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A New Tetrapod from Southern Africa: Spectacular Find at Gai-As, Northwestern Namibia

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Abstract :- *Gaiasia jennyae*, named after its place of discovery, Gai-As, in northwestern Namibia and palaeontologist Jennifer Clack, is a salamander-like predator which lived during the Permian period – at a time when southern Africa was still getting over the extensive Dwyka glaciation. Over two metres long and in possession of a massive head, it was a formidable hunter in those cold waters, and the largest of its kind known to date. Its discovery sheds new light on the evolution and distribution of tetrapods (four-legged vertebrates), hitherto only known from ancient equatorial sites with a tropical climate, in North America and Europe.

Keywords :- Permian, Tetrapods, Gai-As, Excavation, Preparation

Introduction

Tetrapods are animals that have legs, or animals with ancestors that had legs, such as whales, bats, snakes, birds and frogs (Clack, 2009). Palaeontologists have long been interested in finding fossils of earliest tetrapods the better to understand the evolution of land-dwelling animals, from aquatic tetrapods which migrated from water to on to dry land. The earlier transition from fish to tetrapod is postulated to have happened at the end of the Devonian (Clack, 2009). However, theories abound suggesting that such organisms could not have thrived in the southern hemisphere during the Carboniferous period, as climatic conditions were too harsh with glaciers and ice sheets covering much of the land. Therefore, a sampling bias resulted, and the majority of tetrapod finds arose from targeted field sampling campaigns carried out in northern hemisphere localities.

Previous geological work and palaeontological done in the Gai-As Formation of the Karoo-age Huab Basin (northwestern Namibia) uncovered several fossils of fishes, such as *Namaichthys* and *Atherstonia*, molluscs (*Leinzia similis)* and disarticulated bones of larger animals initially identified as amphibians (mastodonsauroids or matoposaurids; Stollhofen *et al*., 2000). The mainly clastic, reddish to purplish sediments (shales, siltstones, sandstones) of the Gai-As Formation reflect the existence of an enclosed, isolated lake which, according to Crossley (1984), Tiercelin (1991) and Baltzer (1991), can be compared to the lakes of the present day Rift Valley of East Africa (e. g. Lake Tanganyika, Lake Malawi).

Renewed fieldwork in the Gai-As area in 2014 and 2015 resulted in the discovery of a new, large tetrapod that would challenge old theories and will shift the search for these primitive tetrapods to the neglected southern hemisphere. *Gaiasia jennyae* was named after its place of discovery, Gai-As, in northwestern Namibia, and palaeontologist Jennifer Clack by its finders (Marsicano *et al*., 2024). Most popular articles have described it as a salamander-like predator, which lived in the cold swamps of Gondwana around 280 million years ago and predated the dinosaurs by millions of years. During this time southern Africa was situated at a much higher latitude than today (~55° S) and still recovering from the widespread Dwyka glaciation of the Carboniferous period. With an overall length of ca. 2.5 m and a large, flat head of a length of 60 cm, it was a fearsome hunter in the dark, murky waters of Lake Gai-As. It is the largest tetrapod of its kind known to date. The description of the animal is based on four incomplete specimens, i. e. one holotype, two paratypes and a specimen found in the early 2000s (Marsicano *et al*., 2024).

Discovered in 2015 by Prof. Roger Smith of the Iziko Museum, Cape Town, South Africa, and his team on occasion of a field trip

to Namibia, *Gaiasia* caused a minor sensation around the world, when its existence was first publicised online in July 2024 in an article in *Nature* (Marsicano *et al*., 2024). At the same time, various international newspapers and science magazines reported on this important find, among them The Guardian (UK), New Scientist (UK), Westdeutsche Allgemeine Zeitung (Germany), New York Times (USA), Washington Post (USA) and Gazeta Brasil to name but a few.

Excavation at Gai-As

During initial exploration of the red hills of Gai-As some fossils were found scattered on the slopes, which had already been eroded out of their sediment cases, making them easily recognisable (Fig. 1).

Figure 1. Finding tetrapod bones on the hillside at Gai-As (in front: Sibusiso Mtungata, left and Roger Smith, right; at the back: Claudia Marsicano)

Elsewhere, it took careful observation and a good eye to discover a hint of a bone, jaw or tooth embedded within the rock, with the rest of the skeleton deeply buried. Once a bone fragment or tooth was identified, large blocks of rock containing parts of the fossil skeleton had to be carefully prised loose of the matrix to avoid damage, and carried downhill on a makeshift stretcher made from hessian cloth, wooden poles and rope. Individuals with strong arms, shoulders and backs thus transferred the precious cargo to the field vehicle for its journey to the National Earth Science Museum in Windhoek and further preparation (Fig. 2).

Figure 2. Sibusiso Mtungata (left) and Leandro Gaetano (right) carrying *Gaiasia jennyae* downhill on a makeshift stretcher

Preparation at Iziko South African Museum in Cape Town

For preparation and further studies, *Gaiasia jennyae* was brought to the Iziko South African Museum in Cape Town, where it remained for a period of three years. With the arrival of this interesting specimen some alterations were effected at the Iziko Karoo Palaeontology Laboratory, which mostly works on Late Permian to Early Triassic fossils, to meet slightly different challenges posed by the rock matrix. In addition - because of the importance and uniqueness of this find and ongoing reconstruction work at the museum lab - special arrangements were made (such as installation of extra dust extractors and allocation of dedicated workstations) to avoid all possibility of contamination in the preparation room (Fig. 3).

Preparation of the palatal fangs was especially crucial and important, as scientists can deduce a lot of information aiding in the identification of the animal from the features of the palate (Fig. 4). This painstaking work - which takes a steady hand - was carried out with a suitable scribe, i. e. the Paleo Tools Micro Jack 3.

The sedimentary rock covering the bone surface *of Gaiasia jennyae* was approximately 10 cm in thickness, hence the long time it took to chisel it out of its “tomb”, where it had rested for eons. Special caution also had to be taken during preparation, as *Gaiasia* shows some unique morphological features resulting in the probe encountering fossil bone in unexpected places, while removing the surrounding rock matrix – a job requiring infinite patience, painstaking precision and diligence. Moreover, the zigzag patterned ornamentation on the skull roof (Fig. 5) posed further challenges to the preparator because of its variable angles and floating osteoderms.

Figure 3. Sibusiso Mtungata preparing *G. jennyae* at the Iziko South African Museum in Cape Town

Figure 4. Meticulous preparation of the palatal fangs of *G. jennyae*

Figure 5. *G. jennyae* skull after complete preparation, showing the osteoderms with the zigzag patterned ornamentation

Return of the Gai As tetrapod to the National Earth Science Museum

On 5 July 2019 the *Gaiasia jennyae* material was returned to the National Earth Science Museum, but the COVID 19 pandemic, which started soon afterwards, temporarily put a halt to plans for its exhibition. However, after the publication of *Gaiasia*'s discovery in *Nature* and the attendant worldwide publicity, the museum received many enquiries and requests, both from locals and the travelling public, expressing interest in this spectacular specimen which, since its arrival back in Windhoek five years ago, had dwelt ignominiously in its backrooms. Accordingly, priority was given to planning and designing a display appropriate to its prominence and fame, which will allow visitors to view both the actual

fossil remains and a reconstruction of what *Gaiasia* (most likely) looked like, when it was haunting and hunting the swamps around Lake Gai-As in Permian times (Fig. 6).

Figure 6. The new *Gaiasia jennyae* display at the National Earth Science Museum, Windhoek

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