EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Public Relations Department

Christfried Dornis
Director

Janna Eberhardt
Research reporter

Phone +49 7071 29-77853
janna.eberhardt[at]uni-tuebingen.de

presse[at]uni-tuebingen.de
www.uni-tuebingen.de/aktuell

Press Release

Dinosaur-eating giant crocodile thrived due to saltwater tolerance

University of Tübingen-led team traces *Deinosuchus* to its proper place on the crocodilian family tree

Tübingen, 25.04.2025

An international research team led by the University of Tübingen's Dr. Márton Rabi has found that the giant crocodile *Deinosuchus* – often called the "terror crocodile" or "greater alligator" – was such a successful predator that it posed a threat even to large dinosaurs. *Deinosuchus* lived in the wetlands and coastal areas of North America in the Cretaceous period, 82 to 75 million years ago. Its huge size and tolerance of salt water allowed it to thrive in highly productive coastal ecosystems. Dr. Rabi and his team carried out a detailed ancestry study showing how *Deinosuchus* became one of the largest and most successful predators in North America. The new study has been published in the latest edition of *Communications Biology.*

The various *Deinosuchus* species were among the largest crocodiles that ever lived. They were widespread in the swamps and lagoons of the western Atlantic and on both sides of a wide, shallow inland sea known as the Western Interior Seaway that extended across the continent from north to south in the middle and late Cretaceous period. *Deinosuchus* existed more than ten million years before the appearance of the famous *Tyrannosaurus rex*. "*Deinosuchus* crocodiles preyed on dinosaurs - that has been deduced from bite marks found even on the bones of early relatives of *T. rex*," says Márton Rabi.

Salt water tolerance as an evolutionary advantage

Until now, *Deinosuchus* crocodiles were thought to be related to the freshwater alligators and caimans. It was unclear how they were able to spread widely in North America despite the obstacle posed by the Western Interior Seaway. Since the inland sea existed before the first *Deinosuchus* fossils, it is unlikely that the populations were separated later, says Rabi.

To determine *Deinosuchus'* ancestry more precisely, the research team drew up a detailed family tree of crocodile species. The researchers collected extensive data from many skulls and skeletons of extinct species that had not previously been studied in detail; they also incorporated genetic information from crocodile species that are still alive today. “Our analysis showed very clearly that the *Deinosuchus* species were not closely related to alligators or caimans, nor to any living crocodilian species,” says Jules D. Walter, PhD student and first author of the study. *Deinosuchus* came from a side linage that separated from the branch of the family tree leading to the species living today, such as the true crocodiles, alligators, caimans and gharials. “*Deinosuchus* was no ‘greater alligator’”, says Walter.

“Given this new placement within the family tree, we now assume that their ancestors’ tolerance of salt water has been preserved in the genus,” says Walter. “Although *Deinosuchus* crocodiles did not live permanently in the sea, they could have crossed the Western Interior Seaway and spread out.” At the end of the Cretaceous period, sea levels fell and the inland sea dried up. There are no more *Deinosuchus* fossils from this period; it may be that the various species became extinct as their vast wetland habitat was lost.

Giant crocodiles depend on a large, food-rich habitat

The research team also reestimated the body length of the largest ‘terrible crocodile’, *Deinosuchus riograndensis*, which was previously thought to be between eight and twelve meters. “We arrive at more modest measurements of around 7.7 meters in total length, but there is evidence of incompletely preserved larger individuals,” Walter says, "We don't have a complete skeleton. The *Deinosuchus* skull has a comparatively long snout, which we think led to an exaggerated earlier estimate." In their analysis, the researchers found that species of giant crocodiles have evolved independently of each other at least twelve times over the past 120 million years. “Around seven-meter-long individuals of living crocodile species, which was not far from the estimated size of *Deinosuchus riograndensis*, existed not only in prehistoric times, but at least until the 19th century,” says Rabi. The researchers found that such giants evolved when the habitat was suitable: they needed extensive, highly productive wetlands or marine ecosystems to produce sufficiently large prey. “The only reasons why there may not be any living, truly gigantic crocodiles left are overhunting and habitat destruction,” says Rabi.

“Paleontological research at the University of Tübingen is constantly producing results that not only contribute new details to the history of evolution, but are also relevant to the protection of today's environment and species,” says Professor Dr. Dr. h.c. (Dōshisha) Karla Pollmann, President of the University of Tübingen.

Late Cretaceous interaction in the southwestern coastal wetlands of the Western Interior Seaway: *Deinosuchus riograndensis* to the left and an early alligatoroid to the right. Image: Márton Szabó

Dr. Márton Rabi (right) and co-author Dr. Tobias Massonne with two record-sized skulls of living crocodilians in the Zoological Collection of the University of Tübingen. Photo: Friedhelm Albrecht/ University of Tübingen

Publication:
Jules D. Walter, Tobias Massonne, Ana Laura S. Paiva, Jeremy E. Martin, Massimo Delfino & Márton Rabi: Expanded phylogeny elucidates *Deinosuchus* relationships, crocodylian osmoregulation and body-size evolution. *Communications Biology*, https://doi.org/10.1038/s42003-025-07653-4

Contact:
Dr. Márton Rabi
University of Tübingen
Faculty of Science
Biogeology
Phone +49 7071 29-78930
marton.rabi[at]uni-tuebingen.de