Abstract

The Triassic was a key period in the evolution of vertebrates, and reptiles in particular, giving rise to a plethora of successful lineages, some of which are still extant. One of the groups that flourished during the early Mesozoic were the tanysaurians (Archosauromorpha: Tanysauria). The scientific goal of this thesis is to unravel the biology of the long-necked tanysaurian *Tanystropheus*. With the new material being excavated in Miedary (Upper Silesia, Poland), an opportunity arose for solving the long-standing debate over several aspects of life of this remarkable animal. These subjects are covered within this dissertation, which consists of an Introduction, four chapters, Conclusions, and an Appendix. Chapters II, III, and IV were created in collaboration with teams consisting of both Polish and foreign scientists, among whom I was the leading author.

Chapter I focuses on the anatomy, taxonomy, and environmental preferences of *Tanystropheus*. I describe the osteology of *Tanystropheus conspicuus* in detail, based on the abundant and diverse remains from Miedary. These include several hundreds of specimens, mostly isolated elements, but with some articulated individuals, and including the first unambiguous cranial remains referred to this species, providing valuable insights into its biology. I provide a new diagnosis for *Tanystropheus conspicuus*, which differentiates it from other *Tanystropheus* species. Several newly observed anatomical features contribute to the dispute on the lifestyle of *Tanystropheus*, which is confirmed to have been an aquatic ambush predator that hunted in shallow nearshore settings.

Chapter II includes the first comprehensive description of the internal structure of the extremely elongate cervical vertebrae of tanysaurians. Through computed tomography and sectioning, we were able to reveal some intriguing features comparable to those seen in pterosaurs and birds. However, contrary to what we see in pneumatic bones, cervicals of tanysaurians contain a singular voluminous cavity. This results in a cylindrical structure in these vertebrae, which likely provided durability, while contributing less to the weight of the neck. Our insights are relevant for better understanding of a unique and extreme anatomy among tetrapods, which evolved as a result of very strict selection for some particular function. Importantly, these findings demonstrate that major modifications of the internal anatomy of vertebrae were not unique to derived avemetatarsalians (pterosaurs and dinosaurs), but more widespread among reptiles. This chapter has already been published.

Chapter III presents the first digital biomechanical analysis of the neck of *Tanystropheus*. We assessed its range of motion and performed finite element analysis on the individual cervical ribs and the neck model in different configurations. Our results indicate that the neck of *Tanystropheus* was not extremely stiff, as previously postulated, and the ribs likely did not impair its movements. They transferred tensile forces towards the base of the neck, similar to what was hypothesised for sauropods. This study elucidates the bauplan of this extremely specialised animal and brings us closer to understand the functionality of neck elongation in vertebrates.

Chapter IV describes some of the taphonomic features of the Miedary assemblage. Fossilised bones can preserve characteristics that are otherwise not recorded in the surrounding rock, and their histotaphonomic features and sedimentary infill can serve as a basis for unravelling the origin of fossil bonebeds. We used a suite of analytical methods on a broad sample of thin sections made from bones of reptiles, amphibians and fishes, to assess the diversity of their taphonomic characteristics. The remains of *Tanystropheus* do not differ in their preservation from those of aquatic taxa, supporting its interpretation as a water-dwelling animal. Our results demonstrate that some Middle Triassic ecosystems combined faunistic elements usually found in different environments, underlining transitional nature of these habitats.

The new material from Miedary allowed for studying the biology of *Tanystropheus* with a holistic approach. Traditional palaeontological methods, numeric analyses, modern imaging techniques, and digital reconstructions gave us new insights into various aspects of life of this animal. *Tanystropheus conspicuus* turned out to be a valid taxon endemic to the Central European Basin. It inhabited shallow near-shore waters. Its extremely elongated neck was composed of vertebrae that were tube-like in structure, which increased their durability. Hyperelongate ribs extended along them, but they did not constrain the movements of the neck, but rather transferred tensile forces.