

Description of a new antiarch head shield found in the Aztec Siltstone of Antarctica

William Mayer, Anthony Zaccagni, and Jason Downs

Delaware Valley University

Academy of Natural Sciences of Drexel University

Abstract

A specimen of the antiarch group *Bothriolepis* from the Late Devonian of the Aztec Siltstone Formation, Antarctica, is described and given a c.f. species assignment. Taxonomic attribution is presented based on key characteristics described in holotype specimens of various *Bothriolepis* species. The troublesome nature of *Bothriolepis* phylogeny is discussed. The research displayed in this paper aims to use specimen ANSP 26049 as a guide for *Bothriolepis* fossil diagnoses moving forward to ensure that new species aren't being recorded in an unjustified manner.

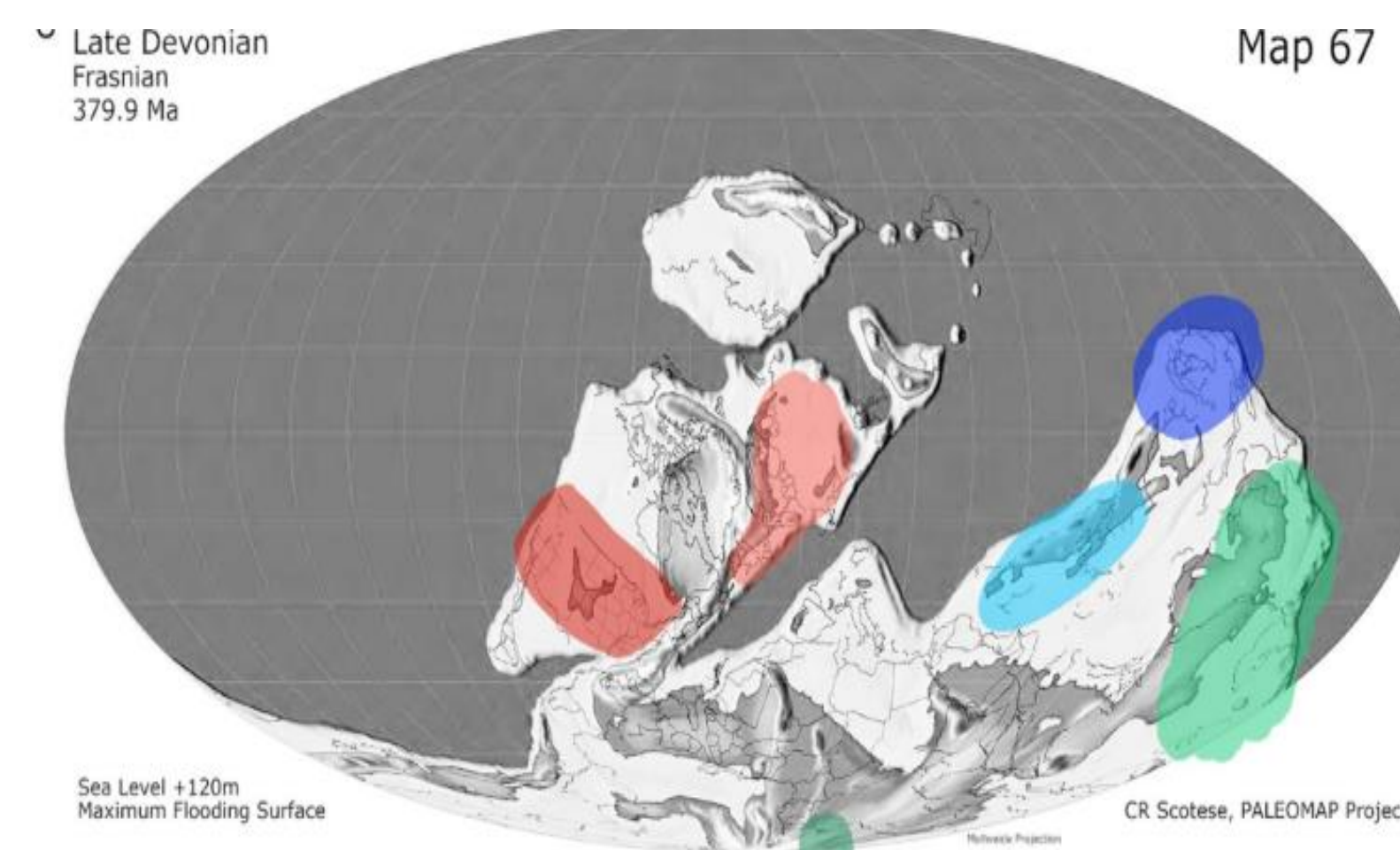


Figure 1. Late Devonian paleomap displaying most common areas of *Bothriolepis* discovery (Dupret et al, 2023)

