This Face Changes the Human Story. But How?

A trove of bones hidden deep within a South African cave represents a new species of human ancestor, scientists announced Thursday in the [journal *eLife*](http://elifesciences.org/content/4/e09560)*.* *Homo naledi,* as they call it, appears very primitive in some respects—it had a tiny brain, for instance, and apelike shoulders for climbing. But in other ways it looks remarkably like modern humans. When did it live? Where does it fit in the human family tree? And how did its bones get into the deepest hidden chamber of the cave—could such a primitive creature have been disposing of its dead intentionally?

This is the story of one of the greatest fossil discoveries of the past half century, and of what it might mean for our understanding of human evolution.

## **Chance Favours the Slender Caver**

Two years ago, a pair of recreational cavers entered a cave called Rising Star, some 30 miles northwest of Johannesburg. Rising Star has been a popular draw for cavers since the 1960s, and its filigree of channels and caverns is well mapped. Steven Tucker and Rick Hunter were hoping to find some less trodden passage.

In the back of their minds was another mission. In the first half of the 20th century, this region of South Africa produced so many fossils of our early ancestors that it later became known as the Cradle of Humankind. Though the heyday of fossil hunting there was long past, the cavers knew that a scientist in Johannesburg was looking for bones. The odds of happening upon something were remote. But you never know.

Deep in the cave, Tucker and Hunter worked their way through a constriction called [Superman’s Crawl](http://voices.nationalgeographic.com/2013/11/23/the-view-from-a-caverscientist/)—because most people can fit through only by holding one arm tightly against the body and extending the other above the head, like the Man of Steel in flight. Crossing a large chamber, they climbed a jagged wall of rock called the Dragon’s Back. At the top they found themselves in a pretty little cavity decorated with stalactites. Hunter got out his video camera, and to remove himself from the frame, Tucker eased himself into a fissure in the cave floor. His foot found a finger of rock, then another below it, then—empty space. Dropping down, he found himself in a narrow, vertical chute, in some places less than eight inches wide. He called to Hunter to follow him. Both men have hyper-slender frames, all bone and wiry muscle. Had their torsos been just a little bigger, they would not have fit in the chute, and what is arguably the most astonishing human fossil discovery in half a century—and undoubtedly the most perplexing—would not have occurred.

## **After Lucy, a Mystery**

[Lee Berger](http://www.nationalgeographic.com/explorers/bios/lee-berger/), the paleoanthropologist who had asked cavers to keep an eye out for fossils, is a big-boned American with a high forehead, a flushed face, and cheeks that flare out broadly when he smiles, which is a lot of the time. His unquenchable optimism has proved essential to his professional life. By the early 1990s, when Berger got a job at the University of the Witwatersrand (“Wits”) and had begun to hunt for fossils, the spotlight in human evolution had long since shifted to the Great Rift Valley of East Africa.

Most researchers regarded South Africa as an interesting sidebar to the story of human evolution but not the main plot. Berger was determined to prove them wrong. But for almost 20 years, the relatively insignificant finds he made seemed only to underscore how little South Africa had left to offer.

What he most wanted to find were fossils that could shed light on the primary outstanding mystery in human evolution: the origin of our genus, *Homo*, between two million and three million years ago. On the far side of that divide are the apelike australopithecines, epitomized by *Australopithecus afarensis* and its most famous representative, Lucy, a skeleton discovered in Ethiopia in 1974. On the near side is *Homo erectus*, a tool-wielding, fire-making, globe-trotting species with a big brain and body proportions much like ours. Within that murky million-year gap, a bipedal animal was transformed into a nascent human being, a creature not just adapted to its environment but able to apply its mind to master it. How did that revolution happen?

The fossil record is frustratingly ambiguous. Slightly older than *H. erectus*is a species called *Homo habilis*, or “handy man”—so named by Louis Leakey and his colleagues in 1964 because they believed it responsible for the stone tools they were finding at Olduvai Gorge in Tanzania. In the 1970s teams led by Louis’s son Richard found more *H. habilis* specimens in Kenya, and ever since, the species has provided a shaky base for the human family tree, keeping it rooted in East Africa. Before *H. habilis* the human story goes dark, with just a few fossil fragments of *Homo* too sketchy to warrant a species name. As one scientist put it, they would easily fit in a shoe box, and you’d still have room for the shoes.

Berger has long argued that *H. habilis* was too primitive to deserve its privileged position at the root of our genus. Some other scientists agree that it really should be called*Australopithecus*. But Berger has been nearly alone in arguing that South Africa was the place to look for the true earliest *Homo*. And for years the unchecked exuberance with which he promoted his relatively minor finds tended only to alienate some of his professional colleagues. Berger had the ambition and personality to become a famous player in his field, like Richard Leakey or Donald Johanson, who found the Lucy skeleton. Berger is a tireless fund-raiser and a master at enthralling a public audience. But he didn’t have the bones.

