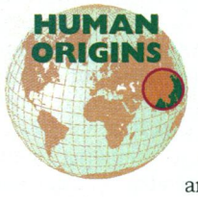
Asian Hominids Grow Older

Fossils from China could alter the picture of human dispersal and evolution—and they're just one of several findings, described on the next three pages, that challenge the textbooks



Wanderlust has been a potent factor in human evolution, spurring early members of our lineage to leave their African homes and spread throughout the world. But exactly when this itinerant urge struck has become a hotly debated issue, especially since it has major consequences for scenarios of later human evolution. For years, the majority view held that the first footloose hominid was *Homo erectus*, thought to have left Africa about 1 million years ago. In the past year, however, new data from Java and the republic of Georgia have suggested that *H. erectus* was already present in those Asian locales as early as 1.8 million years ago.

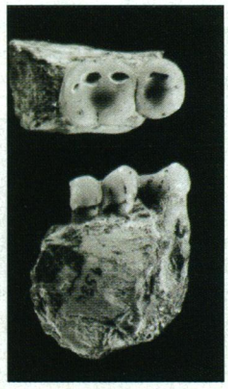
Now, in this week's issue of *Nature*, the idea of an earlier migration gets additional support from a team of Chinese and Western scientists. Based on a three-part package of hominid fossils, dating methods, and primitive tools, they argue that early *Homo* reached central China between 1.7 million and 1.9 million years ago—nearly 800,000 years earlier than had been thought.

And the team's claims go beyond dating. They suggest that the ancient wanderer was not *H. erectus* itself, but an even earlier hominid with ties to more primitive African forms. "Our work shows that there was an early dispersal of [primitive] hominids with basic stone tools out of Africa," says paleoanthropologist Russell Ciochon of the University of Iowa, who led the collaboration with the Chinese. Their results could strengthen a minority view that *H. erectus* evolved not in Africa but in Asia, from primitive hominids like the newly reported Chinese finds. If so, *H. erectus* could be an Asian side branch of the hominid evolutionary tree, rather than part of the African lineage that led to modern humans. But judging from early reaction, the fragmentary new evidence may not be enough to sway researchers who have long held a more classical view of human evolution and dispersal.

The provocative new fossils and stone tools were unearthed in the late 1980s by Chinese scientists, led by Huang Wanpo of the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing. They excavated Longgupo Cave in Sichuan province, known as Dragon Bone Slope in Chinese because the cave's roof and walls have collapsed. They found a rich collection of bones, including prized evidence of hominids: a jaw fragment with two teeth, an upper incisor, and two crude stone tools. The Chinese scientists also analyzed traces of Earth's ancient magnetic field left in sediments associated with the fossils.

Because the field sporadically reverses over time, researchers can date fossils by tying them to a particular period of normal or reversed field. The hominid fossils were determined to have been deposited during a period of normal magnetic polarity, and the Chinese correlated this to a normal polarity event dated at Africa's Olduvai Gorge to 1.77 million to 1.95 million years ago. But their work was not widely known because it was published in a Chinese journal.

Then in 1992 the Chinese invited Ciochon and his colleagues to visit the site to explore its geology and confirm the dates. For this, the researchers used a relatively new method called electron spin resonance (ESR), which measures the electric charges induced in tooth enamel over time by naturally occurring radioactive materials in the surrounding sediments. They weren't able to excavate the cave and so couldn't date the hominid levels directly. But Henry Schwarcz of McMaster University in Hamilton, Ontario, applied ESR dating to a deer tooth from one of the cave's upper levels; he estimated a minimum age of 750,000 years and a most likely age of 1 million years. Together with associated animal fossils, the ESR date "calibrates and constrains the paleomagnetics," indirectly confirming the hominid ages, says Ciochon.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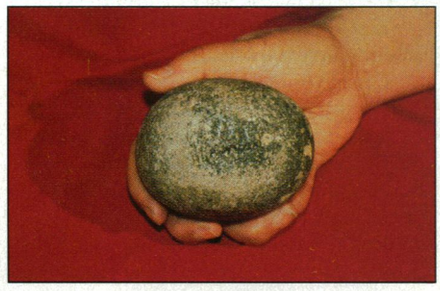

RUSSELL L. CIOCHON

Ancient Asians. These Chinese hominid fossils *(top)* and stone tools *(above)* suggest an early journey out of Africa.

