Oldest primate skeleton discovered

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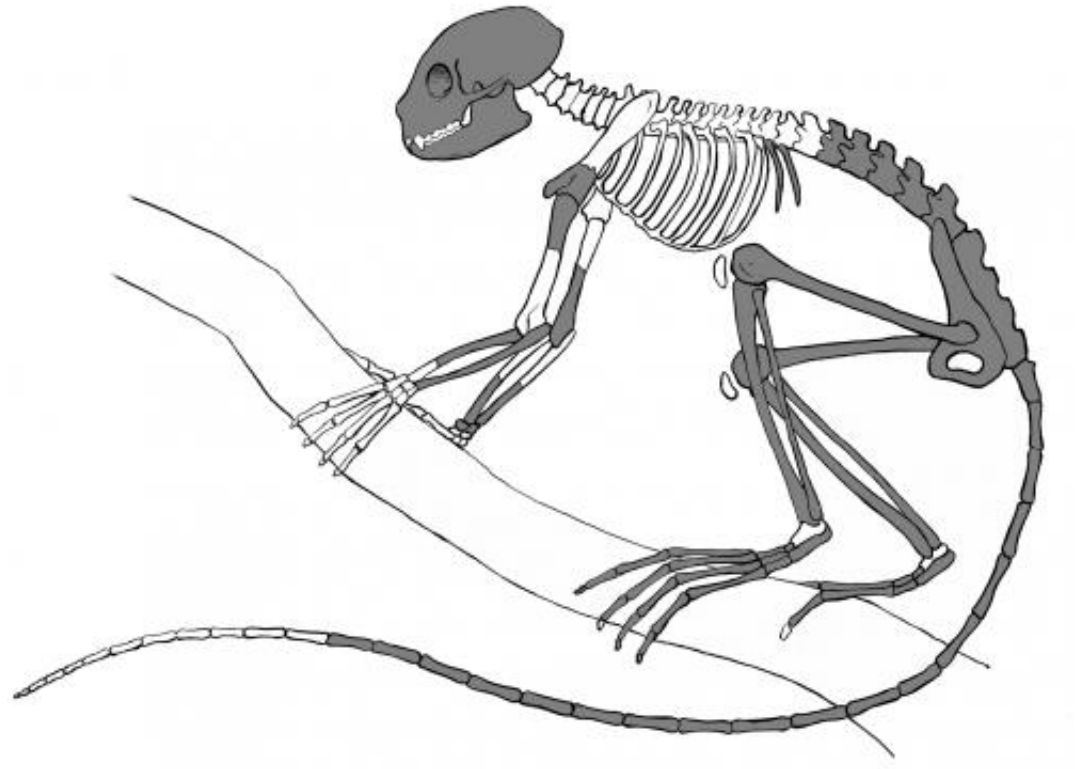


This is an artist's illustration of the skeleton of *Archicebus achilles*. The darkened bones represent the known bony elements of the skeleton found in China. Credit: Mat Severson, Northern Illinois University

An international team of paleontologists that includes Northern Illinois University anthropologist Dan Gebo is announcing the discovery of a nearly complete, articulated skeleton of a new tiny, tree-dwelling primate dating back 55 million years.

The Eocene Epoch fossil was recovered from Hubei Province in central China.

"This is the oldest primate skeleton of this quality and completeness ever discovered and one of the most primitive primate fossils ever documented," Gebo said. "The origin of primates sets the first milestone for all primate lineages, including that of humanity.

"Although scientists have found primate teeth, jaws, occasionally skulls or a few limb bones from this time period, none of this evidence is as complete as this new skeleton from China," Gebo added. "With completeness comes more information and better evidence for the adaptive and evolutionary themes concerning primate evolution. It takes guessing out of the game."

The research team, led by Xijun Ni of the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) at the Chinese Academy of Sciences in Beijing, describes the fossil in the June 6 edition of the prestigious science journal, *Nature*.

Other authors on the article include Marian Dagosto of the Feinberg School of Medicine at Northwestern University in Chicago; K. Christopher Beard of the Carnegie Museum of Natural History in Pittsburgh; Paul Tafforeau of the European Synchrotron Radiation Facility in Grenoble, France; and Jin Meng and John Flynn of the American Museum of Natural History in New York.

This is a 3-D computer graphic image of the skeleton of *Archicebus achilles*, above a background photo of the fossil. The 3-D image was rendered from X-ray computed tomography data. Credit: ESRF/P. Tafforeau

Ni said that while doing fieldwork years ago in Hubei Province, he first came across the fossil, which had been found by a local farmer and was later donated to the IVPP. The fossil was encased within a rock and discovered after the rock was split open, yielding fossils and impressions of the primate on each side of the two halves.

It was discovered in a quarry that had once been a lake and is known for producing ancient fish and bird fossils from the Eocene Epoch. The quarry is near Jingzhou City, south of the Yangtze River, and about 270

kilometers southwest of Wuhan City, the province capital.

"This region would have been a large series of lakes, surrounded by lush tropical forests during the early Eocene," Ni said. "Our analysis shows this new primate was very small and would have weighed less than an ounce. It had slender limbs and a long tail, would have been an excellent arboreal leaper, active during the daytime, and mainly fed on insects."