Then, in 2008, he made a truly important discovery. While searching in a place later called Malapa, some ten miles from Rising Star, he and his nine-year-old son, Matthew, [found some hominin fossils](http://ngm.nationalgeographic.com/2011/08/malapa-fossils/fischman-text) poking out of hunks of dolomite.

Over the next year Berger’s team painstakingly chipped two nearly complete skeletons out of the rock. Dated to about two million years ago, they were the first major finds from South Africa published in decades. (An even more complete skeleton found earlier has yet to be described.) In most respects they were very primitive, but there were some oddly modern traits too.

Berger decided the skeletons were a new species of australopithecine, which he named *Australopithecus sediba*. But he also claimed they were “the Rosetta stone” to the origins of *Homo*. Though the doyens of palaeoanthropology credited him with a “jaw-dropping” find, most dismissed his interpretation of it. *A. sediba* was too young, too weird, and not in the right place to be ancestral to *Homo:* It wasn’t one of us. In another sense, neither was Berger. Since then, prominent researchers have published papers on early *Homo* that didn’t even mention him or his find.

Berger shook off the rejection and got back to work—there were additional skeletons from Malapa to occupy him, still encased in limestone blocks in his lab. Then one night, Pedro Boshoff, a caver and geologist Berger had hired to look for fossils, knocked on his door. With him was Steven Tucker. Berger took one look at the pictures they showed him from Rising Star and realized that Malapa was going to have to take a backseat.

A passageway led into a larger cavity, about 30 feet long and only a few feet wide, its walls and ceiling a bewilderment of calcite gnarls and jutting flowstone fingers. But it was what was on the floor that drew the two men’s attention. There were bones everywhere. The cavers first thought they must be modern. They weren’t stone heavy, like most fossils, nor were they encased in stone—they were just lying about on the surface, as if someone had tossed them in. They noticed a piece of a lower jaw, with teeth intact; it looked human

Berger could see from the photos that the bones did not belong to a modern human being. Certain features, especially those of the jawbone and teeth, were far too primitive. The photos showed more bones waiting to be found; Berger could make out the outline of a partly buried cranium. It seemed likely that the remains represented much of a complete skeleton. He was dumbfounded. In the early hominin fossil record, the number of mostly complete skeletons, including his two from Malapa, could be counted on one hand. And now this. But what *was* this? How old was it? And how did it get into that cave?

Most pressing of all: how to get it out again, and quickly, before some other amateurs found their way into that chamber. (It was clear from the arrangement of the bones that someone had already been there, perhaps decades before.) Tucker and Hunter lacked the skills needed to excavate the fossils, and no scientist Berger knew—certainly not himself—had the physique to squeeze through that chute. So Berger put the word out on Facebook: Skinny individuals wanted, with scientific credentials and caving experience; must be “willing to work in cramped quarters.” Within a week and a half he’d heard from nearly 60 applicants. He chose the six most qualified; all were young women. Berger called them his “underground astronauts.”

With funding from National Geographic (Berger is also a National Geographic [explorer-in-residence](http://www.nationalgeographic.com/explorers/grants-programs/explorers-in-residence/)), he gathered some 60 scientists and [set up an aboveground command centre](http://news.nationalgeographic.com/news/2013/11/131106-lee-berger-human-ancestor-fossil-excavation/), a science tent, and a small village of sleeping and support tents. Local cavers helped thread two miles of communication and power cables down into the fossil chamber. Whatever was happening there could now be viewed with cameras by Berger and his team in the command centre. Marina Elliott, then a graduate student at Simon Fraser University in British Columbia, was the first scientist down the chute.

“Looking down into it, I wasn’t sure I’d be OK,” Elliott recalled. “It was like looking into a shark’s mouth. There were fingers and tongues and teeth of rock.”

Elliott and two colleagues, Becca Peixotto and Hannah Morris, inched their way to the “landing zone” at the bottom, then crouched into the fossil chamber. Working in two-hour shifts with another three-woman crew, they plotted and bagged more than 400 fossils on the surface, then started carefully removing soil around the half-buried skull. There were other bones beneath and around it, densely packed. Over the next several days, while the women probed a square-yard patch around the skull, the other scientists huddled around the video feed in the command centre above in a state of near-constant excitement. Berger, dressed in field khakis and a Rising Star Expedition cap, would occasionally repair to the science tent to puzzle over the [accumulating bones](http://voices.nationalgeographic.com/2013/11/12/multiple-ancient-hominids-found-on-day-2-of-rising-star-expedition/)—until a collective howl of astonishment from the command centre brought him rushing back to witness another discovery. It was a glorious time.

