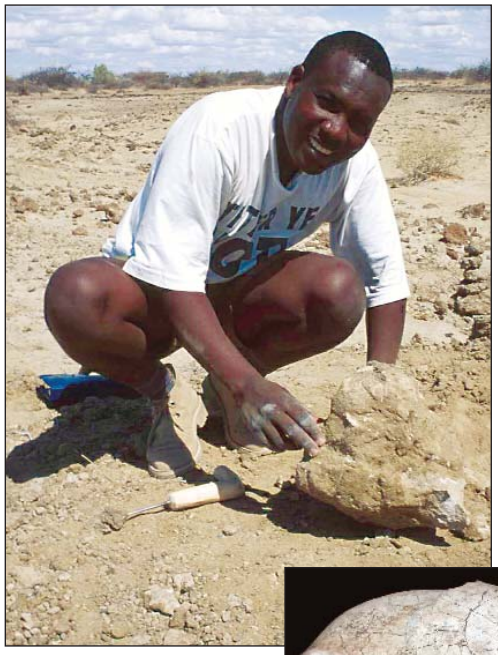
A Shrunken Head for African *Homo erectus*

TEMPE, ARIZONA—About 1200 researchers gathered here from 21 to 26 April for back-to-back meetings of the Paleoanthropology Society and the American Association of Physical Anthropologists.

The long-legged, relatively big-brained hominid called *Homo erectus* has long been considered the Moses of the human family—the species that led the first exodus out of Africa more than 1.5 million years ago. But that view was challenged recently when a team working in Dmanisi, Georgia, uncovered three small, 1.75-million-year-old skulls that are older and more primitive than any *H. erectus* in Africa. They raised the startling possibility that an earlier, small-brained species left Africa first (*Science*, 5 July 2002, pp. 26 and 85).





Ear to the ground. Frederick Kyalo Manthi spotted the ear bone of an ancient human skull in Kenya.

CREDITS: (LEFT TO RIGHT) LOUISE LEAKEY; NATIONAL MUSEUMS OF KENYA

Now another surprisingly small skull has been unearthed—this time in Kenya. Introduced at the meeting, the diminutive fossil bears a surprising resemblance to the smallest skull from Dmanisi, according to paleontologist Meave Leakey, whose team from the National Museums of Kenya dug up the fossil in 2000. The researchers identify the unpublished skull as the smallest *H. erectus* known from Africa, implying that some members of this peripatetic species had a puny brain case.

"It shows the incredible variation in size within *H. erectus*," says paleontologist Fred Spoor of University College London, U.K., a member of Leakey's team. He adds that the resemblance between the Kenyan and Georgian skulls, separated by 3000 kilometers and at least 200,000 years, ties the Georgian fossil more closely to *H. erectus* in Africa.

In a spontaneous viewing in the hotel lobby, the Kenyan and Georgian teams compared casts as a gang of *H. erectus* specialists crowded around to kibitz on the fossils' sizes, shapes, and identities. "This really feels like the skull we found," said Leakey, cradling the cast brought from Dmanisi by David Lordkipanidze of the Georgian State Museum in Tbilisi. She and other researchers turned the skulls over, comparing the angle of the ear bones and the curvature of the sides and back. Most—although not all—of those assembled agreed: The casts were two of a kind.

Back in 2000, when Kenyan paleontologist Frederick Kyalo Manthi spotted an ear bone poking out of the ground in the scrublands at Ileret, east of Lake Turkana, the Kenyan skull was difficult to classify. The skull is 1.55 million years old, reports paleontologist Louise Leakey, who works with her mother Meave at the National Museums of Kenya. That's the same age as another famous *H. erectus* fossil from the opposite side of the lake—the strapping Turkana boy (sometimes classified as *Homo ergaster)*.

The new skull is much smaller, however, and lacks the prominent brow ridge found in the Turkana boy and other *H. erectus* specimens. It is so small that before it was cleaned, Meave Leakey and Spoor thought it might be a late member of *Homo habilis*, a problematic species composed of a grab bag of African fossils from 2.4 million to 1.6 million years old.

