China fossil shows bird, crocodile family trees split earlier than thought

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This is a reconstruction of *X. sapingensis*, based on the fossil. Credit: Sterling Nesbitt

A fossil unearthed in China in the 1970s of a creature that died about 247 million years ago, originally thought to be a distant relative of both birds and crocodiles, turns out to have come from the crocodile family tree after it had already split from the bird family tree, according to research led by a University of Washington paleontologist.

The only known specimen of Xilousuchus sapingensis has been reexamined and is now classified as an archosaur. Archosaurs, characterized by skulls with long, narrow snouts and teeth set in sockets, include dinosaurs as well as crocodiles and birds.

The new examination dates the *X. sapingensis* specimen to the early Triassic period, 247 million to 252 million years ago, said Sterling Nesbitt, a UW postdoctoral researcher in biology. That means the

creature lived just a short geological time after the largest mass extinction in Earth's history, 252 million years ago at the end of the Permian period, when as much as 95 percent of marine life and 70 percent of land creatures perished. The evidence, he said, places *X. sapingensis* on the crocodile side of the archosaur family tree.

"We're marching closer and closer to the Permian-Triassic boundary with the origin of archosaurs," Nesbitt said. "And today the archosaurs are still the dominant land vertebrate, when you look at the diversity of birds."

The work could sharpen debate among paleontologists about whether archosaurs existed before the Permian period and survived the extinction event, or if only archosaur precursors were on the scene before the end of the Permian.

"Archosaurs might have survived the extinction or they might have been a product of the recovery from the extinction," Nesbitt said.

The research is published May 17 online in Earth and Environmental Science Transactions of the Royal Society of Edinburgh, a journal of Cambridge University in the United Kingdom.

This drawing depicts the skull and 10 neck vertebrae from the fossil of an archosaur called *Xilousuchus sapingensis*. The elongated spines on rearward vertebrae indicate the presence of a "sail" on the animal's back. Credit: Sterling

Co-authors are Jun Liu of the American Museum of Natural History in New York and Chun Li of the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing, China. Nesbitt did most of his work on the project while a postdoctoral researcher at the University of Texas at Austin.

The *X. sapingensis* specimen – a skull and 10 vertebrae – was found in the Heshanggou Formation in northern China, an area with deposits that date from the early and mid-Triassic period, from 252 million to 230 million years ago, and further back, before the mass extinction.

The fossil was originally classified as an archosauriform, a "cousin" of archosaurs, rather than a true archosaur, but that was before the discovery of more complete early archosaur specimens from other parts of the Triassic period. The researchers examined bones from the specimen in detail, comparing them to those from the closest relatives of archosaurs, and discovered that *X. sapingensis* differed from virtually every archosauriform.

Among their findings was that bones at the tip of the jaw that bear the teeth likely were not downturned as much as originally thought when the specimen was first described in the 1980s. They also found that neural spines of the neck formed the forward part of a sail similar to that found on another ancient archosaur called Arizonasaurus, a very close relative of Xilousuchus found in Arizona.

The family trees of birds and crocodiles meet somewhere in the early Triassic and archosauriforms are the closest cousin to those archosaurs, Nesbitt said. But the new research places *X. sapingensis* firmly within the

archosaur family tree, providing evidence that the early members of the crocodile and bird family trees evolved earlier than previously thought.

"This animal is closer to a crocodile, but it's not a crocodile. If you saw it today you wouldn't think it was a crocodile, especially not with a sail on its back," he said.

Provided by University of Washington

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