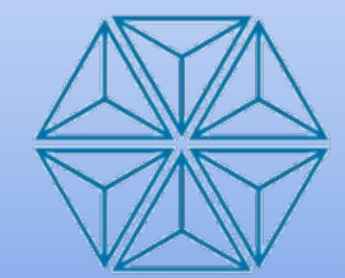


Morphometric Study of *Bothriolepis* sp. from the Catskill Formation of Pennsylvania

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Bristol-Myers Squibb

Abstract

The taxonomy of *Bothriolepis* specimens in North America is historically disorganized. There is much disagreement as to whether North American specimens are of the same or different species. Morphometric analysis of measurements taken from *Bothriolepis* specimens from the Catskill Formation in Pennsylvania show a possibility of two different shape categories. Early results suggest there may be two different shape categories among the Catskill Formation specimens. More data and analyses are needed in order to conclude whether two different species exist.

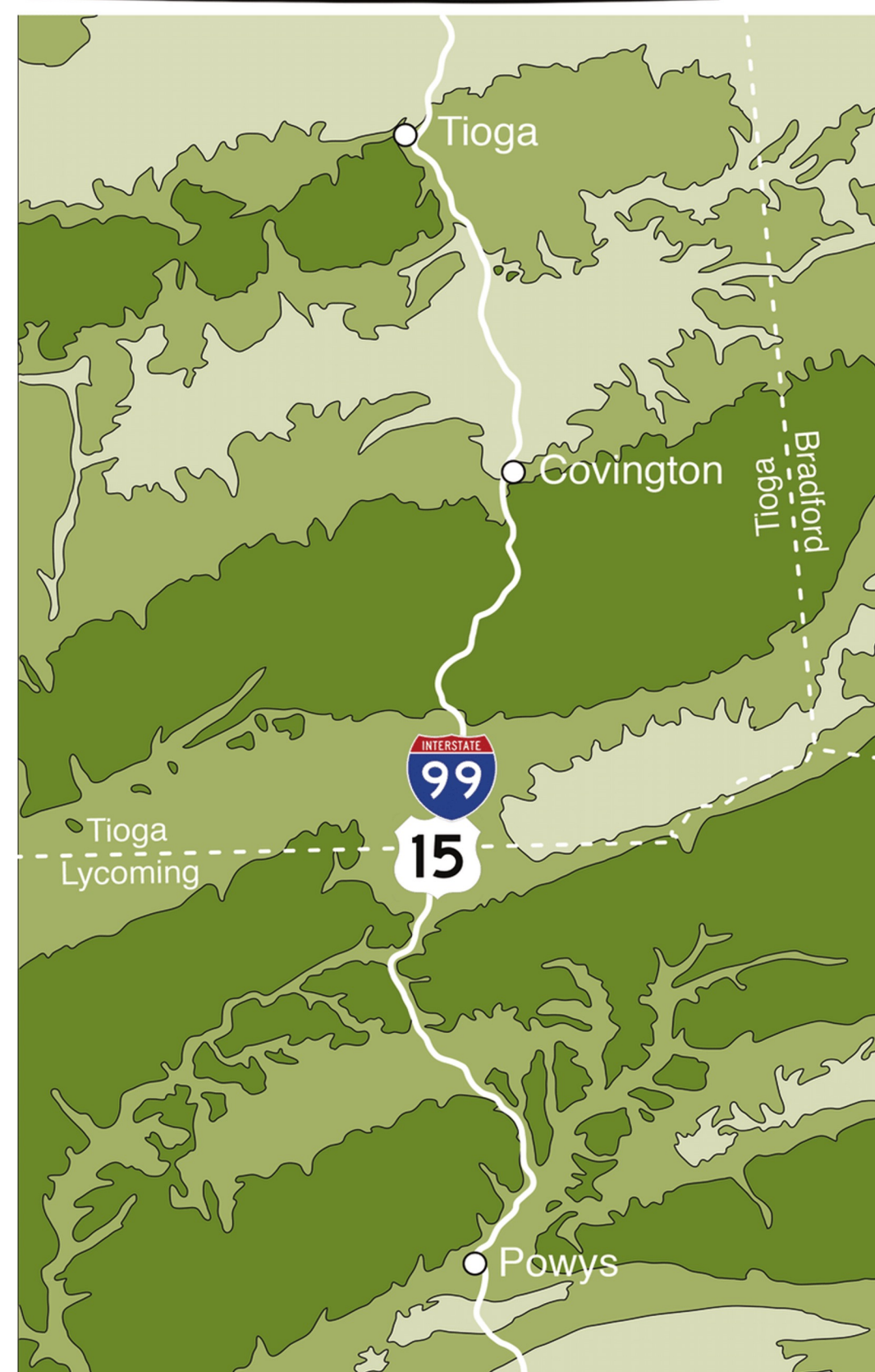
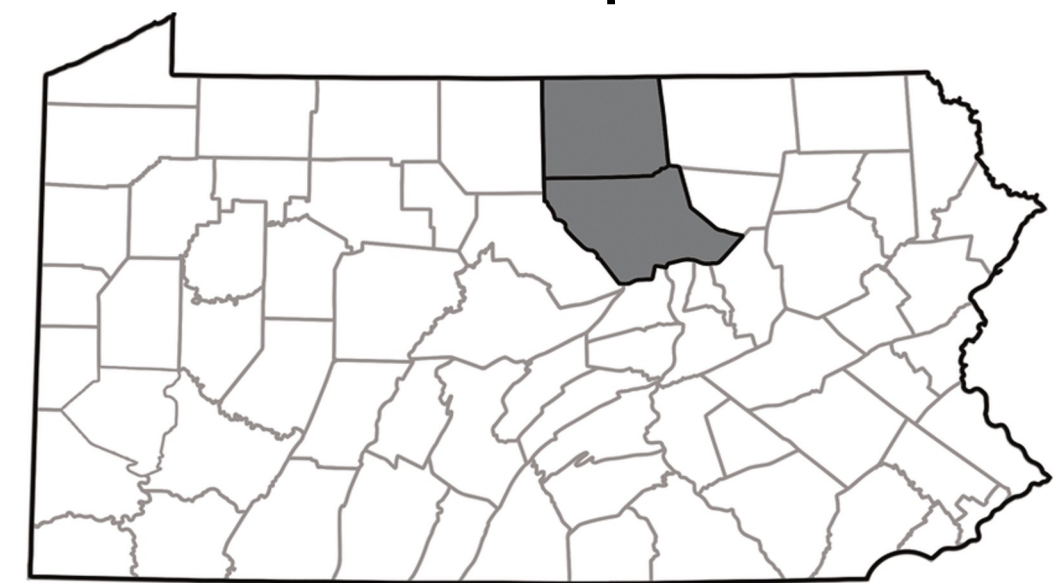