When Lordkipanidze unveiled his smallest skull from Dmanisi last year, Spoor realized that the crania were quite similar. And as he noted in his talk, both have classic *H. erectus* features, including a raised keel on the top and a characteristically angled ear bone. Spoor also noted that both have an oblong shape in side view, a teardrop shape in top view, and no prominent brows. The skulls' small size might be because both were from young adults or teenagers, or from females, says Susan Antón of Rutgers University in New Brunswick, New Jersey.

Despite such similarities, the Dmanisi skulls are not classified as *H. erectus* at the moment. They are more primitive than the Kenyan hominid, with a profile resembling *H. habilis,* says Lordkipanidze. So last year he and his colleagues baptized one of their fossils, a robust jawbone, as a new species, *Homo georgicus*—a proposal rejected for the skulls by most who saw the casts. "I'd argue that this is *H. erectus* and that it was descended from *H. habilis*," says *H. erectus* expert Philip Rightmire of the State University of New York, Binghamton.

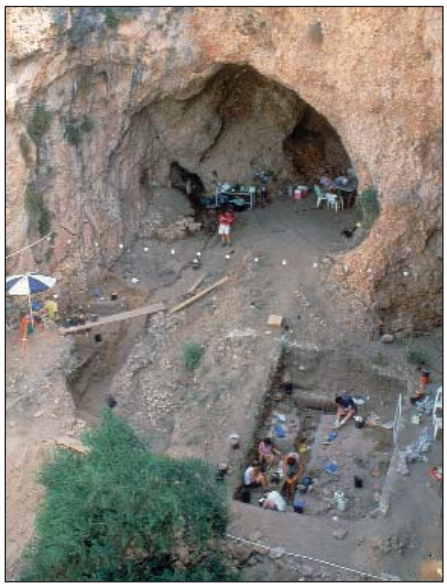
Lordkipanidze announced at the meeting that his team has recently found bones from the neck down plus a fourth, more robust skull, which may help to clarify the fossils' identities. "At the moment I prefer to call [the small skull] early *Homo*," he says. "For me, this is the best candidate to be an ancestor of *H. erectus* [in Asia]."

Meanwhile, the Ileret skull offered one more surprise: the pronounced keel on its top. This feature is commonly found in *H. erectus* in Asia but not in Africa, says Spoor. So the Kenyan skull could be an important link to both Georgian and Asian fossils and may help return *H. erectus* to its venerable status as the first intercontinental traveler.

A Miss for Moderns And Neandertals

Ever since paleoanthropologists discovered that Neandertals and early modern humans had lived in caves as close as 100 meters apart in Israel, the obvious question has been: Did these two types of humans live there at the same time? The answer is no, judging from a new study of the ancient climate and landscape at three caves where fossils of early humans and their prey were found.

In a talk at the Paleoanthropology Society meeting, a team of American and Canadian researchers concluded that early modern humans and Neandertals lived in the caves under different climatic conditions. By analyzing isotopes in the teeth of goats and gazelles eaten by ancient humans, researchers were



Ice age shelter. Neandertals lived in this cave in Amud, Israel, when the climate was cool and wet.

able to trace the plants the animals ate. They reconstructed climate so precisely that they could detect even seasonal differences in the climate experienced by Neandertals and early modern humans, say graduate student Kris Hallin of the University of Wisconsin, Madison, and her adviser Margaret Schoeninger of the University of California, San Diego.

"This is great work," says Stanley Ambrose of the University of Illinois, Urbana-Champaign. "It shows something very important about variation in climate at the annual scale." It also suggests how the two species adapted to different habitats and why they thrived at different times in Israel.

The first fossils of early modern humans and Neandertals were found in the region in the early 1930s, but for many years anthropologists thought Neandertals were ancestral to modern humans and so assumed that their fossils were older. Then in the 1980s, modern radiometric dating methods revealed that modern humans had occupied the caves of Qafzeh and Skhul as early as 110,000 to 92,000 years ago. The Neandertals inhabited the caves of Amud and Kebara considerably later, from about 70,000 to 50,000 years ago.