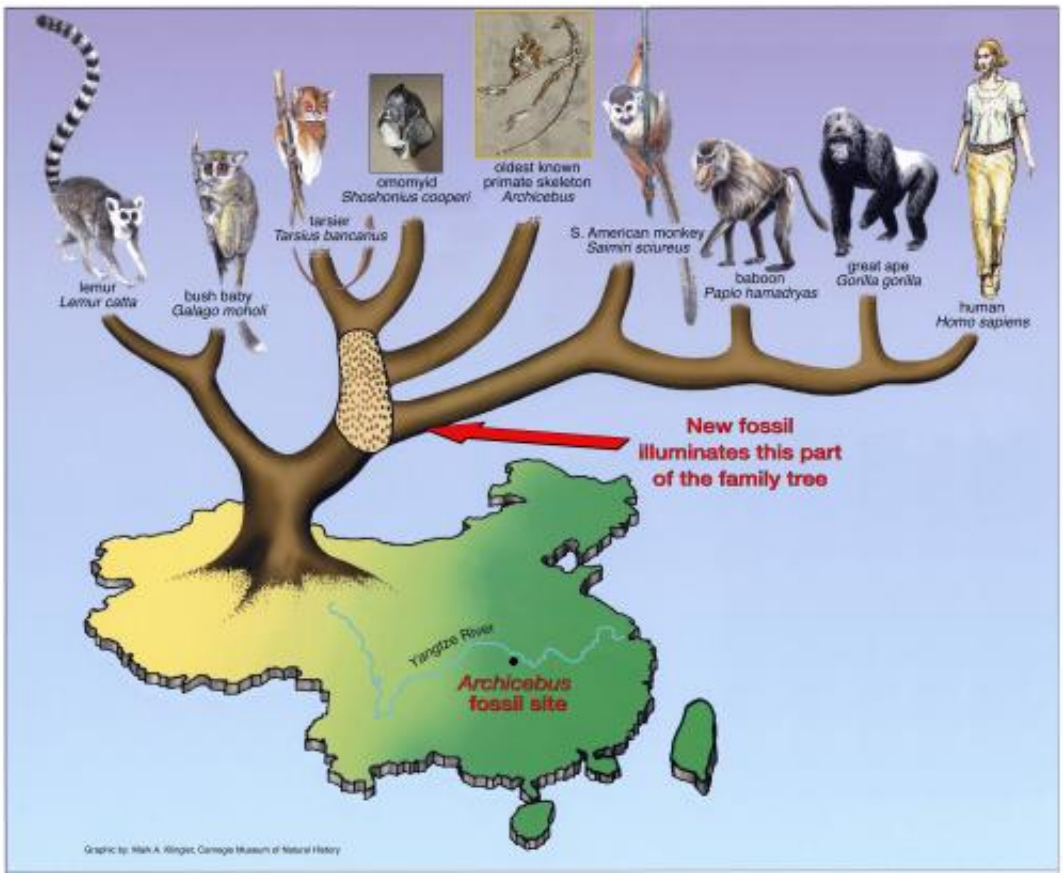
The fossil has been named, *Archicebus achilles*.

This is an artist impression of *Archicebus achilles* in its natural habitat of trees. Credit: Credit CAS/Xijun Ni.

The genus, Archi, is Greek for the beginning, and the prefix is attached to cebus, which translates to "long-tailed monkey," after the long tail of the fossil skeleton. Thus, *Archicebus* is roughly translated as the first long-tailed monkey. The species name, Achilles, is an allusion to its interesting heel anatomy and to the mythological Greek warrior, for whom the Achilles tendon (connecting the heel bone to the calf muscle) is named.

"*Archicebus* marks the first time that we have a reasonably complete picture of a primate close to the divergence between tarsiers and anthropoids," Ni said. "It represents a big step forward in our efforts to chart the course of the earliest phases of primate and human evolution."

Archicebus has an unusual blend of anatomical features that has never been viewed in this combination before, making it challenging for the scientists to interpret. Their study of the fossil included a three-dimensional, high-resolution reconstruction, aided by high-tech scanning of the sample at the European Synchrotron Radiation Facility.



A newly discovered primate fossil is crucial for illuminating a pivotal event in primate and human evolution--the divergence between the lineage leading to modern monkeys, apes, and humans (collectively known as anthropoids) and the branch leading to living tarsiers--small, nocturnal tree-dwelling primates. The relationships between these groups are shown in this diagram. Credit: M.A. Klingler/Carnegie Museum of Natural History

"*Archicebus* differs radically from any other primate, living or fossil, known to science," Beard said. "It looks like an odd hybrid with the feet of a small monkey, the arms, legs and teeth of a very primitive primate, and a primitive skull bearing surprisingly small eyes. It will force us to rewrite how the anthropoid lineage evolved."

The most unusual aspect of *Archicebus* is its foot anatomy, Gebo added.

"There's an odd combination of foot features," he said. "We see typical robust grasping big toes, long toes and nailed digits of primitive arboreal primates, but we also have rather monkey-looking heel bones and monkey-like long metatarsals, often viewed as advanced features that you would not normally find in a primitive early Eocene fossil primate.

This is an artist's conception of what the newly discovered primate, *Archicebus achilles*, might have looked like. Credit: Mat Severson, Northern Illinois University

"We have interpreted this new combination of features as evidence that this fossil is quite primitive and its unique anatomical combination is a link between the tarsier and monkey-ape branches of dry-nosed primates," he said. "This new view suggests that the advanced foot

features of anthropoids (monkeys and apes) are in fact primitive for the entire lineage of dry-nosed primates."

Gebo said primitive primate fossils have been discovered on several continents, including North America, but he believes *Archicebus* and other ancient fossils point to Asia as the continent where primates originated.

"In the past, many scientists believed that Africa was the continent of origin for all primates, but it appears over the last decade that Asia is the more likely continent of origin, and this new skeleton supports that view," Gebo said.

More information: Xijun Ni et al, The oldest known primate skeleton and early haplorhine evolution, *Nature* 6 June 2013, DOI: 10.1038/nature12200

Provided by Northern Illinois University