Figure 1: Fossiliferous Catskill Formation sites along U.S. Route 15/Interstate 99 in Tioga and Lycoming Counties, PA

Literature Cited and Acknowledgements

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Werdelin, L., and Long, J. A. (1986). Allometry in the placoderm *Bothriolepis canadensis* and its significance to antiarch evolution. *Lethaia*, 19(2), 161–169. <https://doi.org/10.1111/j.1502-3931.1986.tb00727.x>

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Introduction

Bothriolepis is a grouping of antiarch placoderms that lived during the Middle to Late Devonian period (390–358 Ma). They are characterized by head, trunk, and pectoral skeletons that are more commonly preserved than the soft tissues. These armored fish were found globally before their extinction at the end of the Devonian period.

The classification of *Bothriolepis* specimens has been done haphazardly since their discovery in the mid-1800s. There are two extremes in *Bothriolepis* taxonomy: those who propose that there are many different species of *Bothriolepis* found across the United States and those who propose that there is just one, *Bothriolepis nitida*. Specimens are either put in the broad category of *Bothriolepis nitida* or labeled as a unique species based on location. Arguments surrounding *Bothriolepis* taxonomy has ended in a stalemate since the consequent publications of Thomas and Thomas (2001), and Weems (2004). Our research looks to begin to rectify the situation by doing a morphometric analysis of specimens collected from the Catskill Formation in Tioga County, Pennsylvania.

Methodology

A survey of the Academy of Natural Sciences of Philadelphia's (ANSP) *Bothriolepis* specimen collected from the Catskill Formation was taken to determine how many specimens in the collection were viable for morphometric analysis. It was found that the collection was mostly made up of dermally preserved dorsal head shields; therefore, measurements were only taken from these elements.

