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EVOLUTION

Stranger in a New Land

Stunning finds in the Republic of Georgia upend long-standing ideas about the first hominids to journey out of Africa

By Kate Wong on June 1, 2006

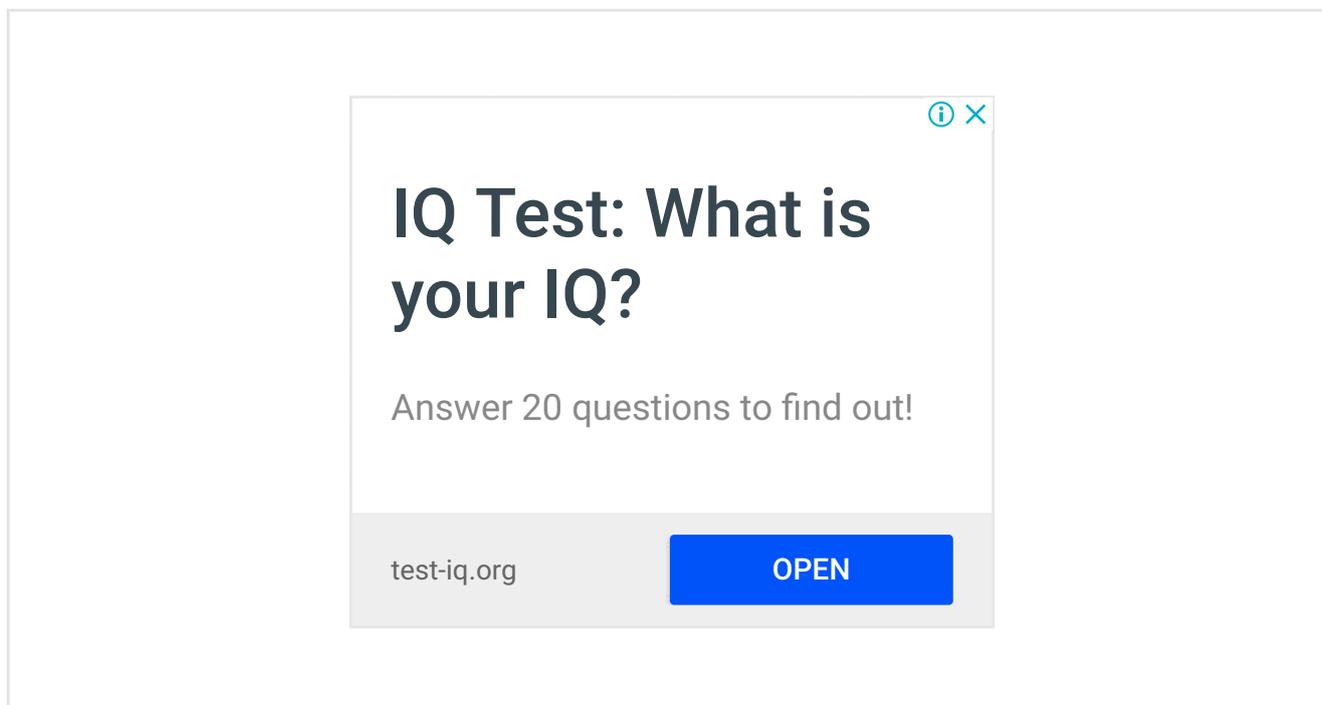


We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.

--T. S. Eliot, Four Quartets: Little Gidding

In an age of spacecraft and deep-sea submersibles, we take it for granted that humans are intrepid explorers. Yet from an evolutionary perspective, the propensity to colonize is one of the distinguishing characteristics of our kind: no other primate has ever ranged so far and wide. Humans have not always been such cosmopolitan creatures, however. For most of the seven million years or so over which hominids have been evolving, they remained within the confines of their birthplace, Africa. But at some point, our ancestors began pushing out of the motherland, marking the start of a new chapter in our family history.

