

Stranger in a New Land

By Kate Wong

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

*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.

PORTRAIT OF A PIONEER: With a brain half the size of a modern one and a brow reminiscent of *Homo habilis*, this hominid is one of the most primitive members of our genus on record. Paleoartist John Gurche reconstructed this 1.75-million-year-old explorer from a nearly complete teenage *H. erectus* skull and associated mandible found in Dmanisi in the Republic of Georgia. The background figures derive from two partial crania recovered at the site.

JOHN GURCHE



SKULL SURPRISES

FOSSIL TROIKA hints at a variable *H. erectus*. These specimens from Dmanisi exhibit characteristic *H. erectus* features, such as a heaping up of bone along the midline of the skull known as a sagittal keel and marked constriction of the skull behind the eyes. But they stop short of the classic morphology of that hominid in several ways—their small brain size, for example, which was about half that of a modern human (*right*). Specimen D2700 (*left*), from a teenager, is especially primitive, resembling *H. habilis* not only in size but in the thinness of its brow, the projection of its face and the rounded contour of the rear of the skull. Some researchers propose that these fossils might represent a new species of *Homo*. Others suggest that the remains belong to more than one species, pointing to the enormous lower jaw known as D2600 that was unearthed in 2000. Indeed, this mandible is far too large to fit comfortably with any of the crania yet discovered (only D2700 turned up with an associated mandible, D2735; the other fossils were isolated finds). For now, the Dmanisi team considers all the fossils as members of the same, mutable species, *H. erectus*.



Early *Homo* from Dmanisi

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.

Overview/*The First Colonizers*

- Conventional paleoanthropological wisdom holds that the first humans to leave Africa were tall, large-brained people equipped with sophisticated stone tools who began migrating northward around a million years ago.
- New fossil discoveries in the Republic of Georgia are forcing scholars to rethink that scenario in its entirety. The remains are nearly half a million years older than hominid remains

- previously recognized as the most ancient outside of Africa. They are also smaller and accompanied by more primitive implements than expected.
- These finds raise the question of what prompted our ancestors to leave their natal land. They are also providing scientists with a rare opportunity to study not just a single representative of early *Homo* but a population.

GOURAM TSIBAKHASHVILI (fossils); CHRISTIAN SIDOR, New York College of Osteopathic Medicine (modern skull)

D2282



D211



Modern *H. sapiens*

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 country's bor-

STONE TOOL TRICK

UNTIL RECENTLY, experts believed that humans could not leave Africa until they had developed an advanced technology known as the Acheulean, in which tools were symmetrically shaped and standardized (see *hand ax at right*). The tools found at

Dmanisi, however, are simple flakes and choppers (*left and center*) manufactured according to much the same primitive Oldowan tradition that hominids in Africa were practicing nearly a million years earlier.



der 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 citadel's 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.

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 and the late Leo Gabunia, also at the Georgian Academy of Sciences, showed the specimen to some of the biggest names in paleoanthropology at a meeting in Germany later that year, their claims 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 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 Earth's magnetic polarity reversed, the so-called Matuyama boundary. Furthermore, remains of animals of known antiquity accompany the hominid fossils—a rodent called *Miomys*, 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.

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

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. Last July, Lordkipanidze's 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*. Only isolated elements from below the neck have turned up thus far—namely, ribs, clavicles, vertebrae, as well as upper arm, hand and foot bones—and they have yet to be formally described. But it is already clear that “these people were small,” asserts team member G. Philip Rightmire of the University of Binghamton.

“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 re-assessing, as will the question of who the founding members of our lineage were. “Maybe *habilis* is not *Homo*,” he muses. In

Brawny, brainy, armed with cutting-edge technology—this was the hominid hero Hollywood would have cast.

fact, a number of experts wonder whether this hominid may have been a species of *Australopithecus* rather than a member of our own genus.

“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 exact proportions of these primitive Georgians are pending, but the discovery of individuals considerably smaller than classic *H. erectus* outside of Africa could force experts to rethink that scenario.

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

DIGGING DMANISI

DMANISI, REPUBLIC OF GEORGIA, JULY—From the Republic of Georgia’s capital, Tbilisi, the village of Dmanisi is just a two-hour drive, yet it seems a world apart from the bustle of the diesel- and dust-choked city. Here in the foothills of the Caucasus Mountains, donkey-drawn carts outnumber cars and the air is fragrant with hay. The locals farm the rich soil and raise sheep, pigs and goats; children spend summer afternoons racing down a stretch of paved road on homemade scooters. Even the roosters appear to lose track of time, crowing not only at daybreak but in the afternoon and evening as well.

