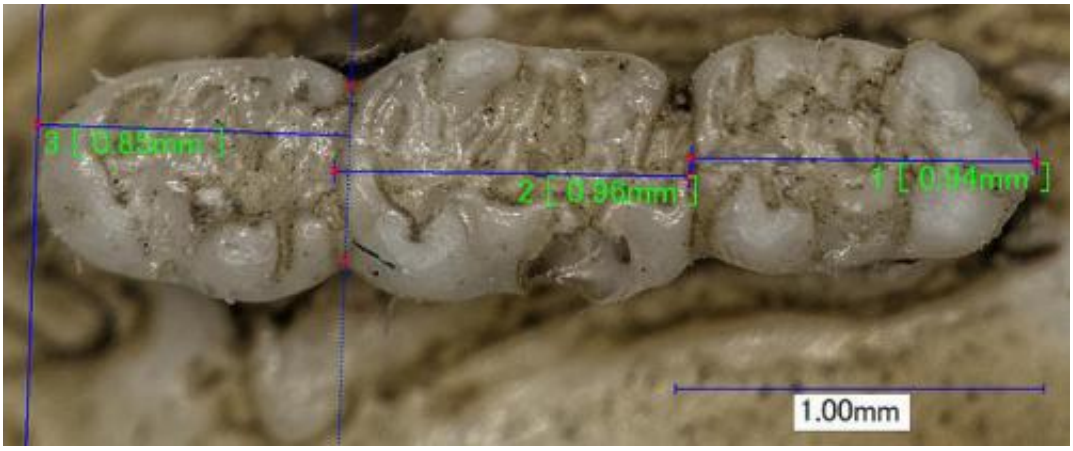
Tiny teeth are new mouse species, a rare 'living fossil'

May 24 2011, by Margaret Allen



Paleontologist Yuri Kimura, Southern Methodist University in Dallas, identified Sicista primus from 17 tiny teeth, whose small size makes them difficult to find. A single molar is about the size of half a grain of rice. The teeth, however, are distinctive among the various genera of rodents known as Dipodidae. Cusps, valleys, ridges and other distinguishing characteristics on the surface of the teeth are identifiable through a microscope. (Credit: Kimura)

(PhysOrg.com) -- Tiny fossil teeth discovered in Inner Mongolia are a new species of birch mouse, indicating that ancestors of the small rodent are much older than previously reported, according to paleontologist Yuri Kimura, Southern Methodist University in Dallas.

Fossils of the new species were discovered in sediments that are 17 million years old, said Kimura, who identified the new species and

named it Sicista primus to include the Latin word for "first."

Previously the oldest prehistoric ancestor of the modern-day birch mouse was one that inhabited Inner Mongolia 8 million years ago.

Adding 9 million years to the ancestry of the rodent family that includes birch mice and jumping mice distinguishes this genus, Sicista, as a "living fossil," Kimura said. That places the genus among some of the most unique rodents on earth — those whose ancestry spans 2 to 3 times the average, she said.

Kimura identified Sicista primus from 17 tiny teeth, whose size makes them difficult to find. A single molar is about the size of half a grain of rice. The teeth, however, are distinctive among the various genera of rodents known as Dipodidae. Cusps, valleys, ridges and other distinguishing characteristics on the surface of the teeth are identifiable through a microscope.

"We are very lucky to have these," Kimura said. "Paleontologists usually look for bones, but a mouse is very tiny and its bones are very thin and fragile. The teeth, however, are preserved by enamel. Interestingly, small mammal teeth are very diverse in terms of their structure, so from that we can identify a species."

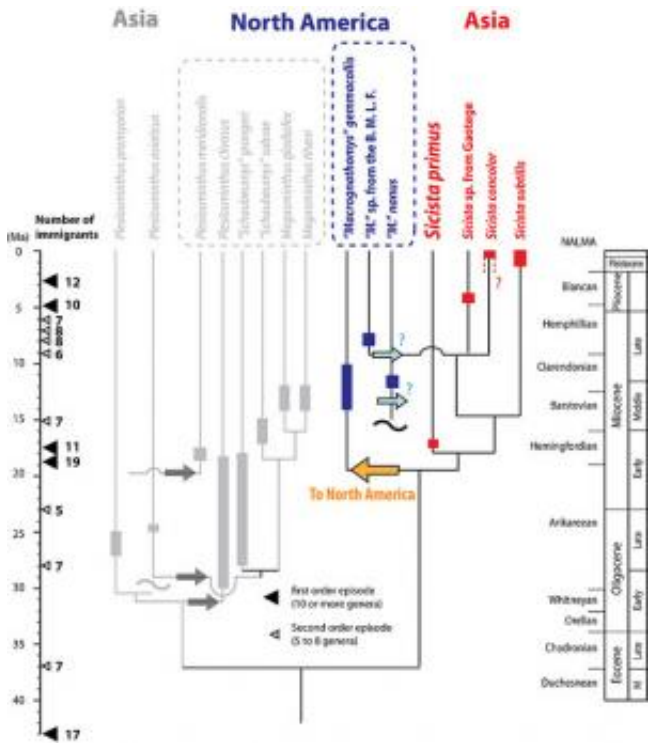
Kimura reported the new species in the article "The earliest record of birch mice from the Early Miocene Nei Mongol, China" in the scientific journal *Naturwissenschaften*.

