Solving the mystery of the mode of life of a long-necked Triassic reptile *Tanystropheus*

The main goal of the project is to determine the life mode and habitat of long-necked reptiles belonging to an extinct genus *Tanystropheus*. Their biology was a subject of many discussions ever since the first remains assigned to this genus were described in the 19th century. We know relatively little about *Tanystropheus*, despite numerous well preserved specimens, including complete skeletons (which are extremely rare in paleontology), having been found in Italy and Switzerland. Most of the known *Tanystropheus* material is flawed – its fossils are extremely flattened, making them an unusable source of information for some analyses. In Poland however, new, fully 3D preserved bones have been identified. By using multiple different methods we can use the new material as the key to understanding the biology of *Tanystropheus*.

Tanystropheus belongs to Archosauromorpha, a group encompassing, among others, dinosaurs, pterosaurs and extant animals like birds, crocodiles and possibly turtles and tortoises (their evolutionary history is complicated). Members of this group were dominating the land ecosystems of the Mesozoic Era. In the Triassic Period, 252-202 millions of years ago, basal archosauromorphs, often equipped with unique anatomical features, were far much more widespread than the dinosaurs. *Tanystropheus* is one of those distant dinosaur relatives, known from numerous sites throughout the world. The most characteristic feature of its body was the unusual anatomy of its neck, distinct from any other know animals, both extinct and extant. *Tanystropheus* was characterized by having 13 cervical vertebrae. In humans and most mammals only 7 are present, but some Mesozoic reptiles could have had over 70. In *Tanystropheus* not the number, but the shape of the vertebrae is unusual – they are extremely elongated, in proportion resembling limb bones of other vertebrates. Moreover, long and narrow cervical ribs run parallel to the vertebral column. In humans they are present only as a pathological condition, but in *Tanystropheus* they served the purpose of stiffening the neck. This sort of "bracing" helped *Tanystropheus* to sustain the neck – which measured up to half of its body length.

Despite many years of research, the life mode of *Tanystropheus* is still highly disputed. The anatomy of its neck was so unique, that any reconstruction does not look realistic. Other body features of *Tanystropheus* do not clearly indicate a specific habitat of life – for example the skull is interpreted as clearly belonging to a piscivorous animal, but limbs are similar to those of terrestrial reptiles. Most of the researchers agree, that *Tanystropheus* probably lived in a coastal environments, and that it may have been able to venture on land.

The basic constraint that limits our analytical abilities concerning the life mode *Tanystropheus* is the characteristics of its known fossil record. Remains of *Tanystropheus* have usually been found isolated and 3D preserved, or numerous and extremely flattened. In the recent years however, new material from the Upper Silesia was found. Scientists from the Institute of Paleobiology of the Polish Academy of Sciences and Faculty of Biology of the University of Warsaw uncovered countless well preserved specimens. These remains belong to multiple gigantic (6-7 meters long) *Tanystropheus* individuals, that also mark the northernmost know occurrence of that genus.

Our project will utilize the new finds to resolve the long-standing dispute over the mode and habitat of life of *Tanystropheus*. New material will be described and compared with the other known specimens. Secondly, we will perform the analyses that, due to the state of preservation of the fossils, were previously difficult to perform. These will include research on bone histology, taphonomical history and compactness (which can differ depending on environment). Thirdly we will scan the bones and build a 3D models of the neck and limbs of *Tanystropheus*, to check their range of motion, which has never been done for that genus.

Our studies will allow for better understanding of an unique organism, which (considering the neck elongation) could have reached the farthest limits of what is biologically possible for a vertebrate. This project will give insight into the phenomenon of convergent neck elongation in multiple distantly related groups of animals, many of which where the largest to ever live in their times and/or environments.