The leisurely pace of modern life belies the region’s storied past, however. Centuries ago Dmanisi was a seat of great power, situated at a crossroads of Byzantine and Persian trading routes. Today the region is littered with reminders of that bygone era. Haystacklike mounds resolve into ancient Muslim tombs on closer inspection; medieval burials erode out of a hillside after heavy

rains; and looming above it all are the imposing ruins of a citadel built on a promontory that once overlooked the Silk Road.

That much about Dmanisi’s past has been known for decades. Only recently have scholars learned that long before the rise and fall of the city, this was the dominion of a primitive human ancestor, the first known to march out of Africa and begin colonizing the rest of the Old World some 1.75 million years ago—far earlier than previously thought. It is a realization that still gives David Lordkipanidze pause. Just a dozen years ago he helped to unearth the first hominid bone at Dmanisi. Four skulls, 2,000 stone tools and thousands of ancient animal fossils later, the 40-year-old is deputy director of the Georgian State Museum and head of an excavation many paleoanthropologists regard as the most spectacular in recent memory. “It is big luck to have these beautiful fossils,” he reflects. But it is also “a big responsibility.” Indeed, equal parts paleontologist and politician, Lordkipanidze



REMAINS OF THE DAY: Excavations of Dmanisi’s medieval city led to the discovery of the much older fossils. So far paleoanthropologists have

thoroughly probed only 100 square meters of the site, which is estimated to span 11,000 square meters.

GOURAM TSIBAKHASHVILI

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.

“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

seems to work around the clock, talking on his cell phone late into the night with colleagues and prospective sponsors.

Largely as a result of those efforts, what started as a 10-person team of Georgians and Germans has mushroomed into a 30-strong collaboration of scientists and students from around the world, a number of whom have gathered here for the annual field season. For eight weeks every summer, the Dmanisi field crew surveys, digs and analyzes new finds. It is a shoestring operation. Team members live in a no-frills house a couple miles from the site, typically sleeping four to a tiny room. Electricity is ephemeral at best, hot running water nonexistent.

Every morning at around 8:30, after a breakfast of bread and tea at the picnic tables on the porch, the groggy workers pile into a Russian army-issue lorry left over from the days of Soviet occupation and drive up to the site. In the main excavation area—the 20-meter-by-20-meter square that in 2001 yielded an extraordinarily complete skull and associated lower jaw—each person tends a square-meter plot, meticulously recording the three-dimensional position of each recognizable bone and artifact uncovered during removal of the sediments. These items are then labeled and bagged for later study. Even nondescript pebbles and sediments are saved for further scrutiny: rinsing and sieving them may expose shells, minuscule mammal bones and other important environmental clues.

On this particular day the fossil hunters are in especially good spirits. A rare bout of soggy weather left them housebound yesterday (waterlogged bones are too fragile to extract), and this morning’s skies threatened to do the same. But the mist draping the mountains has finally burned off, eliciting a chorus of Johnny Nash’s “I Can See Clearly Now,” sung over the taps and scrapes of trowels, hammers and spackle knives against the chalky sediments. They progress slowly. The excavators are now working in the dense upper layer, which does not yield its bones and stones easily. They must take care not to scratch the remains with their implements, lest the fresh marks be mistaken for ancient ones in later analyses. When noon arrives, the diggers break eagerly for lunch—tomatoes, cucumbers, bread, hard-boiled eggs and pungent, brine-soaked cheese (an acquired taste)—and a catnap on the grass before returning to their squares.

Meanwhile, in a makeshift lab back at camp, other crew members sort through remains brought back earlier by the excavators. Seated at metal-topped wooden tables and sharing an outmoded microscope, they identify the species to which each bone belongs and inspect it for telltale breaks, cut marks and tooth



SCRAPING AND BRUSHING away the chalky sediments, crew members expose stone tools and animal remains—the work of hungry hominids.

marks. Such data should eventually disclose how the bones accumulated. Preliminary findings from the main excavation suggest that denning saber-toothed cats may have collected them. In contrast, early data from another dig spot about 100 meters away, known as M6, hint that humans worked there—the abundance of smashed bone in this locale is more characteristic of hominid activity than carnivore activity. If so, M6 could provide critical insight into how the primitive Dmanisi hominids eked out an existence in this new land.

