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PALEOANTHROPOLOGY

Were 'Little People' the First to Venture Out of Africa?

Not long ago, most paleoanthropologists thought that intercontinental travel was reserved for hominids who were big of brain and long of limb. Until very recently, the fossil evidence suggested that early humans did not journey out of Africa until they could walk long distances and were smart enough to invent sophisticated tools. Then, 2 years ago, a team working at Dmanisi, Georgia, shook up those ideas. It reported finding two small skulls dated to a surprisingly ancient 1.75 million years ago and associated with only primitive stone tools (*Science*, 12 May 2000, p. 948).

Now, on page 85 of this issue, the Dmanisi team reports another major discovery: an equally ancient skull that is the smallest and most primitive ever found outside Africa. The fossils, researchers say, appear to bury the notion that big brains spurred our first exodus from Africa, and they raise questions about the identity of the first long-distance traveler. "This is a really cool find," says Ian Tattersall of the American Museum of Natural History in New York City. And Daniel Lieberman of Harvard University predicts that the skull will throw "a monkey wrench into many people's ideas about early *Homo* migration out of Africa."

Taken together, the three Dmanisi skulls suggest that our ancestors left Africa earlier, and at an earlier stage of evolution, than had long been assumed. But where exactly do the Dmanisi remains fit on the hominid family tree—and do they represent one or more species? Those questions are sparking much debate, and they might have important implications for our understanding of how humans expanded out of Africa in the first place.

The team—composed of David Lordkipanidze at the Georgian State Museum in Tbilisi, Georgia, Philip Rightmire of the State University of New York, Binghamton, and other co-workers from Europe and the United States—unearthed a beautifully preserved cranium last August about 20 meters from the site of the original discovery. The cranium, which is much more complete than the previous two were and was found with an associated lower jaw, was in the same stratigraphic level and so is about the same age as the previous finds, says Lordkipanidze.

Overall, the new skull roughly resembles the other two, says Rightmire. "If you line them up together on a table, it would be hard to put them into two groups," he says. Thus, the team classifies the new skull, like the other two, as *Homo erectus*, a long-legged, big-brained species considered to be the first to leave Africa; the African members of this species (sometimes called *H. ergaster*) are thought to be ancestral to our own lineage. If the new fossils do represent *H. erectus*, they are the smallest, most primitive specimens seen yet, and they provide some badly needed clues to the evolution of that species.





Hominid haven. Lordkipanidze (center) helps excavate a third skull (shown here on left), the smallest and most primitive yet, from Dmanisi.

In fact, some features of the diminutive new skull also resemble *H. habilis*, an African hominid that some believe was ancestral to *H. erectus*. Indeed, says Rightmire, if the researchers had found these bones first, they might have called the fossils *H. habilis*.

For example, the skull has thin but well-developed brow ridges that slope gently upward above the eye sockets. Moreover, with a cranial capacity of about 600 cubic centimeters (cc)—compared to about 780 cc and 650 cc for the other two Dmanisi skulls—the new skull is "near the mean" for *H. habilis* and "substantially smaller" than expected for *H. erectus*, the authors report. (Modern human braincases are about 1400 cc.) "The Dmanisi fossils are really the first group that is intermediary between *H. habilis* and *H. erectus*," says Lordkipanidze.

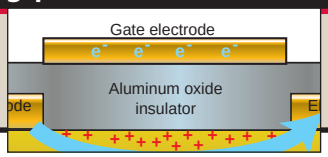
Thus, the team suggests that the Dmanisi hominids might be descended from *H. habilis*–like ancestors that had already left Africa. If so, then soon after our genus arose from presumed australopithecine ancestors—before its members had reached the brain size and stature of *H. erectus*—it was already pushing into new continents. Such a primitive traveler also raises the heretical possibility that *H. erectus* itself evolved outside Africa, long considered the cradle of human evolution, notes Tim White of the University of California, Berkeley.

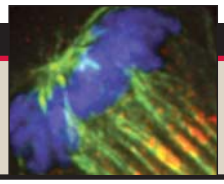
Another possibility raised by some researchers is that more than one hominid species was on the move. Thus, Jeffrey Schwartz of the University of Pittsburgh contends that the three Dmanisi skulls might actually represent two or even three different species. And Tattersall won't classify the new finds as either *H. erectus* or *H. habilis*. "This specimen underlines the need for a thoroughgoing reappraisal of the diversity of early … *Homo*," he says.

Yet, other scientists think that the differences among the skulls simply show how much intraspecies variation there was at this stage of human evolution. "The authors wisely refrain from identifying multiple taxa," says Eric Delson of the City University of New York. Alan Walker of Pennsylvania State University, University Park, notes that brain size varies within living humans by about 15%, so variable brains are also to be expected in *H. erectus*. And Milford Wolpoff of the University of Michigan, Ann Arbor, declares there is "not a chance" that more than one species is represented at Dmanisi. Instead, he suggests that the new skull, which appears to

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be that of an adolescent, might resemble *H. habilis* simply because it was still growing.

