ANTHROPOLOGY

Putting Our Oldest Ancestors In Their Proper Place

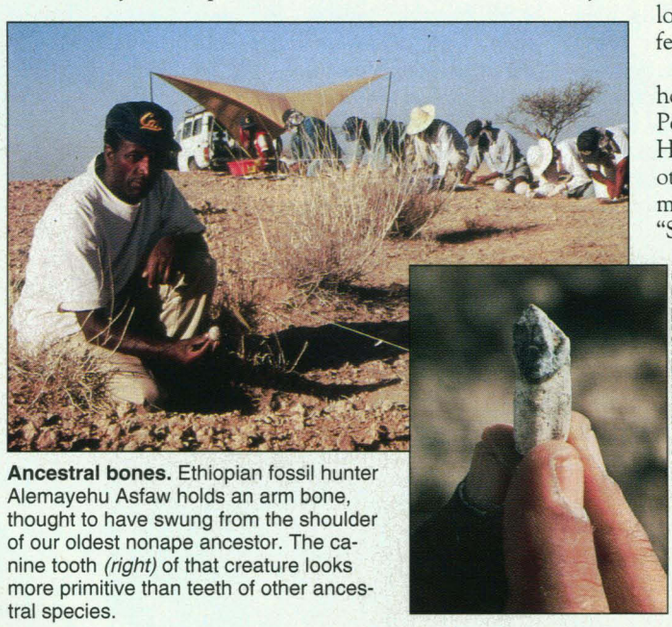
The 17 creatures who perished millions of years ago in what would become Ethiopia are now little more than teeth, scraps of skull and jaw, and four arm bones. But as a body of scientific evidence, these fragments loom large. For they represent, according to the report of their discovery in last week's issue of *Nature*, a new species that is the oldest human ancestor, or hominid, ever found. Dating from 4.4 million years ago, the fossils lie closer than any others to the split between human and chimp lineages, presumed to have occurred some 6 million years ago. For some scientists, in fact, the fossils may lie too close to the split for comfort, making their place in the human lineage open to question.

As word spread of this find—unearthed by a team led by anthropologists Tim White of the University of California, Berkeley, Gen Suwa of the University of Tokyo, and Berhane Asfaw of the Ethiopian Ministry of Cultural and Sports Affairs—its importance was never in dispute. "It's great," enthuses Alan Walker of Johns Hopkins University. "Lots of us have been trying to find stuff that's earlier than 4 million years old, and Tim has found something that's almost 4.5," he says. Adds David Pilbeam of Harvard University, "It's exciting and important. There are features where this is more like a chimp than any other hominid."

But when researchers started trying to fit those features into existing theories of human origins, opinions began to diverge. Some paleoanthropologists found that the fossils bolstered their ideas of what a truly ancient hominid should look like. Others, however, found the fit to be uncomfortable, and suggested that the remains might constitute not just a new hominid species but an entirely new genus. "This is really much more primitive than the others," says Colin Groves of the Australia National Museum. A few researchers even tentatively suggested that the fossils might belong on a completely different branch of the evolutionary tree—the branch that leads to the chimps.

White and his colleagues staked out their contention about the creatures' position in our lineage with the name they gave them: *Australopithecus ramidus*. The first part of the name places the fossils in the same genus as the next oldest hominid species, *Australopithecus afarensis*, which includes the famous skeleton "Lucy." But *ramidus*—from the word meaning "root" in the Afar language, spoken in the region around the Aramis River in Ethiopia where the fossils turned up—indicates that they represent a separate, ancestral species. "What we are doing here is introducing the species that gave rise to *A. afarensis*," White says.

The dating of the Aramis finds supports this interpretation. Radioisotopic dating techniques, as well as the generally accepted ages of other animals found in the same sediments, show that the remains are at least half a million years older than the oldest known *afarensis* specimen. Plant and animal remnants from the sediments also indicate that the habitat of this species was more wooded than that of other hominids, who may have lived in more open places.



PHOTOS BY TIM WHITE/UC BERKELEY

Ancestral bones. Ethiopian fossil hunter Alemayehu Asfaw holds an arm bone, thought to have swung from the shoulder of our oldest nonape ancestor. The canine tooth *(right)* of that creature looks more primitive than teeth of other ancestral species.

