

3D models related to the publication: Reexamining the evolutionary history of the mammalian medial pterygoid muscle

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Abstract

The present dataset contains 3D models used for illustration purposes in Schultz, J. A., Weaver, L. N., Jäger, K. R. K. & Grossnickle, D. M., 2026. Reexamining the evolutionary history of the mammalian medial pterygoid muscle. Evolution. The dataset includes 3D models based on micro-computed tomography (μ CT) data of the postdentary area of the morganucodontan *Morganucodon*, the docodontan *Docodon*, the eutriconodontan *Priacodon* and the cladotherian *Dryolestes*. In addition, the dataset includes manually reconstructed schematic 3D models of the middle ear bones for the morganucodontan *Morganucodon*, the docodontan *Docodon*, the eutriconodontan *Priacodon* and schematic middle ear bones and a virtually rendered juvenile lower jaw of a juvenile monotreme *Ornithorhynchus* (based on illustrations of Zeller [1989]).

Keywords: Cladotheria, Docodonta, Eutriconodonta, Mammalia, Postdentary bones

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INTRODUCTION

The medial pterygoid muscle, a functionally important jaw adductor in modern mammals, inserts on the mandibular angular process in therians (placentals and marsupials). Compared to that, in non-mammalian mammaliaforms, the medial pterygoid is generally assumed to have inserted on the dentary angle (or pseudangular, see Figure 1, MP). This dataset contains 3D models of the postdentary area of the lower jaws of the morganucodontan *Morganucodon*, the docodontan *Docodon*, the eutriconodontan *Priacodon*, the cladotherian *Dryolestes* and the prototherian *Ornithorhynchus*. The 3D models of *Morganucodon*, *Priacodon* and *Dryolestes* were reconstructed based on μ CT scans, the models of the lower jaws of *Docodon* and *Ornithorhynchus* are available freely elsewhere. The models were used to provide anatomical descriptions and landmarks of the postdentary area for possible attachment sites for the medial pterygoid muscle to reexamine the long-standing hypothesis that the medial pterygoid inserted at the pseudangular process in non-mammalian mammaliaforms. Figure 1 shows the postdentary areas with virtually reconstructed middle ear bones (schematic based on illustrations in Kermack et al. [1973], Kermack et al. [1981]) of the morganucodontan *Morganucodon*. The study and related interpretations are published in Schultz et al. (2026). Relevant to the models provided here is the evolutionary history of the mammalian middle ear. During this evolutionary transition, the surangular along with the articular and prearticular detached from the jaw and merged to form the malleus. During the transition to the true mammalian middle ear, the ossicles detach from the dentary and are medially displaced, but stay connected to the lower jaw via the bent Meckel's cartilage in early mammalian taxa (represented here by the eutriconodontan

Priacodon) without a postdentary trough (grooves for middle ear elements). The middle ear elements of *Priacodon* are not known, but we virtually created schematic middle ear bones still connected to the lower jaw, based on fossil evidence reported in Luo et al. 2007 and Mao et al. 2020 for eutriconodontans. Our discussion of the position of medial pterygoid muscle in eutriconodontans is based on the similar anatomy found in the developing monotreme *Ornithorhynchus* documented in Zeller (1989). The position of the medial pterygoid relative to Meckel's cartilage in the ontogeny of monotremes opens a new perspective of how the medial pterygoid evolved in mammals. For further discussion of the origin and evolution of the medial pterygoid, see Schultz et al. (2026). In our study, we conclude an alternative attachment area for the medial pterygoid (Figure 1, aMP) in mammaliaforms (following Patterson 1956) which results in a different anatomical order of Meckel's cartilage relative to the medial pterygoid. Our interpretation suggests homology of the mammaliaform medial ridge and the mammalian pterygoid fossa, a hypothesis that as not been previously recognized.

METHODS

Both the lower jaws of *Morganucodon* (NHM M84028, Natural History Museum London) and *Priacodon* (LACM 120451, Natural History Museum of Los Angeles) were scanned at the University of Texas High-Resolution X-ray CT facility using the NSI scanner. For scanning the following parameters were used: *Morganucodon* was scanned using the Xradia setup, 60 kV, 10 W, 1 s acquisition time, 1 mm SiO₂ filter, with a voxel size of 19.64 μ m; *Priacodon* was scanned using the fine focus high power source, 110 kV, 0.15 mA, no filter, and a voxel size of 10.4 μ m. For further scan information, see Jäger et al. (2020).

| Inv nr. | Taxon | Description |
|---|---------------------------------|---|
| NHM M84028 | <i>Morganucodon</i> sp. | lower jaw with manually reconstructed Meckel's cartilage and schematic middle ear bones (Ectotympanic, Articular/part of Malleus, Surangular/part of Malleus) |
| LACM 120451 | <i>Priacodon fruitaensis</i> | lower jaw with manually reconstructed Meckel's cartilage and schematic middle ear bones (Ectotympanic, Articular/part of Malleus, Surangular/part of Malleus) |
| GuiMam 3-78 | <i>Dryolestes leiriensis</i> | lower jaw with manually reconstructed schematic Meckel's cartilage |
| YPM10649, YPM13735, YPM11823 and YPM11826 | <i>Docodon victor</i> | lower jaw with manually reconstructed Meckel's cartilage and schematic middle ear bones (Ectotympanic, Articular/part of Malleus, Surangular/part of Malleus), for specification of jaw see Schultz et al. (2019) |
| S32167 | <i>Ornithorhynchus anatinus</i> | lower jaw with manually reconstructed Meckel's cartilage and schematic middle ear bones (Prearticular, Articular/part of the Malleus, Surangular/part of Malleus, Angular/Incus) |

