

Researchers discover extinct prehistoric reptile that lived among dinosaurs

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An artistic interpretation of a newly discovered extinct species of lizard-like reptile belonging to the same ancient lineage as New Zealand's living tuatara. The newly discovered *Opisthiamimus gregori* preys on a now-extinct water bug (*Morrisonnema jurassica*), while in the background the predatory dinosaur *Allosaurus jimmadseni* guards its nest. The scene is the floodplain of a river in Late Jurassic Wyoming, approximately 150 million years ago. Credit: Julius Csotonyi for the Smithsonian Institution

Smithsonian researchers have discovered a new extinct species of lizard-like reptile that belongs to the same ancient lineage as New Zealand's living tuatara. A team of scientists, including the National Museum of Natural History's curator of Dinosauria Matthew Carrano and research associate David DeMar Jr. as well as University College London and Natural History Museum, London scientific associate Marc Jones, describe the new species *Opisthiamimus gregori*, which once inhabited Jurassic North America about 150 million years ago alongside dinosaurs like *Stegosaurus* and *Allosaurus*, in a paper published today in the *Journal of Systematic Palaeontology*. In life, this prehistoric reptile would have been about 16 centimeters (about 6 inches) from nose to tail—and would fit curled up in the palm of an adult human hand—and likely survived on a diet of insects and other invertebrates.

"What's important about the tuatara is that it represents this enormous evolutionary story that we are lucky enough to catch in what is likely its closing act," Carrano said. "Even though it looks like a relatively simple lizard, it embodies an entire evolutionary epic going back more than 200 million years."

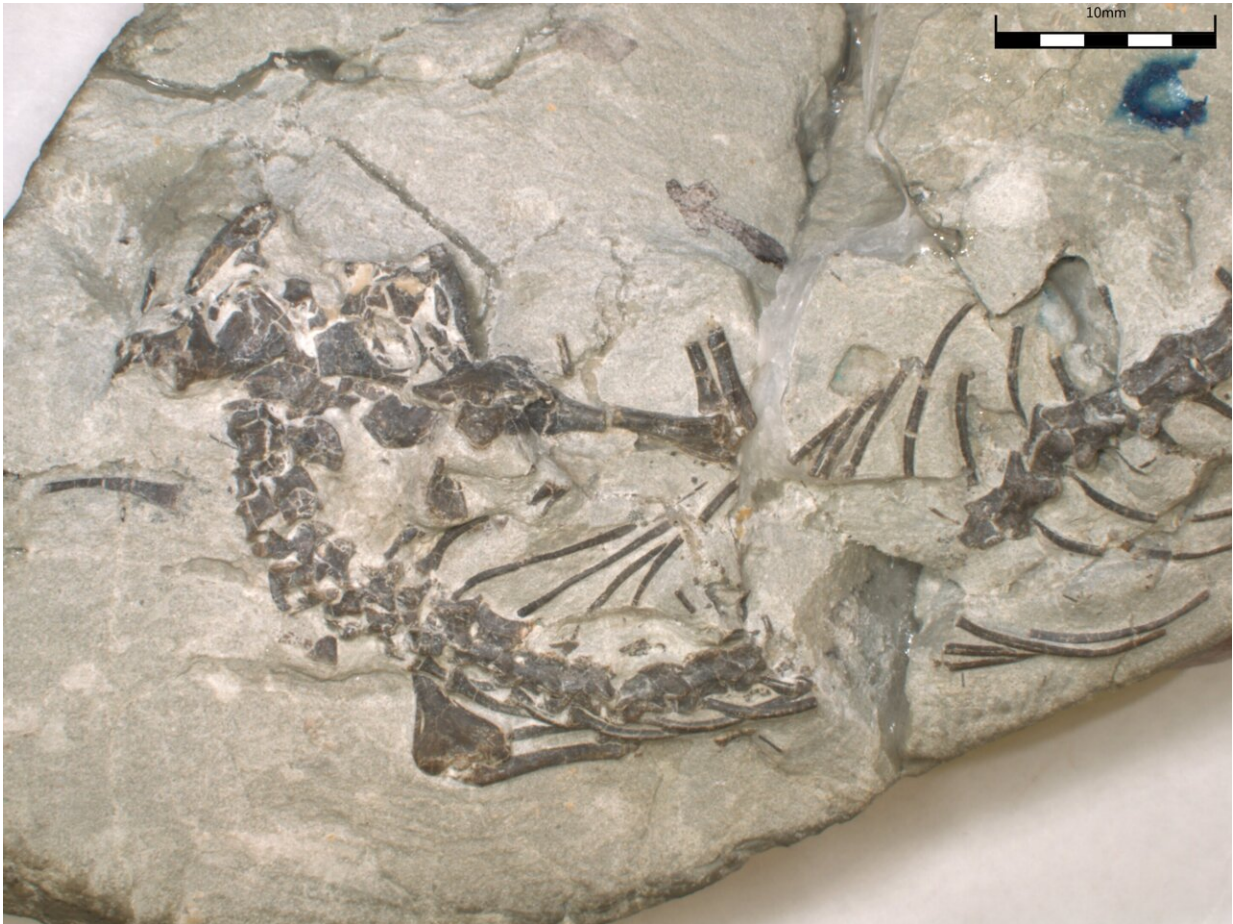
The discovery comes from a handful of specimens including an extraordinarily complete and well-preserved fossil skeleton excavated from a site centered around an *Allosaurus* nest in northern Wyoming's Morrison Formation. Further study of the find could help reveal why this animal's ancient order of reptiles were winnowed down from being diverse and numerous in the Jurassic to just New Zealand's tuatara surviving today.

