



Press Release

Newfound terrestrial crocodile fossil redraws the map of Europe in the age of the dinosaurs

University of Tübingen team debunks evolutionary theory that ancient species crossed land bridge from Africa

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A research team led by Dr. Márton Rabi from the Biogeology Department of the University of Tübingen, together with Máté Szegszárdi and Professor Attila Ősi from the Hungarian Eötvös Loránd University, is challenging the hypothesis that Europe remained connected to Africa during the age of the dinosaurs. One argument for this is the great similarity between fossils of extinct crocodiles discovered in present-day Europe and species occurring in the same era in Africa and South America. If the primeval crocodiles were related, that would indicate a late separation of Europe from the southern continents. But after studying a more complete specimen of the crocodile *Doratodon carcharidens* found in Hungary, the researchers concluded that its similarities with African and South American species did not arise from close kinship; instead, they were shaped by a similar way of life. This calls into question that key piece of evidence for a late separation between the continents. The scientific study has been published in the journal *Scientific Reports*.

During the Permian period, around 300 million years ago, the supercontinent Pangaea encompassed all of Earth's landmasses. About 200 million years ago, Pangaea began breaking apart into its primary divisions: the northern Laurasia, containing Europe, North America and Asia; and the southern continent of Gondwana, including all the rest of the landmasses – according to geological models. "In contrast, paleontologists assumed that European fauna during the age of the dinosaurs shared most of its evolutionary history with species in North America as well as with those of the southern landmasses, including Africa and South America," Márton Rabi says. On this assumption, Europe must have remained connected to Africa for longer than geological models indicate, meaning that "during the Cretaceous period, land animals could have moved freely between the now-separated continents," Rabi says.

A key piece of evidence for this assumption is the spectacular-looking land-dwelling crocodile *Doratodon carcharidens*, whose remains have been found in Europe. With its deep skull and blade-like, serrated teeth, it resembled a carnivorous dinosaur. "These features had previously only been documented in African and South American crocodile species. *Doratodon* was therefore long considered an immigrant from the south, arriving overland," Rabi explains. "However, we had only very fragmentary remains of *Doratodon*, just teeth and incomplete jaws."

Fossil fragments of a single individual

Six years after discovering *Doratodon* remains in 85-million-year-old Cretaceous rocks at Iharkút, Hungary, in 2018, the research team made another discovery: "We found an upper jaw with the characteristic teeth and realized that it and the previously discovered partial skull fitted together perfectly," reports Attila Ősi. "It was clear that it must have belonged to the same individual, and *Doratodon* finally took shape before our eyes." The proportions of the skull and teeth suggest a modestly-sized but fearsome-looking crocodile, some 1.5 meters long, likely with long legs, and a dinosaur-like head. "At first glance, the new finds seemed to confirm the great similarity between *Doratodon* and some extinct crocodile species from Africa and South America," says Ősi.

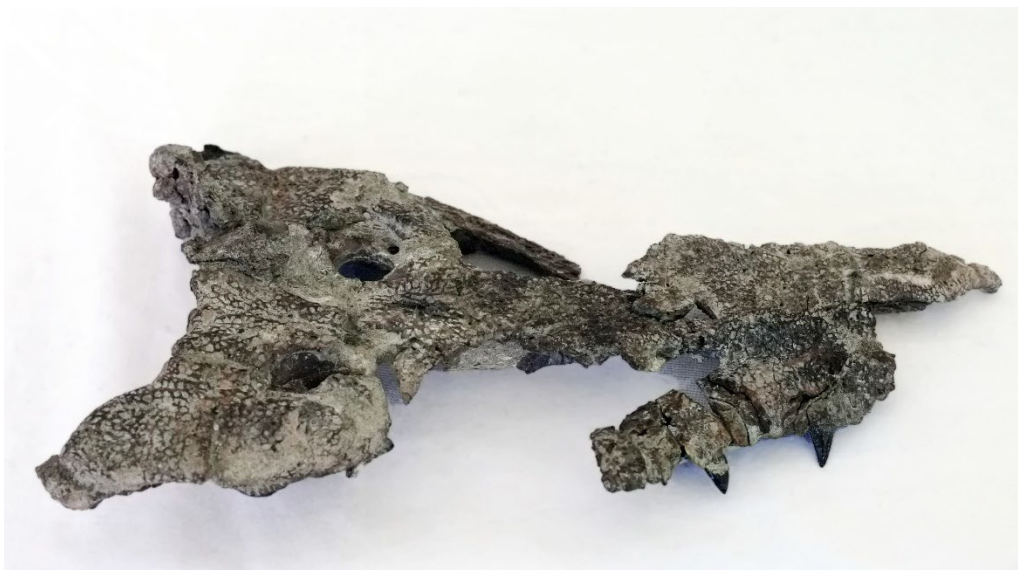
But a comprehensive analysis of *Doratodon*'s anatomical details and evolutionary relationships yielded an unexpected result. "It is not closely related to the southern crocodile species. Rather, it belongs to a group of crocodiles from North America and Asia that more closely resemble our current image of a crocodile," says Máté Szegszárdi, a doctoral student and first author of the study. *Doratodon*'s similarity to African and South American forms has turned out to be a case of extreme evolutionary convergence. This term describes obvious similarities between unrelated species that have developed the same characteristics to adapt to similar ecological roles. "Upon re-examining other European species from this period, including dinosaurs that were previously thought to be immigrants from Africa, we found that their ancestry too needs to be reconsidered. These animals can be viewed as survivors of a once widespread ancestor from the time of the supercontinent. This seems more likely than the idea that they were newcomers, crossing the landmasses into Europe from the south," Rabi says.

"Our findings suggest that the main division of the supercontinent Pangaea into the northern continent Laurasia and the southern continent Gondwana was important in the divergence of crocodile groups," says Rabi. "We now assume an early separation of Europe – as part of Laurasia – from Gondwana during the Jurassic period, around 180 million years ago – which is in better agreement with geological models. *Doratodon* has, in a sense, redrawn the prehistoric map of Europe."

"In paleontological research, findings are pieced together like mosaic tiles. This creates an increasingly complete picture, to which the researchers at the University of Tübingen make important contributions. This work by Dr. Rabi and his team shows how fundamentally our understanding of evolutionary history can change when new discoveries are placed in context," says Professor Dr. Karla Pollmann, University of Tübingen president.



Artist's impression of the land-dwelling crocodile *Doratodon carcharidens*. This is what the now-extinct animal with its long skull and jagged teeth might have looked like. Illustration: Márton Zsoldos



The 85 Myr-old fossil skull of *Doratodon carcharidens* found in Hungary. The length of the specimen is 23 centimeters. Photo: Gábor Rusznák, Eötvös Loránd University



The Iharkút site in Hungary, where fossil remains of the crocodile *Doratotodon carcharidens* were discovered in 85 million year old Cretaceous rocks. Photo: Attila Ősi





Excavations at the Iharkút fossil find site in Hungary. Photos: Attila Ősi

Publication:

Máté Szegszárdi, Attila Ősi & Márton Rabi: Cretaceous crocodyliform reconciles conflicting evidence on the Mesozoic paleogeography of Europe during the Gondwana-Laurasia split. *Scientific Reports*, <https://doi.org/10.1038/s41598-025-28504-6>

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