

Father of Us All?

This chimplike creature roamed the woods of central Africa 7 million years ago. Today it's shaking up the human family tree

by MICHAEL LEMONICK AND ANDREA DORFMAN

In life, the creature probably resembled a chimpanzee more than anything else. It moved through a lakeside landscape of grasslands and forest searching for food, accompanied by small bands of its fellows, most likely, and keeping a sharp eye out for pythons, crocodiles and saber-toothed cats. This animal probably shared the forest with apes and monkeys and, like them, spent some time up in the trees. It may have walked upright, which apes rarely do for very long at a stretch. But at a casual glance, it would have seemed to our eyes like just another chimp.

In death, however, this creature has just sent shock waves through the world of science. After eight grueling years of hunting in the hot, wind-scoured desert of central Africa, an international team of researchers has uncovered one of the most sensational fossil finds in living memory: the well-preserved skull of a chimp-size animal, probably a male, that doesn't fit any known species. According to paleontologist Michel Brunet of the University of Poitiers in France, whose team reported the find in *Nature* last week, there is no way it could have been an ape of any kind. It was almost certainly a hominid—a member of a subdivision of the primate family whose only living representative is modern man. And it has left scientists gasping with astonishment for several reasons.

To start with, it is nearly 7 million years old—a million years more ancient than the previous record holder. Indeed, this new species is as much older than the famous Lucy as Lucy is older than we are. It almost certainly dates from very near that crucial moment in prehistory when hominids began to tread an evolutionary path that diverged from that of chimps, our closest living relatives. Even more surprising, this ancient hominid was not discovered anywhere near the Great Rift Valley of East Africa, where all the record setters of the past three decades have been found. Instead, it turned up in the sub-Saharan Sahel region of Chad, more than 1,500 miles to the west, forcing a rethinking of the conventional wisdom about where humans arose.

Beyond that, the animal's habitat may cast further doubt on the already beleaguered notion that our ancestors first emerged on a treeless savanna. It now looks as though this pivotal event happened in a setting that was at least partly wooded. Most remarkable of all, though, is the skull itself. The creature, known formally as *Sahelanthropus tchadensis* (roughly translated "Sahel hominid from Chad") and informally as Toumai ("hope of life," in the local Goran language), has a mix of apelike and hominid features. And to some paleontologists, the hominid features, especially the face, are a lot more modern-looking than anyone would have expected at so early an evolutionary stage. "A hominid of this age," writes Bernard Wood of George Washington University, in a commentary accompanying the *Nature* articles, "...should certainly not have the face of a hominid less than one-third of its geological age."

Paleontologists are scrambling to digest the implications of this remarkable find. It may simply be that the discovery fills in the evolutionary sequence—the so-called family tree—that leads to modern humans. But some argue that the new fossil might represent something far more revolutionary. It could entirely demolish the idea of a tree, replacing it with something more akin to a thick, bristly bush. Many scientists now believe that the emergence of humans may not have been the neat succession of increasingly modern-looking ancestors suggested by conventional hominid family trees but rather an evolutionary brawl, with multiple species fighting for survival—and the survival of their gene pool—at just about every point in prehistory. No matter what the answer, says Daniel Lieberman, a biological

anthropologist from Harvard, "this is one of the most important fossil discoveries in the past 100 years."

Given the harsh conditions that exist today at the excavation site, a place called Toros-Menalla, it's a wonder that the fossil was found at all. This brutally hot, dune-spattered landscape lies in the middle of the Djurab Desert, about four days' drive north of N'Djamena, the capital of Chad. **Rusting pieces of battle tanks are scattered all about, leftovers from 30 years of civil unrest. Windstorms blow up frequently, sandblasting everything in sight—including the scientists, who have to seek refuge inside their tents for days at a time.** "They really are the most unimaginable field conditions," says Harvard paleontologist David Pilbeam, who has worked with Brunet.

DOZENS OF SPECTACULAR FOSSILS OF HUMAN ANCESTORS had previously been discovered in the Great Rift Valley, part of which slices from the Red Sea through Ethiopia, Kenya, Uganda and Tanzania, but Brunet had reasons to suspect that Chad could also be fruitful. For one thing, the area around Lake Chad had already yielded a rich trove of primitive vertebrate fossils. For another, he knew that the Rift Valley's paleontological track record did not actually prove that humanity had arisen only there. And there was a nice practical advantage as well. As a Frenchman, Brunet was especially well equipped by language and history to work in a former French imperial outpost like Chad. In the Rift Valley, to the east, torrential downpours erode the jagged hillsides and bring ancient fossils to the surface. In the Djurab, Brunet and his colleagues realized, the relentless winds would have a similar erosive effect. So, accompanied by some 40 scientists from 10 countries, Brunet's Franco-Chadian Paleontological Mission began to dig in the Djurab in 1994.