The evolutionary position of the fossils, however, depends not so much on timelines and habitats as it does on the fine points of anatomy. For the Aramis fossils, perhaps the most striking of those points is a milk tooth—a molar—preserved in a child's jaw. According to White, it separates *ramidus* from more recent ancestors by its size, which is smaller than that of *afarensis* teeth and more like the milk teeth of chimps, and by other features such as its elongated shape. "This tooth alone would be enough to recognize a new species," he says. It's not alone, however: A number of other molars and canines, which have thinner enamel than is found on any *afarensis* specimen, also point to a new species, White adds.

Still, primitive as it appears, *ramidus* is tied to humanity, White says. Several other anatomical features link the new species to *afarensis* and keep it from being classified as an ancestral ape. The canines, for instance, are blunt and diamond shaped instead of pointed and V-shaped like comparable chimp teeth. And the foramen magnum, the hole through which nerves from the spine enter the base of the skull, lies farther forward that it does in chimps—closer to its position in other hominids and humans. All of these features indicate the creature is intermediate between *afarensis* and chimps, White says.

Donald Johanson of the Institute for Human Origins in Berkeley, California, who together with White and some others identified *afarensis* in 1978, thinks White has it right. "Ever since *afarensis* was announced, all of us have had a question: What would pre-*afarensis* look like? I always predicted it would look more apelike. This has all those features, such as smaller back teeth."

The thin enamel on those teeth, however, troubles other investigators. Peter Andrews of London's Natural History Museum points out that all other hominids, including modern humans, have relatively thick enamel. "So do all the fossil apes we've found going back to about 10 million years ago," he says. Researchers have assumed that thick enamel—thought to be a sign of a varied diet, instead of one restricted to soft fruits and leaves—is the ancestral condition, as thin enamel is found only on modern chimps. So the thin enamel of *ramidus*, Andrews says, "is more of what you'd expect from a fossil chimp." The same goes for some features of an upper arm bone, Andrews says, such as a large ridge at the lower end that helps stabilize the forearm when weight is put on it; to his eye this suggests knuckle-walking, chimp-style, rather than the bipedality of australopithecines.

White isn't buying: "The canines, incisors, premolars, molars indicate *ramidus* is ... a hominid, albeit the most primitive one so far. Against this, the use of a single character (enamel thickness) known to have evolved independently many times in different mammals as their diet shifted through time is, at best, treading on slippery substrate." Nor does he accept Andrews' contention about the ridge on the arm bone, which White says is found in *afarensis* as well.

Fred Grine of the State University of New York at Stony Brook has similar problems with seeing this creature as a chimpanzee.

"There is nothing here that bespeaks knuckle-walking like a chimp," he says. But Grine and some other researchers raise a different possibility about *ramidus*: "They've documented that it's likely to be a hominid," he says. "But not an australopithecine." In essence, he says, the features that White and his colleagues describe are just too primitive to group *ramidus* with these hominids. Groves agrees. His prescription: "They need to take their courage in hand and describe a completely new genus."

White counters that it isn't courage that he needs to claim a new genus, but additional fossils. Before venturing onto uncharted taxonomic grounds, he'd like to see more bones, particularly leg bones. If bipedality is a hallmark of australopithecines and later hominids, he says, an Aramis hominid knee slightly less adapted for walking could be the signature of a new genus. "I would rather search for the Aramis knee," he says, "than make unsound inferences."

–Joshua Fischman

ASTRONOMY

Revealed: A Lost Tribe of Quasars?

Quasars should be hard to miss. These mysterious objects, which dwell in the far reaches of the cosmos, pour out as much energy as hundreds of ordinary galaxies combined. But Rachel Webster of the University of Melbourne in Australia and her colleagues think that astronomers may have overlooked an entire tribe of them, by assuming that most quasars are brightest in blue light. Dust—their own or that of foreground galaxies—may have reddened the light of as many as half of all quasars, she argues, hiding them from optical searches.

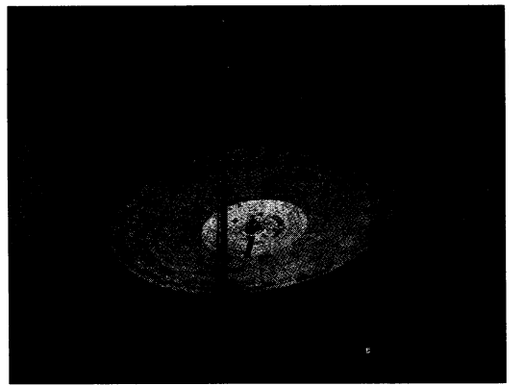
Webster bases her proposal on an ongoing survey of quasars that broadcast powerful radio emissions. By first identifying quasars with a radio telescope and then looking at the color of their light, she and her colleagues hoped to test the assumption that most of these objects resemble the distinctive blue beacons that were first identified as quasars. Last month, Webster reported at the International Astronomical Union meeting in The Hague that a large fraction of these quasars are red. For "radio-loud" quasars and perhaps others, earlier surveys may have cast too narrow a net.