All measurements of relevant specimen were taken with digital calipers. Forty-six specimens with nine different measurements were recorded. Biplots of the ratio of head shield length (LHs) to head shield width (WHs) and the ratio of orbital width (Orbit W) to head shield width (WHs) were made using Microsoft Excel.

Morphometric Analysis

LHs vs WHs

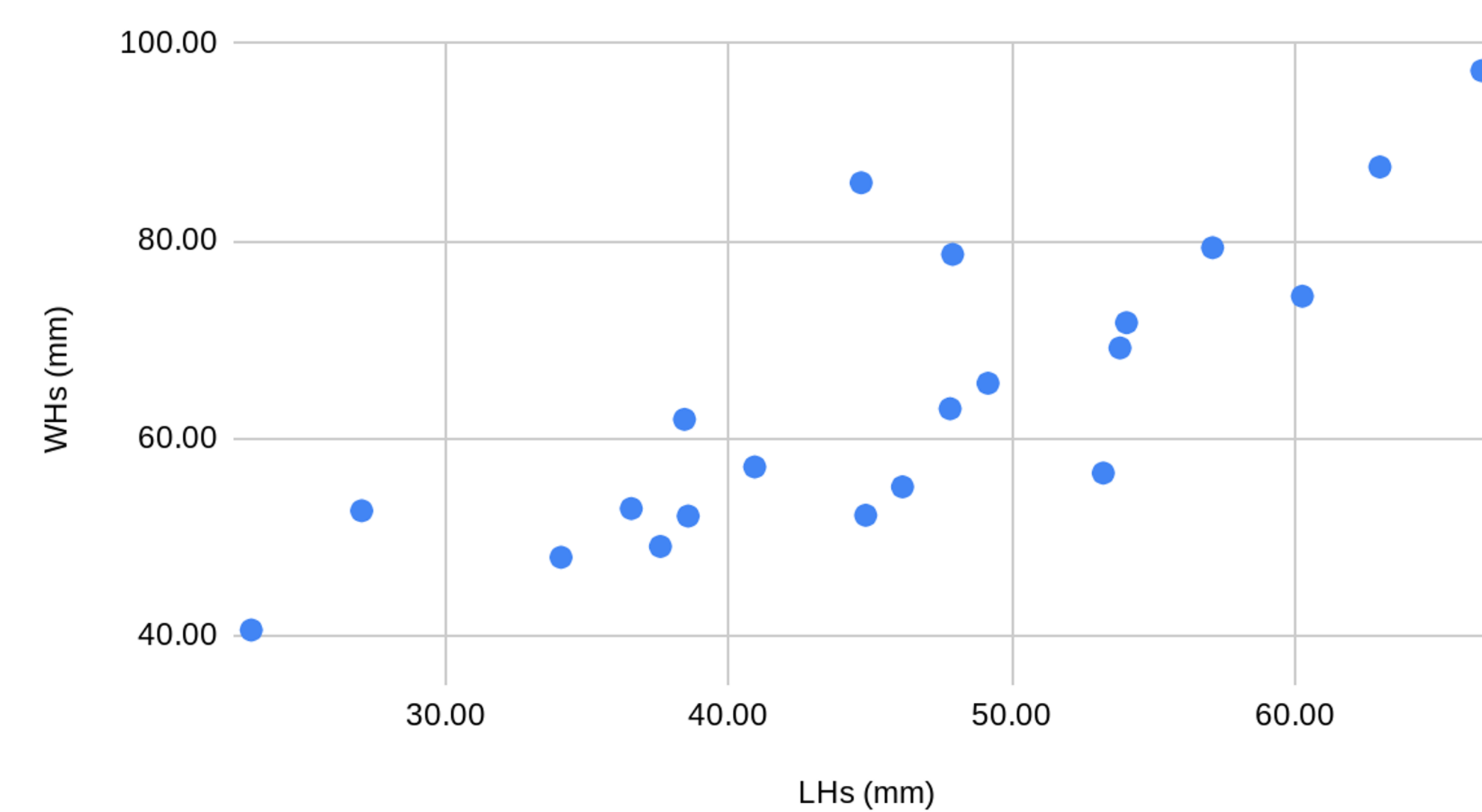


Figure 2: Ratio of head shield width (WHs) to head shield length (LHs) for 21 specimens of Pennsylvania *Bothriolepis* sp.

