Bits & Pieces – Issue No. 78

Christopher L. Murphy

Edited by Gene Baade

What are commonly called burs or burrs are the seed pods of a plant with a terrible reputation. The plant has been around for millions of years, so what it does works and that's all nature cares about.

The little seed pods as seen here have needle-sharp hooked spikes. When they come in contact with anything (animal hair or clothing) they attach themselves and break away from the plant. The idea is that the animal or you will carry the bur to a distant place where it will be removed one way or the other, fall to the ground, and eventually create a new plant.

Back in the day when kids played in the bush, I often came home with burs attached to me that I did not know were there. They were kind of neat to play with because you could gently remove them from the plant and throw them at the back of other kids—they stuck every time. I kind of like them for that reason. Of course, if you threw one at a girl's hair, that was serious because they are very difficult to remove. I sort of remember my sister having a fit.

Here I am some 70 years later and have just read that burs have appeared in sasquatch research. A group came up with the ingenious idea to put tiny electronic tracking devices in burs, which were suspended 6 to 8 feet high with black tread. The idea is that if something tall and hairy walks by a bur will stick to it.

One of the burs found its mark and was carried away by something. After hours of aerial surveillance, the group finally got a signal and were able to trace the movement of the bur-carrier. They could not see it, but they could see where it went until the device battery gave out.

The fact that the burs were suspended 6 to 8 feet high was reasoned to probably eliminate all animals except a sasquatch. Of course, there are pros and cons here and I don't wish to get into that aspect.

All I wish to point out is that if you take a little lesson from nature you are likely better off.

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July 22, 2019 marks the 100th birthday of Dr. Marie-Jeanne Koffmann. She currently resides in a rest home in Paris, France. Marie-Jeanne is one of the original founders of hominology. She is shown in this photo taken of all the founders in 1968 (left to right: Boris Porshnev, Alexander Mashkovtsev, Pyotr Smolin, Dmitri Bayanov, and Marie-Jeanne Koffmann.

Marie-Jeanne did extensive field research on the Russian snowman (almasty). Although she never managed to get a photograph of this hominoid, the evidence she collected was astounding.

Two of her papers are posted on the Relict Hominoid Inquiry (RHI) website along with this short biography:

> Dr. Marie-Jeanne Koffmann was born in France in 1919, but returned to Russia in 1935, as a surgeon in the hospitals of Moscow, anatomist and mountaineer. She commanded a battalion of alpine troops during WW II. Koffmann was a member of the Soviet Union's official expedition to the Pamirs in 1958, as physician. She concentrated her hominological research in the North Caucasus, where she spent decades exploring, collecting ethnographic evidence, modern eyewitness accounts, as well as documenting footprint evidence. Her initial findings were announced to the Russian Geographical Society of the Academy of Sciences (of which she is a member), in 1966. Koffmann has served a term as president of the Cryptozoology Association of the USSR, and was honorary member of the International Society of Cryptozoology.
>
> She now resides in her native France.

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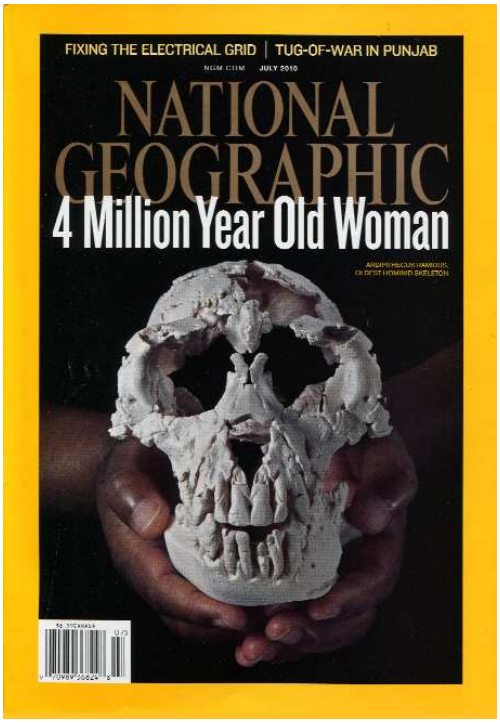


On the following pages I have provided this 2010 National Geographic feature article on hominoid fossils found in Ethiopia. I am sort of reminded of René Dahinden, when in 1953, upon learning of an expedition to find the yeti, and sort of wishing he could be part of this adventure, his boss said, "Hell, you don't have to go that far; they got them things in British Columbia." Thereupon, René devoted his life to finding the sasquatch.

Of course, this group of fossil hunters would not even think of possible living hominoids. Science is a little odd.

It's an old article and I don't know how much has been disputed, which is normally the case with anything scientific. I just thought the article was interesting and wonderfully illustrated.

Try to imagine the article without illustrations. It would be dryer than the bones and fossils discussed. I mention this because I get material with few or no illustrations; just piles of words trying to put in my head what the author has in his (or her) head as he wrote the material.

In John Green's early days photos were expensive and putting them in books was complicated and again expensive. As a result, his remarkable main work, *Sasquatch: The Apes Among Us*, is critically short of photographs.

At this time, with digital cameras and pdfs, there is no excuse for a lack of images. If you can take a photo of something, or legally get a photo of it, then do so and use it. When I submitted my manuscript for *Meet the Sasquatch* (originally called *Meet Bigfoot)* to Hancock House, David Hancock took it to John Green and came back with, "It's great," and went on to produce an astounding coffee-table book. Always keep in mind the old saying that a picture is worth a thousand words.

With this article, you have no trouble imagining the little hominoids in their daily activities as they eke out a living in a very dangerous world. They had to cooperate with each other or death was certain—is there a lesson here for hominology?

I think there are likely both sasquatch bones and fossils in British Columbia. They would probably be in caves where they are kept dry.

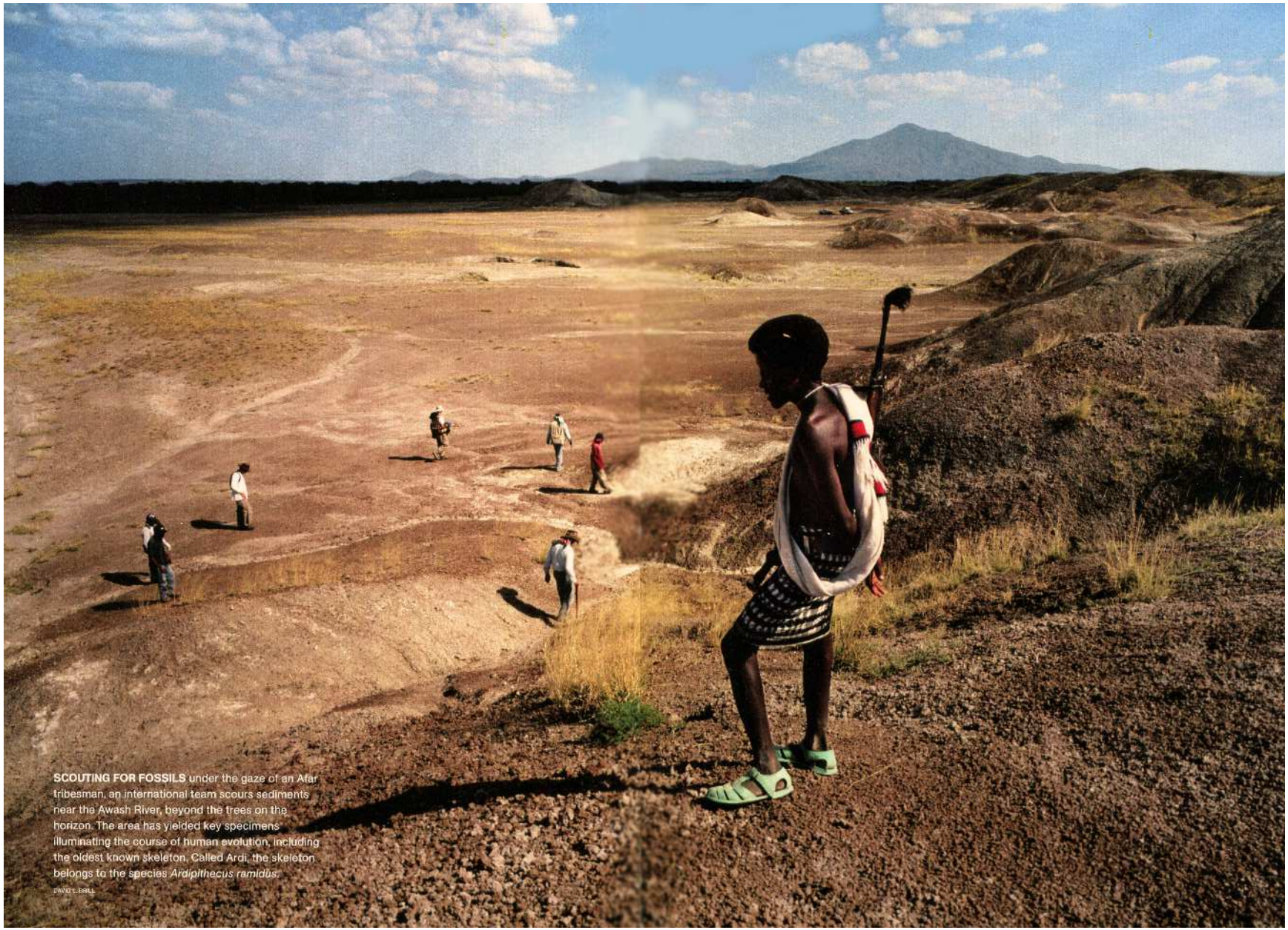
The article starts off with the following image of the hominoid skull shown on the magazine cover; note how it had to be pieced together like a jigsaw puzzle. That takes a lot of patience, something else we need in hominology.

THE EVOLUTIONARY ROAD

by Jamie Shreeve

The Middle Awash area of Ethiopia is the most persistently occupied place on Earth. Members of our lineage have lived, died, and been buried there for almost six million years. Now their bones are eroding out of the ground. Step by step they record how a primitive, small-brained primate evolved to conquer a planet. Where better to learn how we became human?

DIGITAL RECONSTRUCTION OF *ARDIPITHECUS RAMIDUS* MODELED IN RESIN. PHOTO: TIM D. WHITE

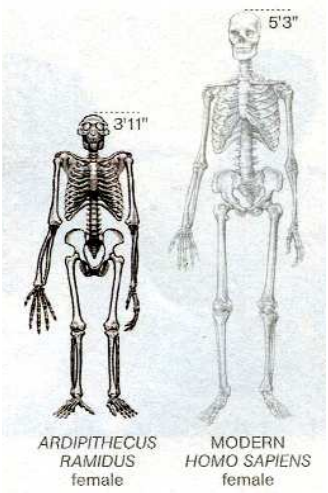


SCOUTING FOR FOSSILS under the gaze of an Afar tribesman, an international team scours sediments near the Awash River, beyond the trees on the horizon. The area has yielded key specimens illuminating the course of human evolution, including the oldest known skeleton. Called Ardi, the skeleton belongs to the species *Ardipithecus ramidus*.

DAVID L. BRILL

ARDI'S TEETH, some still embedded in her jaws, are more precious than jewels for paleoanthropologist Berhane Asfaw, who cradles them in his hands. The thin enamel, wear patterns, and chemical composition testify to a woodland diet of fruits and nuts.

TIM D. WHITE
ALL ORIGINAL FOSSILS COURTESY
NATIONAL MUSEUM OF ETHIOPIA, ADDIS ABABA



IN THE AFAR DESERT OF ETHIOPIA, THERE ARE A LOT OF WAYS TO DIE. THERE IS DISEASE, OF COURSE. ONE CAN ALSO PERISH FROM WILD ANIMAL ATTACK, snakebite, falling off a cliff, or in a shoot-out between one of the Afar clans and the Issa people across the Awash River to the east.

