

A 'MOSAIC' Ape Takes Shape

By BRUCE BOWER

On rare occasions, the best fossil find is the one you do not have to dig for.

Take, for example, the discovery last June of thousands of bone fragments belonging to *Proconsul*, an ape-like creature that lived from about 16 million to 22 million years ago (SN: 9/1/84, p. 135). Many scientists contend that *Proconsul* was one of the earliest hominoids, an ancestor of modern apes and humans. A fossil-hunting team on Rusinga Island in Kenya's Lake Victoria was laboriously digging through rock and fossil sediment when a rainstorm filled their trench and halted work. Some of the Kenyans on the project, which was directed by Richard Leakey of the National Museums of Kenya and Alan Walker of Johns Hopkins University in Baltimore, used the free time to go exploring.

Beside some garden plots on the side of the main path to the lake, they came upon a 30-yard patch of land that the locals had fenced off with short stone walls to prevent erosion. The seasoned collectors were amazed: The ground was white with primate bones.

Work on the trench was wrapped up so the team could collect the open-air bones and sift the topsoil for bone fragments. Three complete feet and a hand lay in the

clay just below the topsoil. All the fossils date from 18 million years ago and belong to *Proconsul*, according to the investigators.

"Before this find, we had a limited sample of *Proconsul* fossils to study," says Hopkins anatomist Mark Teaford, who participated in the expedition. "For the first time we can examine complete wrist and ankle bones." Fragile hand and foot bones are usually crushed or chewed up by predators long before fossil hunters can find them. In this case, however, the delicate appendages were beautifully preserved. Curiously, most of the leg bones at the site are "fairly badly crushed," says Teaford.

Another reason the find is important is that the bones come from five individuals—two adults, an adolescent, a child and an infant. Scientists now can analyze the ancient animal's structural changes during aging. "We may be able to shed light on possible differences in locomotor [movement] capabilities between infants and adults," notes Teaford. "Modern primate infants are good at hanging on to their mothers. Did *Proconsul* infants do the same thing, or were they plopped in a tree somewhere?" More importantly, he adds, did *Proconsul* use its wrists and ankles to walk on all fours, or did it rely on tree swinging to get around?

There may be some answers when Teaford and colleagues at Hopkins complete a preliminary analysis of the bones early this year. Even before the latest find, when *Proconsul*'s scanty remains from the neck down provoked considerable scientific debate, it was still the best known ape of the Early Miocene period (16 million to 23 million years ago). It was also the only hominoid specimen rivaling the more recent remains of the human ancestor Lucy (SN: 7/2/83, p. 8) in completeness. Lucy dates to around 3 million years ago.

The last major unearthings of *Proconsul* occurred over 30 years ago. In 1948, Mary Leakey (Richard's mother) found a *Proconsul africanus* skull on Rusinga. This cat-sized hominoid was the smallest of three *Proconsul* species; it stood 18 inches high on all fours and weighed about 20 pounds. In 1951, geologist Thomas Whitworth found a partial *P. africanus* skeleton at the same site. Several years ago, Walker

and Martin Pickford of the National Museums of Kenya identified more *Proconsul* pieces that had been incorrectly labeled in several museum and laboratory collections. Remains of the other two species, *Proconsul nyanzae* and *Proconsul major*, are more sparse, particularly the latter.

Walker and Pickford's work helped to clarify opinion about *Proconsul* "to some extent," says Harvard University anthropologist David Pilbeam. The consensus now holds that *Proconsul* was an unspecialized, primitive hominoid. It was a tree-dwelling, fruit-eating "formative ape." Males were distinctly larger than females. "In its total pattern it was unlike any living higher primate," says Pilbeam, but parts of its anatomy do have modern parallels. Its elbow and shoulder joints and feet are like a chimpanzee's, its wrist is like a monkey's and its lower vertebrae are like a gibbon's.



The remarkable preservation of the two adult feet is evident even while they are still partially covered at the site.

At first these similarities misled scientists, explains Pilbeam. Some thought *Proconsul*'s form was too specialized to be the forerunner of any living ape and that it might not have been a hominoid. Others felt that it was ancestral to the chimpanzee. "When a fossil animal is found in fragments and over a period of time, the very order of discovery of its various parts will affect [evolutionary and developmental] interpretations," says Pilbeam, "particularly in the case of a 'mosaic' species such as *Proconsul*."

The new find will likely confirm *Proconsul*'s place near the base of the hominoid family tree, after monkeys had evolved as a separate branch but before chimpanzees, gorillas, orangutans and humans branched off. *Proconsul* is about 12 million



Teaford

Alan Walker uncovers the well-preserved feet of an adult *Proconsul*.

years too old to be considered a "missing link" between apes and the first humans.