[The bones](http://voices.nationalgeographic.com/2013/11/10/remarkably-well-preserved-hominid-skeleton-emerges/) were superbly preserved, and from the duplication of body parts, it soon became clear that there was not one skeleton in the cave, but two, then three, then five ... then so many it was hard to keep a clear count. Berger had allotted three weeks for the excavation. By the end of that time, the excavators had removed some 1,200 bones, more than from any other human ancestor site in Africa—and they still hadn’t exhausted the material in just the one square yard around the skull. It took another several days digging in March 2014 before its sediments ran dry, about six inches down.

There were some 1,550 specimens in all, representing at least 15 individuals. Skulls. Jaws. Ribs. Dozens of teeth. A nearly complete foot. A hand, virtually every bone intact, arranged as in life. Minuscule bones of the inner ear. Elderly adults. Juveniles. Infants, identified by their thimble-size vertebrae. Parts of the skeletons looked astonishingly modern. But others were just as astonishingly primitive—in some cases, even more apelike than the australopithecines. “We’ve found a most remarkable creature,” Berger said. His grin went nearly to his ears.

In palaeoanthropology, specimens are traditionally held close to the vest until they can be carefully analysed and the results published, with full access to them granted only to the discoverer’s closest collaborators. By this protocol, answering the central mystery of the Rising Star find—*What is it?*—could take years, even decades. Berger wanted the work done and published by the end of the year. In his view everyone in the field should have access to important new information as quickly as possible. And maybe he liked the idea of announcing his find, which might be a new candidate for earliest *Homo,* in 2014— exactly 50 years after Louis Leakey published his discovery of the reigning first member of our genus, *Homo habilis*.

In any case there was only one way to get the analysis done quickly: Put a lot of eyes on the bones. Along with the 20-odd senior scientists who had helped him evaluate the Malapa skeletons, Berger invited more than 30 young scientists, some with the ink still wet on their Ph.D.’s, to Johannesburg from some 15 countries, for a blitzkrieg fossil fest lasting six weeks. To some older scientists who weren’t involved, putting young people on the front line just to rush the papers into print seemed rash. But for the young people in question, it was “a paleo-fantasy come true,” said Lucas Delezene, a newly appointed professor at the University of Arkansas. “In grad school you dream of a pile of fossils no one has seen before, and you get to figure it out.”

The workshop took place in a newly constructed vault at Wits, a windowless room lined with glass-panelled shelves bearing fossils and casts. The analytical teams were divided by body part. The cranial specialists huddled in one corner around a large square table that was covered with skull and jaw fragments and the casts of other well-known fossil skulls. Smaller tables were devoted to hands, feet, long bones, and so on. The air was cool, the atmosphere hushed. Young scientists fiddled with bones and callipers. Berger and his close advisers circulated among them, conferring in low voices.

Delezene’s own fossil pile contained 190 teeth—a critical part of any analysis, since teeth alone are often enough to identify a species. But these teeth weren’t like anything the scientists in the “tooth booth” had ever seen. Some features were astonishingly humanlike—the molar crowns were small, for instance, with five cusps like ours. But the premolar roots were weirdly primitive. “We’re not sure what to make of these,” Delezene said. “It’s crazy.”

The same schizoid pattern was popping up at the other tables. A fully modern hand sported wackily curved fingers, fit for a creature climbing trees. The shoulders were apish too, and the widely flaring blades of the pelvis were as primitive as Lucy’s—but the bottom of the same pelvis looked like a modern human’s. The leg bones started out shaped like an australopithecine’s but gathered modernity as they descended toward the ground. The feet were virtually indistinguishable from our own.

“You could almost draw a line through the hips—primitive above, modern below,” said Steve Churchill, a palaeontologist from Duke University. “If you’d found the foot by itself, you’d think some Bushman had died.”

But then there was the head. Four partial skulls had been found—two were likely male, two female. In their general morphology they clearly looked advanced enough to be called *Homo*. But the braincases were tiny—a mere 560 cubic centimetres for the males and 465 for the females, far less than *H. erectus*’s average of 900 cubic centimetres, and well under half the size of our own. A large brain is the sine qua non of humanness, the hallmark of a species that has evolved to live by its wits. These were not human beings. These were pinheads, with some humanlike body parts.

“Weird as hell,” paleoanthropologist Fred Grine of the State University of New York at Stony Brook later said. “Tiny little brains stuck on these bodies that weren’t tiny.” The adult males were around five feet tall and a hundred pounds, the females a little shorter and lighter.

