SCIENCE NEWS OF THE WEEK

Evolution Revolution

A major marker on the road of human evolution has been moved back—considerably. The marker is *Homo erectus*, the unequivocally acknowledged primitive form of human being that evolved into *Homo sapiens*. Based on its most widely known forms, Peking Man and Java Man, *Homo erectus* has generally been dated at about 500,000 to 700,000 years old. Now this species will have to be dated at more than twice that age. Richard E. Leakey announced this week the discovery of a complete *Homo erectus* skull that has been reliably dated at 1.5 to 1.8 million years.

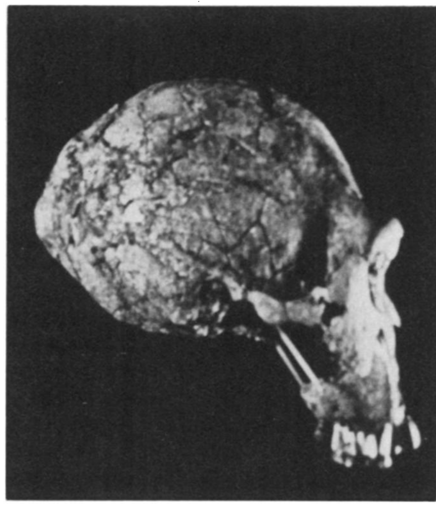
This announcement was only one of several made at a news conference in Washington described as "unique and historic" by its participants. In addition to the almost perfect *Homo erectus* find, Leakey announced the unearthing of two other highly significant fossils: a 2.5- to 3-million-year-old skull of what may be an earlier form of *Homo* and an almost complete hipbone of about the same antiquity. Adding to the import of the news conference was the fact that Leakey was not alone. He appeared with Donald Carl Johanson, who gave the highlights of his previously announced discovery of more than 150 fossilized bones from the Hadar region of Ethiopia's Afar Depression (SN: 1/10/76, p. 20). Leakey, of the National Museums of Kenya, and Johanson, of the Cleveland Museum of Natural History, have sometimes been seen as competitors in the search for humanity's history. Their appearance together was aimed at dispelling that impression and emphasizing the degree of cooperation that is now a function of research into human evolution.

Leakey's *Homo erectus* skull is important for several reasons. It is one of the most complete and certainly the oldest specimen of *Homo erectus* on record. (The Peking or Java fossils might be older, but they have never been accurately dated.) In addition, the skull, which is almost identical to the specimen from China, represents the first solid evidence of *Homo erectus* in Africa.

What was this species doing in China as well as in Africa? It is possible, says Leakey, that the Chinese fossils are older than previously thought or else the species was remarkably uniform in physical characteristics over a long time span and across a vast geographical range. This and other questions are yet to be answered, but Leakey was obviously elated by the find. The skull, with its face, teeth and classic beetled brows, he described as having a "glorious profile. . . . I think it is one of the prettiest skulls I have had the pleasure and privilege of seeing."

Leakey's appreciation, however, is more than aesthetic. This skull helps to prove a hypothesis that he has long held—that true *Homo* coexisted with, rather than descended from, the more ape-like *Australopithecus*. "This is a very, very exciting development for us," says Leakey, "particularly because it is uncontroversially *Homo* and it is from deposits that have also yielded uncontroversial evidence of *Australopithecus*." The skull in question, like most of Leakey's discoveries since 1969, came from the Koobi Fora site on the eastern shore of Lake Turkana (formerly, Lake Rudolf). The actual discovery was made by Bernard Ngeneo, Leakey's Kenyan assistant.

Leakey's other finds also bear on his hypothesis. In 1972, he announced the discovery of a *Homo*-like skull 2.6 million years old. Its cranial capacity was more than that of *Australopithecus* and less than that of *Homo erectus* (SN: 11/18/72, p. 324). This skull, known as 1470, was also discovered by Ngeneo, and Leakey claimed it to be an early form of *Homo*, contemporaneous with *Australopithecus*. Now, another skull from Koobi Fora tends to confirm Leakey's claim. It is of the same age and type as 1470. "I think," says Leakey, "1470 can now be said to be not a freak, but a real entity, a relatively large-brained form of *Homo* that lived in eastern Africa somewhere between 2 and 3 million years ago."