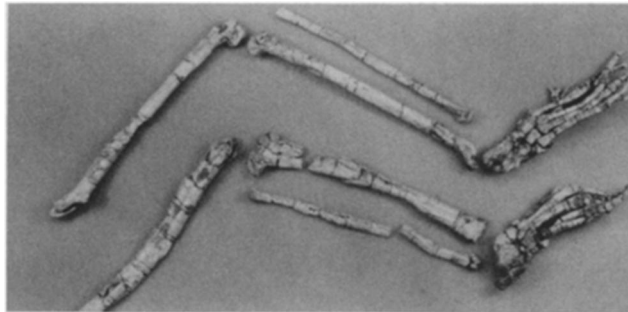
Still, a spectacular cache of bones delights scientists. The recently discovered pieces of the 18-million-year-old mosaic should provide a clearer picture of *Proconsul's* movement capabilities, says anthropologist Mary Ellen Morbeck of the University of Arizona in Tucson. In the early 1970s, Morbeck carefully studied the joints of *Proconsul's* partial skeleton and concluded that it moved about primarily by walking on all fours. Many other researchers held that because *Proconsul* was an ape, its favored method of transportation was tree swinging.

"We're not able to say what the animal's shoulder joint was capable of doing," points out Morbeck. "But it had a lot of rotation in the forearm, a weight-bearing wrist, a grasping hand, a stable ankle joint and a hefty, grasping big toe." This, she says, supports her contention that *Proconsul* walked rather than swung.

Until recently, however, examination of postcranial (from the neck down) bones took a backseat to calculations based on skull and dental remains. "On my first trips to Africa I was the only one there who was looking at *Proconsul's* postcranial bones," recalls Morbeck. Lower skeletal regions have gained more respectability since then, she adds, especially because they provide the best clues to when early human ancestors were first capable of walking on two feet.

Morbeck's approach to *Proconsul* has been to examine the surface features on the ends of limb bones that would be held together as a joint in a living creature. Detailed analysis of these areas reveals an animal's capacity for movement. In addition, she recently began a growth and development study of modern chimpanzees, macaques and humans. "I hope this work will provide a basis for predicting individual body weight from postcranial fossil remains, even though modern animals are not like ancient ones," says Morbeck.

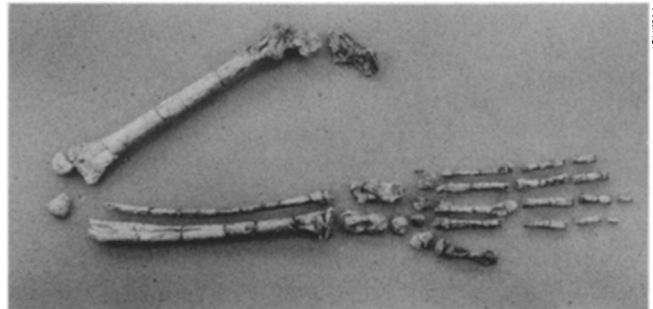
When one of the 20 chimps or 60 macaques now in the study dies, Morbeck and several co-workers dissect its body, weigh muscles from every part of the body and analyze bone and joint surfaces. Data on several human cadavers also have been



At left are the two complete adult hindlimbs of the individual being unearthed by Walker on the facing page. Ironically, there is more damage to some of the larger bones than to the fragile foot bones.

Walker

The complete juvenile hindlimb at right is in a condition similar to that of the adult remains above—some of the larger bones have been partly crushed while the foot bones are in good shape.



Walker

collected.

The study is not complete, but preliminary results show that tooth measurements, which paleontologists have relied upon to predict body weight from fossils, are poor indicators of weight. The trick is to find a relationship between the distribution of body weight in a living primate and the surface features of its joints. If there is one, it could be used to put some figurative flesh on *Proconsul's* bones.

A reliable body weight formula would be invaluable when postcranial fossils are found for other ancient apes, observes Morbeck. A good example, she says, is *Sivapithecus*, a Miocene ape known primarily by jaw and skull remains. In 1983 Walker and Leakey found a 17-million-year-old jaw in Kenya that they identified as *Sivapithecus* (SN: 1/21/84, p. 41). *Sivapithecus* previously had been found only in Asia and had been dated at no older than 12 million years. Was the animal an early African ape and human ancestor that migrated to Asia, as Walker holds, or did it develop on a separate family line that led to Asian orangutans?

The new collection of *Proconsul* bones may eventually be compared to the *Sivapithecus* jaw in an attempt to unravel the latter animal's puzzling role in evolution. For now, though,

Teaford and colleagues are examining casts of the wrist and ankle bones they uncovered. The rest of the specimens are in Kenya, where the investigators plan to return in February.

More fossils are undoubtedly hidden in the clay at the Rusinga site, says Teaford; they may include skull, backbone and shoulder parts in addition to the hand and foot bones that have already been found. A geological analysis of the soil also needs to be done. Time, however, is pressing. In an agreement with the villagers, the scientists must finish their work in five years. The plot will then be turned into a garden.

"These new materials will give us details we never knew about before," says Morbeck. "We'll be able to test much-debated ideas about *Proconsul*."

This does not mean that researchers will use the fossils to divine the relationship of *Proconsul* to modern humans and apes, she cautions, or that the fog will lift from the hazy period between the Early Miocene and the first appearance of human ancestors. For now, there is enough excitement in fitting together so many crucial pieces of a mosaic ape.

As Walker said after last year's discovery, "There is every hope that we shall know the anatomy of *Proconsul*, together with their growth patterns, almost as well as we know it for some living species." □