The Chinese fossils may have a significance even beyond their advanced age: their primitive form. Ciochon says that characters such as a double-rooted premolar and the pattern of cusps on the molar resemble those of early African *Homo* species that predated *H. erectus*. He points to either *H. habilis*, the most ancient member of our genus, known only from Africa, or *H. ergaster*, a species recognized by some researchers as the precursor to *H. erectus* in Africa. The Longgupo Cave fossils provide a link between Asian and early African forms, agrees paleoanthropologist Bernard Wood of the University of Liverpool, noting that the new Asian finds resemble 1.6 million-year-old fossils found in East Africa.

The tools—rounded pieces of igneous rock that show signs of repeated battering—provide additional support for the idea that the fossils belong to a primitive *Homo*. These crude implements recall the basic choppers found with early hominids at Olduvai Gorge, rather than the more complicated tools associated with *H. erectus*, says the team's archaeologist, Roy Larick of the University of Massachusetts, Amherst.

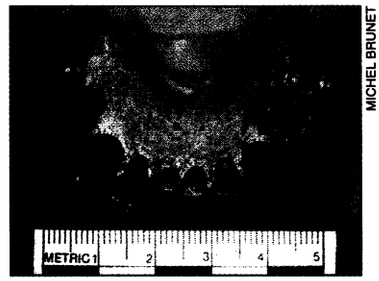
All this adds up to a coherent picture of a pre-*erectus* hominid that left Africa perhaps 2 million years ago, says Ciochon. And the simple stone tools show that hominids were able to conquer new territory before they developed the more complex hand axes once thought to be a prerequisite for long-distance dispersal. "This shows that very soon after the origin of *Homo*, hominids became mobile and were able to disperse rapidly over huge distances," agrees Peter Andrews of the Natural History Museum in London. Furthermore, in this scenario, these first travelers evolved into *H. erectus* while in Asia. And because everyone agrees that our own species arose in Africa, this implies that *erectus* itself was an Asian creature and an evolutionary side branch not directly ancestral to modern humans.

Parts of this theory are extremely controversial, but the early dates are in accord with two recent observations. Last year, Carl Swisher of the Berkeley Geochronology

African Origins: West Side Story

Ask most paleoanthropologists where an ancestral ape took its first humanlike steps, and they're likely to point to East Africa. After all, the oldest known bipedal hominid, 4.1-million-year-old *Australopithecus anamensis*, was found in Kenya, while the slightly younger *Australopithecus afarensis*, typified by the famous skeleton "Lucy," was found in Ethiopia. But the discovery of a 3- to 3.5-million-year-old australopithecine fossil in Chad, some 5400 kilometers to the west in the heart of the African continent, has upset that East African–centric view. "Human origins is not just an east-side story," says Michel Brunet, a paleoanthropologist at the University of Poitiers, who found the partial lower jawbone in January. "It's a west-side story, too."

Brunet's find, preliminarily assigned to *Australopithecus afarensis*—although Brunet himself thinks it may be a new species—is reported in the 16 November issue of *Nature*. It already has scientists backpedaling about previous declarations labeling East Africa the cradle of humankind. "I think that's been a very naive view," says Alan Walker, a paleoanthropologist at Pennsylvania State University, "and so we're going to have to rethink things, which is good for the field."



Dislocated jaw. This new hominid mandible was found in Central—not East—Africa.

One idea being heavily rethought is the notion that East Africa's long Rift Valley acted as a geographical barrier to ape populations in the late Miocene, 5 million to 7 million years ago, separating those that became hominids in the savannas of the east from forest-dwelling apes in the west. "Now we have early australopithecines all around Africa," says Brunet, "which makes it impossible to tell the exact place of origin."