Orbit W vs. WHs

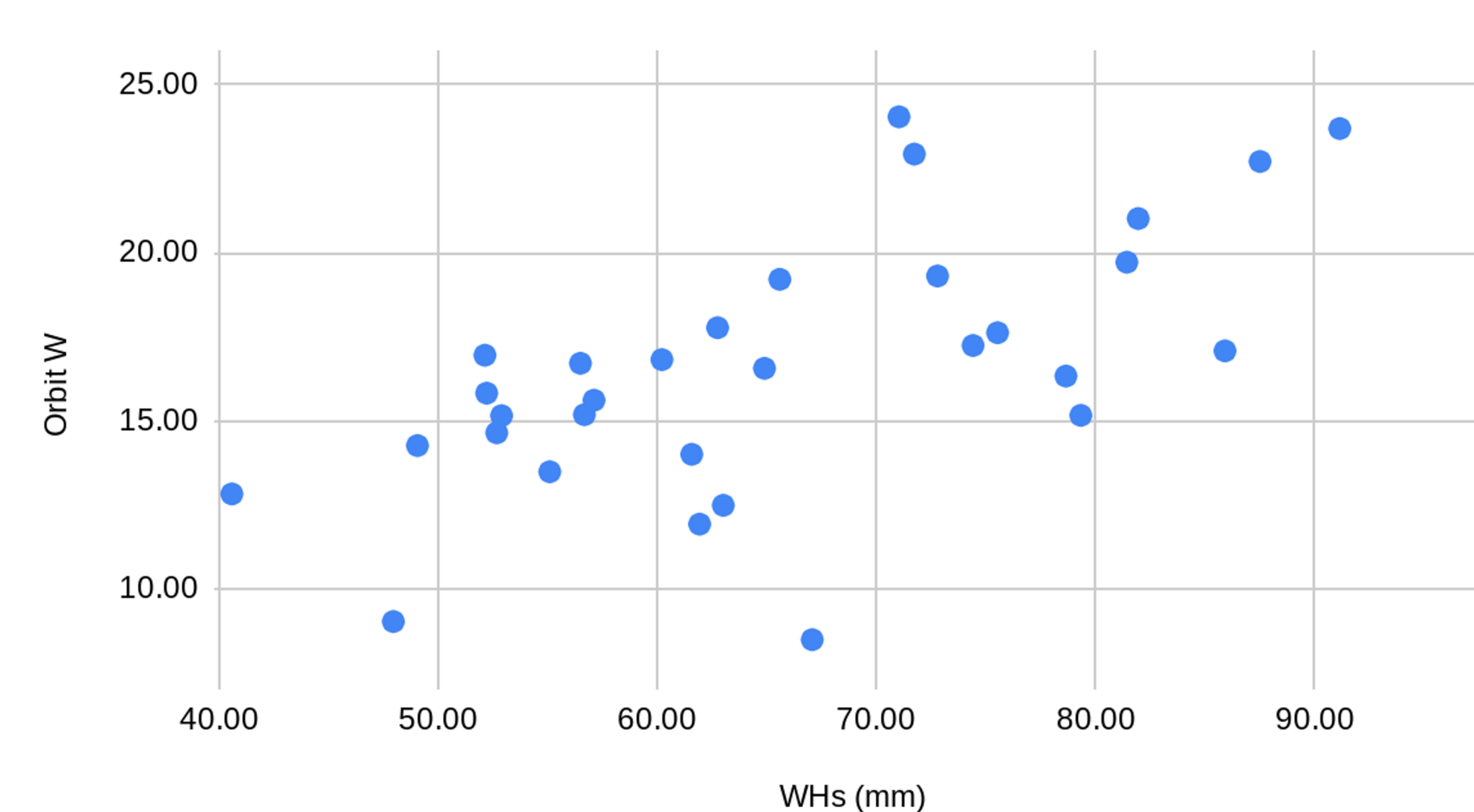


Figure 3: Ratio of orbital width (Orbit W) to head shield width (WHs) for 31 specimens of Pennsylvania *Bothriolepis* sp.

Results and Conclusions

The morphometric analysis of length of head shield versus width of head shield shows no indication of different size/shape categories. This relationship looks to be linear (Fig. 2). This relationship may change as more data are collected.

