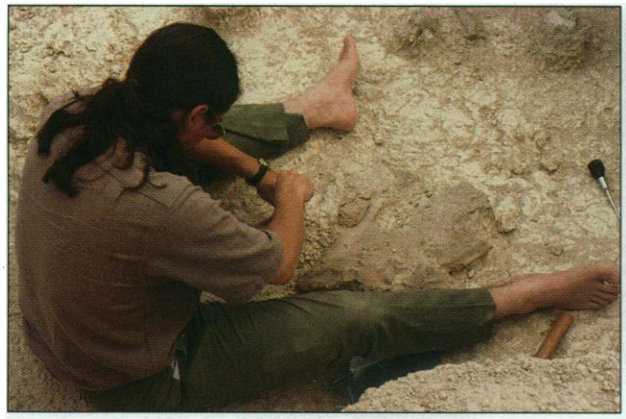
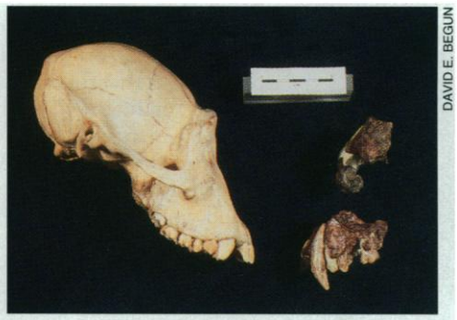
PRIMATE EVOLUTION

Hungarian Fossils Stir Debate On Ape and Human Origins

About 10 million years ago, during the Miocene epoch, a group of hardy apes lived in the wooded swamplands of what is today rural Hungary. All that's left of these extinct primates are fragments of skulls, teeth, and skeletons found on the edges of a giant iron-ore mine pit in the town of Rudabanya. But in the hands of University of Toronto paleoanthropologist David Begun, these smashed bits and pieces are, like the pieces of a jigsaw puzzle, beginning to cohere into a larger picture. And that picture could provide a new view of one of anthropology's enduring mysteries: the evolutionary relations among gorillas, chimps, and humans.



RICHARD POTTS



DAVID E. BEGUN

Evolutionary headway. David Begun *(at left)* thinks that *Dryopithecus (the fossils at far right)* was closely related to the ancestor of chimps *(skull at left)* and humans.

In this week's issue of *Science* (see page 1929), Begun offers a new analysis of these Miocene ape fossils and comes to two provocative conclusions. The first is that they may represent the closest relatives yet discovered of the common ancestor of gorillas, chimps, and humans—a much sought after species that clearly holds the key to the descent of the three groups.

But that's not all. In addition, Begun has come down on the side of the molecular systematists in an ongoing conflict with the paleoanthropologists over whether chimps are more closely related to gorillas or to human beings. The molecular crowd has long argued that chimps are humanity's nearest living relatives, while those who rely on fossils and anatomy believe that the African apes—chimps and gorillas—are closer to each other than either is to human beings. Now, says Begun, the Hungarian fossils could help to resolve this dispute on the side of the chimp-human connection.

The other anthropologists, however, aren't ready to give up their view just yet. "It's important material, and David's the best-qualified person to analyze it," says one of them, Lawrence Martin of the State University of New York at Stony Brook, who has also studied the Hungarian fossils. "But I'm unconvinced that it's going to overturn what we know about the relationships of the hominoids."

If Begun's work does overturn the accepted picture, it would not be the first time anthropologists' ideas about the relationships of the great apes have been upset. For decades, most anthropologists thought there was a fundamental taxonomic distinction between the apes (including chimps, gorillas, orangutans, and gibbons) and human beings, who were put into their own family: the Hominidae. The first blow to this tidy anthropocentric view was delivered in the 1960s when immunological studies by Morris Goodman of Wayne State University showed that the blood serum proteins of gorillas and chimpanzees were more closely related to the serum proteins of humans than they were to those of orangs and gibbons.

In the decades that followed, other studies of blood proteins and DNA confirmed that humans should be grouped with the chimps and gorillas, leaving the orangs and gibbons in two other groups. In this taxonomic reshuffling, not only did human beings lose their categorical exclusivity, eventually most molecular systematists came to believe that chimps are more closely related to humans than they are to gorillas (*Science*, 19 October 1990, p. 376).