“The message we’re getting is of an animal right on the cusp of the transition from Australopithecus to *Homo*,” Berger said as the workshop began to wind down in early June. “Everything that is touching the world in a critical way is like us. The other parts retain bits of their primitive past.”

In some ways the new hominin from Rising Star was even closer to modern humans than *Homo erectus*is. To Berger and his team, it clearly belonged in the *Homo* genus, but it was unlike any other member. They had no choice but to name a new species. They called it *Homo naledi*(pronounced na-LED-ee), tipping a hat to the cave where the bones had been found: In the local Sotho language, *naledi* means “star.”

## **How Did It Get There?**

Back in November, as Marina Elliott and her mates were uncovering that startling trove of bones, they were almost as surprised by what they weren’t finding. “It was day three or four, and we still hadn’t found any fauna,” Elliott said. On the first day a few little bird bones had been found on the surface, but otherwise there was nothing but hominin bones.

That made for a mystery as perplexing as that of *H. naledi*’s identity: How did the remains get into such an absurdly remote chamber? Clearly the individuals weren’t living in the cave; there were no stone tools or remains of meals to suggest such occupation. Conceivably a group of *H. naledi*could have wandered into the cave one time and somehow got trapped—but the distribution of the bones seemed to indicate that they had been deposited over a long time, perhaps centuries. If carnivores had dragged hominin prey into the cave, they would have left tooth marks on the bones, and there weren’t any. And finally, if the bones had been washed into the cave by flowing water, it would have carried stones and other rubble there too. But there is no rubble—only fine sediment that had weathered off the walls of the cave or sifted through tiny cracks.

“When you have eliminated the impossible,” Sherlock Holmes once reminded his friend Watson, “whatever remains, however improbable, must be the truth.”

Having exhausted all other explanations, Berger and his team were stuck with the improbable conclusion that bodies of *H. naledi* were deliberately put there, by other *H. naledi*. Until now only *Homo sapiens*, and possibly some archaic humans such as the Neanderthals, are known to have treated their dead in such a ritualized manner. The researchers don’t argue that these much more primitive hominins navigated Superman’s Crawl and the harrowing shark-mouth chute while dragging corpses behind them—that would go beyond improbable to incredible. Maybe back then Superman’s Crawl was wide enough to be walkable, and maybe the hominins simply dropped their burden into the chute without climbing down themselves. Over time the growing pile of bones might have slowly tumbled into the neighbouring chamber.

Deliberate disposal of bodies would still have required the hominins to find their way to the top of the chute through pitch-black darkness and back again, which almost surely would have required light—torches, or fires lit at intervals. The notion of such a small-brained creature exhibiting such complex behaviour seems so unlikely that many other researchers have simply refused to credit it. At some earlier time, they argue, there must have been an entrance to the cave that afforded more direct access to the fossil chamber—one that probably allowed the bones to wash in. “There has to be another entrance,” Richard Leakey said after he’d paid a visit to Johannesburg to see the fossils. “Lee just hasn’t found it yet.”

But water would inevitably have washed rubble, plant material, and other debris into the fossil chamber along with the bones, and they simply aren’t there. “There isn’t a lot of subjectivity here,” said Eric Roberts, a geologist from James Cook University in Australia, svelte enough to have examined the chamber himself. “The sediments don’t lie.”

Disposal of the dead brings closure for the living, confers respect on the departed, or abets their transition to the next life. Such sentiments are a hallmark of humanity. But *H. naledi*, Berger emphatically stresses, was *not* human—which makes the behaviour all the more intriguing.

“It’s an animal that appears to have had the cognitive ability to recognize its separation from nature,” he said.

## **How Old Is It?**

The mysteries of what *H. naledi*is, and how its bones got into the cave, are inextricably knotted with the question of how old those bones are—and for the moment no one knows. In East Africa, fossils can be accurately dated when they are found above or below layers of volcanic ash, whose age can be measured from the clock-like decay of radioactive elements in the ash. At Malapa, Berger had gotten lucky: The *A. sediba* bones lay between two flowstones—thin layers of calcite deposited by running water—that could also be dated radiometrically. But the bones in the Rising Star chamber were just lying on the cave floor or buried in shallow, mixed sediments. When they got into the cave is an even more intractable problem to solve than how.

Most of the workshop scientists fretted over how their analysis would be received without a date attached. (As it turned out, the lack of a date would prove to be one impediment to a quick publication of the scientific papers describing the finds.) But Berger wasn’t bothered one bit. If *H. naledi*eventually proved to be as old as its morphology suggested, then he had quite possibly found the root of the *Homo* family tree. But if the new species turned out to be much younger, the repercussions could be equally profound. It could mean that while our own species was evolving, a separate, small-brained, more primitive-looking *Homo* was loose on the landscape, as recently as anyone dared to contemplate. A hundred thousand years ago? Fifty thousand? Ten thousand? As the exhilarating workshop came to an end with that fundamental question still unresolved, Berger was sanguine as always. “No matter what the age, it will have tremendous impact,” he said, shrugging.