Introduction

Bothriolepis is a Middle to Late Devonian group of antiarchs, aquatic vertebrates with armored cephalic and thoracic regions. *Bothriolepis* contains 95 species, scattered across the globe. Most specimens are discovered within modern day Antarctica, Australia, Russia, United States, and Greenland. The great diversity of *Bothriolepis* is generally accepted despite the lack of proper guidelines for new species assignment. The Aztec Siltstone of Antarctica is a particularly rich region of antiarchs, specifically *Bothriolepis*. The early work of designating Antarctic *Bothriolepis* species was done by Young (1988, 1989). Due to the globally speciose nature of *Bothriolepis*, taxonomy becomes difficult to interpret. Just within the Aztec Siltstone, ten species are recognized with thirteen species labeled as indeterminate (Dupret et al, 2023).



Figure 2. ANSP 26049, dorsal head shield in dermal impression

Underlying Issue

We analyzed the *Bothriolepis* species described from the Aztec Siltstone. Young (1988) named nine species and described thirteen other indeterminate species of *Bothriolepis*. A number of those were described solely from fragmented portions of various head shield plates. The limited evidence used to create new species only makes *Bothriolepis* taxonomy more complex. We question the legitimacy of *Bothriolepis* species diversity in the Aztec Siltstone.

Why c.f. *B. kohni*?

The holotype of *B. kohni* as described by Young (1988):

- Has ornamentation described as tuberculate to vermiculate with little prominent reticulation.
- PrM is clearly of the elongate type, with maximum width at the level of the infraorbital groove.
- Lateral margin is distinctly notched.
- Orbital margin is slightly concave, and just over one third the width of the plate.

ANSP 26049 fits within the same proportions as *B. kohni*, albeit a bit larger. Young (1988) places an emphasis on morphology and proportions of PrM, PP, and Nu plates. The diagnostic characteristics of the PP and Nu plates are not present in ANSP 26049, hence the c.f. notation.

Abbreviation Key

L, Lateral; PrM, Pre-Median; PP, Post-Pineal; PN, Paranauchal; Nu, Nuchal; F.O., Orbital Foramen