But that view didn't persuade everyone. The paleoanthropologists, who spend their lives studying fossilized bones and casts of bones rather than DNA, continued to think the molecular folks were far out on a limb in grouping chimps with humans. As Stony Brook's Martin points out, gorillas and chimps are "the only two mammals that walk on their knuckles" consistently. Additionally, the fossil evidence supports the gorilla-chimp linkage, since the earliest known human ancestor, *Australopithecus afarensis*, which lived in Africa about 4 million to 3 million years ago, shows no signs of having been a knuckle-walker. Therefore, argues Martin, it is most likely that chimps and gorillas inherited knuckle-walking from a common ancestor that they did not share with humans.

Until now, with the evidence falling fairly evenly on both sides, and lots of pieces missing from the fossil record, there has been no way to reconcile the opposing views offered by molecular and fossil data. But Begun's new evidence could be an important bridge across this scientific chasm. "If Begun is correct," says Eric Delson, an anthropologist at Lehman College of the City University of New York, "this is the first time that strong morphological evidence supports a human-chimp segment" in the hominine subfamily that includes chimps, gorillas, and humans.

When Begun began his analysis, he was surprised by how much the extinct apes, called *Dryopithecus branchoi*, looked like modern gorillas. "Among the African ape-human clade, *Dryopithecus* shares a number of features with the gorilla not found in other hominids," writes Begun. He proposes that gorillas inherited these traits from an ancestor it shared with *Dryopithecus* and other great apes, which also show these traits. Therefore, because these traits are seen in so many of the great apes, they must be "primitive," he argues. It would be too much of a coincidence if each of the apes evolved the same features separately, rather than inheriting them from a common ancestor. But since these "primitive" features are absent in chimps and in early human ancestors, Begun reasoned, these features must have been lost once—in the evolution of the common ancestor of chimps and humans, after it branched off from the ancestor of gorillas. And therefore, chimps and humans must be each other's closest relatives.

So far, paleoanthropologists are responding cautiously to Begun's arguments. They are not convinced that the characteristics he uses to link chimps and humans are any stronger than those that match chimps with gorillas. "We are not convinced he has strong enough data to show that the traits shared by gorillas and *Dryopithecus* are primitive," says Delson, who adds that they could have arisen separately in both species.

But even if Begun can persuade some people that the characters he sees are, in

fact, "primitive," that line of argument puts him right into a quandary. After all, the proponents of the gorilla-chimp connection base their argument on another anatomical similarity: knucklewalking. Why wouldn't knuckle-walking be just as good a measure of relatedness as the cranial features Begun analyzed? Begun's response is that knuckle-walking doesn't necessarily group gorillas and chimps in their own category because there is no evidence to prove the ancestors of *A. afarensis* didn't also walk on their knuckles. The fossil record, he notes, is particularly incomplete from 10 million to 4 million years ago, and it's possible that somewhere in there is a human ancestor who did just that. "I don't know how you can analyze fossils and come up with a conclusion about what their ancestors did," says Begun.

Begun is on stronger ground with his other claim—that the Hungarian apes were closely related to the common ancestor of the African apes and humans. The leading contender to date for the nearest relative to the common ancestor has been *Sivapithecus*, a Miocene ape found in Pakistan and the Middle East. But as evidence has built that *Sivapithecus* was ancestral to the orang, it became clear that another Miocene ape must be a closer relative to the ancestor of the African apes and humans. Begun thinks he has found a better candidate in the Hungarian specimens, which show a complex of facial and dental features that are ancestral for the African apes. But *Dryopithecus* has a competitor for the role of closest human ancestor. A 10-million-year-old fossil, known as *Ouranopithecus macedoniensis*, which was found in 1989 in Greece by French and Greek paleontologists, also shows similarities with the African apes and humans, and could be a closer relative of their common ancestor, says Delson.

Whether Begun's claims ultimately become part of the consensus or not, even his critics applaud him for providing a new way of looking at the question of how to break up the human-chimpanzee-gorilla triad. At the least, he has identified another set of characters that can be used to compare different species. At the most, it may help the morphologists inch a little closer to the molecular systematists' view, without abandoning their approach to solving the problem.