Table 1. Taxon, specimen numbers and 3D data provided. Collections: Natural History Museum London (NHM), UK; Natural History Museum of Los Angeles (LACM), USA; Geological Museum of the National Laboratory of Energy and Geology of Portugal Lisbon, Portugal; Yale Peabody Museum of Natural History New Haven (YPM), USA; Idaho Museum of Natural History, USA

The lower jaw of *Dryolestes* (GuiMam 3-78) was scanned at the Bonner Institute of Organismic Biology (BIOB, formerly Institute of Geosciences, Universität Bonn; section Palaeontology) using the v—tome—x s μ CT device (GE Sensing & Inspection Technologies GmbH phoenix—x-ray). Scan parameters for *Dryolestes*: 240 tube, 90 kV, 180 μ A, 333ms exposure time, no filter, voxel size 24.66 μ m. The lower jaw of *Docodon* is a composite based on specimens YPM10649, YPM13735, YPM11823 and YPM11826 from the Yale Quarry 9 at the Como Bluff Site published in Schultz et al. (2019) and free for download. The 3D models were segmented manually from CT scans using Avizo 8.1. (Visualization Sciences Group). The 3D model of the juvenile *Ornithorhynchus* lower jaw is a virtually edited polygonal surface model of the adult surface model of *Ornithorhynchus anatinus* downloaded from MorphoSource (imnh.r:2125; OBJ mesh file, Idaho Museum of Natural History specimen S32167). The surface model was manually modified and edited in MAYA 16 (Autodesk) based on illustrations of specimen MO 39 from Zeller (1989). For all models, fine tune editing and virtual alignment was performed using Polyworks (2014, InnovMetric Software Inc.) including Gouraud filters for smoothing surfaces, adding and removing triangles, reworking mesh and reducing data size. The schematic 3D models of the middle ear bones and Meckel's cartilages were manually created using MAYA 16 (Autodesk) based on illustrations in Kermack et al. (1973), Kermack et al. (1981), Luo (2011), Luo et al. (2007), Luo et al. (2016), Ji et al. (2009), Mao et al. (2020) and Zeller (1989). All 3D surface models (see table 1) are provided in ply-format, and can be opened with a wide range of freeware.

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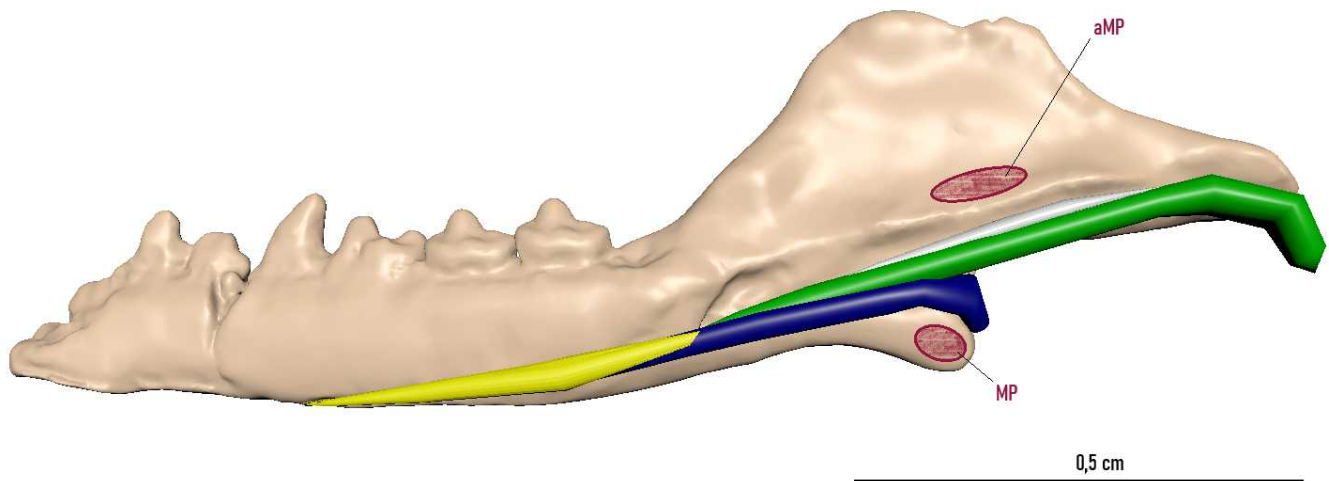


Figure 1. Postdentary area of the morganaucodontid *Morganucodon* with manually edited schematic middle ear bones, based on illustrations in Kermack et al. (1973), Kermack et al. (1981) and Luo (2011). Depicted in color code are the following elements: yellow = Meckel's cartilage, dark blue = ectotympanic, green = articular/part of malleus, white = surangular/part of malleus, beige = dentary, MP = traditional attachment site of the medial pterygoid muscle, aMP = alternative possible attachment site of the medial pterygoid muscle.

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