



AMERICAN MUSEUM OF NATURAL HISTORY

Media Inquiries:

Kendra Snyder, Department of Communications
212-496-3419; ksnyder@amnh.org
www.amnh.org

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RESEARCHERS DISCOVER THREE EXTINCT SQUIRREL-LIKE SPECIES

FINDINGS SUPPORT EARLIER ORIGIN OF MAMMALS, IN LATE TRIASSIC

Paleontologists have described three new small squirrel-like species that place a poorly understood Mesozoic group of animals firmly in the mammal family tree. The study, led by scientists at the American Museum of Natural History and the Chinese Academy of Sciences, supports the idea that mammals—an extremely diverse group that includes egg-laying monotremes such as the platypus, marsupials such as the opossum, and placentals like humans and whales—originated at least 208 million years ago in the late Triassic, much earlier than some previous research suggests. The study is published today in the journal *Nature*.

“For decades, scientists have been debating whether the extinct group, called Haramiyida, belongs within or outside of Mammalia,” said co-author Jin Meng, a curator in the Museum’s Division of Paleontology. “Previously, everything we knew about these animals was based on fragmented jaws and isolated teeth. But the new specimens we discovered are extremely well preserved. And based on these fossils, we now have a good idea of what these animals really looked like, which confirms that they are, indeed, mammals.”

The three new species—*Shenshou lui*, *Xianshou linglong*, and *Xianshou songae*—are described from six nearly complete 160-million-year-old fossils found in China. The animals, which researchers have placed in a new group, or clade, called Euharamiyida, likely looked similar to small squirrels. They weighed between 1 and 10 ounces and had tails and feet that indicate that they were tree dwellers.

“They were good climbers and probably spent more time than squirrels in trees,” Meng said. “Their hands and feet were adapted for holding branches, but not good for

running on the ground.”

The members of Euharamiyida likely ate insects, nuts, and fruit with their “strange” teeth, which have many cusps, or raised points, on the crowns. Mammals are thought to evolve from a common ancestor that had three cusps; human molars can have up to five. But the newly discovered species had two parallel rows of cusps on each molar, with up to seven cusps on each side. How this complex tooth pattern evolved in relation to those of other mammals has puzzled scientists for many decades.

Despite unusual tooth patterning, the overall morphology, or physical characteristics, seen in the new haramiyidan fossils is mammalian. For example, the specimens show evidence of a typical mammalian middle ear, the area just inside the eardrum that turns vibrations in the air into ripples in the ear’s fluids. The middle ears of mammals are unique in that they have three bones, as evidenced in the new fossils.

However, the placement of the new species within Mammalia poses another issue: Based on the age of the Euharamiyida species and their kin, the divergence of mammals from reptiles had to have happened much earlier than some research has estimated. Instead of originating in the middle Jurassic (between 176 and 161 million years ago), mammals likely first appeared in the late Triassic (between 235 and 201 million years ago). This finding corresponds with some studies that used DNA data.

“What we’re showing here is very convincing that these animals are mammals, and that we need to turn back the clock for mammal divergence,” Meng said. “But even more importantly, these new fossils present a new suite of characters that might help us tell many more stories about ancient mammals.”

Other authors on the paper include Shundong Bi, from the Chinese Academy of Sciences and Indiana University of Pennsylvania; Yuanqing Wang, of the Chinese Academy of Sciences; Jian Guan, of the Beijing Natural History Museum; and Xia Sheng, of Shenyang Normal University. This work was funded by the National Basic Research Program of China, the Strategic Priority Research Program of Chinese Academy of Sciences, the National Science Foundation of China, and the Hundred Talents Programs of the Chinese Academy of Sciences.

The American Museum of Natural History, founded in 1869, is one of the world's preeminent scientific, educational, and cultural institutions. The Museum encompasses 45 permanent exhibition halls, including the Rose Center for Earth and Space and the Hayden Planetarium, as well as galleries for temporary exhibitions. It is home to the Theodore Roosevelt Memorial, New York State's official memorial to its 33rd governor and the nation's 26th president, and a tribute to Roosevelt's enduring legacy of conservation. The Museum's five active research divisions and three cross-disciplinary centers support 200 scientists, whose work draws on a world-class permanent collection of more than 32 million specimens and artifacts, as well as specialized collections for frozen tissue and genomic and astrophysical data, and one of the largest natural history libraries in the world. Through its Richard Gilder Graduate School, it is the only American museum authorized to grant the Ph.D. degree. In 2012, the Museum began offering a pilot Master of Arts in Teaching program with a specialization in Earth science. Approximately 5 million visitors from around the world came to the Museum last year, and its exhibitions and Space Shows can be seen in venues on five continents. The Museum's website and collection of apps for mobile devices extend its collections, exhibitions, and educational programs to millions more beyond its walls. Visit amnh.org for more information.

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