TURKANA BASIN INSTITUTE

FAQ: New Kenyan Fossils Shed Light on Early Human Evolution

Question: What do we know now about the origin of *Homo* that we didn't know before the new fossils were found?

Before the new face and lower jaws were known, there was a long debate about whether one or two species of early *Homo* (besides *Homo erectus)* existed at the base of the human lineage. Because the KNM-ER 1470 fossil ("1470" for short) was only a single individual, we couldn't be sure that it wasn't just a weird individual of a variable species. The new fossils show that the distinctive features of the 1470 face, which is long and rather flat, with a forward position of the cheek bones, are not due to individual variation but instead represent a distinct pattern of facial anatomy. The new face is a small version of the distinctly flat and tall face of 1470. Importantly, the new face has a beautifully preserved palate with cheek teeth in place. These allow us to link the new lower jaws with both the new face and 1470. Together, these fossils argue that there are at least two different species of early *Homo* as well as *H. erectus* living in East Africa at this time.

Question: Do the new fossils tell us anything new about the characteristics of early *Homo*?

The new fossils show that there was a lot of size variation in both of these early *Homo* groups. 1470 has a big brain and face, so it used to be thought that others like 1470 would also be large. But the new face is small, even though it is of the same shape as 1470. So, the idea that there was a "big" group of early *Homo* and a "small" group seems to be wrong.

Question: How do two or three closely related human species manage to live in the same place at the same time?

Closely related living mammals manage to co-exist by focusing on different ways of making a living. 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 hominins could have separated their neighborhoods in the same way. They may simply have focused on different primary food items. We do not know for sure what these foods were, but there are clues from the arrangement of the face and jaws that the newly described fossils, and

the previously known KNM-ER 1470, with their tall faces but shortened front tooth row, may have been focusing on foods that required chewing on the back teeth.

Question: How do we know the newly discovered face and jaw bones are from our genus, *Homo?*

We know from the fossil record that a second, large toothed lineage of hominin called *Paranthropus* with strong jaw muscles also lived alongside early *Homo* during the Pleistocene, the time when the newly discovered fossils lived The anatomy of the fossils of early *Homo* and *Paranthropus* differs in a number of distinct ways. The teeth of early *Homo*, especially the cheek teeth, are differently proportioned and smaller than those of *Paranthropus*, and the lower jaw is differently shaped and less robustly built. Fossils of early species of *Homo* had larger brains than *Paranthropus* but smaller brains than modern humans. The new fossils do not include any braincases, but the previously discovered cranium, 1470, which they so closely resemble, does. Its brain is large compared with *Paranthropus*.

Question: Why is it important to understand the beginnings of our genus *Homo?*

Modern humans, *Homo sapiens,* have a unique suite of anatomical and behavioral features that have allowed us to increase our population size, expand into all parts of the globe, and persist as the only surviving member of our genus. This suite includes anatomical (like big brains, small faces and teeth, big bodies with long legs) and behavioral (like slow childhood development and the ability to sustain many dependent offspring at one time), attributes that differ from the earliest known fossil hominins and from our closest living relatives, the great apes. These characteristics are critical to our survival, but we don't know when or why they arose. Was this package crucial to the origin of our lineage? Or did it arise piecemeal over the course of our evolution? The newly discovered fossils speak to the very base of our lineage and tell us that there were initially many species of *Homo* – not just one. And these species seem to have differed in how they made a living.

Question: Why don't you name the new fossils?

One big remaining question is what do we call them? Two possible species names exist: *Homo rudolfensis* or *Homo habilis.* Although the new finds now allow us to reclassify the whole collection of non-*erectus* fossils into two groups which have clear defining characteristics, there still remains a debate about which of these two groups should be called *H. habilis.* The answer depends on whether 1470 and the new fossils should be grouped with a discovery made by Mary and Louis Leakey in the 1960s, called "OH 7". OH 7 is the type specimen for the species *H. habilis.* However, OH 7 has no face bones other than the lower jaw, which was badly deformed after burial. Because of this we can't use its shape to determine if it matches the new fossils. If OH 7 goes with 1470 and the new fossils, then this group should be called *H. habilis*. If not, then the 1470 group will remain

H. rudolfensis, a species name which some scientists had already ascribed to 1470 before these new finds, and the other group becomes *H. habilis.* We chose not to name the new fossils because the OH 7 specimen can't be conclusively assigned at the moment either to the 1470 group, or to the other existing group of early *Homo.*

Question: Even if we can't name them, did we evolve from one of these species?

Although we know we evolved from *Homo erectus,* and we know that this time interval broadly marks the beginning of our genus *Homo*, we don't know what species gave rise to *Homo erectus.*

Question: How old are the newly discovered fossils and how do we know?

The newly discovered fossils are between 1.78 million and 1.95 million years old. The area where they were found has a sequence of rock layers stacked something like a layer cake. Each layer was formed during a particular time in the past. Throughout the rock layers are volcanic layers that can be precisely dated using a technique called argon-argon dating. The age of a fossil is determined by knowing where in the rock layers they were found, the ages of the volcanic material above and below them, and how long the sediments took to accumulate. In the case of these fossils, the age of the volcanic material they are related to, the KBS tuff, was already known.

Question: Why is Kenya so rich in hominin fossils?

Kenya is a great place to find hominin fossils because the Great Rift Valley, which traverses East Africa, presented suitable conditions for the burial of bones of our ancestors, and suitable habitats for our ancestors to live. Hominins evolved first in East Africa and were restricted to Africa for the first three million years of our history. Thus places like the ancient lakes of Turkana in Kenya and Olduvai in Tanzania presented ideal locations in which human ancestors could live, and when they died they were readily buried and fossilized. Finally, because of the geology of the East African Rift, and the arid environment, the rocks that the hominins are fossilized in are constantly eroded and can be dated. Early human ancestors certainly lived in other parts of Africa, but they may not always have been so readily fossilized or later exposed by erosion.

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