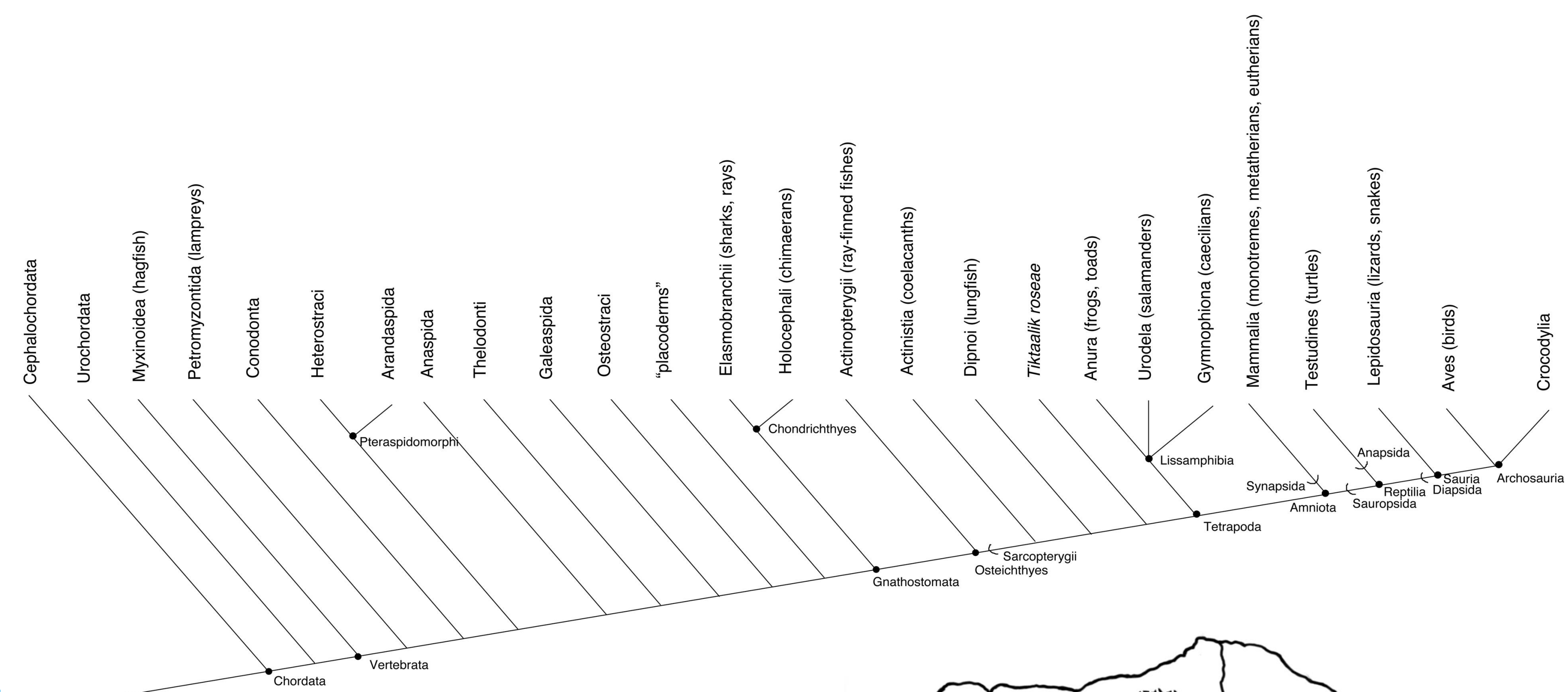


Figure 3. Unpublished cladogram of Chordata highlighting position of 'placoderms'

Do we need all these species of *Bothriolepis*?

We believe it is plausible that many *Bothriolepis* species could coexist in the Aztec Siltstone. We see this today in modern groups of animals with similar anatomy and behavior. Based on ecological principles, we recognize species can occupy similar niches while being in the same locale. This can be explained by behavioral differences such as resource partitioning, reproductive seasons, or even foraging activity at different times of the day. We argue that new species assignment should be taken with care. We do not have the modern luxury of observing ecological behavior to assign new species. Our research is based on morphology alone so we must prepare significant evidence before naming new *Bothriolepis* species. Established species cannot be eliminated so further research is required to supplement them with complete specimens.



