Stunning discovery of pre-human fossil skull in Ethiopia

By Frank Gaglioti
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The discovery of a nearly complete australopithecine skull has greatly extended our understanding of the earliest period of human evolution. The fossil find was reported on August 28 in the science journal *Nature* in a paper titled "A 3.8-million-year-old hominin cranium from Woranso-Mille Ethiopia." Hominins include modern humans and all species considered ancestral to them.

Australopithecus, or southern apes, emerged in Africa around Ethiopia, Kenya and Tanzania about four million years ago and are known to have survived to two million years ago. They had a small brain similar in size to a chimpanzee, but had a hand with an opposable thumb enabling them to use tools. This is considered to be the crucial feature diagnostic of humans. The use of tools led over millions of years to the development of a larger brain and other traits such as language.

Over this period, the east African climate was drying out, leading to the shrinking of the forested areas. *Australopithecus* were an evolutionary adaptation to the new conditions, as they evolved to walking upright rather than dwelling in trees.

The discovery of a nearly complete skull from this period is incredibly rare. It will enable a reassessment of what is known of the earliest period of hominin evolution, particularly the development of the australopithecine species and their development into true humans.

The lead scientist was Yohannes Haile-Selassie, a paleoanthropologist from Cleveland Museum of Natural History, aided by a researcher from the Max Planck Institute for Evolutionary Anthropology Stephanie Melillo.

The upper jaw was originally discovered by a local goat herder, Ali Bereino, from the Mille district of the Afar Regional State. After Haile-Selassie examined the site he found the upper part of the skull three metres away.

"I couldn't believe my eyes when I spotted the rest of the cranium. It was a eureka moment and a dream come true," said Haile-Selassie.

The fossil has been named MRD-VP-1/1 or MRD. It has been designated as *Australopithecus anamensis* through a detailed examination of the jaw and teeth. The name derives from *anam*—the word for lake in the Turkana language, spoken in north west Kenya.

The skull most likely belonged to an adult male. It has wide cheekbones, a long protruding jaw and a large canine tooth. The scientists used micro-CT scans and 3D reconstructions in order to definitively identify the species.

"Features of the upper jaw and canine tooth were fundamental in determining that MRD was attributable to *A. anamensis* … It is good to finally be able to put a face to the name," said Melillo.

The Woranso-Mille site in central Afar is rich in fossils and palaeontologists have been exploring the area since 2004. They have discovered 12,600 fossil specimens from 85 mammalian species and 230 hominin fossils dated from 3.8 to 3.0 million years ago.

A. anamensis is considered to be the direct ancestor of *A. afarensis* made famous after Donald Johanson's discovery of the almost complete skeleton of "Lucy" in 1974. *A. afarensis* is thought to have led directly to Homo, or true human species. The transition from *A. anamensis* to *A. afarensis*was believed to have occurred 2.8 million years ago.

MRD's age suggests that *A. anamensis* and *afarensis* lived contemporaneously for 100,000 years, making this early period of human evolution more complex than previously thought.

Paleoanthropologist Meave Leakey originally named *A. anamensis* in 1994 from teeth and bone fragments discovered in Kenya. An earlier, previously unnamed specimen of an arm bone indicated a tree climbing existence. *A. anamensis* has features of the more

advanced *A. afarensis* as well as more primitive features at the same time. The discovery of MRD enables the consolidation of the species designation.

Haile-Selassie and his team believe that it is highly probable that *A. anamensis* did evolve into *A. afarensis.* This likely occurred due to the isolation of a small group of *A. anamensis* that made the transition to *A. afarensis,* which then became the dominant species. However, the original *A. anamensis* species was able to survive for some time longer.

This theory is not accepted by all scientists who are looking for the discovery of further fossils in order to verify Haile-Selassie's theory. They point to the very low number of *A. anamensis*fossils that have been discovered thus far.

"You cannot make a strong claim on the mode of evolution based on only two specimens," said paleoanthropologist at Arizona State University's Institute of Human Origins William Kimbel.

The complexity of human evolution in this period was highlighted by the discovery in 2012 by Haile-Selassie and his team of a 3.4-million-year-old fossil foot from the Woranso-Mille. The fossil has not been given a species designation as yet, but it had an opposable big toe, indicative of a tree dwelling existence. Such a feature had not previously been seen in hominin species found in that period.

"The discoveries from the Woranso-Mille site have clearly demonstrated to me that there were multiple early hominin species," said Haile-Selassie.

The MRD discovery will cast a light on the significance of earlier species such as *Ardipithecus*, *Orrorin* and *Sahelanthropus*, which lived from about 7 million to 4 million years ago. This is the period covering the controversial area of chimpanzee-human divergence. MRD's time of 3.8 million years ago is proving to be an important transition from apes to true humans.

"For a long time, *afarensis* was considered the best candidate as an ancestor to our kind, but we are not in that position any more. Now we can look back at all the species that might have existed at the time and examine which one may have been most like the first human," stated Haile-Selassie.

Beverly Z. Saylor, Armington Professor of Stratigraphy and Sedimentology, was the lead author of an accompanying paper in *Nature* titled "Age and context of mid-Pliocene hominin cranium from Woranso-Mille, Ethiopia." This examined the ancient geology of the area in order to determine the nature of the environment in which *A. anamensis* lived and died.

Saylor and her team of geologists found that the fossil had been buried on a river delta near a lake surrounded by shrubs and trees. "It probably was either along the river or along the shores of this lake. It died there, and then it was transported down and buried in the delta," she said.

Saylor examined fossil pollens and plant remains in order to determine the type of vegetation in the area at the time. The team discovered that the flora consisted of dry scrubland including grassland, wetland and forest adjacent to a lake.

In order to determine MRD's age, Saylor's team located two tuffs of volcanic ash above and below the specimen. They were able to use the decay products of radioactive potassium-40 to determine the age as between 3.76 and 3.77 million years ago, while the tuff below the skull as just more than 3.8 million years ago. Potassium-40 is known to decay at a precise rate enabling accurate dating.

In an accompanying comment in *Nature*, Professor of Evolutionary Anatomy at London's Natural History Museum Fred Spoor stated that *anamensis* "looks set to become another celebrated icon of human evolution."

As a near complete skull 3.8 million years old, MRD opens the road to future research that will allow scientists to look back to more primitive species, while at the same time being able to reassess the transition to true humans.

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