The tuatara looks a bit like a particularly stout iguana, but the tuatara and its newly discovered relative are in fact not lizards at all. They are actually rhynchocephalians, an order that diverged from lizards at least 230 million years ago, Carrano said.

In their Jurassic heyday, rhynchocephalians were found nearly worldwide, came in sizes large and small, and filled ecological roles ranging from aquatic fish hunters to bulky plant munchers. But for reasons that still are not fully understood, rhynchocephalians all but disappeared as lizards and snakes grew to be the more common and more diverse reptiles across the globe.

This evolutionary chasm between lizards and rhynchocephalians helps explain the tuatara's odd features such as teeth fused to the [jaw bone](#), a unique chewing motion that slides the lower jaw back and forth like a saw blade, a 100-year-plus lifespan and a tolerance for colder climates.

Following O. gregori's formal description, Carrano said the fossil has been added to the museum's collections where it will remain available for future study, perhaps one day helping researchers figure out why the [tuatara](#) is all that remains of the rhynchocephalians, while lizards are now found across the globe.



Fossil skeleton of the new lizard-like reptile *Opisthiamimus gregori*. The fossil was discovered in the Morrison Formation of the Bighorn Basin, north-central Wyoming, and dates to the Late Jurassic Period, approximately 150 million years ago. Researchers named the new species after Smithsonian's National Museum of Natural History volunteer Joseph Gregor who spent hundreds of hours meticulously scraping and chiseling the bones from a block of stone that first caught museum fossil preparator Pete Kroehler's eye back in 2010. The fossil has been added to the museum's collections where it will remain available for future study. Credit: David DeMar for the Smithsonian Institution

"These animals may have disappeared partly because of competition from lizards but perhaps also due to global shifts in climate and changing

habitats," Carrano said. "It's fascinating when you have the dominance of one group giving way to another group over evolutionary time, and we still need more evidence to explain exactly what happened, but fossils like this one are how we will put it together."

The researchers named the new species after museum volunteer Joseph Gregor who spent hundreds of hours meticulously scraping and chiseling the bones from a block of stone that first caught museum fossil preparator Pete Kroehler's eye back in 2010.

"Pete is one of those people who has a kind of X-ray vision for this sort of thing," Carrano said. "He noticed two tiny specks of bone on the side of this block and marked it to be brought back with no real idea what was in it. As it turns out, he hit the jackpot."

The fossil is almost entirely complete, with the exception of the tail and parts of the hind legs. Carrano said that such a complete skeleton is rare for small prehistoric creatures like this because their frail bones were often destroyed either before they fossilized or as they emerge from an eroding rock formation in the present day. As a result, rhynchocephalians are mostly known to paleontologists from small fragments of their jaws and teeth.

After Kroehler, Gregor and others had freed as much of the tiny fossil from the rock as was practical given its fragility, the team, led by DeMar, set about scanning the fossil with high-resolution computerized tomography (CT), a method that uses multiple X-ray images from different angles to create a 3D representation of the specimen. The team used three separate CT scanning facilities, including one housed at the National Museum of Natural History, to capture everything they possibly could about the fossil.

Once the fossil's bones had been digitally rendered with accuracy smaller

than a millimeter, DeMar set about reassembling the digitized bones of the skull, some of which were crushed, out of place or missing on one side, using software to eventually create a nearly complete 3D reconstruction. The reconstructed 3D skull now provides researchers an unprecedented look at this Jurassic-age reptile's head.

Given *Opisthiamimus*'s diminutive size, tooth shape and rigid skull, it likely ate insects, said DeMar, adding that prey with harder shells such as beetles or water bugs might have also been on the menu. Broadly speaking, the new species looks quite a bit like a miniaturized version of its only surviving relative (tuataras are about five times longer).

"Such a complete specimen has huge potential for making comparisons with fossils collected in the future and for identifying or reclassifying specimens already sitting in a museum drawer somewhere," DeMar said. "With the 3D models we have, at some point we could also do studies that use software to look at this critter's jaw mechanics."

More information: A nearly complete skeleton of a new eusphenodontian from the Upper Jurassic Morrison Formation, Wyoming, USA, provides insight into the evolution and diversity of Rhynchocephalia (Reptilia: Lepidosauria), *Journal of Systematic Palaeontology* (2022). [DOI: 10.1080/14772019.2022.2093139](https://doi.org/10.1080/14772019.2022.2093139)

Provided by Smithsonian

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