But life is fragile all over Africa. What is special here is the occasional durability of the deceased's remains. The Afar Basin sits smack atop a widening rip in the Earth's crust. Over time, volcanoes, earthquakes, and the slow accumulation of sediments have conspired to bury bones and then, much later, disgorge them to the surface as fossils. The process is ongoing. In August 2008 a young boy was taken by a crocodile in Yardi Lake, in an area of the Afar known as the Middle Awash. Three months later, Tim White, a paleoanthropologist at the University of California, Berkeley, stood at the lakeshore near where the child had died. Blanketed by lake sediments, he said, the boy's bones had a decent chance of becoming fossils someday too. "People have been dying out here for millions of years," said White. "Occasionally we get lucky and find what's left."

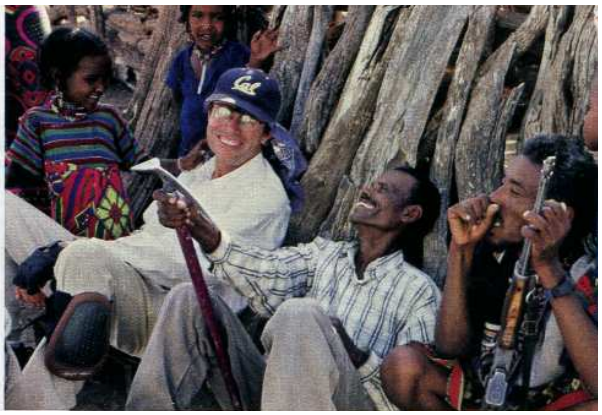
ARDI'S HAND, shown here actual size and recomposed from bones of both her left and right hands, is similar in size to a modern human's, despite her small body size (upper right).

PHOTO: TIM D. WHITE. ART: © J. H. MATTERNES (TOP, LEFT); BRUCE MORSER (TOP, RIGHT)

The Middle Awash research project, which White co-directs with his Ethiopian colleagues Berhane Asfaw and Giday WoldeGabriel, announced its greatest good fortune last October: the discovery, 15 years earlier, of the skeleton of a member of our family that had died 4.4 million years ago at a place called Aramis, less than 20 miles north of today's Yardi Lake. Belonging to the species *Ardipithecus ramidus*, the adult female—"Ardi" for short—is more than a million years older than the famous Lucy skeleton and much more informative about one of evolution's holy grails: the nature of the common ancestor we share with chimpanzees. In the mediaphilic field of paleoanthropology, it has become almost a reflex to claim that one's new find "overturns all previous notions" of our origins. Tim White despises such hyperbole. But in Ardi's case, it seems to be true.

Sensational as it is, however, *Ar. ramidus* represents just one moment in our evolutionary journey from an obscure ape to the species that holds in its hands the fate of the planet. There is no single better place on Earth to see how this transformation took place than the Middle Awash. In addition to Aramis, layers there representing 14 other time periods have yielded hominids—members of our exclusive lineage (also called hominins)—from forms even older and more primitive than *Ar. ramidus* to early incarnations of *Homo sapiens*.

White had told me that many of these "windows of time" lie in such close proximity that one could



literally walk from one to another in the course of a couple of days. He invited me to join the team in the field so they could prove it. Our plan was to begin in the present at Yardi Lake and walk backward through time, peeling away what makes us human, trait by trait, species by species.

Herto: The Ancient Familiar

I RODE INTO THE FIELD WITH TWO dozen scientists and students and six armed guards. Our caravan of 11 vehicles carried enough food and equipment for six weeks. As we threaded through the highlands, sharply terraced fields of sorghum and corn gave way to misted forests. The road was littered with the flotsam of mere history—around a bend the burned hulk of an army armored personnel carrier from the civil war in the 1990s and, farther on, the eroded name "MUSSOLINI" carved in the lintel above a tunnel, a legacy of the Italian occupation of the country in the 1930s.

From the top of the escarpment we switchbacked down a gargantuan staircase formed as the Arabian continental plate pulled away from Africa beginning some 30 to 25 million years ago, dropping the Afar Basin ever deeper into the rain shadow of the highlands. As we descended, the vegetation grew thinner, the sun more intense. A few hundred yards above the basin floor, we pulled over. Below us the western hills in the foreground fell toward a ragged, fault-scarred plain. On the horizon to the southeast, beyond the green ribbon of the Awash River, the highlands seemed to merge with the cone of the young volcano Ayelu. Below Ayelu was a sliver of silver: Yardi Lake.

Two days later we were walking along its shore—White, Asfaw, and WoldeGabriel, along with two longtime members of the project, geologist Bill Hart of Miami University in Ohio and Ahamed Elema, the leader of the Bouri-Modaitu Afar clan. For a while we followed the lake margin, bright dragonflies flitting about our ankles. It was the perfect setting for making fossils, now as in the past. Animals come to eat, to drink, to kill and be killed. Bones get buried, rescued from decomposition. Over eons, water trickles minerals in, organics out. White—58 years old, hard and thin as a jackal—poked with his long-handled ice ax at things newly dead. A catfish skeleton left by a fish eagle beneath an acacia tree. The head of a cow, still wearing a leathery mask of dried flesh. "If you want to become a fossil," he said, "you can't do much better than this."

Our first day's walk would take us east across an uplifted finger of land called the Bouri Peninsula, toward the Afar village of Herto. We emerged from the shade of the lake fringe and crossed some low, gray sand dunes. Soon an Afar boy and girl came with their herd of goats to investigate. The Afar are pastoralists, and except for the addition of firearms, their lives today are not substantially different from the way they were 500 years ago. As we walked in the heat among

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Jamie Shreeve is National Geographic*'s science editor and author of* The Genome War.

SHARED LAUGHS are part of a day's work in the Middle Awash for project co-leader Tim White and Afar clan chief Ahamed Elema (center). In the discovery process co-leaders Berhane Asfaw (left) and Giday WoldeGabriel (far left, with graduate student Leah Morgan) focus near and far.

the gently bleating animals, it was easy to imagine historical time rushing backward with every step.

We approached the grass-covered huts and thornbush stockades of Herto. Asfaw, the affable former director of the National Museum of Ethiopia in Addis Ababa, pointed beneath my feet. "Careful where you step," he said. All around me, pieces of a fossil hippo skull were eroding out of the yellowish, pebbly sand. Nearby rested a teardrop-shaped stone tool, roughly five inches end to end. The Afar people do not make stone tools. We had reached our first window into the past.

In November 1997 the team was surveying where we now stood, just a couple hundred yards from the village, when one of its members spotted a fragment of a hominid skull. Its location was marked with a yellow pin flag, and the team fanned out to search for more pieces. Soon yellow flags sprouted like a field of flowers, concentrated in one spot in particular. Embedded in the sand beneath was what turned out to be a remarkably complete human skull.

While other members of the team excavated these finds, WoldeGabriel, a geologist at Los Alamos National Laboratory in New Mexico, gathered samples—pieces of obsidian and pumice, some as big as tennis balls. Such rocks, spewed in molten form by volcanic eruptions, are gold to a geologist because they can often be dated. The Herto samples were analyzed by Paul Renne of the Berkeley Geochronology Center and in Bill Hart's lab at Miami University. The results gave an age of 160,000 to 154,000 years for the skull.

The date range was immensely significant. By comparing the DNA of modern people from different regions, geneticists had long argued that the ancestry of all modern people could be traced to a population that lived in Africa between 200,000 and 100,000 years ago. But there was little fossil evidence from this time period to support the genetic model. Now there was Herto. As the broad, heavy-browed male skull emerged from its matrix of sand, it proved the perfect face for the out of Africa theory. It was a very early modern *Homo sapiens*—indeed, Tim White argues it is the earliest member of our own species ever found. The most amazing thing about its high, rounded braincase was the sheer size—at 1,450 cubic centimeters in volume, it's larger than that of an average living human. (A second, less complete skull found at the site may be even larger.) But the fossil's long face and a smattering of traits in the back of the skull linked it as well to earlier, more primitive forms of *Homo* in Africa, including a 600,000-year-old skull from the Middle Awash found by another team in 1976 at a site called Bodo, across the river.

"One thing we know about the Herto people, they had a taste for meat, especially hippos," White said, brushing some sand off a hippo skull. Many of the mammal bones collected from Herto bear cut marks from stone tools. It is impossible to say, however, whether the people were hunting the animals or scavenging the kills of other predators. Beach sands with snail shells revealed they were doing the butchering on the banks of a freshwater lake, like Yardi today. But there is no evidence of fire or other sign of occupation, so where they were living is unknown.

Judging by the massive size of Herto man's

DAVID L. BRILL (ALL)

brain, he was just as "human" as anyone alive today. Behaviorally, however, there was something crucial missing. The stone tools found at Herto represent a fairly sophisticated technology—but they are not that much different from tools 100,000 years older or, for that matter, 100,000 years younger. There are no pierced beads at Herto, as there are at other African sites some 60,000 years younger. Nor are there carved figurines or other artwork, as one sees in the Upper Paleolithic of Europe, much less any evidence of the bows and arrows, metalwork, agriculture, and all the cultural and technological virtuosity that would follow. By walking back a mere 160,000 years—an eyewink in our evolutionary journey—we had stripped humanity of one of its defining attributes: innovation.

One curious feature of the bones, however, might serve as an augur of the behavioral complexity to come—a whisper of symbol, of meaning. Several days after the discovery of the adult skulls, Berhane Asfaw uncovered another: that of a child, judged to be around six or seven years old. Cut marks on the skull (as well as on the less complete adult cranium) showed that it had been carefully defleshed while the bone was still fresh, in a way that suggested a ritual practice rather than simply cannibalism. The surface of the juvenile skull had been left intact, and it bore a telltale polish, an indication that it had been handled repeatedly. Perhaps the child's skull was passed around and worshipped as a relic, possibly for generations, before someone laid it down here at Herto, one last time.

Daka: On Our Side of the Divide

AFTER A QUICK LUNCH, we continued our walk on the opposite side of Herto village, dropping down the eastern slope of the Bouri ridge into a scorching moonscape of gray sandstones, barren and bizarre, pocked with little caves and intricately carved pillars. WoldeGabriel explained how these sediments had been tilted up to the southwest by faulting, then sculpted into these shapes by fierce winds, water, and gravity. The many crevices in the slopes made prime denning sites for hyenas. He pointed to one in the distance, loping away at the sight of us.

We had come to a new window of time, known as the Dakanihylo, or "Daka," member of the Bouri formation. The Daka sediments are a million years old. Late in December 1997—a boom year for hominid fossils in the Middle Awash—graduate student Henry Gilbert noticed the top of a cranium eroding out of the Daka sediments. By the end of the day the team had unearthed a hundred-pound bolus of sandstone around the fossil and jacketed it in plaster medical bandages. Back in the museum in Addis Ababa, the surrounding rock was carefully removed with dental picks and porcupine quills, revealing the complete cranial vault of a member of the species called *Homo erectus*—but without a face.