–Ann Gibbons

PLANETARY SCIENCE

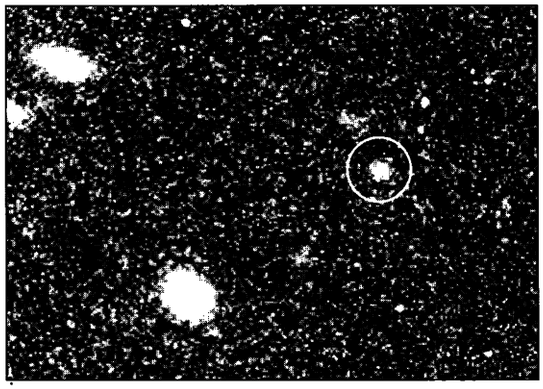
Planetesimal Found Beyond Neptune

Not since the 1801 discovery of the first member of the asteroid belt have planetary astronomers garnered this kind of prize. The 30 August detection of a 200-kilometer object 1.6 billion kilometers beyond Neptune offers the first direct evidence for a belt of dark, icy bodies lying in cold storage on the fringes of the solar system—surplus materials from the formation of the planets. If this discovery proves to be the first of many similar objects, says codiscoverer David Jewitt of the University of Hawaii, astronomers could study "the primordial building blocks of the planets; that would be really neat."

The discovery would be a posthumous triumph for the late planetary astronomer Gerard Kuiper, who predicted the belt of icy bodies, and a feather in the cap of celestial mechanicians who 4 years ago gave quantitative support to Kuiper's gut feeling (*Science*, 18 March 1988, p. 1372). In 1951 Kuiper surmised that when a disk of gas and dust condensed to form the sun and planets, some icy debris could have survived just beyond Neptune. And 30 years later, Kuiper's debris belt was just what theorists needed to explain the origin of comets with relatively short orbital periods—200 years or less.

Comets had all been thought to wander in from a much more distant dumping ground: the spherical Oort cloud, populated by debris flung outward by Neptune and Uranus. But in 1988, theorists Martin Duncan of Queens University in Kingston, Ontario, and Thomas Quinn and Scott Tremaine of the University of Toronto argued that short-period comets had to come from a close-in ring of planetesimals, orbiting the Sun at just 30 to 100 times the Earth-Sun distance (30 to 100 astronomical units, or A.U.)—the same icy belt that Kuiper had predicted. Duncan and his colleagues envisioned a belt of perhaps a billion potential comets, still adding up to a total mass much less than that of Earth.

With the 14 September announcement by Jewitt and Jane Luu of the University of California, Berkeley, that their on-and-off 5-year search had revealed a smallish object at about 41 A.U., the theorists seemed to have just what they were looking for. But the excitement is being tempered by the remaining uncertainties. The only thing known for certain about the object, temporarily named 1992 QB1, is that it's reddish, at least to the sharp eye of astronomical instruments. The reddish tint suggests that its surface is rich in the kinds of primordial organic matter that to the human eye stain comet nuclei as black as coal. With so dark a surface, the object would have to be something like 200 kilometers across—huge by comet standards—to account for its measured brightness.



D. JEWITT AND J. LUU

First of a multitude? The new planetesimal *(circled)* appears as a faint spot near two distant galaxies.

But a single body doesn't amount to a Kuiper Belt. Indirect evidence that QB1 is just one of a multitude should come from the shape of its orbit, something that isn't known yet because the object's apparent motion against the stars is so slow. If the orbit is roughly circular and lies near the orbital plane of the planets, the body could be a representative of the Kuiper Belt, but an inclined, highly elliptical orbit could mark it as a lone interloper from the distant Oort Cloud. Observations of the object's motion during the next few months should decide the question. "I'm reserving judgment until we get a better orbit," says Tremaine. But if it is reasonably circular, "I'll bet there are a lot more of these out there and this is the Kuiper Belt."

Even before then, more direct support for the existence of the Kuiper Belt could come in the form of additional planetesimals. Using the 2.2-meter telescope on Hawaii's Mauna Kea and the latest in charged-coupled-device detectors, Jewitt and Luu searched 1 square degree of the sky—the area of four full moons—with enough sensitivity to detect objects as faint as 25th magnitude. According to earlier estimates, such a search should turn up between one and five of the largest Kuiper Belt planetesimals. Jewitt and Luu got their one, but they have not yet fully inspected their images, leaving the possibility that more planetesimals are lurking in the data.

In the meantime, there is the matter of a permanent name for 1992 QB1. The first asteroid to be discovered was named Ceres, after the patron saint of Italy. Jewitt and Luu may take a different tack with the first member of the secretive Kuiper Belt. "We want to call it Smiley, after George Smiley, the spy in John Le Carré's books," says Luu. "We both like the character and were talking about him at the telescope." If, as astronomers suspect, the Kuiper Belt includes thousands of planetesimals as big as this one, many a stealthy character may yet be immortalized.

–Richard A. Kerr