

Scientists discover two new species of ancient, burrowing mammal ancestors

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This portrait shows the tritylodontid *Fossiomanus sinensis* (upper right) and the

eutriconodontan *Jueconodon cheni* in burrows; both lived the Early Cretaceous Jehol Biota (about 120 million years ago), northeastern China, and showed convergent skeletal features adapted to fossorial lifestyle. Credit: © Chuang Zhao

Paleontologists have discovered two new species of mammal-like, burrowing animals that lived about 120 million years ago in what is now northeastern China. The new species, described today in the journal *Nature*, are distantly related but independently evolved traits to support their digging lifestyle. They represent the first "scratch-diggers" discovered in this ecosystem.

"There are many hypotheses about why [animals](#) dig into the soil and live underground," said lead author Jin Meng, a curator in the American Museum of Natural History's Division of Paleontology. "For protection against predators, to maintain a temperature that's relatively constant—not too hot in the summer and not too cold in the winter—or to find food sources like insects and plant roots. These two fossils are a very unusual, deep-time example of animals that are not closely related and yet both evolved the highly specialized characteristics of a digger."

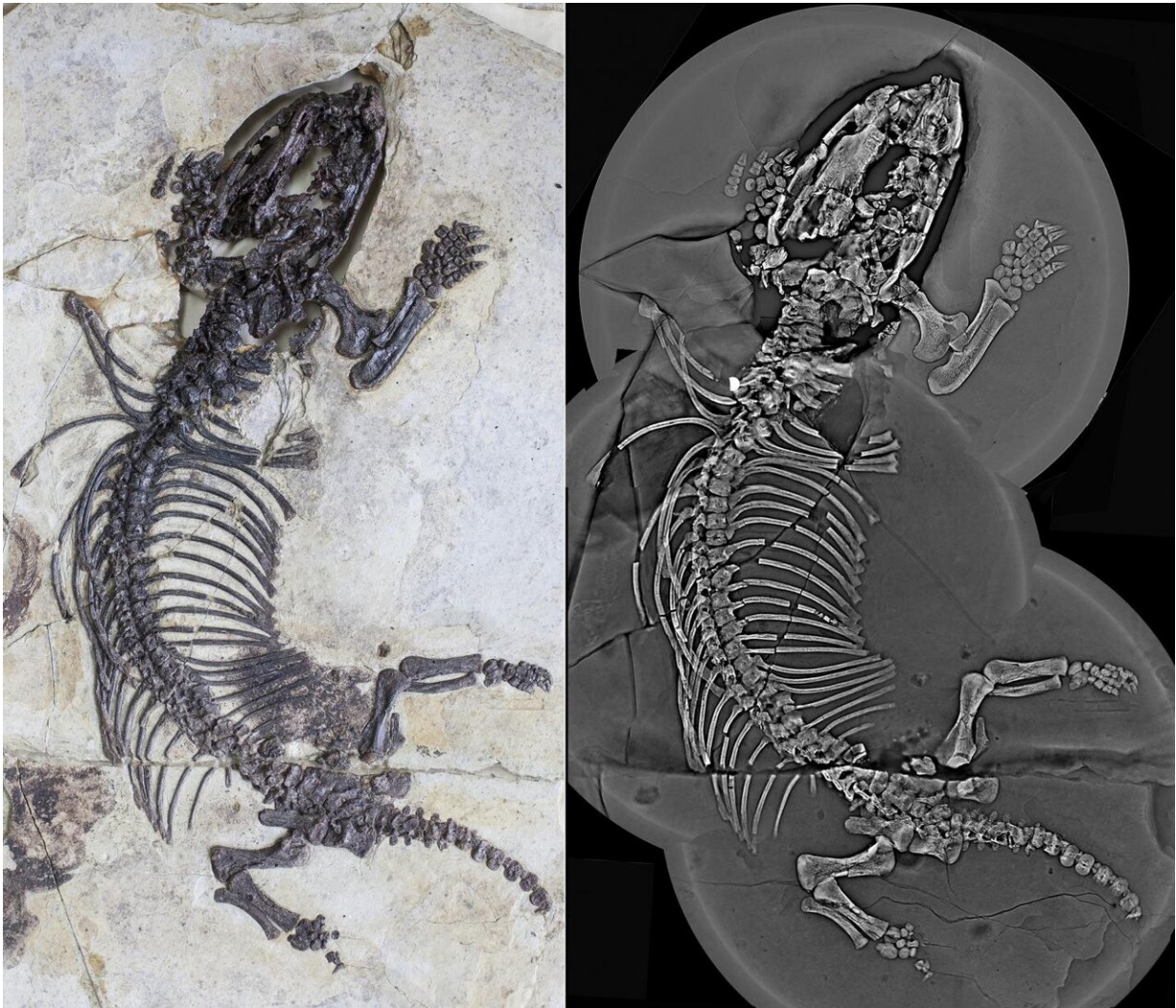
The fossil mammalian species—predecessors to mammals—were discovered in the Jehol Biota, which represents the Early Cretaceous epoch, about 145 to 100 million years ago. One is a mammal-like reptile called a tritylodontid and is the first of its kind to be identified in this biota. About a foot in length, it was given the name *Fossiomanus sinensis* (*Fossio*, "digging" and *manus* "hand;" *sinensis*, "from China"). The other is named *Jueconodon cheni* (*Jue*, "digging"—Chinese pinyin—and *conodon* "cusped tooth"; *cheni* for Y. Chen, who collected the fossil). It is a eutriconodontan, a distant cousin of modern placental mammals and marsupials, which were common in the habitat. It is about 7 inches long.



The dioramic landscape illustrates the Early Cretaceous Jehol Biota with emphasis on mammaliamorphs. Credit: © Chuang Zhao

Mammals that are adapted to burrowing have specialized traits for digging. The researchers found some of these hallmark features—including shorter limbs, strong forelimbs with robust hands, and a short tail—in both *Fossiomanus* and *Jueconodon*. In particular, these characteristics point to a type of digging behavior known as "scratch digging," accomplished mainly by the claws of the forelimbs.

"This is the first convincing evidence for fossorial life in those two groups," Meng said. "It also is the first case of scratch diggers we know about in the Jehol Biota, which was home to a great diversity of life, from dinosaurs to insects to plants."



The holotype specimen of *Fossiomanus sinensis*. Optical image (left) and composite computed laminography image. Credit: J. Meng © AMNH

The animals also share another unusual feature: an elongated vertebral column. Typically, mammals have 26 vertebrae from the neck to the hip. However, *Fossiomanus* had 38 vertebrae—a staggering 12 more than the common state—while *Jueconodon* had 28. To try to determine how these animals got their elongated trunks, the paleontologists turned to recent studies in [developmental biology](#), finding that the variation could be

attributed to gene mutations that determine the number and shape of the vertebrae in the beginning of the animals' embryotic development. Variation in vertebrae number can be found in modern mammals as well, including in elephants, manatees, and hyraxes.

More information: Fangyuan Mao et al, Fossoriality and evolutionary development in two Cretaceous mammaliamorphs, *Nature* (2021). [DOI: 10.1038/s41586-021-03433-2](https://doi.org/10.1038/s41586-021-03433-2)

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