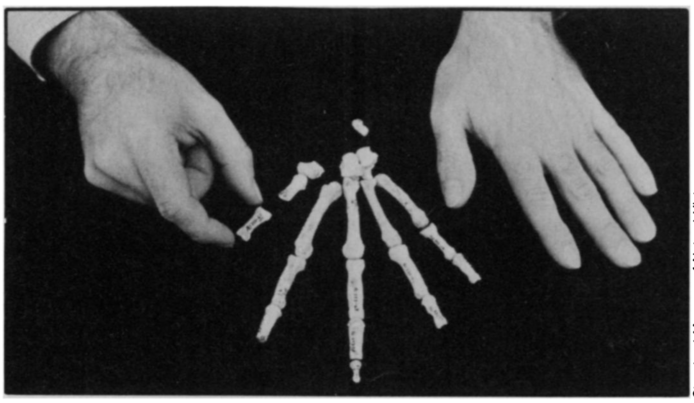


R. J. Trotter/Leakey

Homo erectus: A glorious profile.

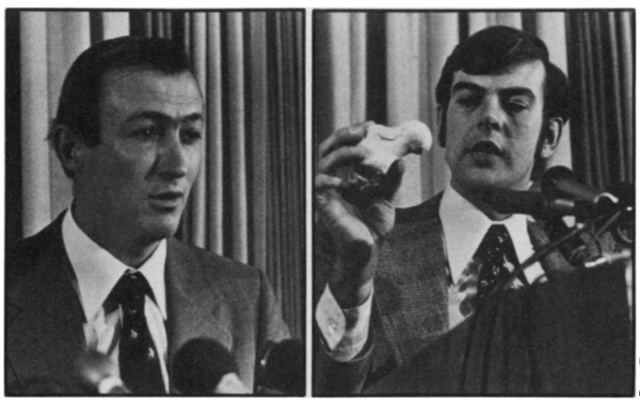
Another piece of evidence suggesting that a true *Homo* existed almost 3 million years ago was also found (again by Ngeneo). It is an almost complete right pelvic bone that shows modern characteristics and comes from deposits that are older than 2 million years. "It is a bone completely consistent," says Leakey, "with what we assume *Homo erectus* would have had. . . . It is very exciting and gives a lot of insight into early modification of the pelvic girdle."

Also adding insights was Johanson. His large collection of fossils, including adults, adolescents and children, has been dated at 3.5 million years and is more like *Homo* than *Australopithecus*. Being mainly postcranial, these bones begin to suggest what an early form of *Homo* may have been like. From a collection of more than 30 hand bones, for instance, a composite hand has been formed. "Our preliminary observations," says Johanson, "suggest to us that there is nothing in the anatomy or morphology of the bones which would preclude the kind of movements that we are capable of with our own hands today." The size and presumed capabilities of this more than 3-million-year-old hand are ultimately tied in with tool use—an ability that *Homo erectus* is well known for.



Cleveland Museum of Natural History

Johanson exhibits composite of 3.5-million-year-old Homo hand.



R. J. Trotter

Leakey, Johanson with femur cast: Spirit of cooperation.

The composite hand shows more. Some researchers have suggested that humans went through a knuckle-walking stage like the chimp or gorilla. Says Johanson, "we were able to discern no evidence whatsoever of the knuckle-walking stage of human ancestry."

Other facts about the development of early humans may also be forthcoming from Johanson's fossils. The association of infants and adults of the same species, he explains, "will give us very valuable information on the developmental process and growth process in these early hominids."

One more piece of evidence from Johanson's site helps tie his and Leakey's research together. It is the proximal or top end of a femur. This leg bone fragment is almost conclusively that of a bipedal, upright walker, most probably a form of *Homo*. It varies considerably from that of *Australopithecus*, a species that was not fully erect in terms of walking. "No *Australopithecus* had a femur like that," said Leakey, obviously pleased with confirmation of his ideas from another site. If this femur had not turned up, critics could have continued to claim that what Leakey and Johanson both call *Homo* is nothing more than an *Australopithecus* with a large head. The evidence of upright walking makes the species almost certainly *Homo*. (The genus is still a question mark.) The femur is just one piece of evidence in Johanson's fossils. Leakey speaks glowingly of them. "He [Johanson] has hands, he has feet, he has all sorts of wonderful things."