It didn't take long for it to become clear that his reasoning was dead on. To date, the team has found 10,000 fossils in the area, including those of all sorts of animals and, seven years ago, at least one ancient hominid—a 3.5 million-year-old jaw that some researchers believe may come from the same species as Lucy (though Brunet has other ideas). Then, on July 19 of last year, a student named Aounta Djimdoumbaye unearthed the astonishing skull. "He is by far our best fossil hunter," says Brunet. "[Our colleague] Patrick Vignaud and I said to him that he would be the one to make a huge discovery."

The cranium was somewhat squashed, and blowing sand had eroded some of its detail, but it was nearly complete. And in a game where an entire jawbone is regarded as a rare treasure, the fossil was almost a miracle. Over the next seven months, the team found pieces of what it believes are at least five individuals of the same species, including two lower-jaw fragments and three isolated teeth. Without a telltale foot, leg or other skeletal feature, the team could not be positive that the animal walked upright, but its skull is similar in important ways to those of hominids that did.

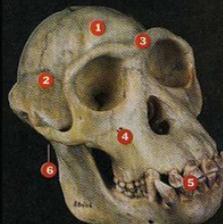
Ideally, the researchers would have preferred to find the bones sandwiched between layers of volcanic ash containing potassium and argon, as these can be precisely dated by tests involving radioactive decay. Unfortunately, the geology at Toros-Menalla did not cooperate.

But the scientists found something nearly as good. The site was replete with fossils from all sorts of other primitive animals, including fish, crocodiles, rodents, elephants, giraffes, aardvarks and more—42 types in all. Many were identical to specimens that have been radiometrically dated with great precision elsewhere. As a result, a team led by Vignaud confidently pinpointed the skull's age at between 6 million and 7 million years, probably much closer to the latter.

That puts the new *Sahelanthropus tchadensis* at a crucial evolutionary crossroads. Scientists have long believed that apes and humans share a common ancestor. But recently, comparisons of fossil and modern primates and analyses of modern ape and modern human dna have independently indicated that a single ancestral ape gave rise to both chimps and hominids between 5 million and 7 million years ago. That presumed great-great-great-grandape almost certainly swung from trees in the African forest. If so, then *Sahelanthropus*, or Toumai, could well have been the very first hominid, or at least one of the first, to begin the evolutionary march that ultimately led to *Homo sapiens*.

SIX POINTS OF SIMILARITY

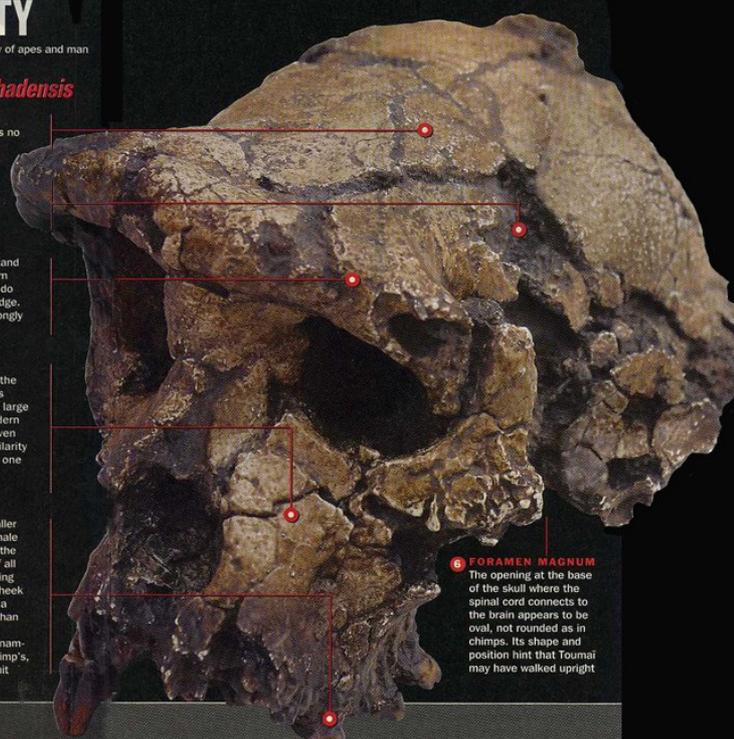
How scientists determined where the new fossil belongs in the extended family of apes and man



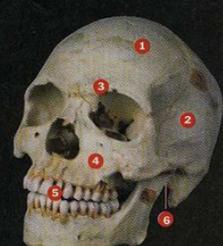
Modern Chimpanzee
From the back, the newfound skull looks a lot like a chimpanzee's