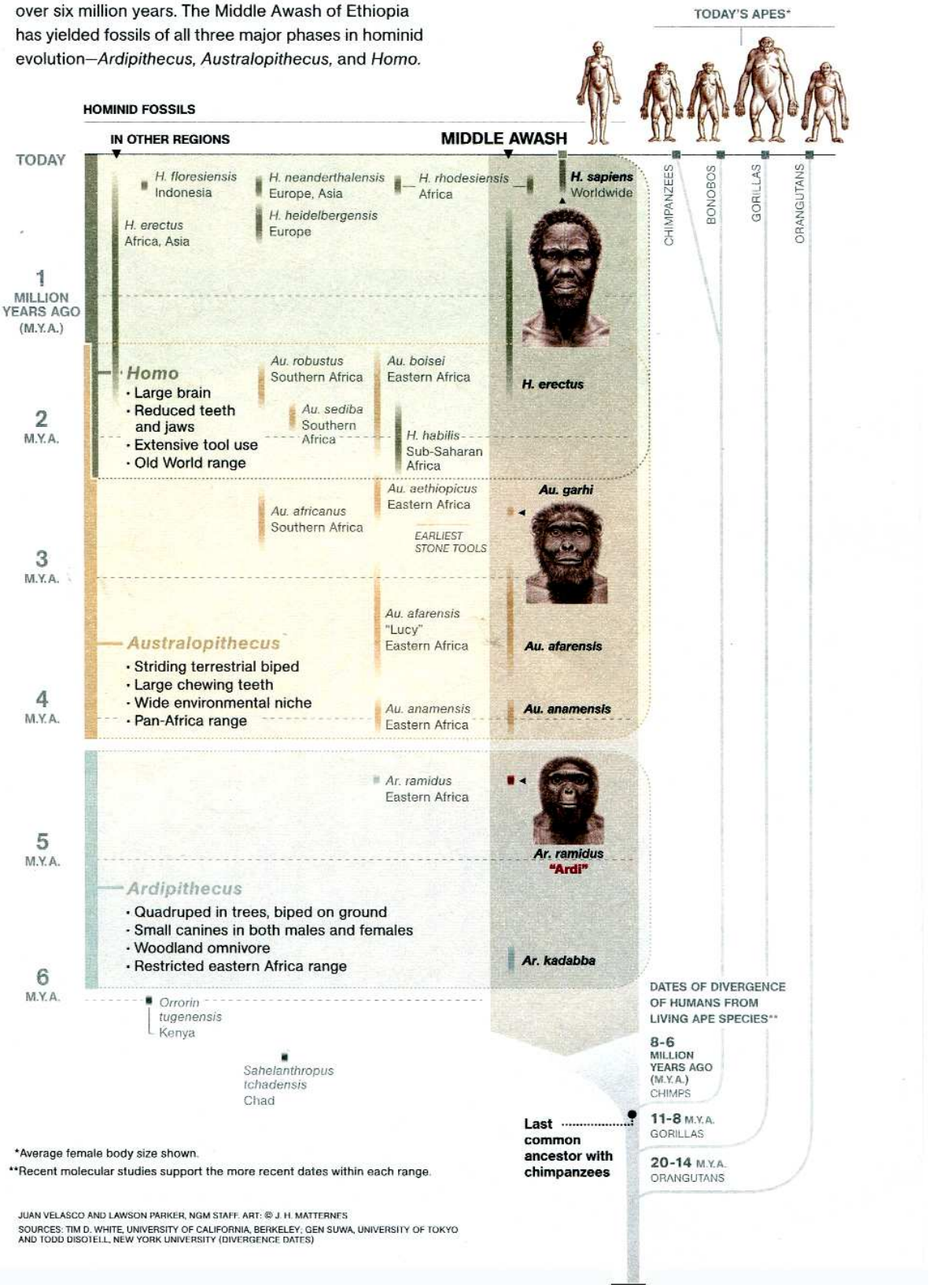
OUR PLAN WAS TO WALK BACKWARD THROUGH TIME, PEELING AWAY THE TRAITS THAT MAKE US HUMAN, TO WHERE WE BEGAN.

"Maybe a hyena chewed off the face soon after it died," White said. "It was trying to get at the brain tissue but couldn't. Too bad for us. But at least it left us the vault."

First discovered in 1891 in Indonesia, *Homo erectus* is one of the best known ancient hominids. In body size and limb proportions it was much like modern people. Its stone-tool culture, known as the Acheulean, was typified in most regions by big, symmetrical hand axes. Elema picked one up to show me: a handsome hunk of black basalt that had been flaked on all sides, missing only its tapered tip. It was a cruder thing than the tools I'd just seen at Herto, but its symmetry nevertheless reflected the key ability to perceive the possibility of form within a chunk of stone and the knapping ability to execute that transformation. Outfitted with those tools and its long legs, *H. erectus* was able to exploit a wide range of habitats and was probably the first hominid

THE HUMAN FAMILY

The record of our lineage in Africa now extends back over six million years. The Middle Awash of Ethiopia has yielded fossils of all three major phases in hominid evolution—*Ardipithecus, Australopithecus,* and *Homo.*



*Average female body size shown.

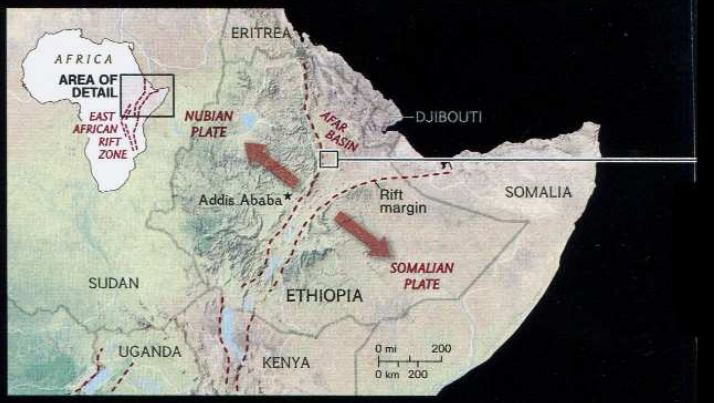
**Recent molecular studies support the more recent dates within each range.

JUAN VELASCO AND LAWSON PARKER, NGM STAFF. ART: © J. H. MATTERNES

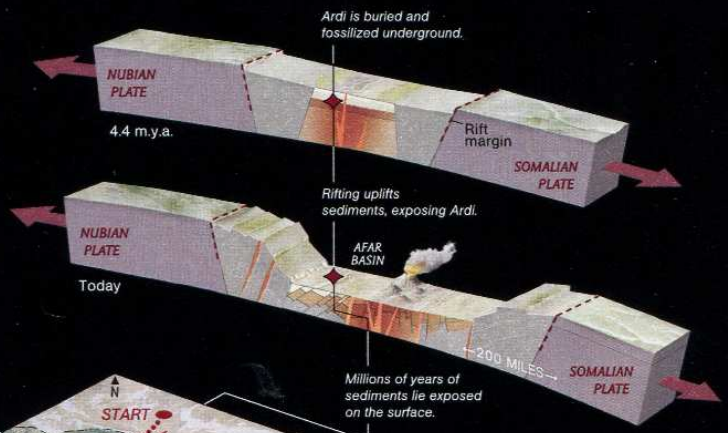
SOURCES: TIM D. WHITE, UNIVERSITY OF CALIFORNIA, BERKELEY; GEN SUWA, UNIVERSITY OF TOKYO AND TODD DISOTELL, NEW YORK UNIVERSITY (DIVERGENCE DATES)

TIME TRAVEL

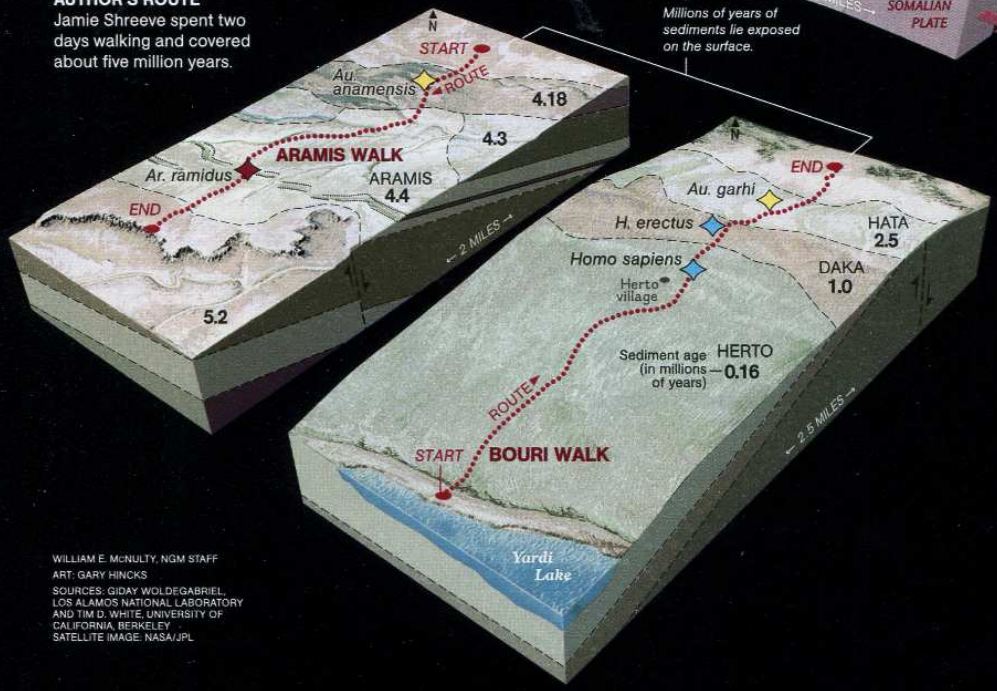
The Great Rift Valley of eastern Africa is uniquely suited to create and preserve fossils. Beneath the surface, continental plates are pulling apart (map, right). Millions of years of tectonic activity and sedimentation have buried, preserved, and brought back to the surface the remains of hominids that once inhabited the region. Associated volcanic material can often be dated.



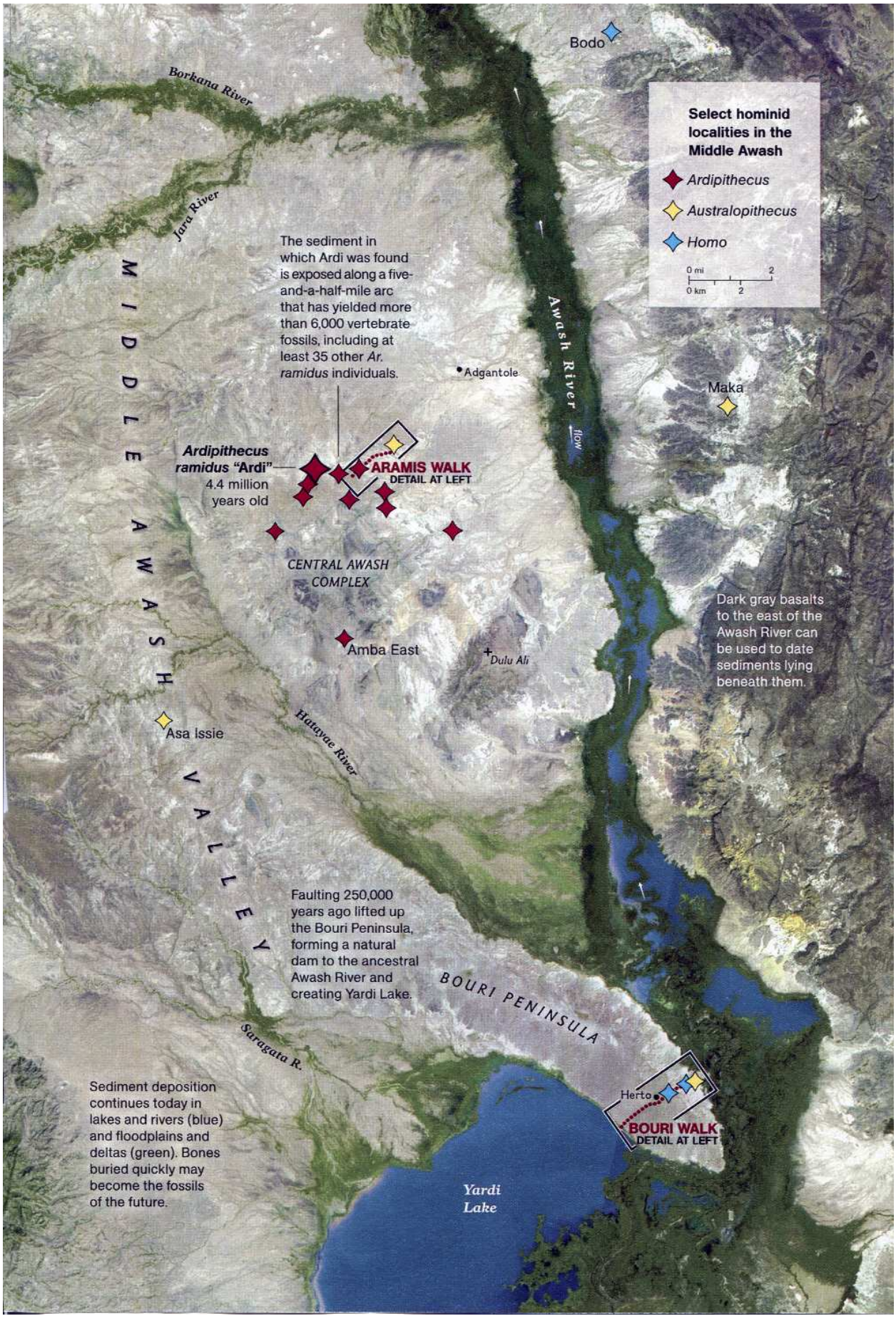
ARDI'S JOURNEY
After Ardi died, her bones were quickly buried. Minerals began to replace organic materials. As rifting continued, the Afar Basin sank and filled with sediments. Faulting, uplifting, and erosion conspired to reexpose her fossilized bones.