Or the cause of that origin. Previously, scientists such as Yves Coppens, a paleoanthropologist at the College de France in Paris and a co-author of the new paper, had suggested that hominids had evolved in the eastern part of the continent because of habitat changes associated with the development of the Rift Valley. "The rise of the western Rift has been linked to the development of the more open savanna country one finds in East Africa," explains David Pilbeam, director of Harvard University's Peabody Museum and another co-author of the new paper. Open country, in theory, created selective pressure driving apelike creatures out of the trees and onto the ground. "And that, in turn, was seen as causing the origin of the hominids. But I don't think the Rift Valley was the mechanism," he says. The habitat of the Chad hominids seems to have been a dry, grassy woodland, according to animal fossils from the site. "We have rhinoceroses, giraffe, and hipparion [horse], which suggest grasslands, and pigs and elephants, which are more adapted to woodlands," Brunet says.

The finds will focus more attention on Central and West Africa as potential hotbeds of hominid activity. "We've always thought of the [current] West and Central African tropical rain forest as being around forever, while the east became a savanna," explains Rick Potts, a paleoanthropologist at the Smithsonian Institution's Natural History Museum. "That ecological distinction was thought to be the critical marker of the human-ape split. Now it's clear that we don't really know a single thing about what was going on in West Africa at that time."

Brunet hopes that future discoveries at his site will give scientists a clearer view of ancient West Africa—and help him nail down the precise species of the Chad specimen. Currently, Brunet says, the two australopithecines known from that period are *A. afarensis* and *A. anamensis*. "I think we will find that it is something new," he predicts. "I think there were more than just two australopithecines 3.5 million years ago—it was more complicated than that, as we know now their origins were, too."

–Virginia Morell

Center and colleagues redated *H. erectus* skulls from Java to 1.6 million and 1.8 million years old (*Science*, 25 February 1994, pp. 1087 and 1118). And earlier this year, scientists in the Republic of Georgia published an *H. erectus* jawbone, estimated to be 1.6 million to 1.8 million years old, from the site of Dmanisi, Georgia.

But many researchers remain skeptical of all three of the earlier dates. The geology of cave deposits such as Longgupo is notoriously complex, because material falling from above may become jumbled with rocks of different ages, says hominid expert Philip Rightmire of the State University of New York, Binghamton. He's not convinced that the hominids are truly older than the deer tooth dated by ESR. And the Chinese team remains leery of the Java dates. The problem, says Ciochon, is that the Chinese hominid looks more primitive than the Javanese ones. Unless there were two ancient hominids in Asia, it doesn't makes sense to have a pre-*erectus* hominid in China at the same time as true *erectus* in Java. Meanwhile, Swisher and Georgian colleagues are now redoing the paleomagnetics for the Dmanisi site.

But even more contentious than the date is the notion that the travelers were "pre-*erectus*." That conclusion is based on "pretty scrappy evidence," says Rightmire. The hominid fossils are incomplete, and the stone tools are so simple that Rightmire and others wonder if they are really artifacts. "This is not the material on which I'd choose to erect bold new scenarios of Chinese prehistory," he says. As F. Clark Howell of the University of California, Berkeley, points out, partial jawbones of early hominids are difficult to classify. To paleoanthropologist Alan Walker of Pennsylvania State University, who supports the more classical idea that *H. erectus* led to *H. sapiens*, the Chinese hominid is "just early *erectus*." If so, *H. erectus* could have evolved in Africa, then dispersed to Asia, albeit earlier than had been thought. But the link between *erectus* and *H. sapiens* would be intact.

Other anthropologists have more fundamental concerns about the fossils' identity. Milford Wolpoff of the University of Michigan, who saw the specimens on a trip to China several years ago, isn't even convinced that the partial jaw is a hominid. "I believe it is a piece of an orangutan or other *Pongo*," he says. He bases that conclusion on a wear facet on the preserved premolar, which to him suggests that the missing neighboring tooth is shaped more like an orang's than a human's.

Yet despite the murmurs of doubt, the evidence is mounting in favor of an early excursion out of Africa, accomplished with only crude stone technology. Whether the first travelers are properly called *H. erectus* or something else, the newest work all points to the same conclusion: The urge to wander is an ancient trait that evolved near the dawn of our lineage.

–Elizabeth Culotta