Sahelanthropus tchadensis

- SKULL** The size of the skull suggests *Sahelanthropus* was no larger than a chimpanzee
- BRAIN** The creature's brain was between 320 cc and 380 cc, comparable to that of a modern chimp
- BROW RIDGE** Continuous and much thicker than any modern male ape's. Modern humans do not have a prominent brow ridge. The thickness of this one strongly suggests Toumai was a male
- FACE** The face is short and relatively flat. In the chimp, the lower portion of the face juts forward to accommodate its large canines and incisors. In modern humans, the lower face is even smaller and flatter. This similarity to later, bipedal hominids is one clue that Toumai may have walked on two legs
- TEETH** The canines are smaller and shorter than those of a male chimp. They are also worn at the tips, which is typical of all later hominids, including *Homo sapiens*. The cheek teeth are larger than a chimp's and smaller than those of some early hominids. The tooth enamel is slightly thicker than a chimp's, suggesting a diet with less fruit



- FORAMEN MAGNUM**
The opening at the base of the skull where the spinal cord connects to the brain appears to be oval, not rounded as in chimps. Its shape and position hint that Toumai may have walked upright



Modern *Homo sapiens*
But many scientists are surprised how much its face looks like a hominid's

LUCY AND HER PALS

 <p>3.6 million to 2.9 million years HADAR, ETHIOPIA <i>A. afarensis</i> This skull, from the same species as the famous Lucy (nicknamed after the Beatles song <i>Lucy in the Sky with Diamonds</i>), was discovered later at the same site</p>	 <p>2.5 million years BOURI, ETHIOPIA <i>A. garhi</i> Pieced together from fragments found in 1997, this skull comes from what might have been the first hominid to make stone tools. Other evidence suggests it used tools for butchering</p>	 <p>1.9 million to 1.6 million years OLDUVAI GORGE, TANZANIA <i>H. habilis</i> Until <i>A. garhi</i> was found, this species, considered by many to be the first human, was also thought to be the first toolmaker in the hominid line</p>
--	--	---

But in the contentious field of human paleontology, "could well have been" leaves plenty of room for heated argument. There seems little doubt, at least, that Toumai was truly a hominid. Though the skull and brain are no bigger than a chimp's, that is no surprise. Our characteristically large brains did not evolve until about 2 million years ago, well after Lucy's time. But features like a short face with a massive brow ridge, a mouth and jaw that protrude less than in most apes, and relatively small canine teeth make it clear that this creature was not a chimpanzee.

Where exactly Toumai falls in the evolutionary scheme of things, though, depends largely on whom you ask. A number of distinguished paleontologists, including Bernard Wood, Ian Tattersall of the American Museum of Natural History in New York City, and Chris Stringer of London's Natural History Museum, perceive the face to be jarringly modern—more modern even than Lucy's species, *Australopithecus afarensis*, which is between 3.6 million and 2.9 million years old—and thus quite different from what they expected to see in such an ancient hominid.

OVER THE YEARS SINCE LUCY WAS FOUND, several even older hominids, including *Ardipithecus ramidus ramidus* (4.4 million years old) and *Ardipithecus ramidus kadabba* (5.8 million), have been put forward as the most ancient of our direct ancestors. But Toumai is older still. If it is as modern looking as Wood believes, Lucy and the others may not be our direct ancestors at all but instead dead-end side branches of the family tree, like the Neanderthals. That would make them not our great-great-great-grandparents but rather ancient uncles and aunts whose lineages have long since gone extinct. One possibility is that *Sahelanthropus* gave rise to intermediate descendant species that have not yet been discovered. These descendants would have led to *Homo habilis* or *Homo rudolfensis*, both of which are contenders for the first member of our genus, which arose about 2 million years ago.

If so, this lends support to an evolutionary scheme that has been gaining scientific support. Instead of a tree, with a main trunk and a few side branches, hominid evolution is now viewed more as an overgrown bush, lush at every point with multiple competing species. The evidence certainly seems to point that way. Over the past couple of decades, anthropologists have been finding more and more hominid species dating all the way from hundreds of thousands to millions of years ago, many of them overlapping in time. During most of our ancestors' history, it appears, multiple species of humanlike creatures walked the earth at once.

That really should not be surprising. Most types of animals—monkeys, whales, cats, apes—come in multiple varieties. As recently as 30,000 or 40,000 years ago, when *Homo sapiens* was sufficiently evolved to make jewelry and paint hauntingly evocative drawings on cave walls, we shared the planet with a second hominid species, the Neanderthals. And although it seems natural to us that only one species of hominid lives today, it is in fact an exception to nature's way of doing things.