AUTHOR'S ROUTE
Jamie Shreeve spent two days walking and covered about five million years.



WILLIAM E. McNULTY, NGM STAFF
ART: GARY HINCKS
SOURCES: GIDAY WOLDEGABRIEL, LOS ALAMOS NATIONAL LABORATORY AND TIM D. WHITE, UNIVERSITY OF CALIFORNIA, BERKELEY
SATELLITE IMAGE: NASA/JPL


Bodo
Borkana River
Jara River
MIDDLE AWASH VALLEY
Awash River
flow
Select hominid localities in the Middle Awash
Ardipithecus
Australopithecus
Homo
0 mi 2
0 km 2
The sediment in which Ardi was found is exposed along a five-and-a-half-mile arc that has yielded more than 6,000 vertebrate fossils, including at least 35 other Ar. ramidus individuals.
Adgantole
Maka
Ardipithecus ramidus "Ardi" 4.4 million years old
ARAMIS WALK
DETAIL AT LEFT
CENTRAL AWASH COMPLEX
Amba East
Dulu Ali
Dark gray basalts to the east of the Awash River can be used to date sediments lying beneath them.
Asa Issie
Hatayae River
Faulting 250,000 years ago lifted up the Bouri Peninsula, forming a natural dam to the ancestral Awash River and creating Yardi Lake.
BOURI PENINSULA
Saragata R.
Herto
BOURI WALK
DETAIL AT LEFT
Sediment deposition continues today in lakes and rivers (blue) and floodplains and deltas (green). Bones buried quickly may become the fossils of the future.
Yardi Lake

DUST FLIES as researchers comb a Middle Awash site called Halibee, where fragments of a 100,000-year-old *Homo sapiens* skeleton have turned up. Loose surface material is swept up for sifting in shaker boxes (at rear). Blue flags define the excavation perimeter, while yellow ones mark the location of fossils or stone tools.

TIM WHITE

to leave Africa, nearly two million years ago, spreading all the way to Southeast Asia.

In the short walk from Herto to Daka, however, something tangible of our humanness had definitely been stripped away too—notably, several hundred cubic centimeters of gray matter. The braincase of the Daka specimen is a thousand cubic centimeters, fairly typical for a *H. erectus* individual and far smaller than Herto or even the intermediate, 600,000-year-old Bodo skull found across the river. And talk about a lack of innovation: Those Acheulean tools made by *H. erectus* remain much the same in the record for over a million years—a span of time one anthropologist has famously described as a period of "almost unimaginable monotony."

White was more charitable. "The species was tremendously successful, expanding geographically by orders of magnitude. *Erectus* was on our side of a great divide—with an expanded cranium and an ecological niche defined by the use of tools. Go farther back in time, take those things away, and you are looking into an alien world."

Hata: A Surprise

A SINGLE STEP TOOK US into that stranger place. Below Daka there is a hiccup in the geological succession where the vagaries of rifting and erosion have deleted a hunk of time. With one long stride over this divide we traveled back another 1.5 million years, then walked out above a stark, gully-cut plain, ashy purple in the high afternoon heat.

The purplish beds below us are called Hata, a deeper time window in the Bouri formation. In the mid-1990s a remarkable hat trick of discoveries here opened a vista on one of the most revolutionary transitions in our evolutionary journey. In 1996, the team uncovered antelope, horse, and other mammal bones showing the telltale cut marks of stone tools—at 2.5 million years, one of the earliest signs of tool use.

"The marks on the inside of one antelope jaw showed they cut out the tongue," White said. "So we not only know they were making tools, we also know what they were doing with them—extracting nutrition from large mammal carcasses." Curiously, no actual tools were found at the site. Perhaps whoever was doing the butchering kept their tools with them when they left. "I don't think they were occupying this place," said White. "It was get in and get out."

Along with these bones came the first intimation of who "they" might be: Just a few feet from where the mammal bones were found, an upper leg bone, some arm bones, and a fragment of lower jaw from a single hominid individual had turned up. The femur was fairly long, an advanced *Homo*-like trait, but the forearm was long too, a more apelike feature.

THIS WAS A CLEVER, TWO-LEGGED PRIMATE EKING OUT AN EXISTENCE AMONG LARGER, FASTER PREDATORS.

So far, it was looking like a paleoanthropologist's dream scenario. By this time, the hominid lineage had forked into two branches. One branch of the genus *Australopithecus* developed specializations for eating tough tubers and other hard foods—huge jaw muscles and massive back teeth. The other branch—hominids with increasingly smaller back teeth, more lightly built, long-legged bodies, and increasingly larger brains—led to us. Bigger brains are useful, of course, but they are also expensive to run. They require high-calorie foods—the kind you get by, say, scavenging the kills of lions and smashing up the bones for their marrow. All that was missing at Hata was a skull that would fit the bill: not as big-brained as *H. erectus* but clearly headed in that direction. Sure enough, in the very next field season team member Yohannes Haile-Selassie, now head of physical anthropology at the Cleveland Museum of Natural History, discovered the first piece of a hominid skull. But it was hardly what the dream scenario predicted.

Now, while the rest of the group walked up a gully scanning for fossils, Berhane Asfaw and I headed down onto the flat plain to the

spot where the skull had been found. Piles of excavated sediment paid testimony to the seven weeks of hard labor it took to remove the fragments. Once it was assembled, the skull did turn out to have some *Homo*-like traits, particularly in the size of the front teeth. But the molars and premolars were huge. And at 450 cubic centimeters, its cranium was no bigger than that of a typical *Australopithecus.* This was not a creature in command of its environment like *H. erectus.* This was a clever, two-legged primate eking out a furtive existence among larger, faster predators and avoiding their jaws long enough to pass its ripening intelligence on to the next generation.

The team chose for it the name *Australopithecus garhi; garhi* means "surprise" in the Afar language. *Au. garhi* was certainly in the right place and time to be the immediate ancestor to *Homo.* Whether it is, however, remains to be seen.

"This mystery will be solved soon," said Asfaw as we hiked back to the cars for the ride to camp. "And it will be solved in the Middle Awash."

Aramis: Discovery Against All Odds

THE NEXT MORNING I FOUND Asfaw, White, WoldeGabriel, and Elema gathered around some maps, conferring on plans for the day. Our path would necessarily encroach on the territory of a belligerent Afar clan called the Alisera. ("Trigger-happy cowboys," one researcher called them.) To avoid trouble, we would first pay a diplomatic visit to their village of Adgantole, bringing the six Afar policemen along. Elema would be another advantage: As a district administrator, the Bouri-Modaitu chief also commanded the respect of all the Afar clans in the Middle Awash. After what we hoped would be a friendly chat, the survey team would drive back west toward Bouri-Modaitu territory, dropping a few of us off when we were out of sight of the village so we could continue our walk into the past undisturbed by the present.

Adgantole was a sour-smelling, dusty village beside the Awash River floodplain. The Afar traditionally greet each other with *dagu*—a flurry of hand kissing and exchange of news. In the other villages we'd visited, people would flock out for dagu. But here just a few people came out to greet us. The clan chief, apparently ill, stayed in his hut. While Elema went in to talk to him, White attempted a little dagu with a dyspeptic-looking young man, who soon walked away.

"A couple of years ago that guy got pissed because I wouldn't hire him," said White. "He went for his knife and had to be restrained."

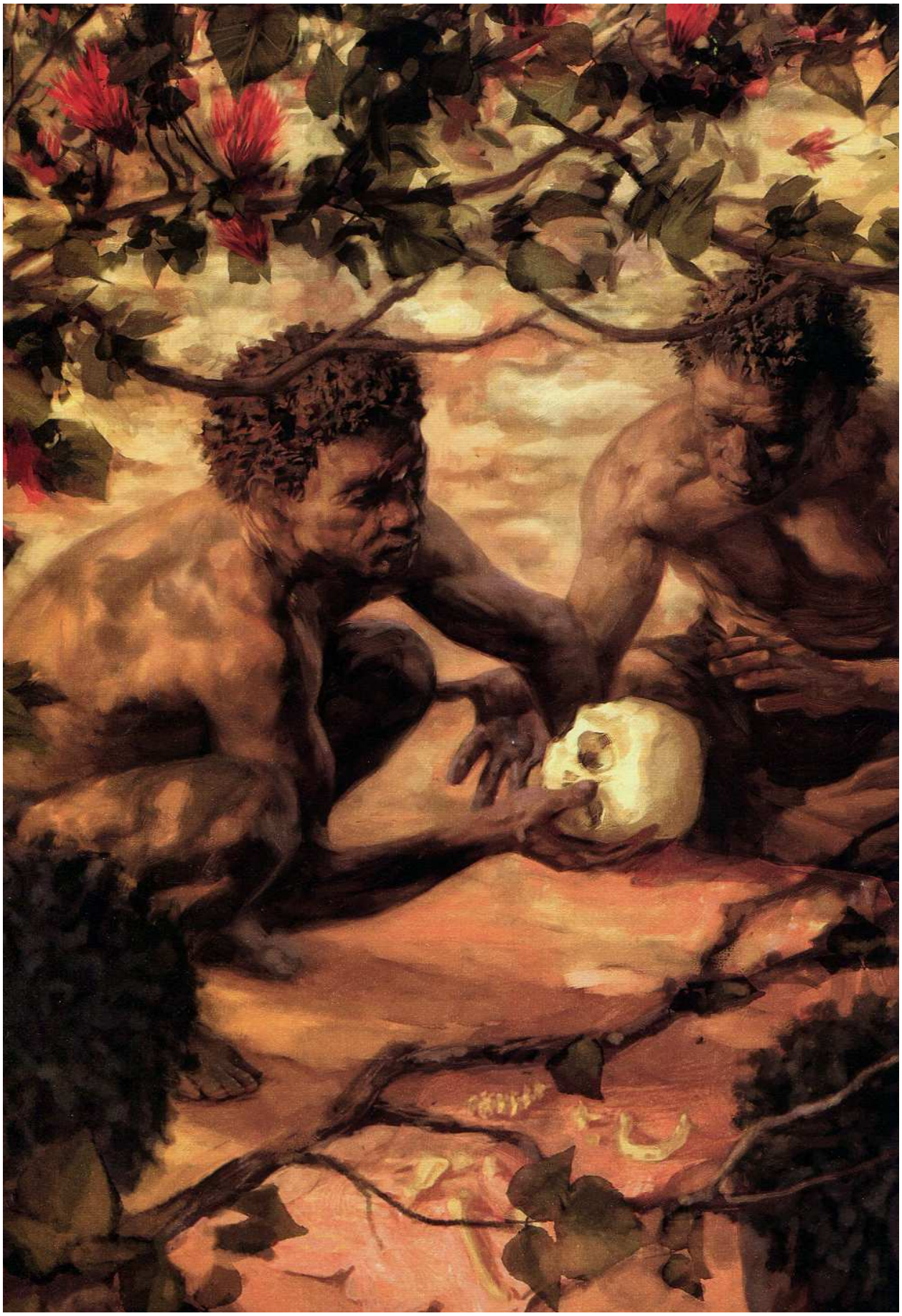
When Elema finished meeting with the chief, we headed back up to the ridge between two stream drainages. Strictly speaking, our next stop on the walk through time should have been a 3.4-million-year-old site called Maka, which had yielded a jaw and some other remains of *Australopithecus afarensis.* But Maka was on the other side of the river. A shooting war between the Afar and the Issa had rendered the land around the river an uncrossable no-man's-land—good for wildlife but bad for fossil hunting.