It was, until recently, a chapter the fossil record had kept rather hidden from view. Based on the available evidence--a handful of human fossils from sites in China and Java--most paleoanthropologists concluded that the first intercontinental traveling was undertaken by an early member of our genus known as *Homo erectus* starting little more than a million years ago. Long of limb and large of brain, *H. erectus* had just the sort of stride and smarts befitting a trailblazer. Earlier hominids, *H. habilis* and the australopithecines among them, were mostly small-bodied, small-brained creatures, not much bigger than a modern chimpanzee. The *H. erectus* build, in contrast, presaged modern human body proportions.

An advertisement for an IQ test. It features a white box with a blue 'i' icon and a close 'x' icon in the top right corner. The main text reads 'IQ Test: What is your IQ?' in a large, bold, dark blue font. Below this, it says 'Answer 20 questions to find out!' in a smaller, grey font. At the bottom left of the box, the URL 'test-iq.org' is displayed in grey. At the bottom right, there is a prominent blue button with the word 'OPEN' in white capital letters.

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Curiously, though, the first representatives of *H. erectus* in Africa, a group sometimes referred to as *H. ergaster*, had emerged as early as 1.9 million years ago. Why the lengthy departure delay? In explanation, researchers proposed that it was not until the advent of hand axes and other symmetrically shaped, standardized stone tools (a sophisticated technological culture known as the Acheulean) that *H. erectus* could penetrate the northern latitudes. Exactly what, if anything, these implements could accomplish that the simple Oldowan flakes, choppers and scrapers that preceded them could not is unknown, although perhaps they conferred a better means of butchering. In any event, the oldest accepted traces of humans outside Africa were Acheulean stone tools from a site called Ubeidiya in Israel.

Brawny, brainy, armed with cutting-edge technology--this was the hominid hero Hollywood would have cast in the role, a picture-perfect pioneer. Too perfect, it turns out. Over the past few years, researchers working at a site called Dmanisi in the Republic of Georgia have unearthed a trove of spectacularly well preserved human fossils, stone tools and animal remains dated to around 1.75 million years ago--nearly

half a million years older than the Ubeidiya remains. It is by paleoanthropological standards an embarrassment of riches. No other early *Homo* site in the world has yielded such a bounty of bones, presenting scientists with an unprecedented opportunity to peer into the life and times of our hominid forebears. The discoveries have already proved revolutionary: the Georgian hominids are far more primitive in both anatomy and technology than expected, leaving experts wondering not only why early humans first ventured out of Africa but how.

A Dubious Debut

AS THE CROW FLIES, the sleepy modern-day village of Dmanisi lies some 85 kilometers southwest of the Georgian capital of Tbilisi and 20 kilometers north of the countrys border with Armenia, nestled in the lower Caucasus Mountains. During the Middle Ages, Dmanisi was one of the most prominent cities of the day and an important stop along the old Silk Road. The region has thus long intrigued archaeologists, who have been excavating the crumbling ruins of a medieval citadel there since the 1930s. The first hint that the site might also have a deeper significance came in 1983, when paleontologist Abesalom Vekua of the Georgian Academy of Sciences discovered in one of the grain storage pits the remains of a long-extinct rhinoceros. The holes dug by the citadels inhabitants had apparently opened a window on prehistory.

The next year, during paleontological excavations, primitive stone tools came to light, bringing with them the tantalizing possibility that fossilized human remains might eventually follow. Finally, in 1991, on the last day of the field season, the crew found what they were looking for: a hominid bone, discovered underneath the skeleton of a saber-toothed cat.



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Based on the estimated ages of the associated animal remains, the researchers judged the human fossil--a mandible, or lower jaw, that they attributed to *H. erectus*--to be around 1.6 million years old, which would have made it the oldest known hominid outside of Africa. But when David Lordkipanidze of the Georgian State Museum and the late Leo Gabunia showed the specimen to some of the biggest names in paleoanthropology at a meeting in Germany later that year, their claims were met with skepticism. Humans were not supposed to have made it out of Africa until a million years ago, and the beautifully preserved mandible--every tooth in place--looked too pristine to be as old as the Georgians said it was. Many scientists concluded that the fossil was not *H. erectus* but a later species. Thus, rather than receiving the imprimatur of paleoanthropology's elite, the jaw from Dmanisi came away with question marks.