When the fossil hunters return with the day’s haul at around 4:00, camp is once again the center of activity. An early dinner leaves time for a shower, a game of chess or a trip down the road to visit the enterprising village woman who vends candy, soda, cigarettes and other luxury goods from a small whitewashed building affectionately dubbed the Mall, before a final hour of lab work and the evening tea.

For Lordkipanidze, the work has come full circle. Here at the site where he cut his teeth on paleoanthropology, he hopes to establish a preeminent field school to train aspiring young archaeologists and anthropologists. In the meantime he and his colleagues have plans to test promising spots elsewhere in the region for hominid fossils. Perhaps Georgia’s biggest surprises are yet to come.

—K.W.

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

Contrary to expectations, some of these early wayfarers were hardly more cerebral than primitive *Homo habilis*.

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.”

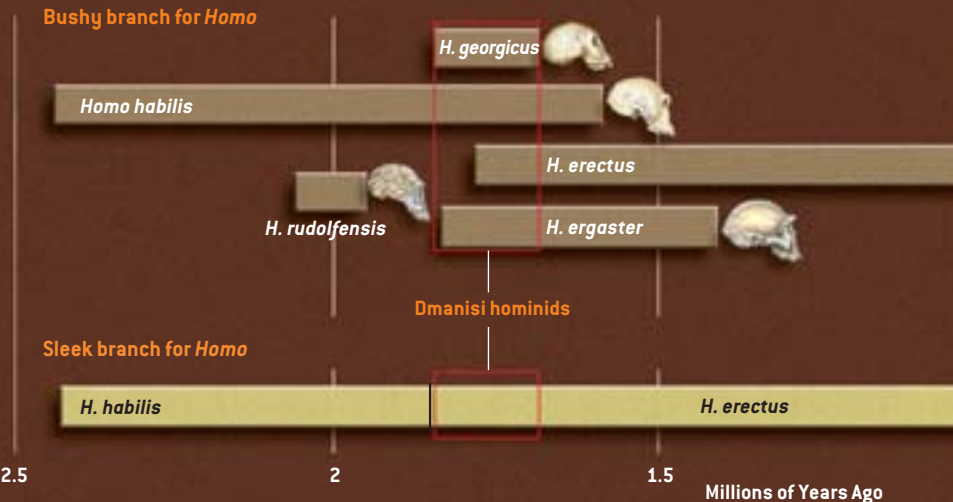
Echoing what has become a common refrain in paleoanthropology, the Dmanisi discoveries in some ways raise more questions than they answer. “It’s nice that everything’s been shaken up,” Rightmire reflects, “but frustrating that some of the ideas that seemed so promising eight to 10 years ago don’t hold 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 Dmanisi’s depths. The fossils recovered thus far come from just a fraction of the site’s estimated extent, and new material is emerging from the ground faster than the researchers can formally describe it—a fourth skull unearthed in 2002 is still undergoing preparation and analysis and a new jaw, tibia and ankle bone were unearthed this summer. Topping the fossil hunters’ wish list are femurs and pelvises, which will reveal how