The best known specimen of *Au. afarensis* is Lucy herself, found by Donald Johanson at the eastern African site of Hadar in 1974 and analyzed and published in 1979 by Johanson and Tim White—then only 28—along with other fossils from Hadar and a site called Laetoli in Tanzania. Dated to 3.2 million years ago, Lucy had a projecting snout and a brain not much bigger than a chimp's. But her pelvis and limb bones—not to mention actual footprints found preserved in ash at Laetoli—revealed that her species was already bipedal. Some scientists, however, argued that her long, curved fingers, long forearms, and some other traits showed she was also adapted to moving about in the trees, like a chimp. Most scientists assumed that her ancestors must have looked and walked even more like a chimp, swinging in the trees and knuckle walking on the ground. All that was needed were the bones to prove it. They were in for a big surprise.

"We thought Lucy was primitive," White said, as we drove along the ridge. He let out a big laugh. "We had no idea what primitive meant."

A few hundred yards farther on, White used his radio to signal the other cars to pull over. Those of us who were time walking got out, and the rest drove on. The previous day we'd walked east toward the river; today we walked southwest, through an eroded expanse of badlands called the Central Awash Complex (CAC). At its heart lay Aramis, home to Ardi herself.

Starting in the early 1990s, Giday WoldeGabriel and colleagues had pieced together the complicated geology of the CAC, and now he



160,000 YEARS AGO

A Sign of Ritual

BOURI-HERTO, ETHIOPIA The skull of a child that was defleshed after death may be a remnant of an early human ritual (artist's conception, left). Dating to between 160,000 and 154,000 years ago, the skull and those of two adult early *Homo sapiens* were found near the village of Herto on the Bouri Peninsula. The polished surface of the child's skull suggests repeated handling: a treasured relic whose meaning we will never know.

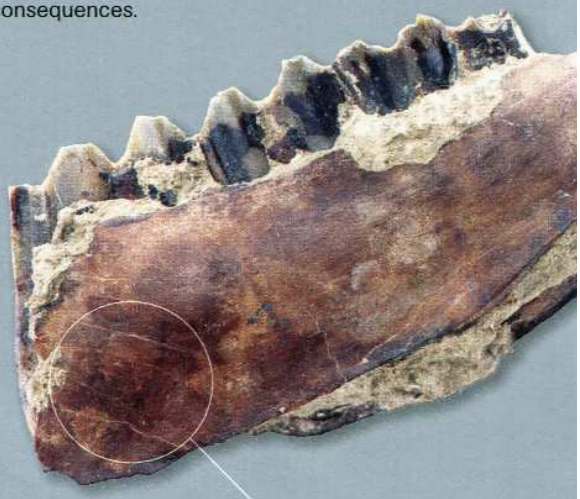
A large-brained, early *Homo sapiens* skull found in 1997 (above) reveals the imposing face of Herto man. Large cleavers (top right, 7.5 inches long) and other flaked stone tools were used to butcher hippos.

ART: JON FOSTER (LEFT); © J. H. MATTERNES (RIGHT). PHOTOS: DAVID L. BRILL

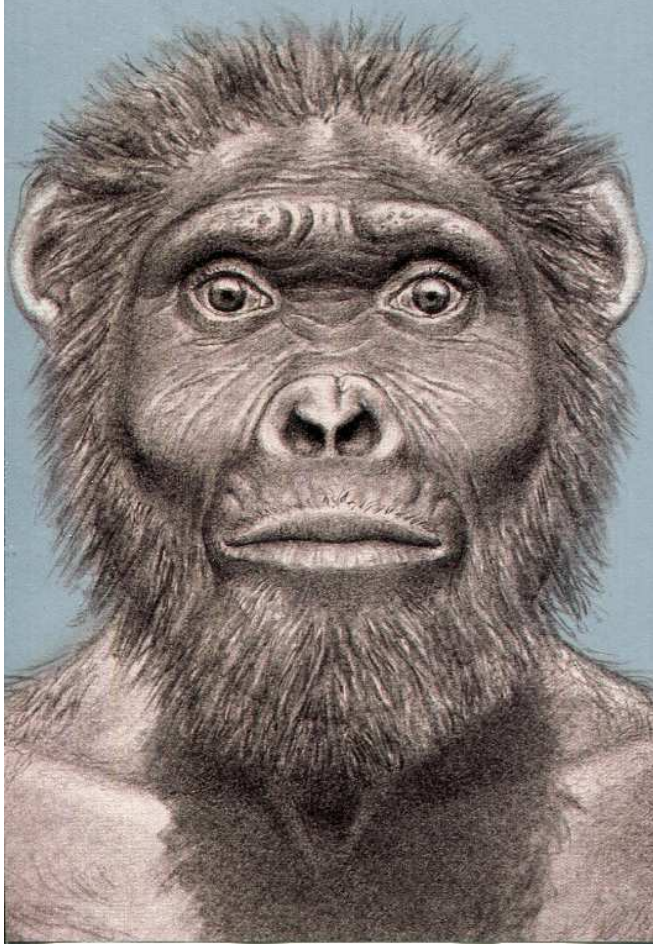
2.5 MILLION YEARS AGO

The Emergence of Tools

BOURI-HATA, ETHIOPIA On open ground, our australopithecine ancestors were more likely to be prey for lions and hyenas than competitors for their kills. Then the game changed. Crude stone tools first appear 2.6 million years ago. Some 100,000 years later, hominids on the Bouri Peninsula used tools to scavenge meat and marrow from large mammal carcasses (artist's conception, right). Such high-energy foods would have been the perfect diet for evolving the metabolically expensive bigger brains characteristic of later *Homo.* The scavengers at Hata were only trying to feed themselves and stay alive another day. But up the evolutionary road, this expansion of diet may have had enormous consequences.



Cut marks on an antelope jaw indicate its tongue was sliced out with a sharp stone flake. The most likely toolmaker is *Australopithecus garhi,* the name given a skull found in 1997 (top left).



ART: JON FOSTER (RIGHT); © J. H. MATTERNES (LEFT). PHOTOS: DAVID L. BRILL

HUNDREDS OF FRAGMENTS of bone, teeth, wood, seeds, and other biological material are sorted by the research crew on a rainy day. When the ground is muddy and streambeds swollen, the crew can't visit the *Ar. ramidus* sites, so they tend to objects they have collected during surface crawls.

gave me a taste. Some 5.2 million years ago, a flood of lava gushed out over an enormous floodplain. Through time, sediments built up atop this base of basalt. Occasional volcanic eruptions would leave thin seams of ash tuffs interlaced among the sediments, like coats of icing between the layers of a great cake. Meanwhile, magma pushing up from beneath the surface tilted the cake up toward the west, reexposing the long-buried sediments and the often datable ash. Our walk took a path into the tilt of the deposits, moving horizontally through space but drilling vertically into time. Unfortunately, through the millennia, the CAC cake has been randomly kicked and flung about by tectonic commotion and chewed by erosion so that slabs of cake and frosting are strewed about in a haphazard mess.

"This isn't like the Grand Canyon," said WoldeGabriel. "It's a patchwork quilt."

As we set off down the ridge, WoldeGabriel stopped to chip with his rock hammer at a seam of pale volcanic rock called the Lubaka tuff. (The volcanic tuffs in the Middle Awash have been given Afar animal names; *lubaka* means "lion.") The Lubaka tuff does not contain minerals that can be dated radiometrically—but not far below it was datable material of a different kind. Throughout the past, the magnetic polarity of the Earth has abruptly flipped and is evident in the orientation of magnetic minerals in some rocks. One of these polarity flip-flops, known to have occurred 4.18 million years ago, left its mark in sediments in the CAC.

Just below this time stamp was our first destination: a bush-pocked flat where a fossil jawbone had been found in 1994. It proved to match closely with fossils Meave Leakey and her team had found at two Great Rift Valley sites in Kenya, which she would name *Australopithecus anamensis.* More evidence would turn up in a Middle Awash locale called Asa Issie—a "quilt patch" composed of the same sedimentary cloth, some six miles distant from where we now stood.

All these fossils were a little older and a little more primitive than *Au. afarensis,* but judging from a shinbone found in Kenya and a thighbone from Asa Issie, *Au. anamensis* was also a biped. Indeed, there is general agreement—a rarity in paleoanthropology—that the chief difference between the two species is merely the passage of time. In other words, the names

DAVID L. BRILL

represent two arbitrary points in a single evolving lineage, with no clear dividing line between them.

Below the *Au. anamensis* level, the view on hominid evolution in the Middle Awash goes temporarily black. The yellowish green clay we were walking through was laid down between 4.4 and 4.3 million years ago, when this part of the CAC was a lake much like Yardi. Nothing was preserved in the clay but fish. Below this fish layer, however, lay the ultimate prize.

We trudged out onto a cobbled, sunbaked pan, featureless but for a rough semicircle of basalt rocks. The cairn marked the spot where, on December 17, 1992, paleoanthropologist Gen Suwa of the University of Tokyo noticed an enigmatic molar peeking out of the ground. There was just enough detail on it to reveal it was hominid. A couple of days later near the same spot, fossil hunter Alemayehu Asfaw found a piece of a child's jaw with a first molar tooth.

"That milk molar was like no other hominid baby tooth I'd ever seen, and I'd seen them all," White told me. "Gen and I just looked at each other. We didn't have to say anything. This was something way more primitive."

The team set up a perimeter and began sweeping the area clean. WoldeGabriel went to work on the geology. He figured out that the hominid-bearing deposits were sandwiched between two volcanic ash layers, the Gàala ("camel") tuff below and the Daam Aatu ("baboon") tuff above. The dates of these tuffs proved indistinguishable—4.4 million years for both. This meant the volcanic eruptions had captured between them a focused lens of time—perhaps as little as a thousand years. And everywhere the deposits outcropped along a five-and-a-half-mile arc, there were fossils—monkeys, antelope, rhinos, bears, birds, insects, fossilized wood, and other plant parts, even fossil dung beetle brood balls. They called the place Aramis, the Afar name for a nearby dry streambed.

"At this place, at that time, all the conditions were met," said White, spreading his arms out wide. "Everything was good."