Undaunted, team members continued work at the site, refining their understanding of its geology and searching for more hominid remains. Their perseverance eventually paid off: in 1999 workers found two skulls just a few feet away from where the mandible had turned up eight years prior. A paper describing the fossils appeared in *Science* the

following spring. That year the fanfare began, recalls Lordkipanidze, who now directs the excavation. The finds established a close relationship between the Dmanisi hominids and African *H. erectus*. Unlike the earliest humans on record from eastern Asia and western Europe, which exhibited regionally distinctive traits, the Dmanisi skulls bore explicit resemblances--in the form of the browridge, for example--to the early African material.

By this time, geologists had nailed down the age of the fossils, which come from deposits that sit directly atop a thick layer of volcanic rock radiometrically dated to 1.85 million years ago. The fresh, unweathered contours of the basalt indicate that little time passed before the fossil-bearing sediments blanketed it, explains C. Reid Ferring of the University of North Texas. And paleomagnetic analyses of the sediments signal that they were laid down close to 1.77 million years ago, when the earth's magnetic polarity reversed, the so-called Matuyama boundary. Furthermore, remains of animals of known antiquity accompany the hominid fossils--a rodent called *Mimomys*, for instance, which lived only between 1.6 and 2.0 million years ago--and a second, 1.76-million-year-old layer of basalt at a nearby site caps the same stratigraphy.



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Together the new fossils and dating results clinched the case for Dmanisi being the oldest unequivocal hominid site outside of Africa, pushing the colonization of Eurasia back hundreds of thousands of years. They also toppled the theory that humans could not leave Africa until they had invented Acheulean technology. The Dmanisi tool kit contained only Oldowan-grade implements fashioned from local raw materials.

Pint-Size Pioneer



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THE GREAT AGE of the Georgian hominids and the simplicity of their tools came as a shock to many paleoanthropologists. But Dmanisi had even more surprises in store. In July 2002 Lordkipanidzes team announced that it had recovered a third, virtually complete skull--including an associated mandible--that was one of the most primitive *Homo* specimens on record. Whereas the first two skulls had housed 770 cubic centimeters and 650 cubic centimeters of gray matter, the third had a cranial capacity of just 600 cubic centimeters--less than half the size of a modern brain and considerably smaller than expected for *H. erectus*. Neither was the form of the third skull entirely *erectus*-like. Rather the delicacy of the brow, the projection of the face and the curvature of the rear of the skull evoke *H. habilis*, the presumed forebear of *H. erectus*.

The discovery of the third skull has led to the startling revelation that contrary to the notion that big brains were part and parcel of the first transcontinental migration, some of these early wayfarers were hardly more cerebral than primitive *H. habilis*. Likewise, the Georgian hominids do not appear to have been much larger-bodied than *H. habilis*. Ribs, clavicles, vertebrae, as well as arm, leg, hand and foot bones--have also turned up, although most have yet to be formally described. But based on the femur, the Dmanisi

people appear to have been only around four and a half feet tall.

This is the first time we have an intermediate between *erectus* and *habilis*, Lordkipanidze observes. Although the fossils have been provisionally categorized by the team as *H. erectus* based on the presence of certain defining characteristics, he thinks the population represented by the Dmanisi hominids may have been more specifically the rootstock of the species, a missing link between *erectus* and *habilis*.