The analysis of width of head shield versus width of orbital fenestra appears to show two different size/shape categories. There is a divide between specimens who have head shield less than 70 millimeters in length and less than 20 millimeters in width, and specimens that have head shields greater than these measurements. The clusters seen in Figure 3 may indicate two different size/shape categories, which could suggest there being two different species of *Bothriolepis* in the Catskill Formation. These results are not definitive, as more data would need to be gathered and analyzed in order to lend additional support to this hypothesis.



Figure 4: Artist reconstruction of *Bothriolepis* sp. (credit: alphynix)

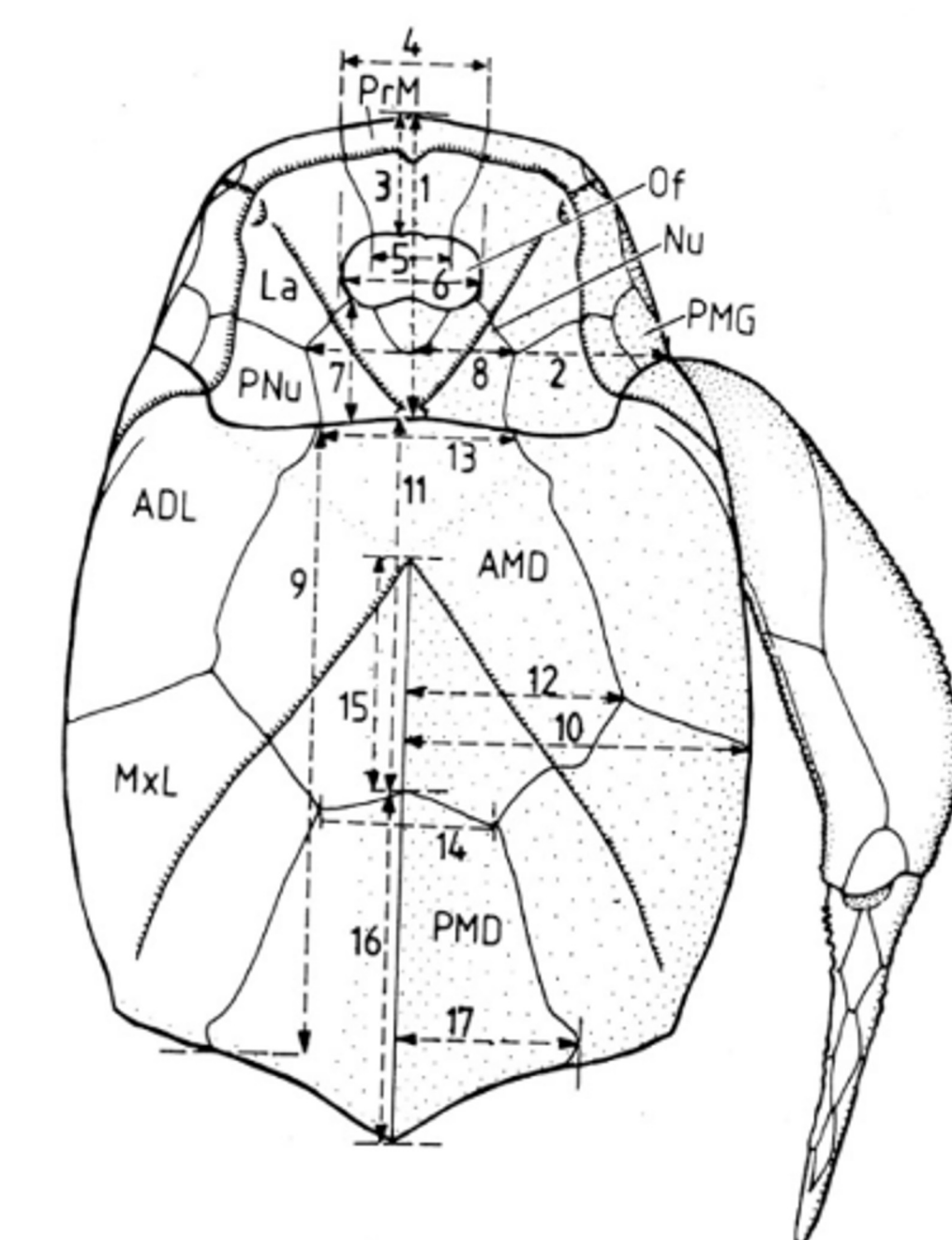


Figure 5: Illustration of linear measurements of interest (credit: Werdelin and Long, 1986)