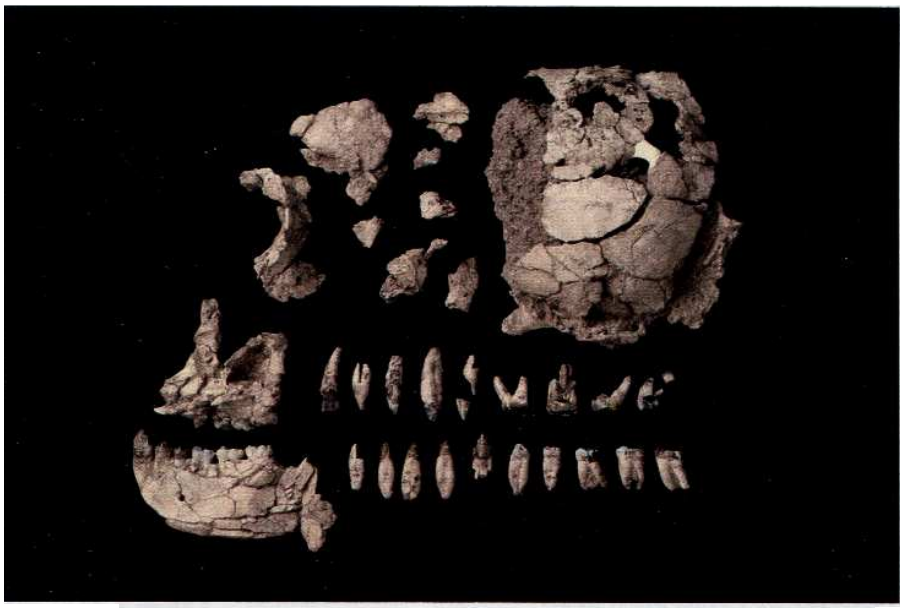
The next year the team began exploring an Aramis exposure less than a mile to the west. More hominid fossils turned up—an unworn upper canine; a pearly, eye-catching molar; more teeth; then an arm bone. But even more important than the hominid bones was the slam dunk evidence for the ecological context the creature had inhabited. For almost a century scientists had assumed that our ancestors first began walking on two legs when they moved out of the forest, where our relatives the apes still live, and onto open grasslands—to move more effectively across long distances, perhaps, or to see above savanna grass. But an overwhelming percentage of the mammal bones at Aramis belonged to woodland-dwelling monkeys and antelope.

THE FIRST INKLING WAS AN ENIGMATIC MOLAR WITH JUST ENOUGH DETAIL TO REVEAL IT WAS HOMINID.

Wear patterns on the hominid teeth and analysis of isotopes in their enamel also suggested a generalized diet more fitted to a woodland environment. If indeed the creature was bipedal—so far, the evidence was only indirect—then one of the hallowed tenets of human evolutionary science might be dead. The team would give the new hominid the name *Ardipithecus ramidus*. (*Ardi* means "ground" or "floor" in Afar, and *ramid*, "root.")

In 1994 the team was eager to return. Normally everyone's energy and nerves are spent on the first day in the field in the frenzied logistics of setting up camp. (White is an exacting "field general," and woe to anyone who pitches his tent before the common area is set up or forgets to bring along a key set of maps.) But with a little light left at the end of that first day, everyone rushed back to the outcrop.

As the sun was setting, Yohannes Haile-Selassie found a hand bone not a stone's throw from where the teeth had been found the previous year. The next day the team began to sieve the loose, sandy silt around the spot—more hand bones and foot bones turned up. Then a sweep of the area produced a tibia. Eventually



RETRIEVED FROM OBLIVION, Ardi's fragmented and crushed skull (above) was too fragile and incomplete to pick apart and reassemble. Instead, Gen Suwa of the University of Tokyo digitally reconstructed a partial skull using micro-computed tomography (CT). From more than 5,000 CT images of the

(Continued on the next page.)

came the skull and pelvis, both crushed. Indeed, all of the larger bones were in bad shape, virtually turning to powder as they weathered out of the hard-packed sediment. When a bone was found, they doused it repeatedly with hardener, excavated a hunk of sediment around it, and wrapped it all in plaster to keep the fossil safe for the ride back to the museum in Addis Ababa.

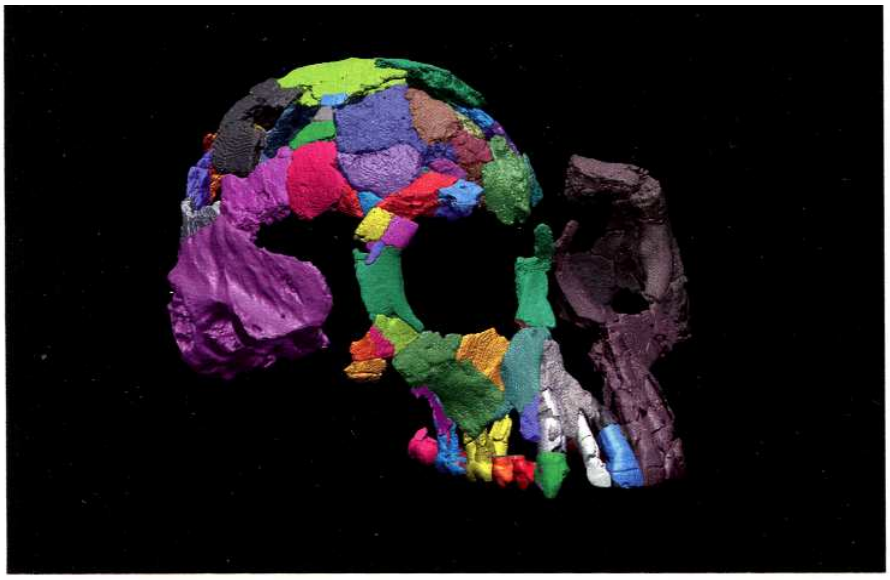
None of the researchers had dared to think it at first, but it was clear they had found the skeleton of a single individual as complete as Lucy but unlike her or anything else that had ever been seen. While most of the other bones at the site showed signs of being ravaged by hyenas after death, the hominid skeleton was miraculously untouched. After the female died, her remains apparently were trampled down into mud by passing hippos or other herbivores and protected from scavengers. After being buried for 4.4 million years, another year or two on the surface would have turned them all to dust.

"It was more than luck," White said. "It was against all odds."

It would take two more years to recover the skeleton, more years to clean and prepare the bones, and still more years to prep and catalog the 6,000 other vertebrate remains from Aramis, conduct isotopic studies of teeth, and parse out the finer points of the geology. Meanwhile, Suwa, a wizard in the new field of virtual anthropology, CT scanned the bones too fragile to handle, creating digital versions that could be analyzed. For 15 years only he, White, and a handful of colleagues had access to the skeleton. Others would have to wait until the team was ready to publish.

On the ride up to Adgantole, we stopped at the Ardi skeleton site itself, on a flat wash below the road, about the size of a tennis court. The excavation was covered by a large mound of stones. The place was silent now, but I could imagine the shouts of excitement as each bone—125 of them in all—peeked out from the earth or later emerged from its plaster jacket in the museum.

"There were no eureka moments," White told me sternly, later, when he was able to talk more freely about the skeleton. Then he described half a dozen of them. One came when he removed the plaster around a little foot bone called the medial cuneiform, which articulates with the base of the big toe. In humans and all other hominids, the joint surface of this bone is oriented so that the big toe lines up with the



fossils, he pieced together 64 digital fragments. Checking his work against other ancient and modern primates, Suwa rebuilt a virtual skull and made a mirror image of part of the face to create its missing left side (brown section). He assigned colors to the rest of the pieces to differentiate them.

others, providing a strong "toe off" for an effective bipedal stride. In apes the joint surface points in a different direction, so that the big toe can pull away from, and grasp against, the other toes to grip on to tree limbs. In this key feature, Ardi was like an ape. Yet in other respects her foot was nothing like an ape at all, bearing characteristics that would enable her to walk upright.

Everywhere the scientists looked, they found a similarly bizarre mosaic of traits: some very primitive, others advanced and exclusive to hominids. Ardi wasn't just another biped, or just another quadruped. Ardi was *both*.

I asked White whether Ardi's transitional form might justify calling *Ar. ramidus* a "missing link." He bristled at the very question.

"That term is wrong in so many ways, it's hard to know where to begin," he said. "Worst of all is the implication that at some point there existed something halfway between a chimp and a human. That's a popular misconception that has plagued evolutionary thought from the beginning, and one Ardi should bury, once and for all."

If the Middle Awash team is right in its interpretation, *Ar. ramidus* is indeed nothing at all like a modern chimp or gorilla. (See "The Birth of Bipedalism," page 62.) Of course apes and humans derive from a common ancestor. But their lineages have been evolving in separate, and quite different, directions ever since.

Beyond: The Last Common Ancestor

BACK IN THE MIDDLE AWASH, I still had a million years to walk before supper. From Aramis we hiked across a cobbled plain until we reached an overlook where more than a hundred square miles of the study area sprawled under an immense blue sky. Below us dark, gullied ridges held another half million years of sediments. Beyond them was the basalt, laid down when this vast plain was swamped in lava, 5.2 million years ago. To the left was the low hump of a relict volcano called Dulu Ali and, beyond, the Bouri Peninsula and Yardi Lake, where we'd started the day before. This vantage point seemed like a good place to look back up the evolutionary road that led from Ardi to us.

"What finding Ardi allows us to do is to think of human evolution as three stages of assembly," White said. "But the boundaries between

DAVID L. BRILL (LEFT); GEN SUWA

even these stages are arbitrary, a matter of convenience." The first stage is best represented by *Ardipithecus*—"ground zero"—a primitive biped with one part of its foot in the past and one in the future, its male canines already reduced and "feminized" in shape, its habitat restricted to woodlands. Then came more than two million years of *Australopithecus*—still small-brained but fully bipedal, no longer restricted to woodlands, and with a geographic range extending fully 1,500 miles west of the rift to Chad and south to the Transvaal of South Africa. A tremendously successful hominid stage, in time and in space.

Did *Australopithecus* evolve from *Ardipithecus*? Hard to say. In the Middle Awash, there's that hominid-free fish layer drawing a curtain between them. Until more evidence is found, there or elsewhere, it is not clear whether Ardi is Lucy's "mother" or a maiden aunt who went extinct without issue.

But White would say there's a better question to ask: Would it be possible to derive *Australopithecus* from *Ardipithecus* parts? Some scientists find this to be too much of a stretch. White disagrees. We now know from genetic studies that small alterations in the regulation of genes can have major anatomical consequences in a short amount of time. If it proved a major advantage to walk upright more effectively, White maintains, it wouldn't take too many millennia for natural selection to evolve a big toe in line with the others and otherwise rejigger the skeletal design.

The same rules apply to the transition from *Australopithecus* to the third stage of our assembly. Start flirting with higher calorie foods, nourish the further growth of the brain that helped you to figure out how to get at them in the first place, and presto—Daka, Bodo, Herto, us. Of course, fossils from other places in Ethiopia and beyond also light up the human evolutionary road, often more brightly than those from the Middle Awash. But its long record of change dramatically demonstrates that evolution is a matter of building on what had been built before.

"A car assembly line is an apt analogy," White said. "Bipedality is the frame. Technology is the body. Language is the engine, dropped in toward the end of the assembly; iPhones are the hood ornaments."