Other scholars have proposed a more elaborate taxonomic scheme. Noting the anatomical variation evident in the skulls and mandibles recovered so far (including a behemoth jaw unearthed in 2000), Jeffrey Schwartz of the University of Pittsburgh suggested that the Dmanisi fossils might represent two or more early human species. If that's the case, I'll eat one of them, retorts Milford H. Wolpoff of the University of Michigan at Ann Arbor. A more likely explanation, he offers, is that the rogue mandible comes from a male and the rest of the bones belong to females.

For his part, Lordkipanidze acknowledges that the massive mandible is a bit of a headache, but given that the fossils all come from the same stratigraphic layer, he reasons, they are probably members of the same population of *H. erectus*. Indeed, one of the most important things about Dmanisi, he says, is that it gives us an opportunity to think about what variation is. Perhaps some researchers have underestimated how variable *H. erectus* was--a notion that recent discoveries from a site called Bouri in Ethiopia's Middle Awash region and another locality known as Ileret in Kenya support. Lordkipanidze suspects that as the Georgian picture becomes clearer, the sex and species of more than a few African fossils will need reassessing, as will the question of who the founding members of our lineage were. Maybe *habilis* is not *Homo*, he muses. In fact, a number of experts wonder whether this hominid may have been a species of *Australopithecus* rather than a member of our own genus.



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It is not cladistically compelling to place *habilis* in *Homo*, comments Bernard Wood of George Washington University. Considering its brain and body proportions, characteristics of its jaws and teeth, and features related to locomotion, *habilis* is more australopithlike than it has been made out to be. If so, the emergence of *H. erectus* may well have marked the birth of our genus. What is unclear thus far, Wood says, is whether the Dmanisi hominids fall on the *Homo* side of the divide or the *Australopithecus* one.

Taxonomic particulars aside, the apparently small stature of the Dmanisi people could pose further difficulty for paleoanthropologists. Another popular theory of why humans left Africa, put forth in the 1980s by Alan Walker and Pat Shipman of Pennsylvania State University and elaborated on more recently by William R. Leonard of Northwestern University and his colleagues, proposes that *H. erectus*'s large body size necessitated a higher-quality diet--one that included meat--than that of its smaller predecessors to meet its increased energy needs. Adopting such a regimen would have forced this species to broaden its horizon to find sufficient food--an expansion that

might have led it into Eurasia. The discovery of individuals considerably smaller than classic *H. erectus* outside of Africa could force experts to rethink that scenario.

Perhaps it was language that enabled hominids to finally break free from the confines of Africa. Received wisdom holds that *H. erectus* lacked the ability to speak because it possessed a spinal cord that was too small to control with sufficient precision the muscles involved in speech production. This conclusion is based on what were long the only known *H. erectus* vertebrae, from the spectacular Kenyan fossil known as the Turkana Boy. But analysis of the Dmanisi vertebrae and the Turkana ones, conducted by Marc Meyer of the University of Pennsylvania, has shown that the Dmanisi people had modern spinal cords--and thus no neural constraint on language. The Turkana Boy, it turns out, had a disease that constricted his spinal cord and is therefore not representative of the normal *H. erectus* condition. Although the new work does not establish that the Dmanisi people had the gift of gab, it raises the possibility that they could have.

Georgia on Their Minds

HOWEVER EARLY HOMINIDS got out of Africa, it is not hard to see why they settled down in southern Georgia. For one, the presence of the Black Sea to the west and the Caspian Sea to the east would have ensured a relatively mild, perhaps even Mediterranean-like, climate. For another, the region appears to have been incredibly diverse ecologically: remains of woodland creatures, such as deer, and grassland animals, such as horses, have all turned up at the site, suggesting a mosaic of forest and savanna habitats. Thus, in practical terms, if the going got tough in one spot, the hominids would not have had to move far to get to a better situation. The heterogeneity of the environment may have promoted occupation, Ferring says. The Dmanisi site in particular, located on a promontory formed by the confluence of two rivers, may have attracted hominids with its proximity to water, which would have not only quenched their thirst but lured potential prey as well.



