**Supplementary Material for “Designating a lectotype for *Mesacanthus pusillus* (Gnathostomata: Acanthodii)”**

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**ANDREWS’ SPECIMENS - DESCRIPTIONS**

**Specimen** **ROM 25846**. This specimen is approximately 80mm in length and is curled into a ‘comma shape’, which is common among *Mesacanthus* specimens (Figure S1A). This curling usually results in the head turning somewhere between 90 and 180 degrees from its life position. In this particular specimen, the head is fully turned back toward the tail and compressed to the ventral side of the body – this ventral (as opposed to dorsal) turning can be easily discerned by reference to the position of the more elongate dorsal portion of the lunate tail. While superficially very similar to the smaller specimen figured by Agassiz (1844-1845), it can be distinguished from it by the fact that in the smaller specimen, the turning of the head is to the dorsal side and not, as is the case in ROM 25846, the ventral side. Furthermore, ROM 25846 has a very distinct dorsal fin projecting almost perpendicular to the main body, which the smaller specimen lacks. The matrix is sandy-coloured and contains a number of what appear as concentric rings of lighter and darker sediment.

**Specimen ROM 25872.** This specimen is also quite poorly preserved and exhibits a high level of post-mortem deformation and twisting (Figures S1B). The tail is visible and distinct. More cranially, the main body is highly distorted. Differing from ROM 25846, the folding of the main body is to the dorsal side. In this respect, ROM 25872 is more similar to the smaller specimen. There are other similarities between the smaller specimen figured and ROM 25872, including the ratio between the tail-length and the diameter of the folded body, the apparent position of the head beneath the main body and the small fold of skin that projects down from the base of the ventral side of the tail. However, in the depiction of the smaller specimen, the surrounding matrix appears to be sandy in colour whereas in ROM 25872 the surrounding matrix is clearly dark grey/blue (Figure S2). That being said, with a degree of leeway afforded to Joseph Dinkel (the artist who produce d the figures for Agassiz (1844-1845)) to allow for the possibility that the original author may have opted for a more aesthetically pleasing presentation of the specimens than the reality, these differences in the surroundings do not necessarily rule out the possibility that these two specimens are one and the same. A similar clear difference between the surrounding matrix of an actual specimen and its depiction in historic literature can be seen in numerous other specimens, such as specimen GSM 21448 (Figure S3B). The apparent mirror-image translation between the specimens could also be accounted for by the way in which the original plate figures of Agassiz (1844-1845) were produced, as these plates might not necessarily show the image in its original orientation, but rather a reverse of it (see, for example, Burrow et al., 2020a).

**Specimen ELGNM 1978.191.1**. This specimen is highly deformed and very difficult to interpret (Figure S1C). It appears to be bent into the same approximate shape as ROM 25872 and ROM 25846. However, it is impossible to say whether this specimen’s anterior portion has been bent dorsally or ventrally, as details of the main body and tail are largely lost. In fact, almost no diagnostic features can be easily made out in this specimen. It is possible, based upon the rough shape of the specimen, that ELGNM 1978.191.1 represents the counterpart to the larger specimen, a possibility also suggested by Andrews (1982). However, given how poor the specimen is, and how little else can be seen of its anatomical features, such comparisons are much harder here than for ROM 25872.

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Figure S1. The three ‘candidate specimens’ that could represent part of the original syntype material of *Mesacanthus pusillus* identified by Baron (2015). A, ROM 25846; B, ROM 25872; C, ELGNM 1978.191.1, scale bars = 20mm

**ORIGINAL FIGURED SPECIMENS**

Two specimens were figured by Agassiz (1884-1885). Here they are referred to as the larger (S2A) and the smaller (S2B) specimens. The smaller specimen is most similar to ROM 25872 (see Figure 1 in the main text).

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Figure S2. The two specimens figured by Agassiz (1844-1845 pl. 28, Figs. 8–10) in the original description of *Mesacanthus pusillus*. A, the larger specimen; B, the smaller specimen. Adapted from Agassiz (1844-1845).

**SYSTEMATIC PALAEONTOLOGY**

Infraphylum GNATHOSTOMATA Gegenbaur, 1874

Genus MESACANTHUS Traquair, 1888

**Type species.** *Mesacanthus mitchelli* Egerton, 1861 (originally *Acanthodes mitchelli*: Agassiz, 1844-1845).

*Mesacanthus pusillus* (Egerton, 1861) Figure 1

**Synonyms**. *Mesacanthus peachi* Egerton, 1861; *Mesacanthus coriaceus* Egerton, 1861

**Lectotype**. ROM 25872 (Figures 1b,c)

**Description**. *Mesacanthus pusillus* is a relatively small acanthodian from the Middle Devonian. The individuals of the species have a relative short head, supporting functional jaws, and a narrow, elongated body that supports paired pectoral, pelvis, dorsal and anal fin spines. These spines would have themselves supported fleshy fin-like structures. In all species of *Mesacanthus* the dorsal fin spine is located posterior to the anal fin spine. *M. pusillus* can be further distinguished from the Lower Devonian species *M. mitchelli* by its greater length to width ratio. The tail of *M. pusillus* is semi-lunate, with the dorsal portion usually extending further posteriorly than the ventral.

**Range**. Middle Devonian (Givetian – Eifelian) - 393.3 ± 2.7 to 382.7 ± 2.8 (Cohen et al. 2018).

**TYPE MATERIAL OF ‘*MESACANTHUS PEACHI*’**

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Figure S3. The ‘holotype’ of the now invalidated ‘*Mesacanthus peachi’*. Now considered to be a specimen of *M. pusillus*, this individual clearly represents that which was first figured by Egerton (1861, pl. 6, fig. 1). A, Adapted from Egerton (1861); B, GSM 21448, compared to scale with Egerton’s figure, and showing the wider block it is actually contained within. This helps to demonstrate the fact that early depictions of acanthodian and other specimens often used a degree of artistic licence when drawing in the surrounding matrix.

**WHAT IS ROM 25859?**

After an extensive search of the ROM collections and archive documents by KLS for information pertaining to the fossil material that came to the ROM from Portsoy Minerals, one specimen was noted as a possible counterpart of an Agassiz type - ROM 25859 (Figure S4). However, visual inspection of the specimen showed it to be highly deformed and very difficult to interpret. It is possible that this specimen is not even, in fact, *Mesacanthus*. It may be that ROM 25895 represents *Diplacanthus*, probably *D. crassisimus* (pers. comm. Carole Burrow, 11.2020). CB thinks that this may be mislabelled and does not think that there are any missing types in this genus.

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Figure S4. Possible specimen of *Diplacanthus crassimus*,­­ROM 25859. This specimen was originally catalogued as ‘ROM 87’ and had, for a long time, been mislabelled as a possible type specimen of *Mesacanthus pusillus*. Photograph by KLS.

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