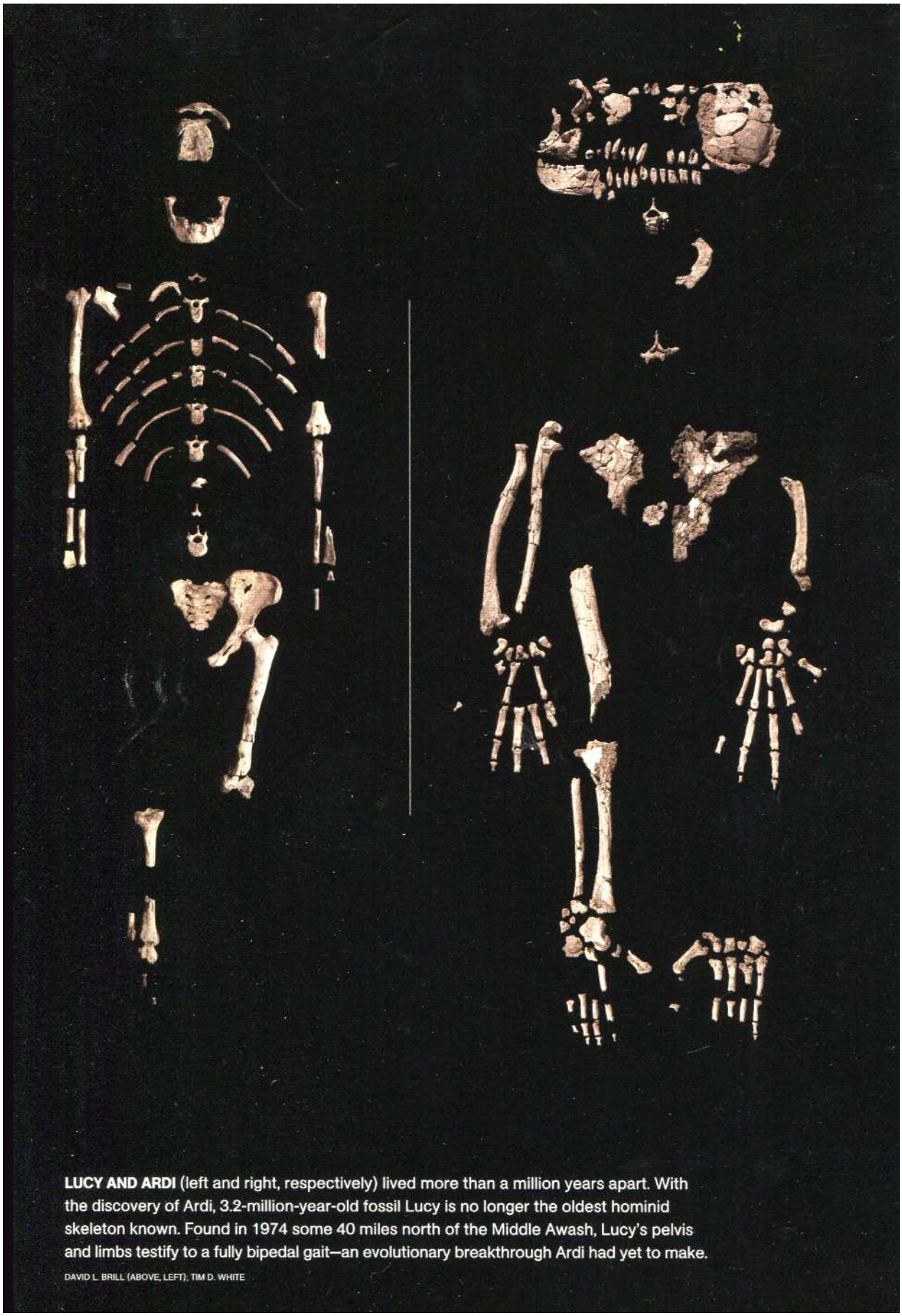
From that overlook in the Awash, we could also look west, farther into the past to the foothills of the escarpment forming the western margin of the study area. Fragmentary hominid bones have been found there too, extending back to 5.8 million years. Collected over four years by Yohannes Haile-Selassie, they have been given the name *Ardipithecus kadabba.* Most scientists believe *Ar. kadabba* to be a "chronospecies" of *Ar. ramidus,* bearing the same relationship to it that *Au. anamensis* bears to *Au. afarensis:* an earlier version of the same basic plan. White

THE MISSING LINK IS A MISCONCEPTION THAT HAS PLAGUED EVOLUTIONARY THOUGHT FROM THE BEGINNING.

and his colleagues would also include in this continuum two even older finds—intriguing six-million-year-old broken thigh bones from Kenya called *Orrorin tugenensis* and a spectacular, if enigmatic, skull from Chad named *Sahelanthropus tchadensis,* tentatively dated at close to seven million years old.

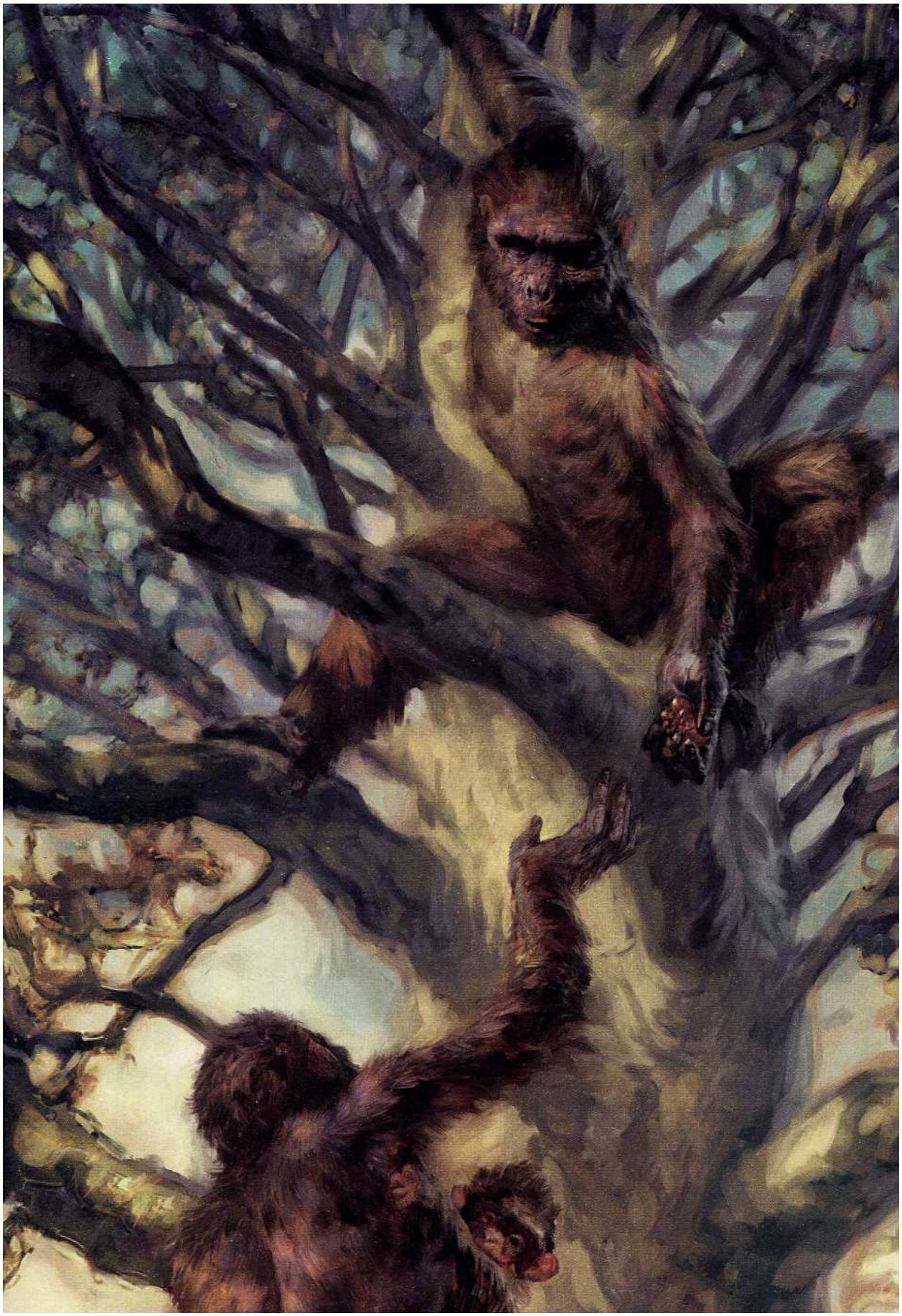
However ancient these isolated specimens are, it is *Ar. ramidus* that, for now at least, gives us the best insight into what lies at the very base of the human lineage: that last common ancestor we share with the chimpanzees. A few months after I returned from the Awash, I asked White what he thought the last common ancestor would have looked like. Nothing like a "missing link" to a chimpanzee, of course. His best guess was that it would resemble Ardi herself, though without the suite of traits that allowed her to walk on two legs, however ineffectively. But this was only a prediction. And if there was one thing I'd learned in the Middle Awash, it was not to trust predictions.

"If you really want to know what something was like, there's only one way," White said. "Go out and find it." □



LUCY AND ARDI (left and right, respectively) lived more than a million years apart. With the discovery of Ardi, 3.2-million-year-old fossil Lucy is no longer the oldest hominid skeleton known. Found in 1974 some 40 miles north of the Middle Awash, Lucy's pelvis and limbs testify to a fully bipedal gait—an evolutionary breakthrough Ardi had yet to make.

DAVID L. BRILL (ABOVE, LEFT); TIM D. WHITE



4.4 MILLION YEARS AGO

The Birth of Bipedalism

ARAMIS, ETHIOPIA

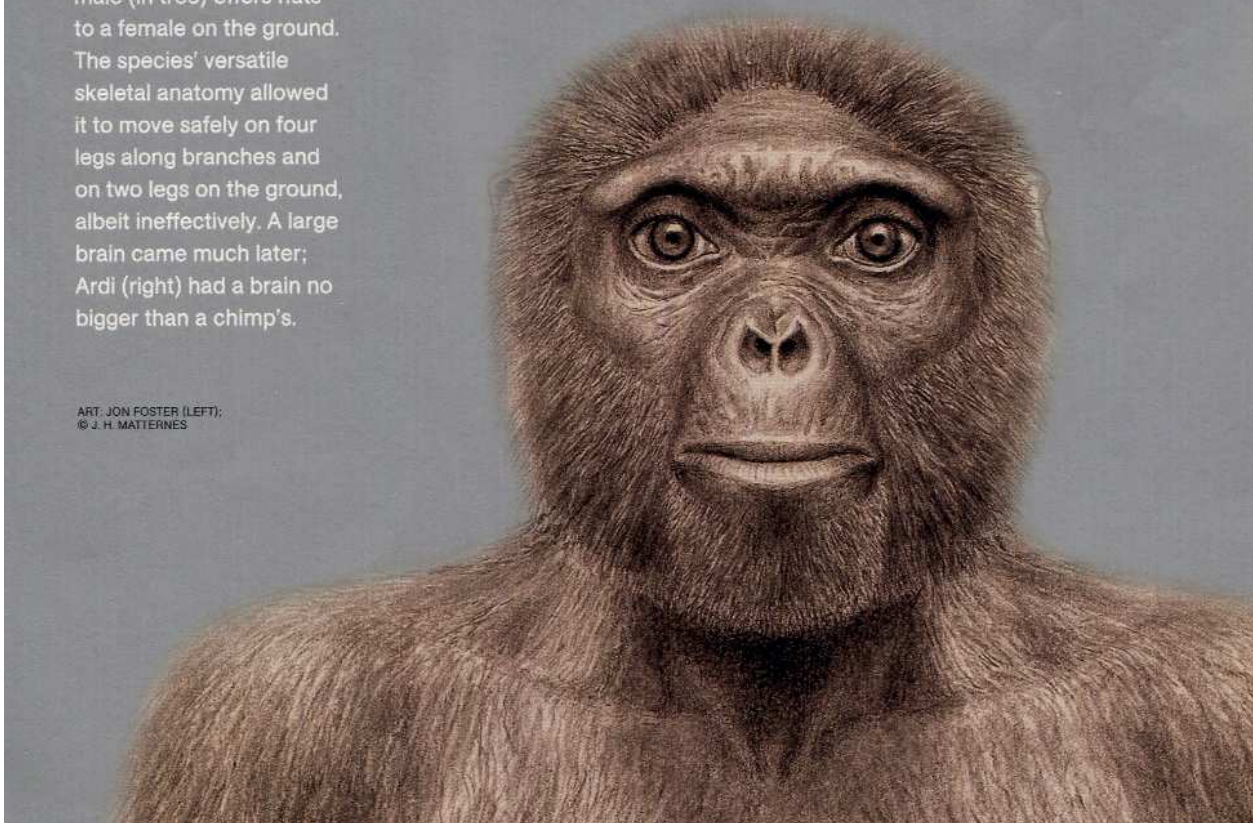
Owen Lovejoy's first glimpse of the female who would preoccupy him for the next 14 years left him cold. It was 1995, and Lovejoy, a comparative anatomist at Kent State University in Ohio, was getting a privileged peek at the freshly excavated skeleton of *Ardipithecus ramidus* in the National Museum of Ethiopia in Addis Ababa. Some of the bones were badly squashed.

