

A PLACODERM WITH PACHYOSTEOMORPH AFFINITIES FROM THE CATSKILL FORMATION (UPPER DEVONIAN) TIOGA COUNTY, PENNSYLVANIA

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Abstract

Pachyosteomorph arthrodires were an advanced group of large placoderms (armored fishes) with a predominantly marine fossil record from the Middle-Upper Devonian. Dermal plates of large arthrodires, some displaying pachyosteomorph affinities, come from a 30-meter section of the lower half of the Catskill Formation (Famennian, Late Devonian). They were collected from a talus slope of an Interstate 99 roadcut, 8-miles north of Mansfield, PA. In this area the Catskill Formation is undifferentiated consisting of red and gray sandstones and siltstones. The associated ichthyofauna consists of the placoderms *Bothriolepis* and *Phyllolepis*, the porolepiform *Holoptychius*, an unidentified tristichopterid, and the lungfish *Aptorhynchus*. Of these the presence of *Phyllolepis* is indicative of a non-marine environmental setting. Large arthrodires are represented at the site by a partial anterior dorsolateral and an anterior lateral plate. Both isolated elements display a fine, dermal ornament and show no signs of being reworked post-deposition. The external surface of the anterior dorsolateral plate was preserved as an impression with residual bone. This allowed for the creation of a silicon peel, which facilitated morphological comparison. The anterior lateral plate displays a suite of features that suggest affinity with pachyosteomorph arthrodires. Its high and narrow proportions are consistent with the presence of a posterior, pectoral incision. The plate has a postbranchial embayment, a broad anteroventral wing with deep concavities, and a well developed obstantic process. Recognition that large, pachyosteomorph arthrodires utilized non-marine environments in the Catskill Deltaic System may prove important to future discussions of the paleoecology of large placoderms.

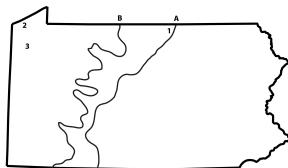


Figure 1. Map of pachyosteomorph placoderm localities in 1, Tioga 2, Erie and 3, Crawford Counties, Pennsylvania, relative to A, middle and B, late Famennian strandlines of the prograding Catskill Delta System (after Boswell 1988).

Paleoenvironment

The Interstate 99 roadcut in Tioga County exposes the lower half of the Catskill Formation. The Tioga locality shows the intertonguing of the Catskill Fm with the underlying marine Lock Haven Formation. Slane and Rygel (2009) interpret the Catskill at this site as representing lower delta plain facies. Thin transitional red beds preserve articulated brachiopods, *Lingula*, and *Skolithos*-like vertical trace fossils. A weak tidal influence is suggested by a bimodal paleoflow. In addition, the *Holoptychius-Bothriolepis* vertebrate fauna includes the ostensibly freshwater placoderm *Phyllolepis* sp.

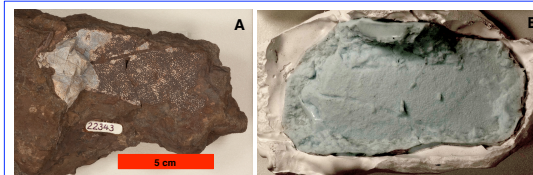


Figure 2. A partial anterior dorsolateral plate (ANSP 22343) preserves a segment of the main lateral line groove and part of the glenoid condyle, which articulates with the head shield. The specimen when collected (A) consisted of an impression of the lateral surface covered in part by remnant bone which was later removed in a 10% HCl bath. A peel of the impression (B) was created following the method of Daeschler and Mullison (2004), but substituting silicon for latex. Paraloid B-72 was used to strengthen the porous matrix before applying silicon to the impression.