Figure 4. Reconstruction of *B. kohni* using ANSP 26049 as a reference

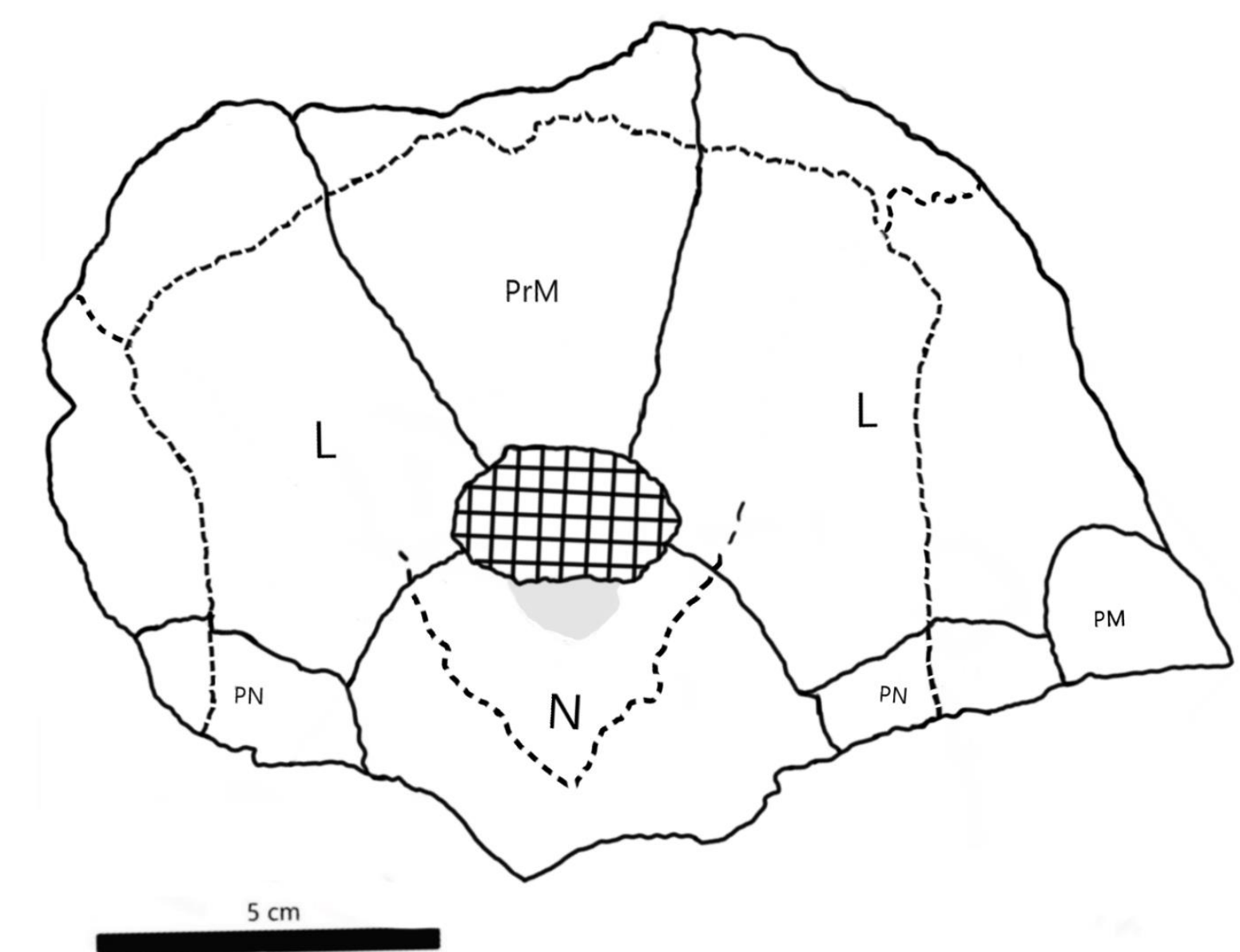


Figure 6. ANSP 26049, illustration of dorsal head shield. Dashed lines indicate positions of pitline sensory grooves.

Literature Cited

- Béchar, I., Arsenault, F., Cloutier, R., & Kerr, J. (2014). The Devonian placoderm fish *bothriolepis canadensis* revisited with three-dimensional digital imagery. *Palaeontology Electronica*. <https://doi.org/10.26879/417>
- Downs, J. P., Daeschler, E. B., Garcia, V. E., & Shubin, N. H. (2016). A new large-bodied species of *bothriolepis* (antiarch) from the Upper Devonian of Ellesmere Island, Nunavut, Canada. *Journal of Vertebrate Paleontology*, 36(6). <https://doi.org/10.1080/02724634.2016.1221833>
- Dupret, V., Byrne, H. M., Castro, N., Hammer, Ø., Higgs, K. T., Long, J. A., Niedzwiedzki, G., Qvarnström, M., Stössel, I., & Ahlberg, P. E. (2023). The *Bothriolepis* (Placodermi, Antiarcha) material from the Valentia Slate Formation of the Iveragh Peninsula (Middle Givetian, Ireland): Morphology, evolutionary and systematic considerations, phylogenetic and palaeogeographic implications. *PLOS ONE*, 18(2). <https://doi.org/10.1371/journal.pone.0280208>
- Young, Gavin C. (1988). ANTIARCHS (PLACODERM FISHES) FROM THE DEVONIAN AZTEC SILTSTONE, SOUTHERN VICTORIA LAND, ANTARCTICA. *Paleontographica A*.
- Young, G. C. (1989). The aztec fish fauna (devonian) of southern victoria land: Evolutionary and biogeographic significance. *Geological Society, London, Special Publications*, 47(1). <https://doi.org/10.1144/gsl.sp.1989.047.01.05>

Acknowledgements

We acknowledge Ned Gilmore for allowing us access to the fossil materials. Many have contributed to the field efforts, but important thanks go to Ted Daeschler, John Long, and Neil Shubin. We thank the Academy of Natural Sciences of Drexel University for granting access to their collections. We acknowledge the Schoenfeld Foundation for providing financial support to student research at Delaware Valley University.