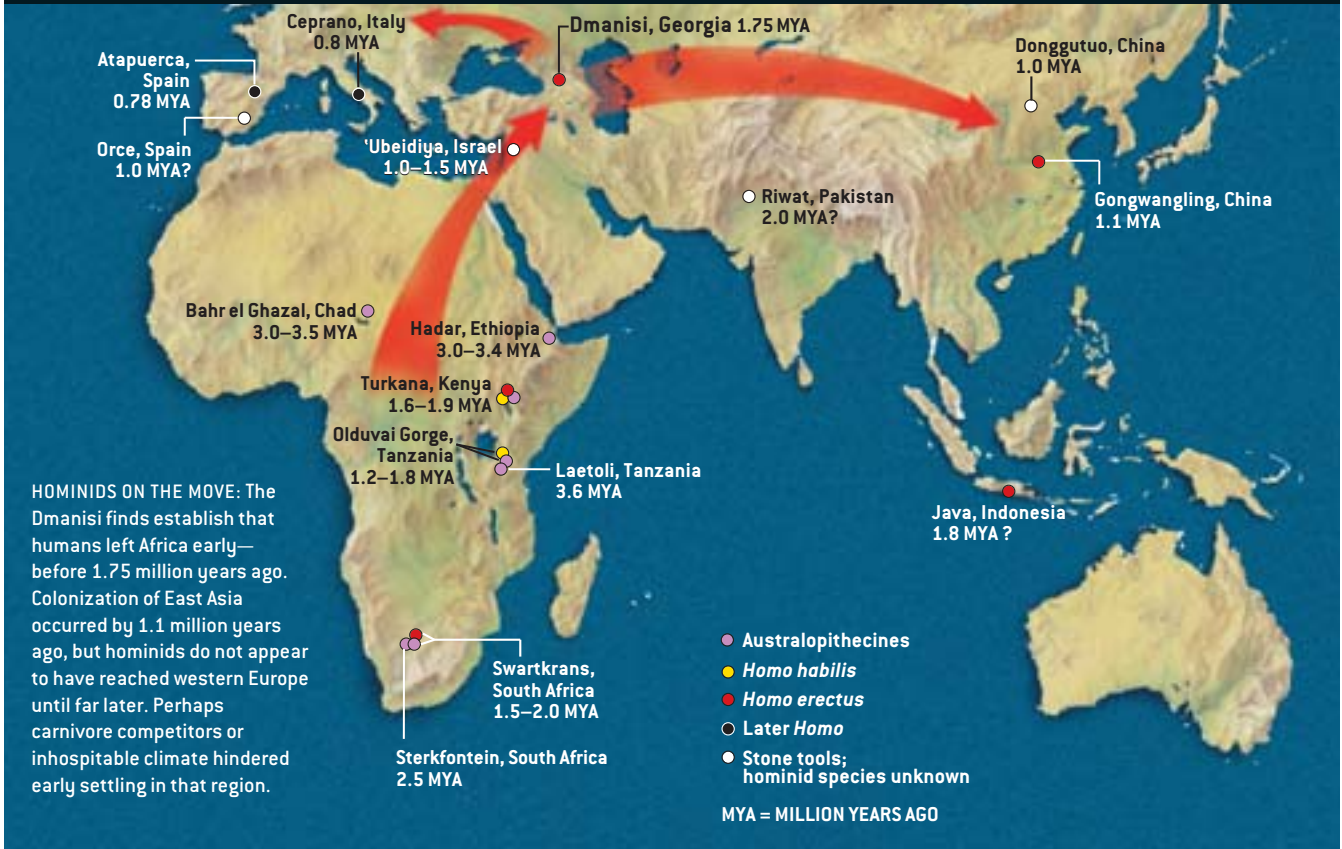
CORNELIA BLIK, PATRICIA J. WYNNE AND EDWARD BELL

TRIMMING THE FAMILY TREE

SPURIOUS SPECIES? Experts vigorously debate just how many species our genus, *Homo*, comprises. The bushiest representations of the *Homo* branch of the family tree contain up to eight species, a number of which were evolutionary dead ends (*top*). Other renditions appear as a streamlined succession of just a few forms (*bottom*). The fossils from Dmanisi—categorized variously as *H. habilis*, *H. erectus*, *H. ergaster* and a new species, *H. georgicus*—could be compatible with scenarios of substantial hominid diversity. Alternatively, the anatomical range evident in the Georgian remains could just underscore how variable a species can be. Viewed that way, some pruning may be in order.



AFRICAN EXODUS



EDWARD BELL

these early colonizers were proportioned and how efficiently they covered long distances. There is every reason to expect that they will find them. “They’ve 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? **SM**

Kate Wong is editorial director of ScientificAmerican.com

MORE TO EXPLORE

The Human Career: Human Biological and Cultural Origins. Second edition. Richard G. Klein. University of Chicago Press, 1999.

Earliest Pleistocene Hominid Cranial Remains from Dmanisi, Republic of Georgia: Taxonomy, Geological Setting, and Age. Leo Gabunia, Abesalom Vekua, David Lordkipanidze et al. in *Science*, Vol. 288, pages 1019–1025; May 12, 2000.

The Environmental Context of Early Human Occupation in Georgia (Transcaucasia). Leo Gabunia, Abesalom Vekua and David Lordkipanidze in *Journal of Human Evolution*, Vol. 38, No. 6, pages 785–802; June 2000.

A New Skull of Early Homo from Dmanisi, Georgia. Abesalom Vekua, David Lordkipanidze, G. Philip Rightmire et al. in *Science*, Vol. 297, pages 85–89; July 5, 2002.

Food for Thought. William R. Leonard in *Scientific American*, Vol. 287, No. 6, pages 106–115; December 2002.

A segment based on this article will air October 23 on *National Geographic Today*, a program on the National Geographic Channel. Please check your local listings.