## **Berger’s Triumph**

A few weeks later, in August of last year, he travelled to East Africa. To mark the occasion of Louis Leakey's description of *H. habilis*, Richard Leakey had summoned the leading thinkers on early human evolution to a symposium at the Turkana Basin Institute, the research centre he (along with the State University of New York at Stony Brook) had established near the western shore of Lake Turkana in Kenya.

The purpose of the meeting was to try to come to some consensus over the confounding record of early *Homo*, without grandstanding or rancour—two vices endemic to palaeoanthropology. Some of Lee Berger’s harshest critics would be there, including some who’d written scathing reviews of his interpretation of the *A. sediba*fossils. To them, he was an outsider at best, a hype artist at worst. Some threatened not to attend if he were there. But given the Rising Star discovery, Leakey could hardly not invite him.

“There’s no one on Earth finding fossils like Lee is now,” Leakey said.

For four days the scientists huddled together in a spacious lab room, its casement windows open to the breezes, casts of all the important evidence for early *Homo*spread out on tables. One morning Meave Leakey (who’s also a National Geographic explorer-in-residence) opened a vault to reveal brand-new specimens found on the east side of the lake, including a nearly complete foot. When it was his turn to speak, Bill Kimbel of the Institute of Human Origins described a new *Homo*jaw from Ethiopia dated to 2.8 million years ago—the oldest member of our genus yet. Archaeologist Sonia Harmand of Stony Brook University dropped an even bigger bombshell—the discovery of dozens of crude stone tools near Lake Turkana dating to 3.3 million years ago. If stone tools originated half a million years before the first appearance of our genus, it would be hard to argue anymore that the defining characteristic of *Homo* was its technological ingenuity.

Berger meanwhile was uncommonly subdued, adding little to the discussion, until the topic turned to a comparison of *A. sediba* and *H. habilis*. It was time.

“More of interest perhaps to this debate is Rising Star,” he offered. For the next 20 minutes he laid out all that had happened—the serendipitous discovery of the cave, the crash analysis in June, and the gist of its findings. While he talked, a couple of casts of Rising Star skulls were passed hand to hand.

Then came the questions. Have you done a cranio-dental analysis? Yes. The *H. naledi*skull and teeth place it in a group with *Homo erectus*, Neanderthals, and modern humans. Closer to *H. erectus* than *H. habilis* is? Yes. Are there any tooth marks on the bones from carnivores? No, these are the healthiest dead individuals you’ll ever see. Have you made progress on the dating? Not yet. We’ll get a date sometime. Don’t worry.

Then, when the questions were over, the gathered doyens did something no one expected, least of all Berger. They applauded.

## **The Braided Stream**

When a major new find is made in human evolution—or even a minor new find—it’s common to claim it overturns all previous notions of our ancestry. Perhaps having learned from past mistakes, Berger doesn’t make such assertions for *Homo naledi*—at least not yet, with its place in time uncertain. He doesn’t claim he has found the earliest *Homo*, or that his fossils return the title of “Cradle of Humankind” from East to South Africa. The fossils do suggest, however, that both regions, and everywhere in between, may harbor clues to a story that is more complicated than the metaphor “human family tree” would suggest.

“What *naledi* says to me is that you may think the record is complete enough to make up stories, and it’s not,” said Stony Brook’s Fred Grine. Maybe early species of *Homo* emerged in South Africa and then moved up to East Africa. “Or maybe it’s the other way around.”

Berger himself thinks the right metaphor for human evolution, instead of a tree branching from a single root, is a braided stream: a river that divides into channels, only to merge again downstream. Similarly, the various hominin types that inhabited the landscapes of Africa must at some point have diverged from a common ancestor. But then farther down the river of time they may have coalesced again, so that we, at the river’s mouth, carry in us today a bit of East Africa, a bit of South Africa, and a whole lot of history we have no notion of whatsoever. Because one thing is for sure: If we learned about a completely new form of hominin only because a couple of cavers were skinny enough to fit through a crack in a well-explored South African cave, we really don’t have a clue what else might be out there.

**Fossils found in African cave are new species of human kin, say scientists**

The two amateur cavers had to feel their way along the cave’s winding passages, crawl on their stomachs through an opening less than 10 inches high, ascend a jagged wall, cross a narrow ledge dubbed the “Dragon’s Back,” and make a 400-foot descent, sideways, through a vertical crack before finally arriving at the prize: a 30-foot-long chamber probably between 2 million and 3 million years old.