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Biologically this was a happening place, remarks Martha Tappen of the University of Minnesota. Of the thousands of mammal fossils that workers have unearthed along with the hominid remains, many come from large carnivores such as saber-toothed cats, panthers, bears, hyenas and wolves. Tappen, whose work centers on figuring out what led to the accumulation of bones at the site, suspects that the carnivores may have been using the water-lined promontory as a trap. The question, she says, is whether hominids were, too.

So far Tappen has identified a few cut marks on the animal bones, indicating that, at least on occasion, the Dmanisi settlers ate meat. But whether they scavenged animals brought down by the local carnivores or hunted the beasts themselves is not known. The matter warrants investigation. One of the few remaining hypotheses for what allowed humans to expand their range into northern lands holds that making the transition from the mostly vegetarian diet of the australopithecines to a hunter-gatherer subsistence strategy enabled them to survive the colder winter months, during which plant resources were scarce, if not altogether unavailable. Only further analyses of the

mammal bones at the site can elucidate how the Dmanisi humans acquired meat. But Tappen surmises that they were hunting. When you're a scavenger, the distribution of animals is so unpredictable, she remarks. I don't think it was their main strategy.

That does not mean that humans were the top carnivores, however. They could have been both the hunters and the hunted, Tappen observes. Telltale puncture wounds on one of the skulls and gnaw marks on the large mandible reveal that some of the hominids at Dmanisi ended up as cat food.

Outward Bound

THE GEORGIAN REMAINS prove that humans left Africa shortly after *H. erectus* evolved around 1.9 million years ago. But where they went after that is a mystery. The next oldest undisputed fossils in Asia are still just a bit more than a million years old (although controversial sites in Java date to 1.8 million years ago), and those in Europe are only around 800,000 years of age. Anatomically, the Dmanisi people make reasonable ancestors for later *H. erectus* from Asia, but they could instead have been a dead-end group, the leading edge of a wave that washed only partway across Eurasia. There were, scientists concur, multiple migrations out of Africa as well as movements back in. Dmanisi is just one moment, Lordkipanidze says. We need to figure out what happened before and after.

Echoing what has become a common refrain in paleoanthropology, the Dmanisi discoveries in some ways raise more questions than they answer. It's nice that everything's been shaken up, team member G. Philip Rightmire of Binghamton University reflects, but frustrating that some of the ideas that seemed so promising eight to 10 years ago don't hold up anymore. A shift toward meat eating might yet explain how humans managed to survive outside of Africa, but what prompted them to push into new territories remains unknown. Perhaps they were following herd animals north. Or maybe it was as simple and familiar as a need to know what lay beyond that

hill, or river, or tall savanna grass--a case of prehistoric wanderlust.

The good news is that scientists have only begun plumbing Dmanisis depths. The fossils recovered thus far come from just a fraction of the sites estimated extent, and new material is emerging from the ground faster than the researchers can formally describe it. Team members reported last year that a fourth skull unearthed in 2002 turned out to come from an elderly male who had lost all his teeth, indicating that he would have to have been cared for by other members of the group--possibly the oldest known evidence of compassion for the infirm. And just last summer a fifth skull was found. It is still undergoing analysis.

Topping the fossil hunters wish list are pelvises, which will help reveal how these early colonizers efficiently covered long distances. There is every reason to expect they will find them. Theyve got the potential to have truckloads of fossils, Wolpoff says enthusiastically. There is work for generations here, Lordkipanidze agrees, noting that he can envision his grandchildren working at the site decades from now. Who knows what new frontiers humans will have explored by then?

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ABOUT THE AUTHOR(S)

Kate Wong 



Kate Wong is a senior editor for evolution and ecology at *Scientific American*.

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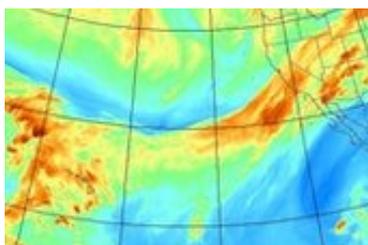
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