"My first thought was, Why did they bring us over here to look at roadkill?" Lovejoy recalls. "It took about ten minutes to realize that all the important parts were there. My second thought was, Jesus Christ, who could have predicted *this*?"

Over the years, as Ardi's bones were freed from their rock-hard matrix and reconstructed, Lovejoy's astonishment would only grow. It had long been assumed that the further one probed into the human evolutionary past, the more our ancestors would look like our closest living relatives, the chimpanzees. At 4.4 million years, Ardi was over a million years older than the famous Lucy skeleton, which Lovejoy had also analyzed. *Ar. ramidus* didn't look like Lucy—but she didn't look like a chimpanzee either. Instead, she possessed a weird combination of very primitive traits seen before only in monkeys and extinct apes from the Miocene epoch and traits seen only in our own hominid lineage.

Consider Ardi's foot. All later hominids, including Lucy, have a big toe that lines up with the other toes, helping to provide the propulsive force

An *Ardipithecus ramidus* male (in tree) offers nuts to a female on the ground. The species' versatile skeletal anatomy allowed it to move safely on four legs along branches and on two legs on the ground, albeit ineffectively. A large brain came much later; Ardi (right) had a brain no bigger than a chimp's.



ART: JON FOSTER (LEFT);
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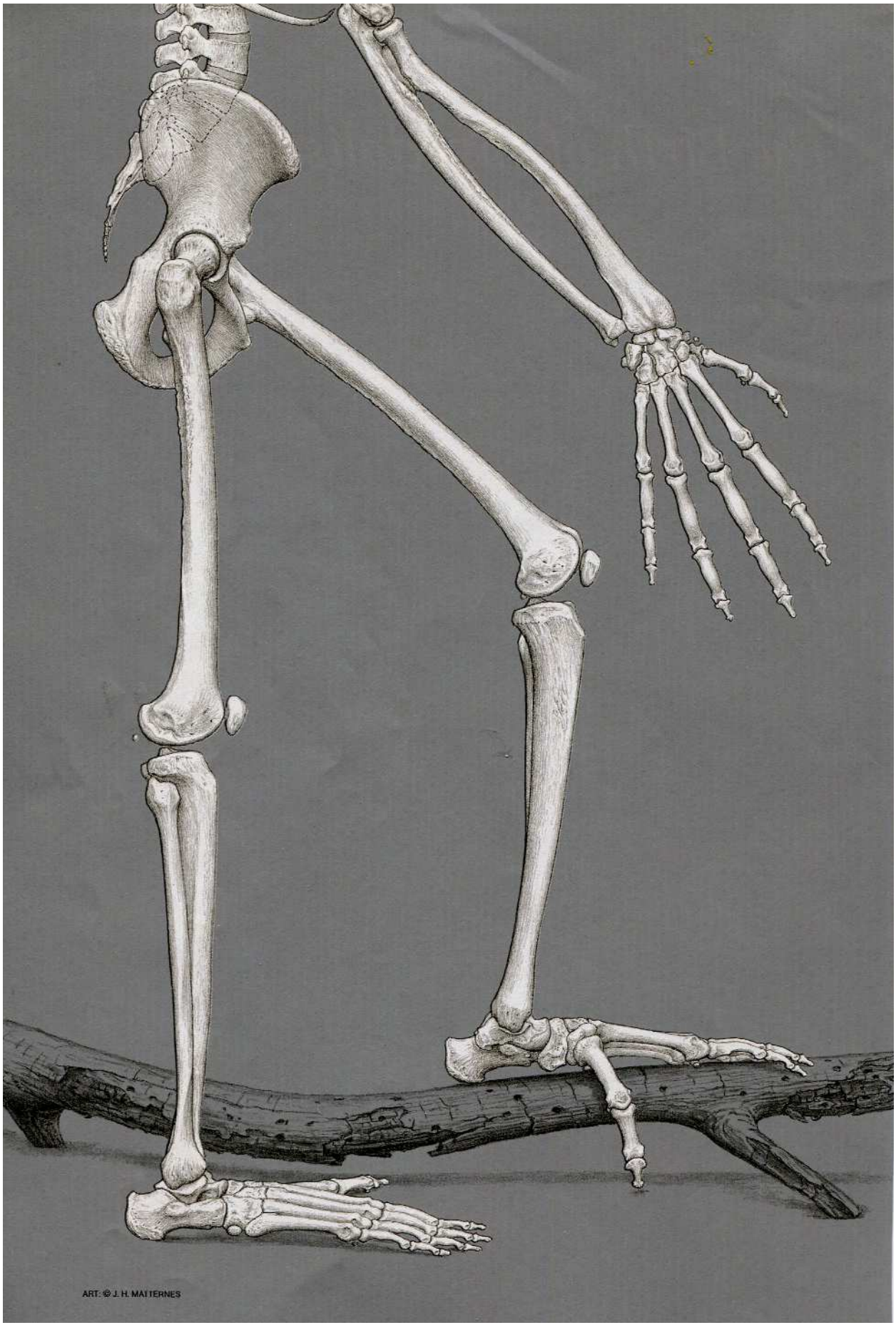
ART: © J. H. MATTERNES

Ardi's foot features an opposable big toe: well suited for grasping branches but a poor arrangement for push off in a bipedal stride, as in later hominids. According to her discoverers, the other four toes carried that load. Moving in the trees was aided by long fingers and highly flexible wrists.

in upright walking, long the hallmark of our lineage. Ardi's big toe instead splayed out to the side, like those of apes—the better to grasp on to limbs when clambering about in the trees. Yet Ardi's foot also contains a small bone called the os peroneum—retained in the hominid lineage from ancient apes and monkeys but almost never seen in chimps and gorillas—that keeps the bottom of the foot more rigid. Lovejoy and his colleagues believe that this rigidity enabled *Ar. ramidus* to walk upright on the ground, using its four aligned toes to provide the levering "toe off" that propels a bipedal stride.

Ardi's pelvis also bears witness to a primitive primate caught in the act of becoming human. The human pelvis has undergone a major overhaul to adapt it for upright walking—a locomotor juggling act requiring one limb or the other to be suspended in the air while the other pushes forward. As far back as Lucy, 3.2 million years ago, our hip bones had become broader and shorter to enlarge attachment areas for gluteal muscles that stabilize the supporting hip joint. In contrast, chimp pelvises are narrow and long and provide more rigid support for climbing but force chimps to lurch side to side when walking upright. Ardi's upper pelvis is short and broad and shows other features rarely seen except in hominids, such as a protrusion on the inside edge of the pelvis where bone was added during development to bolster support for a bipedal stride. Yet the lower pelvis is thoroughly apelike, with attachments for massive hind-limb muscles needed for effective climbing.

Then there is Ardi's surprising hand. Living African apes have long fingers and palms adapted to arboreal climbing and strong, stiff joints in their hands to support their weight on their knuckles when they walk on the ground. Since this knuckle-walking adaptation is seen not only in chimps but also in gorillas, which separated from our lineage even farther in the past, it has long been thought that it represents the primitive condition that our own ancestors passed through on their way to walking upright. Ardi's hand utterly confounds that assumption. Though her fingers are long, her palm is short and very flexible. This would have allowed her to walk on her palms on top of tree limbs, more

Owen Lovejoy (in white shirt) confers with Bruce Latimer about Ardi's pelvis and hips, which would have enabled both bipedal walking and powerful climbing in the trees. In an artist's reconstruction (far right), Ardi's lower lumbar vertebrae are not attached by ligaments to her hip blades (as they are in modern apes). This primitive skeletal arrangement was inherited from ancient apes and repurposed in hominids for upright walking.

like a monkey than any living ape, as well as hold on to branches well behind her head as she moved along limbs.

Combined with the other very primitive traits in *Ar. ramidus*, this monkey-like hand holds enormous repercussions for understanding our origins. If Ardi's discoverers are right, our ancestors never passed through a chimp-like, knuckle-walking phase on their way to walking upright. To argue that they did so would require that very early in our lineage we developed a chimp-like tool kit of adaptations—and then lost them all again and reverted to the primitive condition by the time *Ar. ramidus* was walking around. This is highly unlikely.

Still, given all the extremely primitive traits, some researchers argue that *Ar. ramidus* isn't really a hominid in the first place. Terry Harrison of New York University, for instance, points out that there was a tremendous diversity of ape species throughout most of Africa and Eurasia in the Miocene epoch, between 23 and 5 million years ago. "Perhaps it was just one of those apes running around, rather than the one that gave rise to hominins," says Harrison. In response, Lovejoy points to more than two dozen distinct traits that link *Ar. ramidus* exclusively to later hominids—which, if what Harrison postulates is right, would all have somehow ended up together by coincidence in an extinct ape that had nothing to do with us.

Even if *Ar. ramidus* is a hominid, was it really bipedal? Before Ardi was found, such a question would have been unthinkable. Among higher primates, only hominids are bipedal, ergo all hominids must be bipedal. But people assumed all hominids must have enlarged brains too—until the first little-brained australopithecine was found in 1924. Many scientists simply don't see how Ardi would have gotten around very well on two feet, especially with that widely divergent big toe.

"That ain't the foot of a biped!" comments William Jungers, an evolutionary morphologist at Stony Brook University. "Ardi has one of the most divergent big toes you can imagine. How did she get up in the trees without vertically climbing the trunks? Did she fly up there?" Why, asks Jungers, would an animal fully adapted to quadrupedal movement in trees elect to walk bipedally on the ground?

Lovejoy has a provocative answer to Jungers's question: sex. Lovejoy views the origins of bipedalism as the consequence of an epochal shift in social behavior. A key part of his theory is not something gained in our lineage but something lost: those daggerlike male canine teeth of apes, so effective as weapons against other males vying for mating opportunities. Males of virtually all living and extinct apes have large, pointed canines that sharpen by honing against their lower teeth. Hominid male canines are much smaller, more like a female's. Canines from 21 individuals were found in the *Ar. ramidus* sediments of the Middle Awash, presumably both male and female. All share the hominid pattern.

Instead of gaining access to females through conflict with other males, in Lovejoy's view, a male *Ar. ramidus* would supply a targeted female and her offspring with high-fat, high-protein foods, gaining her sexual favors exclusively in return—a reproductive strategy that ensured the children he was providing for were his own. This would require, however, that the male's hands be freed from their role in quadrupedal locomotion so they could carry back the food. Bipedality may have been a poor way for *Ar. ramidus* to get around, but through its contribution to the "sex for food" contract, it would have been an excellent way to bear more offspring. And in evolution, of course, more offspring is the name of the game.

Whatever the reason for Ardi's incipient bipedality—if that's what it was—a mere 200,000 years later Lucy's genus, *Australopithecus*, appeared in the same region—fully bipedal, like all the hominids that would follow. Did primitive, splay-toed *Ar. ramidus* undergo some accelerated change in those 200,000 years and emerge as the ancestor of all later hominids? Or was it a relict species that carried its quaint mosaic of primitive and advanced traits with it into extinction?

"These finds are incredibly important, and given the state of preservation of the bones, what the discoverers did was nothing short of heroic," says Jungers. "But this is just the beginning of the story." *—Jamie Shreeve*