American paleoanthropologist Lee Berger had asked the men to keep their eyes open for fossils, though the well-explored cave at the Cradle of Humankind World Heritage Site in South Africa had given up most of its treasures decades ago.

What they found in September 2013 nearly took their breath away: fossil fragments of a relative of the human species, and a cache of bones and teeth buried in ancient clay that would eventually number more than 1,500 — the largest hominin fossil discovery of its kind in Africa.

After a month of excavation under some of the most difficult and dangerous of conditions, then two years of analysis by more than 50 international experts, Berger and the leaders of the expedition announced Thursday that those fossil fragments do indeed belong to a new species of human relative they are calling *Homo naledi*.

“It was soon apparent that what I thought was an individual skeleton was dozens of individuals,” Berger, a researcher in human evolution at the University of the Witwatersrand in Johannesburg, said during a Wednesday teleconference for the media hosted by the National Geographic Society, which helped support the expedition. “With every bone in the body represented multiple times, it is already practically the best-known fossil member of our lineage.”

*[*[*Who owns those bones?*](https://www.washingtonpost.com/news/speaking-of-science/wp/2015/09/10/who-owns-those-bones/)*]*

The announcement by the university, National Geographic and the South African Department of Science and Technology/National Research Foundation, was made in Johannesburg, about 25 miles northwest of the cave complex, called the Rising Star, where the fossils were found. (“Naledi” means “star” in Sesotho, a local South African language, and the chamber where the fossils were unearthed was called Dinaledi, or “many stars.”)

Although the fragments have not yet been dated, the scientists said they could well represent one of the most primitive members of the genus *Homo*, which includes today’s humans.

*[*[*Possible human relative, Australopithecus sediba, found in cave in South Africa*](https://www.washingtonpost.com/national/health-science/possible-human-relative-2-million-years-old-a-snapshot-of-evolution-in-action/2011/09/07/gIQAzCNACK_story.html)*]*

Perhaps more remarkable, they added, was that the pieces belonged to at least 15 individuals of the same species — men, women, children and infants — and all of them appeared to have been deliberately placed there after death. The implication was as astonishing as the initial discovery: It suggested the ritualized disposal of bodies.

“It’s enormously surprising to see a very primitive member of the genus, not very humanlike overall, to do something unique to humans,” Berger said. “To see it in a small-brained hominid is completely surprising. None of us expected it.”

*H. naledi*is an unusual combination of the primitive and the modern, the scientists said. Its brain was no larger than a baseball; its shoulders and torso primitive; its fingers long and curved, allowing *H. naledi*to climb and swing from the trees. At the same time, *H. naledi* *’s* wrist bones indicated that it used tools. Its long legs and feet, nearly indistinguishable from those of modern man, allowed it not only to walk upright but also to travel for many miles at a time.

“One of the most exciting things for us is we discovered something new in biology. We had never seen a creature like this before,” said John Hawks, an anthropologist at the University of Wisconsin at Madison and the lead scientist in the analysis, which included experts in primitive feet, teeth, hands and skulls. “*H. naledi* is unlike anything in our genus. . . . When you look at the anatomical elements across the body, it’s an enormous assemblage of fossils. The task was to interpret these fossils and put them in the context of evolution and where they fit on the human tree.”

The unprecedented number of fragments found made the scientists feel confident that they had found a new species of human relative.

“We have 190 teeth, and they are represented multiple times,” Hawks said. “We have more than a dozen molars, and the differences are typically less variable than in small populations of humans. Every member of every team . . . agreed we were looking at the same species. The hand may be telling us a different story than the shoulder, but it would beg belief that we mixed things” belonging to different species.

The fossils were recovered over 21 days in November 2013 and seven days in March 2014 by a team assembled by Berger and his colleagues through social media. The archaeologists thought the only way to mount a major excavation was to have a team of people slender enough, but also experienced enough, to handle the hazardous work.

The six who were eventually chosen were all women, including American University PhD candidate Becca Peixotto, who took part in the Wednesday teleconference from Washington.

“I saw an ad on Facebook,” Peixotto said, and she immediately signed on. “We had a lot of spectacular moments, and a few stand out: a fragment of a skull from the centre of the chamber. It took days to excavate, and the removal of this fossil was complicated by overlying fossils. Late one evening, it was finally free from the soil and packaged in a box big enough to hold the fragment and small enough to fit [through the narrow cracks of the cave]. Then it was all hands on deck. . . . We formed a bucket brigade to pass the skull box up the chute, out the slot, down the Dragon’s Back . . . through the crawl, up another ladder, out to the surface. . . .There was huge cheering as it reached the light of day.”