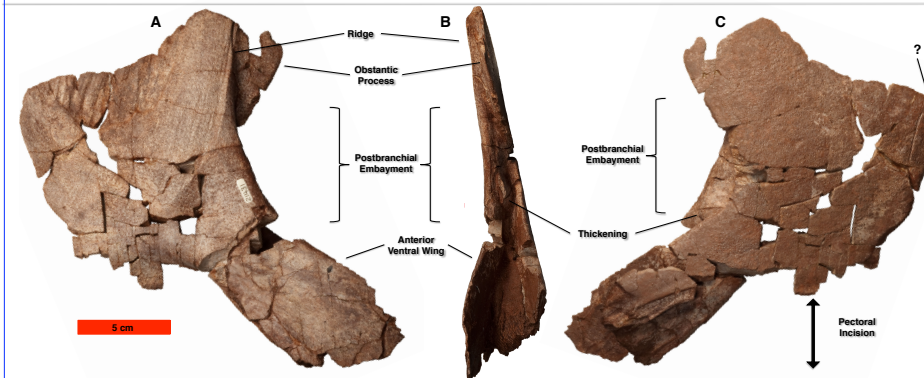


Figure 3. Photographs of a left anterior lateral plate (ANSP 21431) from a pachyosteomorph placoderm in A, medial B, anterior and C, lateral views.

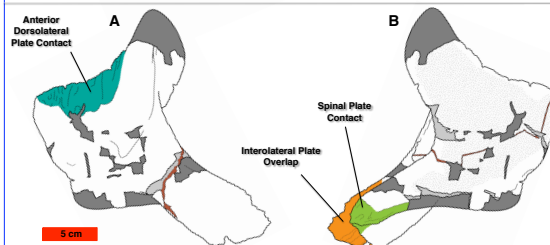


Figure 4. Interpretive line drawings of the left anterior lateral plate (ANSP 21431) in A, medial and B, lateral views showing contact surfaces with adjacent plates.

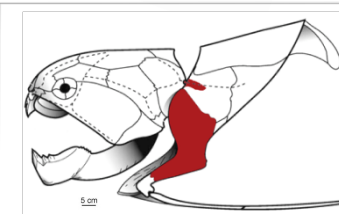


Figure 5. Reconstruction of *Dunkleosteus terrelli* (Newberry) showing the position of the anterior lateral and partial anterior dorsolateral plates in the placoderm dermal skeleton (modified from Carr, 2010).

Previous Work

Isolated placoderm plates assigned to *Dunkleosteus* sp. have been reported from the Upper Devonian of northwestern Pennsylvania (figure 1). Confirmed occurrences include two median dorsal plates from the Chadokoin Fm in Erie County and a left anterior dorsolateral plate from the Riceville Fm in Crawford County (Randall et al., 1996). These rocks are an extension of the black shale facies of the Cleveland Shale Member of the Ohio Shale, which has yielded a species-rich placoderm fauna.

Dermal Plate Morphology

Several features of the anterior lateral plate (ANSP 21431) associated with reduction of the trunk armor indicate an affinity with pachyosteomorph arthrodires (see figures 3 and 4). Other features that may be relevant to a more specific identification within the Pachyosteomorphii (Stensiö, 1963) are the presence of a spinal plate, indicated by the contact surface, and a fine denticular ornamentation on the external surface (figure 4). The anterior dorsolateral is too fragmentary to preserve any features of diagnostic importance but the size of the fragment suggests that it came from a large placoderm.

Paleoecological Implications

The paleoecology of pachyosteomorph arthrodires is in the process of being reevaluated. Recently, Carr (2010) concluded that *Dunkleosteus terrelli* (Newberry, 1873) was a free-swimming predator—not an obligate bottom-dweller—based on the distribution of gnathal plates from that species in the Cleveland Shale. This is seen as consistent with the cosmopolitan distribution of the species. The large arthrodire from Tioga County demonstrates that similar animals utilized brackish and possibly freshwater environments of the lower delta plain in addition to adjacent marine ones. For now, it remains uncertain whether this new occurrence is the result of the organisms life history (e.g. anadromous) or its possible peripatetic lifestyle.

Literature cited

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