Harvard paleoanthropologist Ofer Bar-Yosef, noting that a 1980s study found that modern humans coexisted with African mammals and Neandertals with European ones, proposed that modern humans moved north into the region during the interglacial period 128,000 to 71,000 years ago. Then the cold-adapted Neandertals moved south to the same places during the last ice age, 70,000 years to 45,000 years ago. But uncertainties about the dating raised the possibility that the two types of humans could have met, since all the caves are within 100 kilometers of each other and often closer.

To explore whether the Neandertals and moderns took shelter in the caves under different climatic conditions, Hallin analyzed isotopes in fossil animal teeth. During the year or two that a tooth develops and erupts, it accumulates isotopes of carbon and oxygen. The ratio of carbon-13 to carbon-12 reflects whether an animal ate grasses in dry, open landscapes or plants in a more forested landscape. The variation of oxygen-18 to oxygen-16 reveals the season in which an animal consumed water, thus reflecting seasonal rainfall.

Hallin applied the method to the fossil teeth of goats and gazelles found in the hearths and garbage of the ancient humans. She found that those eaten by the modern humans at Qafzeh and Skhul grazed in dry grasslands and consumed little water except during winter rains—a climate similar to that of Israel today. Conversely, the animals eaten by Neandertals at Amud lived in a cooler climate in which it rained year-round. (The Neandertals ate more gazelles; the moderns, more goats.) "There was a major change in climate in Israel between the time that it was occupied by modern humans and the time when Neandertals were present," says co-author and geochemist Henry Schwarcz of McMaster University in Hamilton, Ontario.

To Bar-Yosef, the isotope work chiefly confirms the evidence from animal fossils. But Hallin's precise climatic reconstructions use animals that were apparently served up as ancient meals rather than simply found in the same layer as the humans. Thus the work adds new evidence to the idea that this region was an important crossroads, with moderns and Neandertals moving in and out as climatic conditions changed. And it shores up the case against coexistence, adds Tel Aviv University paleoanthropologist Yoel Rak. Neandertals and our ancestors, he says, "were not sitting in the caves playing cards together."

First Modern Remains in Europe

Three Romanian spelunkers were exploring the Transylvanian Alps last year when they came across a jawbone lying in the middle of a newfound cave. They took one look at the robust bone and knew it was very old, so they quickly contacted Romanian Academy scientist Oana Moldovan, who in turn called paleoanthropologist Erik Trinkaus of Washington University in St. Louis, Missouri. Trinkaus examined the bone last May and sawed off a sliver for radiocarbon dating. At the meetings he announced his results: The jaw is at least 35,000 years old—which makes it "the first modern human found in Europe."

Modern humans are thought to have swept into Europe about 40,000 to 35,000 years ago, swamping or replacing the Neandertals who had evolved there during the previous 400,000 years (*Science*, 7 March, p. 1525). Archaeologists have detected the moderns' entrance not by fossils but by the art and tools left behind, including blades, beads, and bone tools more sophisticated than those used by Neandertals. But although modern tools begin to appear in eastern Europe 40,000 years ago, only poorly dated scraps of modern human bones older than 32,000 years have been found.

"The jawbone is the earliest well-dated and identifiably modern human fossil in Europe so far, and that is important," says paleoanthropologist Chris Stringer of the British Museum of Natural History in London. The date, which is a minimum age, is unusually reliable because it was done on the human bone itself rather than associated animals, notes Robert Franciscus of the University of Iowa in Iowa City. A second lab is now confirming the results, says Trinkaus.



Chin up. This jawbone is the oldest in Europe with a modern chin.

Trinkaus reported at the meeting that the lower jaw has distinctly modern features such as a chin and a wide piece of bone in the back. But it also has some archaic traits, such as "huge" wisdom teeth, which he thinks link it with earlier archaic humans. Thus, although their tools may have been sophisticated, modern humans were still evolving anatomically as late as 35,000 years ago. Or, as Trinkaus says: "Early modern humans were not particularly modern."

–ANN GIBBONS

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