But if multiple hominid species have been the rule all along, there is no reason to think this wasn't the case right from the beginning. Evolution provides plenty of examples in which new types of animals emerge not just as single species but as collections of similar species that share many but not all physical attributes. The rich diversity of finches that Charles Darwin discovered in the Galapagos Islands is perhaps the most famous example.

According to many anthropologists, Brunet's discovery supports the idea that evolutionary diversity was true for hominids as well. "My guess," Wood offers, "is that *Sahelanthropus* is the first of what will turn out to be a whole handful of apes and apelike creatures living throughout Africa 6 or 7 million years ago." In this bushy model of evolution, even a remarkably modern face might not guarantee that Brunet's new hominid was a direct ancestor of modern humans. Maybe it was just one of several modern-looking hominids that arose at about the same time.

Or maybe all these learned experts are barking up the wrong evolutionary tree after all. At least one equally eminent paleontologist, Tim White of the University of California, Berkeley, disputes the assertion that Toumai derails the standard evolutionary family tree, let alone plants a bush in its place. The discovery is a tremendous accomplishment, he says. "This fossil is the closest we've got to the common ancestor. But dentally, it's just like *Ardipithecus*, except for a few minor characteristics." The mix of primitive and more advanced traits leaves him similarly unimpressed, since such mixing has been seen in various species discovered over the past 80 years. In spite of what his colleagues say, White believes that Toumai may well be the direct ancestor of all later hominids, Lucy and ourselves included.

If the new hominid does eventually upend the conventional wisdom, however, it will raise all sorts of questions. For example, if *Sahelanthropus* had descendant species that gave rise to *H. habilis*, asks Harvard's Lieberman, where are they? Nobody knows, moreover, what triggered the emergence of the earliest hominids in the first place. Virtually everyone now agrees that walking upright was the key physical adaptation that set the hominid line in motion. But that adaptation had to have some evolutionary advantage for it to persist. What, exactly, was so great about walking on two legs?

A decade ago, the leading theory suggested that climate change had dried Africa out, replacing the forests, where apes thrived, with grasslands. A walking ape would be better suited to this environment, since tree climbing would be useless. Standing would give a better view over the top of the grasses of potential enemies. Also, a vertical position would offer less exposure to the harsh rays of the sun.

That all made sense until field scientists, including White, began finding early hominids who lived in partly wooded places, not pure savanna. As deduced from the sorts of animals Brunet found at Toros-Menalla, that seems to be the kind of environment *Sahelanthropus* inhabited as well. With the simple climate theory already on the way out, paleontologists have come up with other ideas. They now believe that woods survived in the changed climate but were probably interspersed with patches of savanna—precisely the setting in which Brunet found Toumai.

An ape walking on two legs could traverse these open expanses, much as the earlier theory contended, to get to a safe and comfortable habitat in the next forest over. With its free hands, the ape could carry extra food—very useful when crossing expanses where fruit might

not be available for the plucking. Free hands might also be useful for sex, although not in the way you might think. The best male upright walkers could bring back food for the females of their species, increasing their chances of winning a mate and passing on their genes—or so suggests C. Owen Lovejoy of Ohio's Kent State University, the leading proponent of this theory.

AS FOR THE POPULAR PERCEPTION that human evolution began in East Africa—well, on reflection, that was never as convincing as it was made out to be. Even those who leaned toward that view knew intellectually that a few dozen individuals from a few sites spaced over millions of years constituted a pretty slim line of evidence. After all, even a shambling, apelike hominid could range a few thousand miles—from Chad, say—in a mere generation or two. The fact that so very few hominid fossils have been found, even in East Africa, makes it clear how rarely these ancient bones survived. "If you think of Africa as a giant place where human ancestors existed for the past 7 million years," says Berkeley's White, "you have to get lucky to find places where environmental conditions allowed them to live and where the geological conditions allowed them to be preserved."

But that also means that paleontologists could get lucky in many more places than they have looked so far. White and other old East Africa hands will continue the excavations they have under way in those traditionally fertile fossil fields. Other, less established scientists, though, may now feel emboldened to look in other parts of Africa with greater confidence that there is something important to find.

Brunet, meanwhile, has every reason to keep mining the windswept desert of Chad. "There's still plenty of work to do," he says. He and his team will be looking not only for additional *Sahelanthropus* bones but also for even older sediments that are between 7.5 million and 10 million years old—rocks that could yield the ancestral species that gave rise to both humans and chimps. Paleontologists often take months or years to announce the existence of discoveries they have in hand, so it is quite possible that he and his team have already found something more.

Indeed, the last sentence of their paper in *Nature* declares that while *Sahelanthropus* will be central to illuminating the earliest chapter in evolutionary history, "more surprises can be expected." Given the splash Toumai has made, that could prove to be an understatement.

With reporting by Delphine Schrank/Poitiers