Understanding which species were present at Dmanisi—and their biology—might eventually be key to figuring out how they left Africa in the first place, researchers say. For example, although skeletal remains from African *H. erectus* indicate that this long-legged species was a sturdy walker, the so-far-scanty evidence from *H. habilis* specimens in Africa suggests that it was relatively short legged.

"If the new skull is associated with bones indicating *H. habilis*–like body proportions, we're really going to have to rethink ideas about how the oldest humans spread beyond Africa," says Richard Potts of the Smithsonian Institution in Washington, D.C. "Either this new thing was simply spreading as African habitats spread north into the Caucasus, or a *H. habilis*–like species was present in Eurasia early."

Some of the questions swirling around the new skull might be answered if the site yields leg bones or other skeletal parts. Word is already leaking out from Dmanisi that a few such fossils were found last year. One thing is already clear, says Rightmire: "It wasn't a full-blown *Homo erectus* and a big brain … that enabled people to push out of Africa. The first pushing was done by little people."

–MICHAEL BALTER AND ANN GIBBONS

CANCER RISKS

Acrylamide in Food: Uncharted Territory

More questions than answers emerged from a high-profile group of food experts who met in Geneva last week to consider what should be done about acrylamide. This compound, identified long ago as a potential industrial hazard, has now been found in many cooked foods. The World Health Organization (WHO) responded by sponsoring a safety data review. At the end of a 3-day closed meeting, the WHO experts issued an urgent call for more research, but the most striking aspect of their 12-page summary report, released 28 June, might be how little new information it gives on health risks.

Acrylamide has been used since the 1950s to make paper and dyes and to purify drinking water. Its only known adverse effect in humans—most of whom were exposed in the workplace—is neurological damage. But because it can induce cancer and heritable mutations in lab animals, acrylamide is classed as "probably carcinogenic to humans" by the International Agency for Research on Cancer (IARC) in Lyon, France. Considering the available evidence, "we have to think about the possibility that this could be a human carcinogen," said Swiss health official Dieter Arnold, who chaired the meeting, at a press conference in Geneva.

The news that acrylamide is pervasive came as a shock. In April, Swedish researchers announced that the compound was present at high levels in starch-based foods cooked at high temperatures, such as potato chips and certain breads. Initially dismissed as a food scare, the issue took on new urgency when British, Norwegian, and Swiss scientists obtained similar findings in cereals, French fries, and cookies. To find carcinogens in food is not new, says Arnold. But it is new to find such high levels of a cancer-causing substance—and in staples. The expert group also considered risks for children, who may "take in more acrylamide per kilogram of body weight," says Peter Farmer, a toxicologist at the University of Leicester, U.K.



Risk unknown. High-temperature cooking can produce acrylamide in starchy foods.

Acrylamide binds to nerve cell proteins, interfering with transport of essential materials, says Peter Spencer, a neurotoxicologist at the Oregon Health and Science University in Portland. In rats, he says, protein binding might also be responsible for injury to testes, whereas heritable mutations and tumors are likely related to DNA damage through another mechanism. But extrapolating from animal studies is difficult, and there is no solid evidence of acrylamide-related cancer in humans. The question is whether the levels of acrylamide found in foods pose a serious risk over time.

Although scientists "understand how to measure acrylamide in foodstuffs now," says Laurence Castle of the Central Science Laboratory in York, U.K., they have not set rigorous analytical methods. And almost nothing is known about how acrylamide is formed through cooking, except that it develops at temperatures above 120°C, and amounts increase with cooking time.

Nor is food the only source: Tobacco smoke and environmental exposure are two others. Acrylamide could even be generated naturally in the body. Although minute amounts of acrylamide are present in drinking water, "it is most unlikely that anyone would consume dangerous amounts of acrylamide by drinking tap water," according to Jerry Rice of IARC. Estimating exposure is also tricky, because diets vary among people and across cultures.

For now, no one is calling for a change in dietary habits. The WHO expert committee has recommended cooking food thoroughly but not excessively, eating a balanced and varied diet, investigating ways of reducing acrylamide levels, and setting up an international network to share information. The U.S. Food and Drug Administration (FDA) has developed a methodology and begun testing a limited set of foods, according to an FDA official. McDonald's Corp., meanwhile, has issued a statement claiming that its French fries have been unfairly targeted.

Acrylamide in food has probably been around since fire, says Farmer: "I think it's an achievement of toxicological science to have discovered it now." But the precautionary principle dictates that once you have established the presence of a known carcinogen, you are bound to investigate it. "What we know today may change tomorrow," says Rice.

–GISELLE WEISS

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HOMELAND SECURITY

Scientists Pan Plans For New U.S. Agency

The U.S. science community has begun putting proposals to create the new Department of Homeland Security (DHS) under the microscope. In a string of hearings last week, research leaders told Congress there were serious flaws with the plans for the department's science and technology programs.

On 6 June, President George W. Bush

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