The National Geographic Society, which has funded many of Berger’s expeditions, is featuring the discovery of *H. naledi*on the cover of its magazine next month and in “Dawn of Humanity,” a special by National Geographic and “Nova” that premieres on PBS next Wednesday and is also available for online streaming. Two papers about the discovery also will be published in the open-access scientific journal eLife.

The age of the fossils will be difficult to determine, Berger says, because they were not fused into rock, which can be dated, and the researchers wanted to wait to do radiocarbon dating until they knew more about what they had. What he did say, with confidence, was that *H. naledi* “comes near or at the root of the genus *Homo*,” in excess of 2.5 million years ago.

“This is an anatomical mosaic that evolutionary history gave us,” Hawks said. And at the very least, until more can be determined, “it gives us a different model for how things could fit in our own origins.”

In the meantime, Berger said, the team plans on further expeditions and excavations.

“This chamber has not given up all its secrets.”

# Mysterious New Human Species Emerges from Heap of Fossils

In October 2013 scientists working in South Africa announced that they had discovered [a trove of fossil human remains](https://www.scientificamerican.com/article/the-new-science-of-human-origins/) in the pitch-black depths of an underground cave system. They began a rapid recovery effort that yielded some 1,550 specimens of bones and teeth—just a fraction of the material at the site, yet already the largest assemblage of human fossils ever found in all of Africa. Now the team has published its eagerly anticipated analyses of the remains, and the conclusions are startling. The researchers suggest that the fossils represent a previously unknown species in [our genus, Homo,](https://www.scientificamerican.com/article/first-of-our-kind/) one that had a peculiar mix of physical traits and engaged in surprisingly sophisticated behaviour for its brain size. But the age of the fossils has yet to be determined, leaving other scientists unsure of what to make of them.

Cavers collected the bones from a difficult-to-reach chamber 30 meters below ground within the Rising Star cave system in South Africa’s Cradle of Humankind region, which is famous for its human fossils. In their [paper](http://elifesciences.org/content/4/e09560) describing the new remains, published today in the journal eLife, paleoanthropologist Lee Berger of the University of the Witwatersrand in Johannesburg and his colleagues report that the remains include multiples of nearly every element of the skeleton and represent at least 15 individuals. For a field in which even an isolated bone can constitute a major discovery, this find is an absolute windfall.

The fossils exhibit a combination of primitive features that bring to mind our ancient australopithecine predecessors (including [Lucy](https://blogs.scientificamerican.com/observations/40-years-after-lucy-the-fossil-that-revolutionized-the-search-for-human-origins/) and her ilk) and features that are associated with Homo. For instance, the pelvis has a flared shape like that seen in Australopithecus,whereas the leg and foot resemble those of Homo sapiens. Likewise, the skull combines a small braincase with a cranium that is otherwise built like that of early Homo. The teeth, meanwhile, are small like those of modern humans, yet the third molar is larger than the other molars—a pattern associated with australopithecines. And the upper limb pairs an Australopithecus-like shoulder and fingers with a Homo-like wrist and palm. “All that combined leaves us with a really, really strange creature,” Berger remarks.

Standing about 1.5 meters tall, with a small brain, clever hands and a body built for upright-walking as well as climbing, this creature possessed a unique mosaic of traits that Berger and his co-authors think reveals a new species of human. Given the many Homo-like traits evident in the bones—particularly in those regions that contact the environment (namely, feet, hands and teeth)—the team put the creature in the genus Homo, rather than Australopithecus, calling it H. naledi.

But exactly where H. naledi belongs in the human family tree, apart from somewhere on the Homobranch, is unclear. The confusion arises in large part from the fact that thus far the researchers have been unable to determine the age of the bones. The bones could be several million years old or tens of thousands of years old, though the team seems to favour the idea that H. naledi stems from a point close to the origin of Homo. (The oldest known fossil of Homois a lower jaw bone from Ethiopia that dates to 2.8 million years ago).

However old the *Homo naledi* bones turn out to be, they will dramatically impact how scientists interpret human evolution, Berger says. If the remains are quite old, then certain physical and behavioral traits associated with later *Homo* emerged surprisingly early, and possibly in species that did not give rise to *H. sapiens.* If the remains are intermediate in age, some of their more australopithecine-like traits might be the result of reversals, in which a more primitive trait re-evolves, possibly because it becomes adaptive again in some way. If the remains are young, then scientists will have to come to terms with the fact that a small-brained human species with tool-wielding hands managed to persist alongside larger-brained human species—possibly including *H. sapiens*—for an amazingly long time. In that case, says team member John Hawks of the University of Wisconsin, perhaps *H. naledi* was among the archaic human species that interbred with *H. sapiens* and thereby contributed DNA to the modern human gene pool, like Neanderthals did. (The team plans to try to obtain DNA from the *H. naledi*bones, though the warm, damp conditions in the cave system are not ideal for preservation of ancient DNA.)

