier types of humans without interbreeding with them. Now, the most divergent, deep-rooted mtDNA sequence of any anatomically modern human has turned up thousands of miles from Africa. "We don't say that humans evolved in Australia," Thorne says—but the logic behind earlier genetic studies could lead to just such an absurd conclusion, he says. Instead, Thorne thinks the new data support the multiregional hypothesis, which holds that *Homo sapiens* may have inherited DNA from precursors such as *Homo erectus*, who spread into Eurasia more than 2 million years before the presumed Out of Africa migrants did. Thorne and Milford Wolpoff of the University of Michigan, Ann Arbor (see p. 231), are central proponents of multiregionalism.

"For many years people have been saying Out of Africa is correct because the genetic evidence is consistent," says John Relethford of State University of New York College at Oneonta. But the Australian study "suggests that if we saw more ancient sequences we might get a very different picture than we get from looking only at the DNA of living

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populations." Other now-extinct sequences, for example, might well include traces of DNA indicating that *Homo sapiens* interbred with Neandertals—evidence that has disappeared from modern genetic material.

Most scientists, however, will need far more evidence to be talked out of the replacement scenario. Evolutionary biologist S. Blair Hedges of Pennsylvania State University, University Park, says the key piece of evidence, the LM3 sequence, must be replicated in independent laboratories in order to be convincing. Svante Pääbo of the Max Planck Institute for Evolutionary Anthropology in Munich, who obtained the first Neandertal DNA in 1997, agrees. "We know from many failures in our laboratory that contamination can rear its head in many forms," he says, and the Australian researchers did not meet his criteria—which include cloning, sequencing, and replication in independent labs—for ascertaining that the DNA sample is authentic. Although Pääbo says that at this point he can't evaluate the study's conclusions, he notes that extinct sequences such as LM3's might simply indicate that humans used to have more genetic variation than they do today. Still, "these scenarios do not change the observation that mtDNA found in humans alive today go back to a recent common ancestor in Africa."

But Thorne says that DNA from living populations alone will never reveal the true story of human origins. Finding this surprise in an ancient Australian "makes clear that it is the lineages that have been lost in the past that may hold the key," he says.

—CONSTANCE HOLDEN

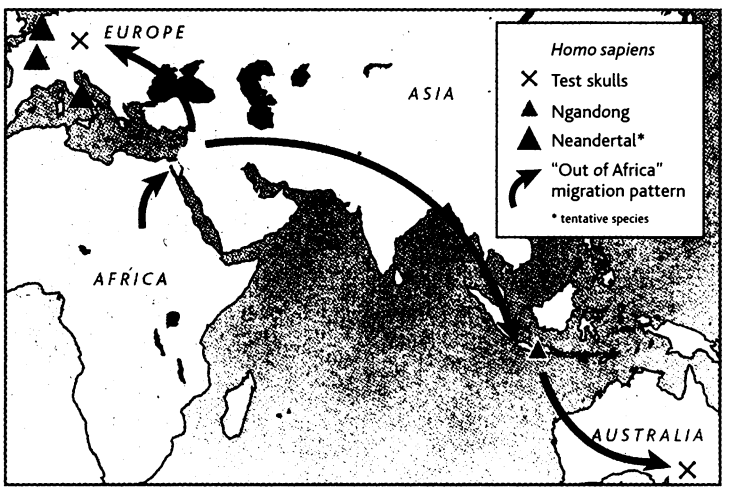
Skull Study Targets Africa-Only Origins

While Australian researchers invoke ancient DNA to discredit the notion that "Out of Africa" migrants completely replaced earlier humans, Milford Wolpoff is assaulting it with bones. Wolpoff, an anthropologist at the University of Michigan, Ann Arbor, has long championed multiregionalism—the dissident view that several populations of early humans evolved modern traits, merging into one *Homo sapiens* species through interbreeding. On page 293 of this issue, he and collaborators put the two rival scenarios to the test. Applying a statistical technique little used by anthropologists, they analyzed 25 ancient skulls from throughout the Old World and determined that three relatively recent ones had both local and African ancestry. "The implication of this finding is that replacement cannot be correct," Wolpoff says. Most other paleoanthropologists, however, remain unconvinced.

Borrowing an analytical technique called pairwise comparison from their colleagues who study DNA data, Wolpoff's team drew up a list of skeletal features and scored the presence or absence of each one in several sets of fossils. The fewer the differences, they assumed, the more likely a pair of skulls is to be closely related. The work is "a welcome attempt to quantify previous claims" of multiregionalists, says Chris Stringer of the Natural History Museum in London, although he disagrees with the study's conclusions. Adds Janet Monge, a physical anthropologist at the University of Pennsylvania in Philadelphia who says she's still undecided about multiregionalism, "It's as objective as any test that I have seen put forth on human evolution."

The researchers started with a 14,000-year-old skull from southeastern Australia and a pair of partial adult male skulls from Moravia in the Czech Republic—two distant places that the Out of Africa migrants would have had to reach in populating the globe. They compared the Australian skull with archaic human fossils from Ngandong, Java—likely ancestors if modern humans evolved locally—and with six fossils from Africa, close relatives if the Out of Africa hypothesis is correct. In analyzing the Moravian skulls, they used four Neandertal skulls from throughout Europe—the putative local ancestors—and five skulls of early modern humans from Qafzeh and Skhul caves in Israel, who would have been part of the replacing population from Africa.

Wolpoff and colleagues examined the skulls for features such as the flatness of the forehead or the size of a bony projection behind the ear. "We know these traits are diagnostic for distinguishing the ethnicity of modern skulls," Wolpoff says. Then, through pairwise comparisons, they ranked the skulls in order of decreasing similarity. The Australian skull wound up much closer to the Java fossils than to the African or Israeli fossils—possible evidence of Asian roots. The results for the Moravian fossils were less dramatic but indicated that dual European and African ancestry was possible, Wolpoff says.



Mixed beginnings. Ancient skulls in Australia and the Czech Republic suggest that anatomically modern humans had deep-rooted local ancestors as well as African ones.

The work puts "another nail in the coffin of replacement," says Geoffrey Clark, a paleoanthropologist at Arizona State University in Tempe, a longtime advocate of multiregionalism. Paleoanthropologists in the Out of Africa mainstream, however, leaped to voice their skepticism. "I and a number of other workers have previously analyzed these crania and have come to very different conclusions about their affinities," says Stringer. Stringer says he reached pro-replacement conclusions after studying facial features of skulls—features he wishes Wolpoff and colleagues had been able to include in their work. Philip Rightmire of the State University of New York, Binghamton, criticizes the group's choice of specimens; he thinks that another Australian skull, which looks much different from the one Wolpoff picked, would have yielded different results. All in all, Ian Tattersall of the American Museum of Natural History in New York City says of the study, "I don't think it's going to change anybody's position."

But Monge says she welcomes Wolpoff's "provocative and evocative" work. Pairwise comparison will give her and her students a new way of looking at casts and fossils, she adds. "Often you don't see very much coming out from the [multiregional] side," she points out, "so it's good to get these data out there."

—ELIZABETH PENNISI

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