

Exciting New Kenyan Fossils Challenge Established Views on Early Evolution of Our Genus Homo

Two new fossils, described this week in the journal *Nature*, cast fresh light on a little understood and important period of human prehistory at the dawn of our own genus, Homo.

The new fossils were discovered by the Koobi Fora Research Project, an international group of scientists directed by mother-daughter team Meave and Louise Leakey, and affiliated with the National Museums of Kenya (NMK).

Human evolution over the last two million years is often portrayed as a linear succession of three species: Homo habilis to Homo erectus to ourselves, Homo sapiens. Of these, Homo erectus is commonly seen as the first human ancestor which is like us in many respects, but with a smaller brain. The new fossils are significant because both their relative geological ages and their physical attributes directly challenge these views about our human ancestry.

One of the two fossils, an upper jaw bone of Homo habilis (KNM-ER 42703), dates from 1.44 million years ago, which is more recent than previously known fossils of that species. This late-survivor shows that Homo habilis and Homo erectus lived side by side in eastern Africa for nearly half a million years.

"Their co-existence makes it unlikely that Homo erectus evolved from Homo habilis," explains Meave Leakey, one of the lead authors of the paper. Instead, both species must have had their origins between 2 and 3 million years ago, a time from which few human fossils are known. "The fact that they stayed separate as individual species for a long time suggests that they had their own ecological niche, thus avoiding direct competition."

The second fossil (KNM-ER 42700), found in the same region of northern Kenya, is an exquisitely preserved skull of Homo erectus, dated to about 1.55 million years ago. "What is truly striking about this fossil is its size," says Fred Spoor, another lead author. "It is the smallest Homo erectus found thus far anywhere in the world."

Significantly, the variation in size of East African Homo erectus fossils, from the petite new skull to a large specimen discovered previously at Olduvai Gorge in neighboring Tanzania, almost rivals that shown by modern gorillas. "In gorillas males are much larger than females, and this sexual dimorphism is related to their strategy of having multiple mates," observes co-author Susan Antón. "The new Kenyan fossil suggests that, contrary to common belief, this may have been true of Homo erectus as well." Because great sexual dimorphism is thought to be a primitive, or ancestral, feature during human evolution, the diminutive new find implies that Homo erectus was not as human-like as once thought.

Both human fossils were found during fieldwork in 2000, in the Ileret region, east of Lake Turkana. The Homo erectus skull was exceptionally well preserved, because it was still almost entirely encased in sandstone when it was initially spotted by NMK researcher Fredrick Manthi. Painstaking laboratory preparation at the NMK by Christopher Kiarie was required to free the fossil from its sediment. To establish the age of the two fossils, the geological layers were studied by Patrick Gathogo, Frank Brown, and Ian McDougall.

FREQUENTLY ASKED QUESTIONS

Question: How do we know the small Homo erectus specimen is not Homo habilis? And why is the upper jaw Homo habilis rather than Homo erectus? What are the main characteristics that tell the two species apart?

Answer: The small skull's gentle ridge (a "keel") running in the midline over the top of the vault, its rather delicate jaw joint, and the shape in the neck area are all characteristic of Homo erectus rather than Homo habilis or other species of human ancestors. The Homo habilis upper jaw has six teeth preserved, from the canine tooth to the wisdom tooth, and these are typical of that species in size and shape.

Question: If the linear theory that Homo habilis evolved into Homo erectus and on into Homo sapiens is debunked, then what did Homo sapiens evolve from and when?

Answer: All available evidence suggests that Homo sapiens did indeed evolve from Homo erectus, possibly via an intermediate form recognized by many as a separate species. This process happened in Africa, sometimes after one million years ago. The new fossil jaw suggests that Homo habilis was a sister species of Homo erectus, living at broadly the same time, rather than the mother species giving rise to it.

Question: What are possible candidates for ancestors of Homo habilis and Homo erectus?

Answer: Difficult to tell. The two species will likely have had a common ancestor living in Africa between two and three million years ago. Earth layers from this time period with well-preserved fossils of mammals are rare in Africa. Hence, few fossils have been found that could belong to this ancestor, and all are fragmentary.

Question: What are the different ecological niches the two species were inhabiting?

Answer: We do not know for sure, but there are clues from the teeth and jaws, which are smaller in Homo erectus, that the diet of Homo habilis was tougher - perhaps including more vegetation - than that of H. erectus. And Homo erectus may have included greater quantities of animal meat and fat in their diets than did Homo habilis. Both seem to have favored areas with a ready source of water, but they may simply have focused on different primary food items. For example, gorillas and chimpanzees live in some of the same habitats today - but while they both enjoy ripe fruit, gorillas spend more time eating tough vegetation than do chimpanzees. The early hominids could have separated their neighborhoods in the same way.

Question: Why is a notable body size difference between males and females (sexual dimorphism) considered a primitive condition?

Answer: Early human ancestors, such as species of Australopithecus, are known to show high levels of sexual dimorphism, whereas modern humans, and their closer relatives such as Neanderthals are less sexually dimorph. Reduced size differences between the sexes is thus considered a character acquired during human evolution. Homo erectus was commonly thought of as a less-dimorphic, more human-like species, but the discovery of the small skull suggests that males and females of this species still differed substantially in size.

Question: Why is knowing about the degree (or amount) of sexual dimorphism in human ancestors important.

Answer: Size differences between males and females of a species arise for a number of different reasons, many of which relate to reproductive strategies and sexual selection. Monogamous primates such as gibbons show very little difference in size and shape between males and females. On the other hand, primates that have multiple mates - such as Gorillas and Baboons show more differences between the sexes. These differences are usually thought to relate to features that help in competition for mates. That Homo

erectus may still have been very dimorphic suggests the possibility of a reproductive strategy that mostly was not monogamous - and this may have implications for understanding behavioral evolution, the size of groups that Homo erectus may have lived in and so on.

Question: The Homo habilis upper jaw bone was found on the surface, rather than still encased in rock. How reliable is the age of 1.44 million years, given that it is unexpectedly young for this species?

Answer: Study of the geology in the area indicates that the fossil jaw bone was part of the earth layers it was found on. Theoretically, it could have been part of layers above the current surface that have been eroded away by water and wind, leaving any encased bones behind. This would make the jaw bone even younger and certainly not older (higher earth layers are younger, as they were deposited on top of older layers).

Citation: "Implications of new early Homo fossils from Ileret, east of Lake Turkana (Kenya)", *Nature*, 9 August 2007, by: Fred Spoor, Meave Leakey, Patrick Gathogo, Frank Brown, Susan Antón, Ian McDougall, Christopher Kiarie, Frederick Manthi, and Louise Leakey.

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