What do all of these wonderful things add up to? It now seems clear that *Homo* and *Australopithecus* lived side-by-side more than 3 million years ago and that *Homo* continued to evolve after the australopithecine line died out about 1 million years ago. And that leaves one more question to be settled. If *Homo* did not descend from *Australopithecus*, when did we get our start? Things like the Johanson femur, Leakey explains, would have taken several million years to develop. Therefore, Leakey says he will be disappointed if the *Homo* line is not found to go back at least 4 or 6 million years. □

Termite defense: Recruit and entangle

"When you're trying to study the interactions between two quick little animals like ants and termites," says Thomas Eisner, "you've got a real problem." So Eisner, a biologist at Cornell University, devised a unique system to study just that. All it took to investigate insect defensive behavior were some magnetic ants, some trailing termites and a movie camera.

'Nozzle-head' workers attack centipede.

Eisner, Cornell Univ.

Eisner and colleagues at Cornell were interested in the community defense system of the Australian termite, *Nasutitermes exitiosus*. It has been known for years that when ants, centipedes or other enemies approach the huge mounds in which these termites live, cadres of workers with nozzle-shaped heads attack. These workers spew a sticky, entangling compound on their enemies. The substance restricts movement, irritates the enemies' skins and blocks their air passages.

"It's been suspected that this defensive spray does more than just deter enemies," Eisner says. "We wondered if it also acts as a chemical alarm to recruit other termites so large numbers will converge on the site of trouble." This dual-purpose system has been found already in ants and bees, he says. So the team set up an unusual experimental system to test the theory for termites.

The team placed a small rotating magnet under a petri dish full of trailing worker termites. Then they added a "magnetic ant"—a small bar of metal that twirls inside the dish above the rotating magnet. With a movie camera prefocused on the robot ant, they filmed the termites' defensive responses. The entangling compound, before it "killed" the twirler, did, indeed, recruit workers from across the dish—a distance of nine to ten termite body lengths. Subsequent chemical studies showed that the compound contains alpha and beta pinenes as well as uncharacterized chemicals that may, Eisner says, act as insecticides. The work is reported in the January-February JOURNAL OF BEHAVIORAL ECOLOGY AND SOCIOBIOLOGY.

"Humans and termites have a common problem," Eisner says. "Insects are among our major enemies. By studying their chemical defense systems, we're hoping to discover what termites have learned during millions and millions of years of contact with insect enemies, and perhaps help ourselves fight insects—including termites—more effectively." □

Vitamin A and cancer prevention

Although cancer prevention is one of the most valuable areas of cancer research, pathetically little progress has been made in this area beyond advising people that if they give up smoking, they greatly reduce their chances of getting lung cancer, or that by eating roughage, they reduce their chances of getting colon cancer. However, a third cancer preventive may now be in the offing—it's vitamin A.

During the past few years, scientists have found that a deficiency in vitamin A or in related natural compounds, the retinoids, increases the susceptibility of experimental animals to chemically caused cancer. A study of 8,000 men suggested that a relatively low dietary intake of vitamin A correlated with a relatively high incidence of lung cancer after matching the men for equivalent smoking habits. Consequently, investigators began exploring retinoids' potential for preventing cancer. Michael B. Sporn and his colleagues at the National Cancer Institute, for example, found that the retinoids can keep precancerous tissues from becoming cancerous in laboratory animals and in tissue culture. Nutritional pathologist Paul Newberne and his colleagues at the Massachusetts Institute of Technology found that giving rats 10 times their usual vitamin A intake dramatically slashed their susceptibility to lung cancer.

The problem with using the natural retinoids to prevent cancer, however, is that they are excessively toxic if used in large amounts. Investigators then turned to synthesizing artificial retinoids and determining whether they would retain the cancer-preventing ability of natural retinoids yet not be toxic. Their ultimate aim was to use one of these compounds on persons particularly susceptible to cancer—say, lung cancer patients who already had their tumor removed surgically or uranium miners, who are 20 times more susceptible to lung cancer than is the general population.

At a science writer symposium at the National Institutes of Health last week, Sporn announced that he and his team may begin giving one artificial retinoid, retinoic acid, to human volunteers within a year. He says that it appears safe enough for experimental use. The research strategy would be to pick a group of people known to be at extremely high risk of developing a given type of cancer and feed them retinoic acid daily for several years to see whether the rate of cancer appearance among the group proved to be significantly lower than in a comparable group given no preventive drug treatment.

How the retinoids prevent cancer is not known precisely. Evidence suggests that they counter cancer-causing chemicals. □