

The dawn of the Triassic aquatic reptiles in the light of discoveries from the Lower Muschelkalk

At the beginning of the Mesozoic Era, around 250 million years ago, Earth's ecosystems were undergoing a drastic transformation in the aftermath of the end-Permian mass extinction. Yet, just a few million years later, in the Triassic, we can already see diverse animal communities inhabiting various environments. This remarkable turnover gave rise to many tetrapod groups that would later dominate terrestrial, aquatic, and aerial ecosystems (e.g., ancestors of dinosaurs, pterosaurs, and lizards). In the seas, a group of extremely evolutionarily successful reptiles appeared – the sauropterygians. Plesiosaurs are probably the best-known members of Sauropterygia, but their earlier relatives were already numerous and diverse at the beginning of the Triassic. The fossil record of this time, and with it, the ancient marine reptiles, is preserved within the Muschelkalk rocks known from Europe. Vertebrate remains from this geological unit are, however, predominantly found as isolated bones. To fully understand these marine animal communities, we have to start by revisiting the best-preserved specimens. This study aims to improve our knowledge of the diversity of aquatic reptiles in the early Mesozoic by analysing several partial sauropterygian skeletons from the Gogolin Formation in Poland.

In this project, six historic reptile skeletons will be reinvestigated through computed-tomographic scanning and 3D modelling. This method allows us to isolate each of the preserved bones and refer them to their original anatomical position in the skeletons of the studied Triassic reptiles. This will allow us to create a detailed osteological description, compare them with other similar taxa known from similar sites around the globe, and improve our ability to classify isolated remains from the same strata. With these insights, we might be able to identify additional remains of trachelosaurids, another group of unusual aquatic reptiles more closely related to crocodiles and dinosaurs. Trachelosaurids have just recently been identified in Europe, as their remains appear similar to sauropterygians through convergent adaptation to an aquatic environment. To better understand the relationships of the animals studied in this project, we will perform a numerical analysis comparing different morphological characters of their skeletons to other related animals.

This study will be the first to holistically analyse the skeletons of sauropterygians through computed tomography. The gathered data will be easily accessible to other researchers and will pave the way for further studies. Understanding the anatomy of the early Mesozoic marine reptiles, their paleobiology, adaptations to the aquatic environment, and evolutionary relationships will allow us to uncover the source of their success. By situating these findings within the broader context of Early/Middle Triassic ecosystems, the project will contribute significantly to our understanding of the marine communities of the early Mesozoic.