An SMU doctoral student in the Huffington Department of Earth Sciences, Kimura was part of the international team that discovered the fossils during expeditions to Inner Mongolia in 2004, 2005 and 2007.

Microscopic evidence of a living fossil

The new fossils of Sicista primus from the Early Miocene age are also now the earliest known record of Sicista, the birch mouse genus that comprises 13 modern and 7 fossil species, said Kimura. As a result, Sicista now boasts the most ancient ancestry of the 326 genera in the largest rodent suborder to which it belongs, Myomorpha. The suborder includes laboratory mice and rats.

"The birch mouse is a rare case of a small mammal genus persisting from the Early Miocene without significant morphological changes," Kimura said in reporting the findings.



(Credit: Kimura)

Rodents, both modern and prehistoric, rank as the most prolific mammals on earth. After the reign of dinosaurs, 65 million years ago,

rodents evolved and dispersed worldwide during the Cenozoic, the "Age of Mammals." They comprise about 42 percent of all living mammals. Scientists know now that only 1.5 percent of modern rodent genera, however, go as far back as the Early Miocene or older.

"Diversity within a rodent genus is not unusual, but the long record of the genus Sicista, first recognized at 17 million years ago, is unusual," said Kimura. "The discovery of Early Miocene S. primus reveals that Sicista is fundamental to understanding how a long-lived genus persisted among substantially fast-evolving rodent groups."

Birch mice migrated from Asia to North America

Previously the record for the oldest species of Sicista belonged to an 8 million-year-old species identified in Eurasia, Kimura said.

In identifying the new species, Kimura also reverses the long-held hypothesis that ancestors of birch mice migrated from North America to Asia. That hypothesis has been based on a 14.8 million-year-old specimen from South Dakota, which was identified in 1977 as the separate rodent genus Macrognathomys. Kimura's analysis, however, concludes that Macrognathomys is actually Sicista. For that reason, she concluded, Sicista first inhabited the forests and grasslands of prehistoric Asia and then dispersed to North America via the Bering Land Bridge, Kimura said.

In a comparison of the molars and premolars from Macrognathomys and Sicista primus, Kimura reported finding 12 shared dental characteristics. In addition, phylogenetic analysis to identify evolutionary relationships indicated that both belong to the same genus, Sicista, she said.

Reconnaissance of earlier Central Asiatic Expedition

localities yields small mammals

The teeth of Sicista primus were discovered in fine sediments gathered from Gashunyinadege, a fossil locality in the central region of Inner Mongolia.

Gashunyinadege is one of several fossil localities near Tunggur, a fossil site discovered in the 1920s by the Central Asiatic Expedition, which was led by Roy Chapman Andrews from the American Museum of Natural History.

Kimura is a member of an international scientific team sponsored by the Chinese Academy of Sciences Institute of Vertebrate Paleontology and Paleoanthropology and the Natural History Museum of Los Angeles County. The team's expeditions have been led by paleontologists Qiu Zhuding, IVPP; Wang Xiaoming, Natural History Museum of Los Angeles County; and Li Qiang, IVPP. Their expeditions retrace important classic localities, as well as prospect new fossil localities.

Kimura and other members of the team discovered the birch mouse fossils by first prospecting Gashunyinadege for small mammal fossils visible to the naked eye. Those fossils indicated the possibility of even smaller mammal fossils, so the team gathered 6,000 kilograms, more than 13,000 pounds, of Early Miocene sediment. Using standing water from recent rains, they washed the sediments repeatedly through continually smaller screens to separate out small fossils. Bags of concentrate containing particles the size of mouse teeth were returned to IVPP laboratories to hunt for fossils with a microscope.

More information: www.springer.com/life+sciences/journal/114

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