The mix-and-match anatomy of the *H. naledi* bones is not the only puzzling aspect of this discovery, however. At other fossil sites in the Cradle of Humankind, fossils are encased in sediment and animal bones are found mixed in with the human remains. The bones of humans and animals alike accumulate in the caves there through catastrophic events such as falling down a hole in the ground into an underground cave and getting trapped, or becoming dinner for the large carnivores that denned in the caves. But the Rising Star bones are not encased in sediment, nor do any remains of any vertebrate animals, apart from a few rodents and birds, accompany them.

Given the absence of any evidence to indicate that Homo naledi fell or washed into the underground chamber or was transported there by a predator, the discovery team suggests that this small-brained human deliberately disposed of its dead. Furthermore, the location of the H. naledi bones in a chamber that appears to have always been lightless and difficult to access suggests that the humans went to great lengths to deliver the bodies there, and possibly needed an artificial light source (perhaps a simple torch) to do so. The behaviour is important because it implies that H. naledi had, as Hawks puts is, “a shared cultural knowledge of mortality.” Paul Dirks of James Cook University in Australia and his colleagues published their [analysis](http://elifesciences.org/content/4/e09561)of the geology of the site and how the bones got there in a second paper published today in eLife.

The team’s claims have met with scepticism. “I find [the discovery] fabulous but confusing,” says Susan Antón of New York University, who studies the evolution of Homo.  She notes that the remains highlight an ongoing debate among paleoanthropologists about what constitutes the genus in the first place. Early Homo fossils tend to be scrappy at best, which makes it hard to figure out which traits first distinguished our genus from Australopithecus. H. naledi has multiple body parts preserved, but “we don’t have any idea how old this stuff is or whether it’s relevant to the origin of Homo,” Antón comments.

Bernard Wood of George Washington University agrees with the authors that the remains represent a new species, but he does not think that they will force experts to revise the overarching story of human evolution. Instead he suspects that bones represent a relic population that might have evolved its odd traits in relative isolation in South Africa, which he describes as a cul de sac at the bottom of the African continent. Wood points to another small-brained species of Homo, [H. floresiensis](https://www.scientificamerican.com/article/the-littlest-human/) from the island of Flores in Indonesia, as another example of such a relic population.

The suggestion that small-brained H. naledi was systematically disposing of its dead has likewise raised eyebrows. “It would be quite radical,” says Alison Brooks of George Washington University. “There are people who think [Neanderthals](https://www.scientificamerican.com/article/secrets-of-neandertal-cognition-revealed/) didn’t bury their dead,” she observes. (Neanderthals are our closest relatives; they had brains as large as our own and engaged in a host of sophisticated behaviours. Whether or not they buried their dead is a matter of some debate. ) “I don’t want to rule it out entirely that they’re right, but I just think it is so far out there that they really need a higher standard of proof.” Brooks adds that the team would have a better case if it could show that the remains all date to the same time period.

But to other observers, the team’s preferred explanation for how all those bodies of *H. naledi* ended up together without any animal remains in the mix rings true. Travis Pickering of the University of Wisconsin, who has worked at fossil sites in the Cradle of Humankind for the past 20 years, calls the circumstances of  *H. naledi* fossils unique, and says that intentional disposal of the remains by other humans is the most sensible explanation for the phenomenon. But “whether that means *Homo naledi*was a rather cultural advanced species with well-developed mortuary practices or simply an atavistic one that had the sense not to cohabit with rotting corpses is currently unanswerable,” he remarks. Pickering adds that it is impossible to say whether the *H. naledi* individuals were lured or pushed into the cave to be murdered, or whether they were placed there, once dead, as part of a ritual. In fact, another, contemporaneous human species might have disposed of *H. naledi’s* bones in that spot.

The discovery team focuses on the possibility that H. naledidisposed of its own dead, however--a behaviour that is not necessarily unexpected, in Pickering's view. Observations of modern chimpanzees demonstrate that apes with modestly sized brains distinguish death from life. Surely, he says, a human species with a brain larger than a chimp’s would be able to make the same type of connection. “What is important about the new observations out of Rising Star is that they might be confirming this very point,” Pickering offers.

For his part, Hawks notes that the behavioural insights from Rising Star hint at an interesting parallel to the anatomical story. “We have all these things we think of as human. From an anatomy point of view walking upright is human, a large brain is human, tool-making hands are human. But all of these things happened at different times in different ancestors. The package we think of as human did not appear simultaneously," he observes. “I don’t know why we would think behavior is any different—a package evolved and different parts appeared at different times.”