"It is as if we had been looking through a piece of Swiss cheese, and our view of distant objects has been limited to those things that happened to be visible through the holes," says Webster. By finding another vantage point, says Jeremiah Ostriker of Princeton University, Webster's team has made "a strong case for a new population of red radio-loud quasars." They may also have laid a new challenge for quasar theorists: fitting thick clouds of dust into their speculations about the structure of these mysterious objects, which are thought to be powered by supermassive black holes.

Since Maarten Schmidt of the California Institute of Technology identified the first quasar 30 years ago, surveys that concentrated on the blue end of the optical spectrum have netted thousands of these objects. In 1988, however, Julia Heisler, then at Princeton, and Ostriker suggested that other quasars might be lurking unseen at the red end of the spectrum, their light reddened by dust in intervening galaxies. And at about the same time, John Huchra of the Harvard-Smithsonian Center for Astrophysics and other researchers reported finding several very red quasars in images from the National Aeronautics and Space Administration's Infra-Red Astronomy Satellite (IRAS). The finding led him to suggest that such red quasars might be as common as the familiar blue species.

Huchra's proposal attracted little attention at the time, perhaps because his sample of red quasars was small. The Australian work, however, provides systematic support for it. Webster's team used data from the 64-meter Parkes radio telescope to identify about 300 radio-loud quasars. They then turned to an optical telescope to study the color of each quasar's light and found that more than half of the sources emit more strongly in the red and near-infrared regions of the spectrum than in the blue. In an optical survey, Webster says, they might well have been overlooked.

Dust is the obvious culprit because it could redden a quasar just as it reddens the setting sun. But so far, says Webster, the evidence doesn't provide much support for Heisler and Ostriker's suggestion that dust in the disks and halos of foreground galaxies is responsible. In that scenario, the reddening should be strongest for the most distant quasars because their light would travel through more intervening dust before it reached Earth. The small number of red quasars for which the Australian team has measured redshifts—a spectral feature that is a clue to distance—show no such trend.



PETER MENZEL

All ear. The Parkes radio telescope in Australia, which carried out a colorblind quasar survey.

Other observations suggest, instead, that quasars themselves are often embedded in thick clouds of dust. Astronomers had already noted that the x-ray emissions from some quasars are cut off at longer wavelengths, perhaps because a curtain of dust blocks the less energetic wavelengths. And in last week's issue of *Nature*, a team of astronomers led by Robert Antonucci of the University of California, Santa Barbara, reported Space Telescope observations hinting that a quasarlike nucleus lies at the heart of the radio galaxy Cygnus A, which is surrounded by a donut-shaped cloud of dust so thick that the quasar's light would be completely blocked.

But not all astronomers are convinced that dust clouds thick enough to redden a quasar are common. In July, for example, Richard McMahon of Cambridge University and his colleagues reported radio emissions from two distant quasars implying that the objects are embedded in vast, warm dust clouds. Neither quasar was reddened significantly, though, probably because the dust was not very dense along the line of sight. McMahon's conclusion: Quasars red enough to have eluded earlier surveys may not be as abundant as Webster thinks. "We may be missing perhaps 10%," he says.

And even if Webster is right about radio-loud quasars, the fraction reddened by dust might not be as large for their radio-quiet cousins, which could have a very different structure. "If the obscuration [by dust] is intrinsic to the object, there's no reason to expect it would be the same for radio-quiet quasars as for radio-loud ones," Ostriker points out. "The fraction could be larger or smaller." The answer is crucial to Webster's proposal that half of all quasars could have been overlooked, she concedes, because "radio-quiet" quasars make up 90% of the population.

To find out, Webster and her colleagues have mounted a second quasar search at the 2.3-meter Australian National University Telescope. By making the observations at infrared wavelengths, they should be able to spot quasars of all types and determine just how often dust is a cure for quasar blues.

–Ray Jayawardhana

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